Assessing Farmers' Willingness-to-Pay for Improved Common Bean Seed Varieties in Malawi: A Case Study of Kasungu and Dedza Districts

by

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Submitted in partial fulfilment of the requirements for the degree

MSc Agric (Agricultural Economics)

in the

Department of Agricultural Economics, Extension and Rural Development,
Faculty of Natural and Agricultural Science
UNIVERSITY OF PRETORIA
PRETORIA

June 2013

DEDICATION

To my little niece ‘baby Gabriella’ who was born whilst I was in school, my parents and my siblings: Yezgani, Iness and Yankho, you guys have been my tower to lean on and I have never loved you more……

DECLARATION

I, Grace Timanyechi Munthali, declare that this thesis hereby submitted for the degree of Master of Science in Agricultural Economics at the University of Pretoria, is entirely my own work and has not been submitted anywhere else for the award of a degree or otherwise.

I therefore take responsibility for all errors in thinking and ommissions.

Signature: …..…….

Date: ……

ACKNOWLEDGEMENTS

Firstly, I would like to thank God almighty for providing me with wisdom and life for me to undertake this masters degree. My special gratitude also goes to my beloved daddy, my number one promoter, Dr Bruce C Munthali for providing financial support throughout my study and father, thanks for believing in me. Special thanks to Dr Rowland Chirwa and CIAT Malawi for providing a research grant for my dissertation. To Professor Johann Kirsten and staff of the Department of Agricultural Economics, Extension and Rural Development, thanks for all knowledge and support provided throughout my study at the University.

Special acknowledgements are also due to my study leader, Dr Frikkie Liebenberg for all the expert guidance in rationalising my constant irrational and scrambled thoughts into this manuscript. I would also like to thank the extension workers in Bembeke and Kaluluma planning areas for the help in organising farmers and again thanks to the farmers in those planning areas for their participation in this study. Thanks goes to my enumaration team for their hard work and team spirit, I could not ask for a better team.

Gratitude is also due to PhD students in LEVLO and the department of Economics, DARS for their support and allowing me to come to school, my lecturers at Bunda College of Agriculture, workmates, classmates for all those late night discussions and pap, my beloved friends from back home and SA, thanks for maintaining me as your friend even when I could not communicate due to a busy schedule at school and to everyone out there who contributed to my success, thank you for all the support.

Lastly, I would like to thank my ever supportive parents,sisters, Yezgani & Iness and my only brother Bruce (Jnr) for their everlasting love, finincial and moral support. To my extended families: Chawezi, Chamaine, Marriam, Andy & Ndinda, all the Munthalis, Ngalaukas, Naijas, Nthuzis, Mkandas, Sinkhani's, the Kabambe's, grannys 'Analiyela' and 'Gogo Maggie'. I am forever grateful for all the love and support that sustained me not only throughout my study but since time immemorial. *Thank you all……..*

ABSTRACT

Assessing farmers' willingness-to-way for improved common bean seed varieties in Malawi: A case study of Kasungu and Dedza districts

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Common beans are one of the most important food and cash crops for most Malawians. The insufficient production of the crop in the country coupled with low yields has made scientists give much interest to the crop so that they can address the constraints to the productivity problems. In this regard, breeders have been engaged in the development and release of improved varieties of common beans which in most cases are disease resistant, high yielding, drought resistant, and fast cooking. Therefore it is the interest of this study to find the reasons why productivity of the crop is still low despite the release of the improved varieties.

The study adopted contingent valuation (CV), a method frequently used to assess willingness-to-pay of people for non-market goods or services and this was applied to assess farmer's willingness-to-pay for the new improved bean seed varieties which are high yielding. Double bounded dichotomous choice with an open ended follow-up format was used to obtain the household's willingness-to-pay. In addition; the study reviewed the existing dissemination channels of bean seed to make recommendations with regard to seed supply.

Descriptive statistics from the 132 households interviewed shows that the structural constraints to seed acquisition are compounded by farmers' poverty. Otherwise, most farmers

are aware of the existence of improved varieties of common bean seed and perceive that with the use of this seed, productivity can improve hence willing to pay for the good. The study is 95% confident that mean price farmers are willing to pay for improved common bean seed is between MK 527.78 and MK 591.92. Three major existing informal dissemination channels of bean seed were discovered in the study areas.

Therefore there is a need for government to work in collaboration with NGOs towards ensuring a formal supply system of bean seed characterised by vertically organised production and dissemination of tested and approved seed varieties, and using strict quality control rules, so that farmers can be assured of accessing improved seed varieties. This will increase the nation's food security.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Malawi is a landlocked country whose economy is predominantly agricultural with about 80% of the population living in the rural areas. Agriculture accounts for more than one third of GDP and 90% of export revenues (World Fact Book, 2011). It is reported that about 90% of the country's population practices subsistence farming and the smallholder farmers produce a variety of crops including maize, common beans, rice, cassava, tobacco and ground nuts (Bureau of Public Affairs, 2011).

The common bean (*Phaseolus vulgaris* L.), also known as dry bean, is considered to be one of the most important food and cash crops for the majority of Malawians (Scott, 2003:1). The crop is a significant source of protein and its demand has increasingly grown in the country due to scarcity and unaffordability of animal protein. The crop also provides quick revenue to farmers and serves as an insurance against malnutrition and food insecurity because of its short duration to mature (Buruchara, 2007).

Chirwa and Aggarwal (2000:1) report that, in Malawi, common beans are mostly produced on a small scale by subsistence farmers, of which the majority are women. The crop is grown throughout the country under several systems of cropping, which include relay; in alleys of tree crops; in dimba gardens on residual moisture; irrigation after rice schemes; pure as well as mixed stands with other crops. Its shade tolerance and early maturity makes beans an important component in production systems and prominent in different cropping systems, hence an ideal crop for strengthening of the existing farming system.

Despite the crop's importance to the majority of the population in the country, production continues to be too low to meet the demand of the growing population as well as exports. Its average yield remains lower than the potential yield, which is in excess of 1500 kg/ha when managed at a research station under good environment (Chirwa *et al*., 2007:44). However, the

annual production of common beans in the country has increased from 27,500 metric tons in 1989 to 101,317 metric tons in 2001 owing to the increased land area allocated to the crop (Chirwa & Aggarwal, 2000:1).

Reports show that low productivity of common beans in Malawi is caused by several factors including biotic, abiotic and socio-economic constraints. The biotic constraints include insect pests and diseases while the abiotic constraints include low soil fertility and unreliable rainfall mainly due to recurrent droughts, a short rainfall season and long dry spells. Socio-economic constraints deal with issues like lack of access to improved bean seed varieties, inappropriate pricing policies, lack of inputs for the farm and poor storage facilities (Mkandawire, 1992).

In 1995 and in response to some of the socio-economic problems, the Department for International Development (DFID) through the Department of Agricultural Research Services initiated the Bean Improvement Programme. The Bean Improvement Programme (BIP) is aimed at transferring technology to seed production enterprises in a sustainable manner, providing technical advice and practices to the seed multiplication enterprises. There are several technological practices which are encouraged, some of which include use of improved seed varieties, recommended fertiliser types and rates, enhanced cropping systems and pest, disease and weed control. The BIP in conjunction with Bunda College of Agriculture, which are the two main seed breeding institutions in Malawi, has been releasing improved varieties of bean seed for multiplication (Phiri *et al*., 2001).

Chirwa (2007) reported that over the years, much investment has been done in research for development of beans in Malawi. The traditional varieties were crossed with new improved bean varieties from South America and came up with a composite variety that combats most of the crop's production constrains mentioned above. These new improved composited varieties have traits like high yielding, drought resistance, pest and disease resistance and above all, they are adaptive to the local conditions. Such efforts have resulted into release of many varieties which all have a combination of the above traits but only differ in colour, shape and size that determines consumer's attractiveness.

Like most countries in sub-Saharan Africa, Malawi has a problem with seed retention and access to improved seed. Studies reveal that smallholder farmers tend to secure their seed

through informal channels which include seed exchanges or gifts among farmers, own seed (farm saved seed) and/ or from local markets. In most cases, seed from these channels is uncertified and probably less vigorous and more easily susceptible to diseases, thus resulting in low productivity of the crop and also low household revenue (Rubyogo, 2007).

The National Agricultural Research Service (NARS) working on beans in Africa via the Pan Africa Bean Research Alliance (PABRA) and CIAT as catalyst have been promoting strategic associations to expose farmers to improved germ plasm. This is done through a decentralised participatory variety selection (PVS) method which aims at meeting with farmer's preferred choices and develop more integrated seed supply systems in partnership with various stakeholders in the seed industry (Chirwa *et al*., 2007:4). It is not clear whether the supply systems are effective or if there is a need for experts to redesign the strategy currently in place. PVS is deemed as a good approach since it involves various stakeholders like traders, farmers, NGOs and seed companies, to come up with their improved preferred varieties for wider uptake and it is again good for sustainability of the preferred improved varieties.

Much research on the common bean has been done in Malawi and many improved bean seed technologies have been developed from this, even farmer preferred improved varieties. However, assessment of consumer demand for these varieties through farmer's willingness to pay has not been considered. Lusk and Hudson (2004:152) state that there are two factors that can affect the possibility of a new venture in any kind of business: production costs and consumer demand for the new product or service. In most instances, these are the key determinants of product adoption and pricing.

Studies have shown that adoption studies have attracted the interest of several economists since agriculture is the backbone of most of the less developed countries and improved technologies are deemed to offer increased production opportunities and sustainability of income. In Malawi, about 80% of the population live in rural areas and rely on agriculture and therefore these new technologies provide an opportunity to improve crop productivity and income (FAO, 2009).

Therefore, it was thought necessary to conduct research on farmers' willingness to pay for a new improved common bean seed variety so as to assess consumer demand for the improved

bean seed among farmers in Malawi. Subsequently, propositions can be made on how farmers in the study areas can access the markets so as to enhance their bargaining power and incomes.

1.2 PROBLEM STATEMENT AND JUSTIFICATION OF THE STUDY

The common bean (*Phaseolus vulgaris*) is an important legume in Malawi due to its versatile benefits. The crop can be consumed at different stages of its development hence provides great and prolonged food supply in different forms like leaves, green pods, and fresh or dry seeds. The health benefits of the crop include the supplement of key elements for mental development (iron and zinc) in human beings and it is an important source of dietary protein (22%). In addition, consumption of beans reduces colon and breast cancer due to their natural source of antioxidants and phytochemicals and beans are also good for maintaining blood sugar in the normal range and even reducing the risk of heart diseases (US Dry Bean Council, 2011; Leterme & Muñoz, 2002).

Furthermore, the economic benefit of beans to households is that they are a quick source of income, especially because they mature fast and can be intercropped with other crops (Buruchara *et al*., 2011). Like any other legume, beans are a high value crop hence households can generate more income if incorporated in their cropping system. Beans are also biologically superior at fixing nitrogen in significant amounts, enhancing phosphorus availability and increasing yield, not only of itself but also of the subsequent cereal crop (Kerr *et al*., 2007). In this regard, there is no doubt that the contribution of the common bean to households' food, diet, income, nutrition and environmental security is remarkable. Therefore, adopting improved bean seed varieties which aims at increasing productivity of beans can improve the welfare of the farmers in every aspect of their lives.

Farmers in Malawi despite growing the local bean varieties whose seed is sourced through traditional systems experience most of the aforementioned benefits of common beans. The traditional system is an informal source of seed that involves selection of the largest, healthiest seed for planting (Msiska & Chibambo, 2002:2). This is mostly done with traditional varieties though farmers also apply this practice to improved varieties. The problem with this system is that with every recycle, the production potential of the seed

decreases. As such, there is a need to increase yields and stability of the crop so as to minimise the risks of food insecurity as well as generate a surplus for sale.

The unequal land distribution in Malawi leaves more than 40% of the smallholder farmers cultivating less than 0.5 hectares of land (Msiska & Chibambo, 2002). Priority is therefore given to crops like maize and tobacco, which are the main staple and cash crops, respectively. This leaves a very small portion of land mostly on marginal soils for bean production, hence the subsequent yield gap.

To address this yield gap, farmers need to adopt improved bean seed varieties. The advantages of improved varieties cannot be overemphasised; they are in most cases high yielding since they are designed to combat major production constraints including low yield potential, drought and pest and disease vectors (Katungi *et al.*, 2009). The annual value of bean sales in Africa exceeds US$ 500 million (FAO, 2011). In 2008 alone, bean production in Malawi was 90,700 metric tons valued at approximately US$ 72 million while the estimated[1] potential production was 418, 262 metric tons with a value of US$ 331 million. The gap[2], which is 327,562 metric tons valued about US$ 260 million, is the room for expansion. This gap coupled with the numerous potential markets within and outside the borders of Malawi shows that use of improved varieties can potentially contribute to the country's economy hence broadening the infringed foreign exchange base (Chirwa, 2009).

Despite large numbers of improved bean seed developed and released in Malawi, the varieties do not reach farmers due to limited government efforts to multiply, promote and distribute the seed. Again there is poor complementarity between government and the private sector. Previously, the National Seed Company of Malawi (NSCM) was involved in the multiplication and distribution of breeder's seed before the company lost interest in self-pollinated crops (Tripp & Rohrbach, 2001:2). Companies are not economically attracted to the bean seed industry because they fear that farmers will not regularly renew their seed stock due to their tendency of using informal seed sources (Katungi *et al.*, 2010). Due to this reason,

1 The expected yield is the estimated output given the use of right inputs which includes use of improved seed varieties and its value given the government recommended farm gate prices for common beans for 2008 (converted in US$) (Chirwa, 2009).

2 This shows that the country is realising a small fraction of the expected output.

thus is why the new improved bean seed are considered as functional goodsThis does not only affect the production and distribution of bean seed but also farmer's ability to access new improved varieties hence multiplication and distribution is a stumbling block in the adoption of improved varieties of common bean (Chirwa *et al.*, 2007).

In order to understand farmers' adoption of the released varieties, it is important to identify the drivers of adoption. The footprint from maize shows that farmer preferences trigger the decision to adopt the improved varieties. Scientists therefore need to consider farmer's consumption preferences when breeding improved varieties (Masangano, 2004). Issues of affordability are also important as far as adoption of an innovation is concerned. Because companies are not interested in venturing into the seed industry, over time it leads to unavailability of seed on the market and consequently high prices of certified seed. Improved common bean seed varieties have higher production and transaction costs that render them beyond the economic reach of farmers (Chirwa *et al.*, 2007). Thus, there is a need to assess farmers' willingness to pay for farmer-preferred varieties. Furthermore, if farmers are to move from recycling to buying seed every year then the marginal benefits of adopting improved varieties need to be substantial.

1.3 PURPOSE STATEMENT

The underlying purpose of the proposed study is to assess the consumer demand and/or acceptability of improved common bean seed varieties in Malawi, through evaluating farmer's willingness to pay for the product, and to gauge the relative adoption levels of common beans among common bean farmers.

1.4 HYPOTHESIS

The study's main hypothesis is that new improved common bean seed varieties have the potential to improve productivity of common beans among smallholder farmers and they are likely to be willing to pay for it. This will be investigated through the following three hypotheses:

1. It is hypothesised that farmers attitude towards new improved bean varieties, which will be influenced by different factors including knowledge and perception, will determine farmer's willingness to pay.

2. Farmers would be willing to pay for an improved common bean seed variety despite its higher price because of the benefits accrued from the variety.

3. Reliable and shorter dissemination channels are expected to have a positive influence on farmer's willingness to pay for improved varieties.

1.5 RESEARCH OBJECTIVES

The study intends to specifically achieve the following objectives:

1. To assess knowledge/awareness, attitude and perception with regard to the improved common bean seed varieties among seed production enterprises.

2. To measure farmers' willingness to pay for the new improved common bean seed varieties and evaluate the different premiums that they are willing to pay for the different varieties of their preference.

3. To analyse the marketing/ dissemination channels through which the common bean seed passes to the end user.

1.6 ACADEMIC VALUE AND CONTRIBUTION OF THE PROPOSED STUDY

Concepts underlying consumer demand for new improved technologies need to be made known to all agricultural development agents like scientists, breeders, extension workers and policy makers, if productivity, consumption and distribution (the main drivers of food security) are to be improved. Therefore, information drawn from this study will help scientists develop suitable, cost-effective and sustainable bean seed technologies and target appropriate

farmers in different environments and socio-economic domains. Apart from the above, a formal bean seed supply system can be assured, contributing to a food secure nation.

In other words, consumer demand and/or acceptability studies can improve the efficiency of technologies and extension services. The assessment will enable policy makers in identification of policies and institutional factors that can contribute to increased adoption and distribution of new common bean seed technologies for increased welfare benefits. The study will also act as a base for more detailed and comprehensive research in other areas of Malawi.

1.7 LIMITATIONS

The study was conducted in only two districts where the common bean is largely grown, hence limited in terms of area coverage. Willingness to pay for improved agribusiness products can be influenced by several factors which may vary across areas. One factor may influence willingness to pay positively in one area and negatively in another. Hence it is difficult to identify distinct factors either hindering or enhancing willingness to pay for improved agribusiness products common to the rest of the country.

The proposed study was limited to identifying how much information the seed enterprises (farmers and traders of improved bean seed) have about the improved varieties, the existing dissemination channels and how much the farmers are willing to spend on the improved common bean seed varieties in the districts, though similar studies in other areas can use this study as reference. Lastly, it is of importance to point out that the study was limited to farmers and traders who were involved in improved bean seed enterprises.

1.8 DEFINITION OF KEY WORDS

Willingness to pay

In this study, willingness to pay is the maximum amount a person is willing to spend, sacrifice, or exchange in order to receive a good or to avoid something undesired such as pollution or food insecurity.

Non- Market goods

A good is considered non-market when its economic value cannot be directly obtained from the market (Alpizar *et al.,* 2003). In the study, the new improved bean varieties are considered as non-market goods since their value is not determined by forces of demand and supply in the market. There is no literature on formal marketing or pricing of bean seed in Malawi. Private seed companies are not attracted to the industry because it is not profitable due to farmer's tendencies to recycle seed. And yet seed companies are a major source of any produce's seed multiplication and outlet. Farmers sell their produce to the local market but there is no or little information on price formation of improved bean seed and the distinction between grain and seed at the market is also a major constraint.

1.9 RESEARCH METHODOLOGY

The study used both primary and secondary data to assess the willingness-to-pay for improved common bean seed varieties in Malawi. Several analytical tools and techniques are used in this study to answer the overall objective. Firstly, the socio-economic characteristics of the farmers and traders are discussed. This will help to create a better understanding of the different production and marketing systems. This is followed by an evaluation of how much information on improved varieties the production enterprises have. This will determine their decision process on whether to adopt the technology or not. Thirdly, market channels are identified to answer the second hypothesis. It is believed that shorter channels are more effective than longer channels which are also associated with higher marketing costs (Longwe *et al.*, 2010:10).

Lastly, a contingent valuation method (CVM) was used to elicit farmer's willingness to pay for improved varieties of common beans seed. CVM is a survey-based evaluation method where individuals are asked to state directly their willingness to pay to obtain the benefits of using that status quo. There are four types of CVM surveys, namely the open-ended format, payment cards, bidding game and dichotomous choice. The dichotomous choice approach is one method which has been largely adopted, despite criticism, because it seems to be incentive compatible in theory. The limitation of the dichotomous choice approach is that it does not reveal the estimates of willingness to pay by respondents (Haab & McConnell,

2002). Hence the introduction of follow-up question of the dichotomous choice to improve the accuracy of the willingness-to-pay estimates (Alberini & Cooper, 2000). Generally, each of the four elicitation methods has advantages and disadvantages and can be used for different purposes in the technology assessment, hence the study adopted different valuation methods.

1.10 ORGANIZATION OF THESIS

The dissertation consists of six chapters. The first chapter introduces the study and states the problems and objectives of carrying out such study. The second chapter reviews the literature on similar and related empirical studies. The third chapter discusses the methodology and describes the study area and different techniques used to achieve the chosen objectives. Chapters four and five present the results and discuss these against the three objectives. The last chapter gives a summary and presents some recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will among other things seek to investigate the agricultural situation, the economic importance of beans and the bean seed systems in Malawi. This information will be gathered through an in-depth review of past studies and literature on related aspects under consideration.

2.2 AGRICULTURE IN MALAWI

With a per capita GDP of $342 in 2010, Malawi is one of the least developed countries in the world (Index Mundi, 2011). Table 2.1 shows the GDP distribution by sector of origin in order to demonstrate the importance of different sectors. Agriculture remains the dominant sector and contributed between 34.4% in 2001 and 30.2% in 2010 to the economy (Table 2.1). The sector also contributes 90% of the export revenue (World Fact Book, 2011).

Eighty percent of Malawi's population lives in rural areas and practices subsistence farming and agriculture employs 90% of the labour force. Smallholder agriculture is the backbone of the agricultural economy and the mainstay of the majority of the population, as shown in Table 2.1 (Barbier & Burgess, 1992: 37). Therefore, this means that growth in agriculture, particularly in smallholder-based agriculture, is critical if the country's food security and poverty reduction goals are to be met. This has resulted in the country's structural adjustment policies for the past decades to be focussed on stimulating smallholder agriculture (Sahn & Arulpragasam, 1991:219).

Table 2.1: Gross Domestic Product by Sector of Origin at 1994 Factor Price (MK' Million)

Sector	1994	1995	1996	1997	1998	1999	2000	2001
Agriculture	2319	3238	4064	4069	4490	4944	5210	5365
Smallholder	1624	2332	3070	2964	3520	3990	4059	4265
Estate	695	906	993	1105	969	951	1151	1100
Mining	43	47	206	157	164	170	188	210
Manufacturing	1597	1685	1675	1691	1717	1749	1705	1690
Electricity/water	149	152	152	161	172	172	189	198
Construction	202	198	231	254	266	293	288	281
Distribution	2537	2576	2575	3018	2838	2765	2760	2939
Trans & communication	465	550	565	553	559	576	552	580
Financial & prof services	627	691	834	1128	1034	1032	1057	1253
Ownership of dwellings	162	165	169	172	176	180	185	189
Pvt and social services	211	215	237	260	262	264	271	279
Producers of gvt services	1114	1198	1168	1200	1232	1257	1282	1297
Unallocated fin. services	−278	−305	−317	−361	−344	−378	−387	−456
GDP factor cost	9149	10411	11498	12303	12568	13023	13300	13601
Agric % of GDP	25.34	31.1	35.3	33.07	35.7	39.9	39.17	39.4
Average % of GDP								34.4

Source: MNEC (2001)[3]

Malawi's agricultural sector is divided into three subsectors: estates, commercial smallholders and subsistence smallholders. Estate production occurs mainly on leasehold or freehold land and focuses exclusively on cash crop production, which includes crops like burley tobacco, tea, sugarcane, coffee and macadamia nuts. Commercial smallholder production consists of relatively large areas and produces for own consumption as well as marketing. This is the group of smallholders that mostly adopts new technologies and can afford to grow cash crops. The subsistence smallholders are the poorer farmers who do not even have enough land to produce for their subsistence with the prevailing technologies. They depend on the market for wage labour and food, and nearly half of the households from this group are headed by women (Lele, 1990:1207).

[3] Smallholder farming contributes more to the economy than estate farming.

In this regard, Malawi's adjustment has been more oriented to supply augmentation than demand contraction and emphasis has been put on promoting agricultural growth within the smallholder subsector (Sahn & Arulpragasam, 1991). In most developing countries, a lot of agricultural land is being operated as small farms. There might be a decline in the importance of farming in household incomes, but the number of households that use farming to sustain livelihood still continues to grow. Agricultural growth that improves productivity on small farms has proven to work in reducing poverty and hunger and improving living standards, as in the case of large parts of Asia during the green revolution (Hazell *et al.*, 2010).

Approximately 1.8 million ha is cultivated under customary tenure by about 1.6 million smallholder families in Malawi. The average farm size is about 1.17 ha with 55% of the holdings being less than 1.0 ha, 31% between 1 and 2 ha. Only 14% are above 2 ha in size. Maize is the main staple crop and is grown on 75% of the cropped area (Barbier & Burgess, 1992:37). The other major subsistence crops include cassava, sorghum and sweet potatoes, etc. Burley tobacco, grain legumes (beans, soybeans and groundnuts), cotton, coffee and spices are some of the important cash crops also grown by smallholder farmers.

2.3 ECONOMIC IMPORTANCE OF BEANS

The common bean is a major staple food throughout Southern Africa. It is the second most important source of human dietary protein and the third most important source of calories (Wortman *et al.*, 1998). The crop is considered diverse in terms of its uses, ability to adapt to different environments, viability in terms of morphology and cultivation methods. Common beans can be cultivated in a monoculture, mixed stands or rotation. The crop is consumed in different forms and at different stages. The mature dry bean is consumed as a pulse and the leaf, immature pods & seeds, as vegetables hence it is an important crop for food security. It is also an important crop for food diversification as well as adding flavour to carbohydrate rich meals, like maize, etc. As a major source of protein to most Malawians, the common bean is referred to as "*the meat of the poor*" even though wealthy people also prefer it. The residues of the crop are often used as fodder, hence it is a very economical crop (Wortmann, 2006). Other authors also agree that beans are economical crops due to their low input requirement demands. Beans fix nitrogen in the soil and this reduces the demand for nitrogen fertiliser to be used, hence cutting down input costs (Snapp *et al.*, 1998).

Common beans are an important cash crop as they provide a good source of income for many Malawians (Chirwa *et al.*, 2007). About 40% of Africa's total production of common beans is marketed at an annual value of US$ 452 million even though the production is largely for subsistence and mainly grown by women (Hillocks *et al.*, 2006). Generally, legumes are considered profitable compared to other crops since they have a short duration to mature and thus provide quick revenue.

Production of common beans in the country has been improving. For instance, in 2006 the country's production of dried beans was at 117,274 metric tons and in 2009, the production rose to 171,420 metric tons (FAOSTAT, 2011). It is incorrect to assume that the increase in production is equivalent to increase in productivity or yield. The crop's national average yield still remains low, explaining why people are still food insecure and malnourished. Therefore there is still a need to increase production to meet the growing population and to address food security.

2.4 BEAN SEED PRODUCTION AND DISSEMINATION IN MALAWI

There are several seed production systems in Malawi, including the formal seed production system and the local seed system. The formal seed system includes the contractual production and the seed imports whilst the local seed system includes the farmer saved seed. The most popular amongst smallholder farmers is the farmer saved production system. Below is an overview of bean seed production and the seed systems.

2.4.1 Overview of bean seed production

Despite all the associated benefits of growing beans, production of the crop remains relatively low in Malawi and Africa in general. For instance, of the 20 million hectares sown with legumes in Africa, only 5 million is under beans compared to the 11 million of cowpeas (Lupwayi *et al.*, 2011). In Tanzania, bean yield is 500 kg/ha as compared to a potential yield of 1500–3000 kg/ha under reliable rainfed, using improved seed varieties and proper crop and land husbandry (Hillocks *et al*, 2006). The same applies to Malawi where the yield increased from 237 kg/ha in 1994 to 459 kg/ha in 2003, but the average yield still remains lower than the potential which is in excess of 1500 kg/ha (Chirwa *et al.*, 2007). Some of the factors

accounting for this include poor performance of landraces due to pest and disease susceptibility, poor seed quality, poor management of the crop and drought. These problems mostly lead to seed insecurity at household farmer level and seed security is defined as the state in which a farmer has access to sufficient quantities of seed of their preferred varieties with adequate physical quality, at the right time of planting (Sperling & Cooper, 2003).

Over the years, much effort has been put into research and development so as to improve bean seed security among farmers. Such efforts have led to the release of several improved common bean varieties, nine by Bunda College of Agriculture and eight by Chitedze Research Station, adding to farmers own landrace varieties (Chirwa & Phiri, n.d.). Bean varieties have different characteristics that determine their attractiveness to consumers, however, for example, color, shape and size (Mazuma *et al.*, 2008). Consequently, the Ministry of Agriculture and Irrigation in Malawi under the Bean Improvement Programme started focusing on smallholder farmers' bean seed production as a way of promoting the improved varieties. Through provision of improved technologies, the Bean Improvement Programme encouraged smallholder farmers to produce the improved bean seed locally. The released bean varieties mostly combat the aforementioned production constraints (Chirwa *et al.*, 2007).

Bean crop production and productivity is mostly constrained by inadequate availability of seeds of suitable bean varieties. It is therefore important to note that preferences for varieties vary among farmers, traders and consumers, and likewise varieties vary in their adaptation to diverse environments including biotic and abiotic stress factors. As a way of improving production and productivity, a participatory varietal selection was conducted to identify preferred bean types and to develop efficient bean seed production and delivery systems. A total number of 20 preferred varieties was used for 2007 PVS trials across the country and the varieties included: NUA 35, NUA 56, NUA 45, NUA 59, CIM 9422-2, VTTT 924/17-2, VTTT 925/11-7, VTTT 924/4-4 3, PAN 150, MC 12832-8, Kabalabala (UBR (92) 25), Kholophethe (sugar 131), VTTT 924/2-4-2-1, VTTT 926/9-4, MC 12832-9, BOA 5-8/13, SSDT 55-C2, ECAB 07, MR 13508-8 and Local. Out of these 20 varieties, only five varieties were chosen to be preferred in Malawi. Farmers' selection criteria included: disease resistance, resistance to drought, tolerance to low soil fertility, early maturing, good leaf

texture for vegetable, good grain colour, large seed size, high yield, and marketability (Mazuma *et al.*, 2008).

The preferred five varieties plus some varieties bred by CIAT which are grown in the study areas were used to find the farmers' own preferred varieties in this study and reasons as to why they are preferred. Table 2.2 shows the varieties used for PVS in the study.

Table 2.2: List of Varieties Used for PVS in the Study

Variety name	Source	Year Released	Seed Size and Colour	Potential Yield (Kg/Ha)
Kambidzi (A286)	BIP	1995	Small, tan seeds with brown stripes	2500
NUA 45	DARS	2009	Large, red kidney, mottled seed	2400
NUA 59	DARS	2009		
VTTT924/4-4	DARS	2009		
Sapatsika (DRK 57)	BIP	1995	Large, red kidney seed	2000
Mkhalira (A344)	BIP	1995	Small tan/ khaki	2500
Napilira (CAL 143)	BIP	1995	Medium red speckled	2000
Maluwa (CAL 113)	BIP	1995	Medium red speckled	2000
Kholophethe (sugar 131)	BIP	2002	Medium cranberry sugar	2000
Kabalabala (UBR (92) 25)	BIP	2002	Small white canning type	2500
Nagaga (A 197)	BIP	1995	Large, tan seeds	2000

Source: Mazuma *et al.*, 2007; Reports

The choice of the varieties also depended on the region in which they are grown. There are some varieties which were used for the PVS in the study conducted country-wide but which cannot be used in this study since the varieties are not grown in Kasungu and Dedza districts. Therefore there was a need to strategically select the varieties and/or names of the varieties according to the area for conducting the study.

2.4.2 Formal bean seed systems in Malawi

Before any grain is called seed and ready to be planted, it needs to go through a process of germ plasm manipulation to develop an appropriate variety or hybrid. Once done, it goes through a multiplication process before it is released to farmers. Below are steps of seed systems from the breeder to the farmer who is the end user (Jaffee & Srivastava, 1994); (Maideni, 2001):

- **Development and release of variety**

  This involves breeding new varieties through selection, mutation, hybridisation, and or a genetic engineering process.

  The seed is tested on farm for other performance characteristics and gets permitted for use in definite environments.

- **Seed multiplication**

  Genetically pure seed known as 'breeder seed' direct from the plant breeder is further multiplied into certified seed through numerous generations to produce enough seed for general distribution.

  After the first multiplication of breeder seed, it becomes foundation or basic seed that can be further multiplied to produce certified seed which is taken by farmers for use. When the seed is not officially certified, the term used for the last generation is 'commercial seed'.

- **Seed processing**

  Processing of seed involves drying, shelling and sizing; the removal of inert matter and foreign seeds plus a range of seed handling or treatments for seed health.

- **Marketing and distribution of seed**

  This is where handling, transportation, storage, marketing research and on-farm demonstrations are done.

- **Quality Control**

  This is done at each stage after breeding, i.e. from seed multiplication to marketing and distribution. It involves seed crop inspection, testing and certification in order to prevent the flow of poor quality and foreign seed to farmers. It is also done to preserve genetic and physical purity.

2.4.3 Local bean seed systems in Malawi

Local seed systems, which supply about 99% of bean seeds in east and central Africa, are progressively being supported as an alternative to facilitate the accessibility of improved bean varieties to farmers. However, these systems have been rightly or wrongly criticised for supplying substandard quality seeds.

It is common practice for farmers in Malawi to retain seed from previous harvests for subsequent crop years. Most of the seed planted each year comes from seed retained from previous years. Even if certified bean seed is not made available to farmers, they still plant the crop. Farmers do their own quality control by choosing healthy and strong looking grains (Maideni, 2001). Research shows that 90% of the bean seed planted each year in Malawi comes primarily from seed retained from previous years but 80% of farmers can sometimes use sources from off-farm as well. They all have more than one source, though the 80% from off-farm is mostly used in times of crisis (Cromwell & Zambezi, 1993). Similar reports come from east and central Africa, where the local seed system supplies about 99% of bean seed planted (Rubyogo *et al.*, 2009). The reason for this is that farmers are often poorly linked to innovations in new bean varieties, for example, in areas where the National Agricultural Research Service has few mechanisms to enhance farmer exposure to new materials (Mazuma *et al.*, 2008). The poor complementarity between government and private sector investment and the lack of a focused varietal promotion programme limit the development of a commercial seed sector in Africa except in a few countries such as South Africa. According to Tripp and Rohrbach (2001), government policies in Africa focus primarily on public sector-based varietal development, production and distribution. In contrast, donor-initiated community seed projects provide free or subsidised seed as part of relief programmes. The

effect of this is that the development of a commercial seed industry is compromised in the face of limited profits.

Prior to 1995, the Bunda College of Agriculture released seed varieties to the National Seed Company of Malawi (NSCM) for multiplication and sale. However, the interest of the company in bean seed multiplication declined since it was not profitable as a result of farmers' tendency to rely on retained seed for a couple of years before replenishing their seed stocks. Since then, farmers can no longer access new and improved varieties (Chirwa *et al.*, 2007). To solve this problem, the BIP was introduced to develop a seed strategy using informal channels. This strategy involves multiplication of seed informally using smallholder farmers and distributing it through grocery shops, rural traders, extension agents, health clinics and NGOs. This is reinforced through leaflets, publicity, brochures, posters and radio messages in close cooperation with farmers, village traders, extension agencies, NGOs and various other institutions (Chirwa & Aggarwal, 2000).

The majority of farmers in Africa access seed mainly through informal channels which include seeds saved from farm, seed exchanges among farmers and the local seed markets. These channels contribute about 90–100% of seed supplies, depending on the crop (Rubiogo *et al.*, 2007:1). This study will identify the existing dissemination channels for farmer preferred varieties and their efficiency.

2.5 BEAN SEED MARKETING IN MALAWI

Good quality seeds of any preferred variety are the basis of improved agricultural productivity because they respond to farmers needs for both increased productivity and crop uses (Pelmer, 2005). Despite biotic and abiotic challenges faced by small scale farmers, responding to market demands seems to be a growing problem as well.

There are several factors influencing the marketability of a bean variety in a market. A study on consumer preferences for beans in Malawi and their influence on price reveals that the choice of beans in the market is to a large extent influenced by colour, which is usually associated with consumers' prior knowledge of factors such as familiarity, cooking time, and the taste of the variety. The country's bean prices at the market are mainly influenced by

principles of demand and supply, although social factors such as cooking time and grain colour can also have an influence on price (Chirwa, 2007).

In a study conducted to assess factors affecting demand for common beans in Malawi, it was found that bean prices varied within and across markets as well as across the bean types, based on preference. Price of beans mainly depended on availability. However, some variety characteristics such as cooking time, grain color and taste have also an influence on price of the bean varieties. The study found that the main marketing constraint was that market information about the most popular bean types was not shared among traders and producers for fear that producers would demand higher prices for their commodity. This leads to shortage of popular bean types which eventually results in high prices for such bean types. Bridging the information gap between traders and farmers is thus vital for consumers and producers to get the choice of bean varieties they want at the right price (Chirwa & Phiri, n.d.).

2.6 CONSTRAINTS TO AGRICULTURAL PRODUCTION IN MALAWI

Dorward (2006) reports that Malawi's economy performs poorly due to too much reliance on agriculture, high population density versus small land holding sizes, low maize productivity (the staple crop which accounts for around 70% of cultivated area), depressed world prices for traditional export crops, lack of other renewable natural resources, high import and export costs due to the land-locked location of the country and poor external transport systems, large budget deficits due to poor macro-economic management, high interest rates, continuing large devaluations of the Malawi Kwacha (MK) and high inflation rates, poor physical infrastructure, weak governance, high rates of HIV/AIDS infection, chronic poor health with very high infant mortality from malaria, water-borne diseases and mal- and under-nutrition (50% of those aged under five are malnourished) and low literacy levels plus poor education.

Since the economy depends heavily on agriculture, poor performance in the rest of the economy constrains growth in agriculture and contributes to constraining agricultural productivity in the country. Too much dependence on erratic rainfall, small farm size, limited use of modern inputs, and poor access to markets result in many farmers failing to meet their

subsistence requirements, leading to food insecurity. In addition, factors that constrain agricultural productivity in Malawi are:

- **Decreasing agricultural land productivity**: A decrease in agricultural land productivity is caused by several factors, including land degradation and scarcity of agricultural land. On average, there are 0.4 people per ha in sub-Saharan Africa compared to 2.3 rural people per ha of agricultural land in Malawi only. An increase of 0.25 ha per capita of cultivated land can decrease the likelihood of food insecurity by an average of 24.3% across the country, as predicted by Lewin and Fisher's model simulation. In this regard, there is therefore a need for government to concentrate on policies that increase productivity per unit land area through an expanded use of modern farm inputs as well as improving market infrastructure (Makombe *et al.*, 2010).

- **Lack of market infrastructure investment**: A study by Lewin and Fisher concluded that food insecurity increases as the distance from a weekly market among households in the north of Malawi increases and with increasing distance from an Agricultural Development Marketing Corporation (ADMARC) depot in the central region. If food security is to be achieved, farmers need reliable access to markets for selling and purchasing of products (Makombe *et al.*, 2010).

- **Limited smallholder farmer education**: Education can enhance farm productivity in many ways like better understand of technologies, improved access to information especially that which comes through written documents and many other different ways. Education is thought to be most crucial to agricultural production in a rapidly changing economic or technological environment. Unfortunately, literacy rates in urban areas are obviously higher than in rural areas because of lack of awareness. A study by Lewin and Fisher shows that productivity can improve if the education of the household head is increased. On average, farmers in Malawi attain 4 to 6 years of education, and extending this to 12 years to secondary level would make a difference in farming. The extended education should incorporate skills and/or vocational training as part of primary and secondary training (Makombe *et al.*, 2010).

- **Minimal extension services**; Extension services assist in disseminating information on the new technologies available, marketing systems and many other issues. Farmers in Malawi are facing challenges like lack of information and knowledge on markets, technologies and rural financial services and the government is constrained to setting up an information and knowledge system that can reach smallholder farmers.

2.7 CONSUMER DEMAND CONCEPT

"*Consumer demand is a key driver to today's agricultural and food demand*" (Caswell and Joseph, 2007). Consumers no longer purchase food just to satisfy their physiological calorie requirement, but are increasingly concerned about quality. For instance, a Malawian bean variety called Phalombe was found to be preferred by farmers and consumers due to its taste, shorter cooking time and its grain colour which gives a deep red sauce when cooked, making it a good contrast with the white maize-based dish which is the staple food for Malawi (Chirwa & Phiri, n.d.). New products or varieties that successfully cater to consumers' demand for quality and other attributes often outsell comparable alternatives.

Even with highly diversified and rapidly changing consumer preferences, new products and their associated marketing strategy must adapt as well. Increasing interest in the preferred varieties can be seen as a response to this trend and it is expected that improved varieties will continue to be developed in the future. Therefore, regardless of producer size, consumer acceptance is the key element in determining if the market for improved varieties is sustainable. When an improved variety is released, consumer acceptance should be assessed.

2.8 WILLINGNESS-TO-PAY FOR NEW IMPROVED BEAN SEED VARIETIES

The primary determinants of technology/ product adoption and pricing decisions are production costs and consumer demand for the new technology/ product. Production costs are easy to estimate, but assessing consumer demand for a technology or/ product is more complex. In the traditional sense, consumer demand, or willingness to pay (WTP) is a Hicksian surplus measure. Willingness to pay is the price that an individual is willing to spend or give up to obtain a good or service. Theoretically, it measures the maximum amount of money an individual is willing to give up to either obtain a product with quality q or exchange

a product with quality q_0 for a product with quality q_1 (Lusk & Hudson, 2004). The principle behind WTP is that the maximum price that someone is willing to pay for a good portrays the value the individual attaches the good.

There are three basic methods to elicit willingness to pay (consumers' economic value) for preference, and these includes: written surveys, personal interviews and experimental auctions. The three broadly used techniques used to estimate willingness to pay are; conjoint analysis, contingent valuation and experimental auctions (Umberger *et al.,* 2002).

Experimental auctions basically deals with kind of real situations where a consumer determines how much they can pay for a good or service. The flaw of this mention is that there is no control for demand reduction or wealth effects (Lusk, 2003; Feuz *et al.,* 2004). Conjoint analysis and contingent valuation are hypothetical valuation methods that use survey responses to elicit willingness of consumers (Munene, 2006).

Contingent valuation is originally an environmental and private good concept but has recently extended to evaluation of WTP for private goods especially those that do not have a defined market (non-market goods). The method uses surveys to elicit WTP bids. The questionnaire used can be open-ended or close-ended questions. The method uses single-bounded or double-bounded dichotomous choice questions to estimate non-market good and extended to assessment of novel food products (Lusk and Hudson, 2004)

2.9 WILLINGNESS TO PAY THEORY REVIEW

Contingent valuation (CV) is a survey-based method of assessing how consumers evaluate goods and services not found in the market place. These surveys only give meaningful results if they are properly grounded in a consumer or producer maximisation framework (Hanemann & Kanninen, 1998). Haab and McConnell (2002) define CV as a method of recovering information about preferences or willingness-to-pay from direct questions and its function is to estimate individual willingness-to-pay for changes in the quantity or quality of goods or services, as well as the effect of covariates on willingness-to-pay. Agribusinesses such as farming, technology and agricultural service providers assess producer or farmer willingness-to-pay for a new product or service. Although the concept of willingness-to-pay has

commonly looked at utility maximisation of consumers, evidence has shown that it can be extended to producers. In such a case, the producer's profit maximisation decision is subject to a given production function (Lusk & Hudson, 2004).

According to Lusk and Hudson (2004), fixing the level of input r exogenously, a farmer chooses to use the level of input x. Therefore, r can be the level of a new technology, or the quality of some input. Given w as a vector of input prices and p as a vector of output prices, the farmer then chooses the optimal level of inputs and outputs, which yields the indirect restricted profit function, $\pi\ (p, r, w)$. Assuming that quality of an existing seed technology is to be improved from r_0 to r_1, the willingness-to-pay for the change will be: WTP = $\pi\ (p, w, r_1)$ $-\pi\ (p, w, r_0)$. Hence willingness-to-pay represents the maximum amount of profit a producer would be willing to forgo to obtain r_1 rather than r_0. In the context of this study, willingness-to-pay is the maximum amount of income the farmer is willing to spend for the preferred improved varieties.

People differ in their WTP for a particular good with particular attributes, and interesting market information is drawn from these distributions among the target population. Estimation of this distribution can be through open-ended or close-ended questions. Often, people find it difficult to mention the amount they are willing to spend for the good quality product in open-ended questions, though such questions provide direct estimate willingness-to-pay and are easy to analyse (Hanemann & Kanninen, 1998). Close-ended questions are often the method of choice since it is closer to real-life situations (Arrow *et al.*, 1993). WTP is not directly observed in this method, but assumptions about its distribution and its parameters can be made from the sample data and the mean WTP of a population in monetary terms can be estimated (Lusk & Hudson, 2004).

There are several approaches developed including the single-bounded, double-bounded and multiple-bounded dichotomous choice. The conventional single-bounded contingent valuation method survey involves asking a respondent if they would pay a given amount to secure a given improved quality commodity. In this case, the respondent is only presented with one bid to either accept or reject. However, the method is statistically not very efficient and also requires a large sample size. With the double-bounded contingent valuation method, the initial question is followed with a second question, involving a specific monetary cost to which a

binary response can be given. The amount presented in the second bid depends on the first bid. If the answer was a 'no' to first bid, the second bid will be a lower amount, if 'yes' then a higher amount. This method integrates information on individual's willingness-to-pay; hence it provides more efficient estimates and tighter confidence intervals (Hanemann *et al.*, 1991). The double-bounded method has been extensively used in valuing non-market goods, as well as, assessing consumer acceptance of improved technologies (Kimenju & De Groote, 2008; Li *et al.*, 2002; Lusk, 2003). However, maximum likelihood estimation is required when doing analyses of the double-bounded approach and the interpretation is not always straightforward.

Multiple-bounded and polychotomous choice methods offer multiple bids and multiple choices (Alberini *et al.*, 2003). Multiple bidding becomes useful in the case where limited information is initially available to decide which bids to include. Multiple choices offer the possibility of including options for uncertainty. However, the approach is subject to design bias, and is influenced by the variety of bids included. More research is currently being carried out and it is expected that it will shed more light on the shortcomings of this approach (Kimenju & De Groote, 2008).

2.10 REVIEW OF EMPIRICAL STUDIES ON WILLINGNESS-TO-PAY

A number of recent studies have reviewed and reported willingness-to-pay (WTP) estimates for technologies with potential application for many agribusiness studies. Therefore, this section will provide a review of different willingness-to-pay studies, the methodologies used and choice of methodology for this study.

Lusk & Hudson (2004) came up with a guide for improving future studies estimating consumer willingness-to-pay, especially when the aim is assisting agribusinesses in product adoption decisions. According to their study, there is a need to recognise the objective of willingness-to-pay elicitation, which is different depending on whether the application is agribusiness related versus environmental policy. With the emerging growth of novel food products, agricultural economists have turned their attention towards estimating value of the products so as to help agribusinesses with adoption decisions. To elicit consumer WTP for the novelty products or food, rigorous contingent and experimental valuation techniques have been developed.

Loureiro & Hine (2001) assessed consumer preference for local (Colorado-grown), organic and GMO-free products in order to find their potential niche market. Socio-demographic characteristics that affect consumer preference were identified and compared to the effects of different attributes of consumers' willingness-to-pay. The contingent valuation (CV) technique was used to value the different attributes of consumers' willingness-to-pay and to identify the socio-demographic characteristics that affect consumer preferences; the multiple-bounded Probit analysis was used. The study concluded that the 'Colorado-grown' attribute affords the potato producer the highest consumer acceptance and premium (relative to organic and GMO-free). The 'Colorado-grown' potatoes must be of high quality in order to secure a higher premium.

Kimenju and De Groote (2008) assessed consumer WTP for GMO food in Kenya using a double-bounding dichotomous choice model. The study concluded that there is still a low awareness and a need for appropriate communication to involve the consumer in the debate. Consumer acceptance of GMO products was found to be high.

In a case study of pure blueberry sweetener, an assessment to analyse the demand for new value-added product was conducted and a single-bounded contingent valuation (CV) approach was used to elicit consumer WTP. Results showed that on average, survey respondents in Kentucky were not willing to pay enough for the product to cover its production costs (Hu *et al.*, 2010).

Lusk (2003) conducted a study to determine the effects of 'cheap talk' on consumer willingness-to-pay for golden rice and contingent valuation using double-bounded dichotomous choice was used to assess willingness-to-pay. The results showed that cheap talk significantly reduced willingness-to-pay for consumers unknowledgeable about golden rice and genetic engineering. The advantage of using single-bounded dichotomous choice to estimate willingness-to-pay is that it is straightforward to answer and reduces the time needed to complete the whole survey (Hanemann, Loomis & Kanninen, 1991). The conventional valuation techniques like the single-bounded dichotomous question are not incentive-compatible when considering the provision of a new private good in a hypothetical context. The most commonly used method is the double-bounded dichotomous approach where there is a follow-up question included dependent on the first answer.

The advantages of the double-bounded approach include an increase in the statistical and valuation efficiency. The approach yields more efficient estimates of mean willingness-to-pay than the single-bounded dichotomous approach. This is due to the fact that the double-bounded dichotomous approach incorporates more information about an individual's willingness-to-pay than the single-bounded dichotomous choice approach (Hu *et al.*, 2010). Despite all the advantages, the drawbacks of the double-bounded dichotomous approach are that the method may not be incentive compatible in a hypothetical context, first and second dichotomous choice questions may not be perfectly correlated and bring into question which willingness-to-pay estimate is most relevant and finally, the approach suffers starting point biases: responses to the second question depend on the price offered in the first (Lusk & Hudson, 2004).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The methodology employed for this study is the contingent valuation method using double-bounded dichotomous choice. This chapter will therefore give a detailed account of the application of double-bounded dichotomous choice to willingness-to-pay. The chapter will begin by briefly discussing the sample and sampling techniques, data collection methods and data analysis.

3.2 SURVEY DESIGN

A survey was used to collect data on the farmer's willingness to pay for new improved common bean seed varieties as well as on the traders marketing channels in the Kasungu and Dedza districts. Farmers involved in bean production were the target group of this study coupled with local traders involved in bean seed trade. Initially, the study targeted all the traders in the value chain of bean seed production but since the good is only traded informally, the target group narrowed to only local traders who in most cases are also involved in farming. The farmers' questionnaire had ten brief sections. Sections one to four had information on identification of households, socio-economic data and demographics of households, income of households and information on bean seed production, knowledge and awareness. Section five has information on perception of farmers with regard to new improved bean seed, section six was on farm labor and size. Sections seven and eight were on output and output costs and market access and availability of commodity on market. Section nine was on the extension services farmers receive and finally the last section was on the farmers' willingness to pay. A scenario was presented first followed by the questions on willingness to pay. With traders, the questionnaire was slightly different but basically has most information similar (Appendix II).

3.3 MEASUREMENT OF WILLINGNESS-TO-PAY

Of the three techniques reviewed earlier, the study adopted contingent valuation method. The conjoint analysis and experimental auction were thought not to be appropriate for this study. With the experimental auction, the commodity needs to be already established at the market (Maynard *et al.,* 2004). This could have been a problem with the improved variety of beans which are not yet established on the market. The conjoint analysis, even though it is a hypothetical method like the contingent, Lusk and Hudson (2004) reported that the method is consistent with Lancaster's theory of utility maximasation, and it mimics a typical consumer's experience in shopping. The method portrays decisions made by consumers as realistically as tradeoffs among multi-attribute products. This method is usually used in development of new products since it understands how consumers develop preference for certain goods or services (Darby *et al.,* 2008).

There are several factors that add up to the total utility of an improved bean seed. In addition to the increased nutrition and the health benefits which includes iron and zinc supply to human beings, there are other factors that are important traits but cannot be hypothesized. These factors are taste, smell, and touch. Experimental auction would be the best option to capture this using sensory evaluation. But due to time and cost constraints, the study could not adopt this method leaving the contingent valuation the best option.

3.4 THEORETICAL FRAMEWORK OF CONTINGENT VALUATION

Theoretically, it is assumed that the willingness-to-pay of a group of consumers for a particular product at a price (or bid) β, have a certain probability distribution function. Furthermore, this distribution function can be seen as a function of the price, with the higher the price the lesser the probability of being accepted. In applied research, the most commonly used function is the logistic distribution with effects of price entered indirectly in an argument called the index function, denoted as v. The most common index function is linear in the price or bid, β:

$$v = a - p\beta \tag{3.1}$$

The probability distribution of the willingness-to-pay is then:

$$P(WTP = \beta) = \exp(v) / (1 + \exp(v))2 \tag{3.2}$$

The advantage of logistic function is the closed-form cumulative distribution function G (.), which represents the proportion of the population of which their willingness-to-pay lies below a certain value β:

$$G(W) = P(WTP < \beta) = \exp(v) / (1 + \exp(v)) \tag{3.3}$$

Respondents who accept an offer of value β are those whose willingness-to-pay is equal to or higher than β (Hanemann & Kanninen, 1998; Hanemann *et al.*, 1991). In the double-bounded dichotomous choice, a household is presented with two bids, either to accept or reject. The household's choice can be analysed using binary response statistical models. The outcomes of the responses can be modelled to take the values (0, 1), thus 0 for a household that decides to reject the bid and 1 for a household that decides to accept. However, the limitation of this study is that it will not adopt any statistical model due to the type of data collected.

The level of the second bid is dependent upon the reaction to the first bid. If the participant said 'yes' to the first bid $\left(\beta_i^1\right)$, the second bid $\left(\beta_i^u\right)$ will be an amount greater than the first bid $\left(\beta_i^1 < \beta_i^u\right)$; if the response was 'no' to the first bid $\left(\beta_i^0\right)$, the second bid $\left(\beta_i^u\right)$ will be a smaller amount compared to the first bid $\left(\beta_i^u < \beta_i^0\right)$. Therefore, there will be four possible outcomes: (a) both answers are 'yes'; (b) both answers are 'no'; (c) a 'yes' followed by a 'no'; and (d) a 'no' followed by a 'yes' and respectively, the likelihoods of these outcomes are: $\pi^{yy}, \pi^{nn}, \pi^{yn} and \pi^{ny}$. Under the assumption of a utility maximising respondent:

$$\beta_i^u > \beta_i^1$$

$$\pi^{yy}\left(\beta^{1}_{i},\beta^{u}_{i}\right)=\Pr\left\{\beta^{1}_{i}\le\max WTP \text{ and } \beta^{u}_{i}\le\max WTP\right\} \tag{3.4}$$

$$=\Pr\left\{\beta^{1}_{i}\le\max WTP\middle|\beta^{u}_{i}\le\max WTP\right\}\Pr\left\{\beta^{u}_{i}\le\max WTP\right\}$$
$$=\Pr\left\{\beta^{u}_{i}\le\max WTP\right\}=1-G\left(\beta^{u}_{i},\theta\right)$$
$$\text{Since,with }\beta^{u}_{i}>\beta^{1}_{i},\Pr\left\{\beta^{1}_{i}\le\max WTP\middle|\beta^{u}_{i}\le\max WTP\right\}\equiv 1$$
$$\text{Similarly,with }\beta^{0}_{i}<\beta^{1}_{i},\Pr\left\{\beta^{0}_{i}\le\max WTP\right\}\equiv 1$$

$$\pi^{nn}\left(\beta^{1}_{i},\beta^{0}_{i}\right)=\Pr\left\{\beta^{1}_{i}>\max WTP \text{ and } \beta^{0}_{i}>\max WTP\right\}=G\left(\beta^{0}_{i},\theta\right) \tag{3.5}$$

When a 'yes' is followed by a 'no,' we have $\beta^{u}_{i}>\beta^{1}_{i}$ and

$$\pi^{yn}\left(\beta^{1}_{i},\beta^{u}_{i}\right)=\Pr\left\{\beta^{1}_{i}\le\max WTP\le\beta^{u}_{i}\right\}=G\left(\beta^{u}_{i},\theta\right)-G\left(\beta^{1}_{i},\theta\right) \tag{3.6}$$

When a 'no' is followed by a 'yes,' we have $\beta^{0}_{i}<\beta^{1}_{i}$ and

$$\pi^{ny}\left(\beta^{1}_{i},\beta^{0}_{i}\right)=\Pr\left\{\beta^{1}_{i}\ge\max WTP\ge\beta^{0}_{i}\right\}=G\left(\beta^{1}_{i},\theta\right)-G\left(\beta^{0}_{i},\theta\right) \tag{3.7}$$

In equation (2.7) and (2.8), the second bid permits the researcher to place both upper and lower bound on the respondent's unobserved true WTP, while in equation (2.5) and (2.6) the second bid sharpens the single bound it raises the lower bound or lowers the upper bound. If probabilities of the four outcomes are to be combined, the log-likelihood function for a sample of *N* respondents takes the form:

$$\ln L^{D}(\theta) = \sum_{i}^{N} \left\{ \ln \pi^{yy}\left(\beta_i^1, \beta_i^u\right) + d_i^{nn} \ln \pi^{nn}\left(\beta_i^0, \beta_i^u\right) + d_i^{yn} \ln \pi^{yn}\left(\beta_i^1, \beta_i^u\right) + \ln \pi^{ny}\left(\beta_i^0, \beta_i^u\right) \right\} \tag{3.8}$$

Where $d_i^{yy}, d_i^{nn}, d_i^{yn}$ and d_i^{ny} are binary variables with 1 representing the occurrence of that particular outcome, and 0 otherwise (Hanemann & Kanninen, 1998; Hanemann *et al.*, 1991).

3.5 SELECTION OF THE CROP

Beans were selected due its importance in alleviating food insecurity and the significance of the crop to Malawi's economy. Apart from the above mentioned reasons, the research was sponsored by the International Center for Tropical Agriculture (CIAT) of which in one of the organization's projects had an objective which fitted well with this topic. CIAT has global responsibility for the improvement of two staple foods, cassava and common bean, together with tropical forages for livestock. The organisation believes that these crops are vital for global food and nutrition security.

An interesting question would be why the use of hypothetical method on a good that is already on the market? It is a known fact that in contingent valuation, responses are obtained from individuals as to their actions contingent on the incident of a specific hypothetical situation. A contingent valuation approach which is a hypothetical valuation technique is appropriate for this study, even though the good being valued is on the market already. The concept of improved new varieties is relatively new to some farmers and besides they are still using traditional seed thus why shortages in production persist. Farmers who are not well informed may not pay attention to new improved seeds neither will they be able differentiate improved seed varieties from the traditional seeds.

Some studies have researched on goods which are already on the market using contingent valuation, for instance; Munene (2006) on the analysis of consumer attitude and their willingness to pay for functional foods in America.

3.6 SAMPLE AND SAMPLING TECHNIQUES

The aim with sampling is to select individuals or entities in a population in such a way as to permit generalisation about the phenomena of interest from the sample of the population. The most important element of the sampling procedure is the choice of the sample frame to constitute a representative subset of the population. Again, sampling is also concerned with representativeness in the selection of individual respondents from the sample frame. One feature of representativeness is to give each potential respondent an equal chance of being included in the sample. Random selection of households from the sample frame is required in order for demonstrate representativeness. Another feature of representativeness is selection of a specific respondent from each household. In the household study, this is what is called purposive sampling. Therefore, this shows that sampling issues involve judgment rather than the simple application of a technique (Pinsonneault & Kraemer, 1992). In this study, both purposive and random sampling was employed.

The survey was conducted in Kasungu and Dedza districts. These areas were chosen because they are amongst the major growing districts of common beans and are located along the M1 main road that run across the country, passing through Lilongwe, the capital city of Malawi, which promotes the trade of common beans produced in these districts. In both districts, improved bean seed varieties were introduced and PVS was conducted among the farmers.

A purposive selection was done of the Kaluluma and the Bembeke Extension Planning Areas (EPAs) in the Kasungu and Dedza districts respectively. In the Kaluluma EPA, households were sampled from Bokosi, Chibai, Shawa, Chinseu. Julius Chirwa, Kaindeinde, Kambadya, Makopala, Robert, Siladi and Sitima villages. In the Bembeke EPA, households were sampled from Chikosa, Chimlambe, Chitsonga, Kafulama, Kamgulitse, Kantande, Katsinde, Masula and Ng'ona villages. These villages formed the intervention households. Simple random selection was used to select the study participants and a total number of 132 participants was sampled.

To describe and analyse marketing channels of common bean seed, traders around the EPAs were also interviewed and a total sample of 19 traders was selected using purposive sampling. These are traders located in the areas and markets around the villages.

3.5.1 Sample Size Selection

Determining sample size and dealing with non-response bias is essential in sampling design. The question is how large a sample can be in order to infer research findings back to a population. Given a population which is categorised into those using the improved varieties and those not using them, a sampling technique with categorical data is going to be used.

At a confidence level of 95% and a confidence interval of 5%, a sample frame of 422 common bean farmers and 38 traders should have been interviewed in line with equation 3.1 given below. But due to time constraints, 132 farmers growing beans plus 19 traders involved in trading bean seed were interviewed. This is due to the fact that in parametric analysis, a sample above 30 is representative. Below is the equation used to calculate sample size and the actual calculations are shown in Appendix I (Bartlett *et al.*, 2001:47)

$$n = \frac{t^2 * (p) * (q)}{d^2} \qquad (3.9)$$

Where:

n = sample size

t = value of selected alpha level (e.g. 1.96 for 95% confidence level)

p and q = percentage of picking a choice expressed as decimal (e.g. 0.5)

And

q = 1- p

d = percentage error in a given confidence interval (e.g. 0.05= ± 5%)

3.6 DATA COLLECTION

The type of data which was collected was primary. This is data collected directly from individuals for a purpose of a specific study or information (Agarwal, 2006). The method of enquiry used was personal interviews also known as personal enquiry methods. Primary data was collected through the administration of structured questionnaires (Appendix I & II). The

data collected focused on the demographic, institutional, economic, awareness, and willingness-to-pay for improved varieties of beans among farmers and traders. Four enumerators were used to undertake the data collection. Training of enumerators on methods of data collection and interviewing techniques was done prior to data collection. The principal investigator continuously supervised the whole process to correct possible errors on the spot.

The study also used secondary data. This is statistically treated data collected by certain people or agency (Agarwal, 2006). Secondary data such as economic, past studies and production data was collected from different sources like books, journals, reports, research publications and census reports, among other sources. Qualitative methods, for instance, observations and informal discussions with key informants were used to collect general information like practices, knowledge and attitude towards the improved varieties.

3.7 DATA ANALYSIS

The data collected was entered in Statistical Package for Social Scientists (SPSS) for analysis. Data cleaning was done to remove outliers and incomplete responses. Data was analyzed and measure of central tendencies and dispersion like mean, median, standard error and variance were used in the analysis. Inferences about the population were made through frequency distributions, t-tests and chi-squares.

To measure knowledge and awareness of respondent's with regard to new improved seed varieties, farmers were asked if they had ever heard of or planted new improved bean seed and source of information. Respondents' perception was captured by issuing a statement requiring responses to a five-point likert scale ranging from strongly disagree to strongly agree. A neutral response was included so to allow possibility of respondents with lack of opinion.

The existing marketing channels were found by asking farmers how they access improved bean seed varieties. If they mention purchase, a follow up question on where they purchase was asked. Similarly, traders were asked on their buying and selling market of the improved bean seed. After gathering such information, a qualitative analysis was done to come up with the channels.

The study sought to assess farmer's willingness to pay for new improved varieties of common beans. For one to make a financial commitment in order to obtain a good there is need for awareness and importance of the commodity. Based on that knowledge, the individual will make a perception which will help them decide whether the commodity is wealth the premium or not. Therefore a scenario was presented to the respondents, explaining the importance of common beans to human nutrition and economy, the characteristics of the improved bean seed. This was done to bring awareness of the improved bean seed varieties to the respondents. The respondents are also made aware of the problems associated with planting poor quality seed. It is always important to know that when designing a scenario for a CV study, it is good to make it simple to ensure understanding of the respondents. Anonymities can affect the answer of WTP (Mattsson *et al.,* 2007). Therefore, proper consideration and care was taken when designing the scenario.

Frequencies were used to come up with frequency distribution of the responses from the open ended question. To find mean willingness to pay, confidence interval was used. Confident intervals for willingness to pay are known for producing accurate results. A study on evaluating of four approaches to estimating confidence intervals for willingness to pay measures came into a conclusion that the simulation study was supported by the findings of the empirical application in that all the methods produced fairly similar confidence intervals hence can use either approach of confidence interval (Hole, 2007).

CHAPTER 4

FARM HOUSEHOLDS CHARACTERISTICS AND WILLINGNESS-TO-PAY SURVEY RESULTS

4.1 INTRODUCTION

The chapter outlines the empirical findings of the farm households from the survey. A descriptive analysis of the sampled farmer households is given in order to provide a contextual understanding for the study. Chi-square and t-tests were used in the analysis for the statistical hypothetical test. Further in the chapter is an outline of descriptive analysis of households' willingness-to-pay and the mean willingness-to-pay is computed.

4.2 SOCIO-ECONOMIC CHARACTERISTICS OF THE HOUSEHOLDS

4.2.1 Sex of respondent and household head

The key aspects of household composition, which include sex, age and education of household head coupled with size of the household, are important since they are associated with the welfare of the household. For instance, it is mostly perceived that female-headed households are poorer than those headed by men, age of household head is associated with experience and the more educated the household head is, the more the chances of being creative in widening the income base in a household. Economic resources are less adequate in households with large numbers of people than in smaller households.

During the survey, 68.9% of the total respondents were female compared to 31.1% male. Although more female members were interviewed, most Malawian households are headed by males. The Malawi Demographic and Health Survey (MDHS) reported that, on average, 72% of the households in Malawi are male-headed (NSO, 2011). Table 4.1 shows a summary of the sex and marital status of the sampled farmer households. Results show that 84.1% of the bean farmer households are male-headed and 15.9% are female-headed-slightly higher results

than the national average. The table further shows that 82.6% of the male-headed households are married whilst the rest are separated (4.5%), widowed (11.4%) or single (1.5%).

Table 4.1: Summary of Sex of Respondents and Household Head

Sex of household head	**N**	**Percentage**
Male	111	84.1
Female	21	15.9
Total	**132**	**100.0**
Marital status	**N**	**Percentage**
Married	109	82.6
Separated	6	4.5
Widowed	15	11.4
Single	2	1.5
Total	**132**	**100.0**

Source: Author (2012)

In this regard, a conclusion can be made that even though a number of female-headed households are involved in this activity, findings from the study confirm that farming is mostly an activity of married people and it can even be said that women are more receptive to development than men. There is a direct relationship between marital status and household size, as farmers who are married tend to have children who contribute to farm labour (Abu *et al.*, 2011).

After testing the relationship between gender of the household head and willingness-to-pay for the improved varieties of common bean, results from Table 4.2 below show that willingness-to-pay is independent of sex of the household head.

Table 4.2: Sex of Household Head and Willingness-to-Pay for the Improved Varieties

Sex	**Willing-to-Pay**		**Not Willing-to-Pay**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
Male	97	73.5	11	8.3	108	81.8
Female	20	15.2	4	3.0	24	18.2
Total	**117**	**88.6**	**15**	**11.4**	**132**	**100.0**

Source: Author (2012)[4]

[4] $x^2 = 0.75, p = 0.387$

There is no statistically significance association between sex of household head and willingness-to-pay for the improved varieties.

4.2.2 Age of household head

It is important to take note of the age of a farmer since it can be used as a proxy for experience in farming. Table 4.3 shows the age of household head and that the mean age of the household head among common bean farmers is 46 years with 24.2% of the household head above 60 years of age. The cross-tabulation results show that the number of people willing to pay for the improved varieties increases with age, as it was found that 22.7% of the household heads, which is also the largest category, are above 60 years of age and willing to pay for the improved varieties.

Table 4.3: Age of Household Head and Willingness-to-Pay for the Improved Varieties

Age	Willing to Pay		Not Willing to Pay		Total	
	N	%	N	%	N	%
20–29 yrs	18	13.6	2	1.5	20	15.2
30–39 yrs	26	19.7	3	2.3	29	22.0
40–49 yrs	28	21.2	3	2.3	31	23.5
50–59 yrs	15	11.4	5	3.8	20	15.2
> 60 yrs	30	22.7	2	1.5	32	24.2
Total	**117**	**88.6**	**15**	**11.4**	**132**	**100.0**

Source: Author (2012)

The cross-tabulation results confirm that the older the farmer the more experienced he/she is from all the years spent in farming and it is expected that they respond well to improved technologies hence will be willing to pay for improved technologies. However, these results are not statistically significant.[5]

4.2.3 Education of the household head

Access and use of information is an important element as far as adoption of new technologies is concerned. One of the key factors that play a major role in uptake of information is education. Studies have shown that farmers with at least basic education are better informed,

[5] $x^2 = 4.677, p = 4.008$

not only about technologies, but also about the negative effects of unsustainable practices (Mathijs, 2003:14). The more educated the individual is, the more rationally he/she thinks, and the adoption of innovations involves rationality.

Below is Table 4.4 with a summary of willingness-to-pay against education. It is clearly shown in the table that most of the farmers who have adopted the improved common bean varieties in the study area have at least attained basic education. Only 5.3% of household heads are illiterate, meaning they did not attend any form of education at all. Most (78.8%) of the farmers who are growing the improved varieties of common beans have attained junior and senior primary education. Only a few household heads (15.9%) had attended school beyond primary level, i.e. secondary school.

Table 4.4: Willingness-to-Pay by Education Level of Household Head in Years of Formal Schooling

Education	Whether WTP for improved varieties or not				Total	
	Yes		No			
	N	%	N	%	N	%
No education	6	4.5	1	0.8	7	5.3
Std 1–5 junior primary	41	31.1	3	2.3	44	33.3
Std 6–8 senior primary	50	37.9	10	7.6	60	45.5
Secondary education	20	15.2	1	0.8	21	15.9
Total	**117**	**88.6**	**15**	**111.4**	**132**	**100.0**

Source: Author (2012) Note: $x^2 = 3.546$ (1, N = 132), $p = 0.315$

In absolute values, most of the farmers who attained primary education are more willing to pay for the improved varieties. But statistically, there is not much difference among the educational classifications since a number of farmers are still willing to pay regardless of education. In this study, the results show that educational attainment of household head on its own does not influence willingness-to-pay. As such it can be concluded that none of the farmers had attained enough education to influence willingness-to-pay for the improved varieties of common beans hence education is independent of willingness-to-pay.

4.2.4 Household family size

Family size is an important element in a household unit because it can determine the income levels of a family. Big family size can be advantageous and/or disadvantageous in that, if

there are a lot of family members in a household who are in the economically active group, they can contribute to labour on the farm as well as the income base. On the other hand, a big family size can increase expenditure in the household.

Table 4.5 shows the results of family size of the surveyed households against willingness-to-pay. On average, most households in the study area, regardless of whether willing-to-pay for improved varieties or not, have 4–6 family members. The exact average household size was found to be 5.27, which is slightly higher than the national average of 4.6 (NSO, 2011). The number of households with an average of 4–6 members, which were WTP for the innovation, was 55.3% of the total sample as compared to 12% of the total population in the same family size category which was not willing to pay for the innovation, as shown in Table 4.5.

Table 4.5: Household Family Size and Willingness-to-Pay

Total household size	WTP for preferred improved bean variety				Total	
	Yes		No			
	N	%	N	%	N	%
1–3	20	15.2	1	0.7	21	15.9
4–6	73	55.3	12	9.1	85	64.4
7–9	20	15.2	2	1.5	22	16.7
10–12	4	3.0	0	0	4	3.0
Total	**117**	**88.6**	**15**	**11.4**	**132**	**100.0**

Source: Author (2012)[6]

Assessing the composition of adults in the household, it was found that 44% of the households had at least 2 adults in a household. The mean household composition of adults is 3. This can mean that on average 3 adults can help with farm activities. The study further analyzed the mean number of hour's family members spend in a farm and it was found that, on average, adults spend about 5 hours per day and children spend about 2 hours per day on their farm. This shows that most adult members work on the farm on full-time basis.

[6] The chi-square test shows that family size is independent of willing-to-pay or in other words, there is no relationship between family size and willingness-to-pay for improved varieties of common bean seed as $X^2 = 2.174$ $_{(3,\ 0.537)}$ $p = 0.537$

4.2.5 Occupation of household head

Malawi is predominantly a rural country with an agricultural-based economy. The majority of rural people derive their livelihood from agriculture since the rural area is characterized by lack of decent jobs and poverty. The country is characterized by smallholder farmers as opposed to commercial (FAO, 2011).

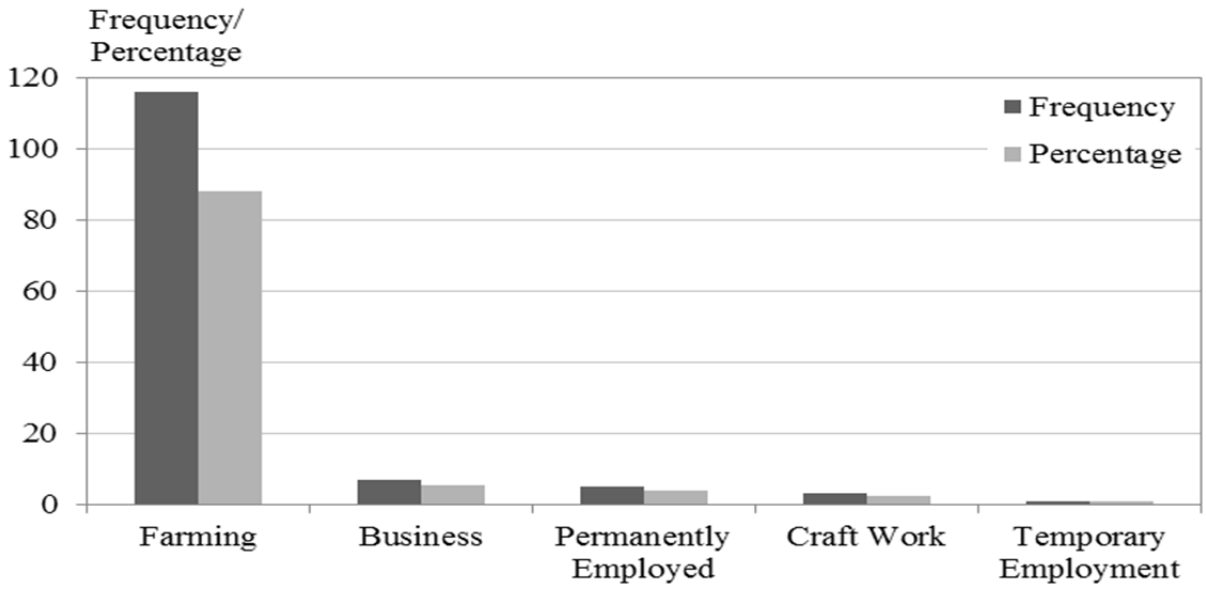

Figure 4.1: Main Occupation of Household Head

Source: Author (2012)

This is also true with the study area, as shown in Figure 4.1 above, that about 88% of the household head's main occupation is farming. The remaining 12% is shared among these occupations: business, permanently employed, craft work and temporary employment.

4.2.6 Income of a household

To capture household income, the study used monthly expenditure as a proxy for income since people cannot spend more than what they earned plus borrowed and because many farmers do not disclose the real value of their monthly income. Therefore, income was calculated from expenditures on various items on a household such as: food items, household items, education, clothing, transport, housing, farm input and labor, land rentals, miscellaneous expenditures and savings/borrowed.

Table 4.6 shows the average monthly income expenditure of the farmer households in the study areas. The results show that the majority of the sampled households are living above the poverty line of $1.25. Seventy-four percent of the sampled households spend MK 6,262.50 ($37.50) to MK 25,049.99 (149.99), meaning in a day they spend in the range of $ 1.25 to $ 5. On the other hand, 9.1% of the sampled households are living below the poverty line, which is less than MK 6,262.49 ($ 37.49) a month. The elite of the study areas are 23% and their daily expenditure ranges from $ 5 to $ 10, which is MK 25,0510 ($ 150) to MK 850,100 ($ 300) a month.

Table 4.6: Average Monthly Income Expenditures of Households

Income[7]	**N**	**Percentage**
MK 6,262.49 and less	12	9.1
MK 6,262.50 to MK 25,049.99	97	73.5
MK 25,050 to MK 50,100	23	17.4
Total	**132**	**100.0**

Source: Author (2012)

In this study, households were divided into three income categories: the low, middle and high income groups. The low income group is defined as those farmers living below $ 1.25 a day; the middle income group is comprised of those living on $ 1.25 to $ 5; and the elite are the highest income category living on $ 5 to $ 10 or more a day. No farmer was said to have spent more than $ 10 a day. Most farmers are living above the poverty line because they sell the beans after harvesting, thus increasing the income base of the family.

4.3 AWARENESS, ATTITUDE AND PERCEPTION OF COMMON BEAN FARMERS TOWARDS THE IMPROVED VARIETIES

4.3.1 Farmer awareness of improved varieties and source of information

Knowledge about improved common bean varieties among farmers seems to be there as it was found that 99% of the respondents have heard about these improved varieties. Farmers who have heard or read about the improved varieties of common bean were asked how they

[7] The conversion rate is 1 USD = MK 167

got to hear about this information and Table 4.7 summarises the results. It was found that 51% of the bean farmers reported to have heard the information through community organisations, for example CIAT and Concern Universal. This is the most important source of information since about half of the population heard through that channel.

Table 4.7: Source of Information

Source of information	N	Percent
Friends and neighbours	39	29.8
Community organizations	67	51.1
Research institutions	17	13.0
Radio	4	3.1
Other (not sure)	4	3.1
Total	**131**	**100.0**

Source: Author (2012)

The second important information channel is friends, neighbours and family as 29.8% of the respondents heard through this source. This is a particularly important source for those farmers who cannot read (Kimenju *et al.*, 2005). The other sources include research institutions and the radio. The radio is the least cited source of information.

Analysing correlations between source of information and education level of household head in Figure 4.2, the conclusion can be made that there is no significance difference between the two variables as the p-value was found to be high. This means that channel of information flow is independent of educational level of a farmer.

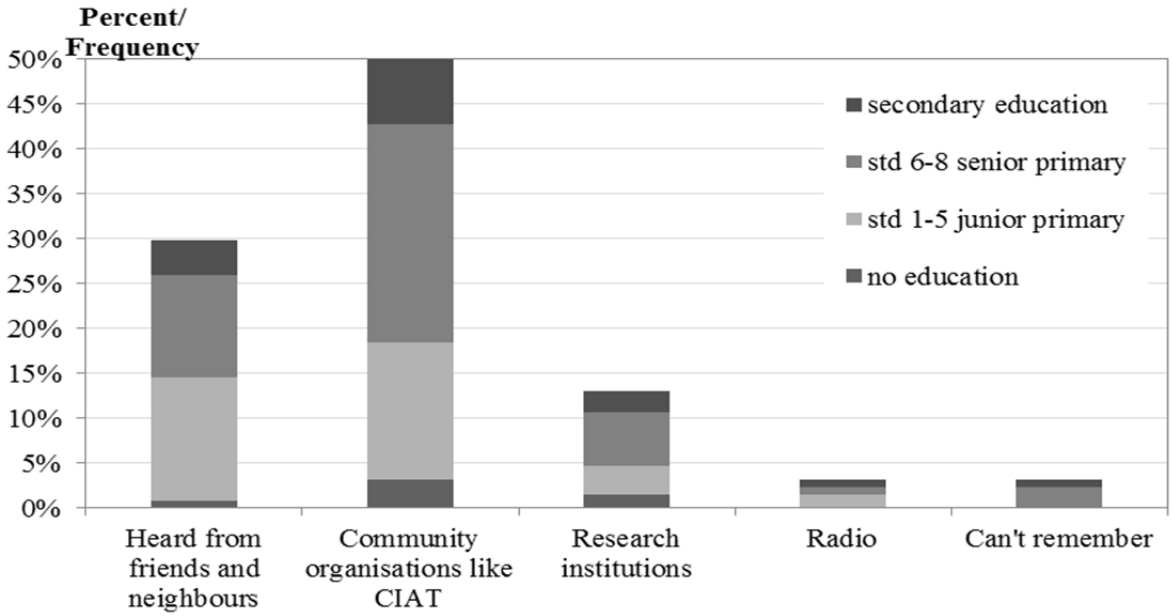

Figure 4.2: Source of Information against Education Level of Household Head

Source: Author (2012)

Looking closely at Figure 4.2, it is observed that community organisations are an important source of information for all education categories even among those without education. Information from received from friends and family decreases with increasing education level of the household head. This is supporting the point that it is a particularly important communication channel for people who cannot read.

4.3.2 Perceptions

The farmers' perceptions of the improved common bean varieties were evaluated using a psychmetric response scale which is normally used in research surveys known as the Likert scale. The Likert scale helps to find out the level of the respondent's agreement with a statement (Bertram, 2008). The study used a 5-point Likert scale with the responses strongly disagree, disagree, neutral (agree or disagree), agree and strongly agree, to the statement that with the use of improved varieties of common beans, productivity of beans can increase. The responses were put into a scale of 1 to 5, with 1 being strongly disagree, 2 being disagree, 3 neutral, 4 being agree and 5 strongly agree.

Table 4.8: Perceptions of Improved Common Bean Varieties

Perception	N	Percent
Strongly disagree	0	0.0
Disagree	0	0.0
Neutral (Agree or disagree)	6	4.5
Agree	40	30.3
Strongly agree	86	65.2
Total	**132**	**100.0**

Source: Author (2012)

The results in Table 4.8 shows that farmers in the study areas are fully aware of the importance of using improved varieties as it was found that none disagreed with the fact that the use of improved varieties of common beans can increase productivity of common beans. Some respondents (4.5%) were uncertain, hence neutral, whilst 30.3% and 65.2% of the respondents agreed and strongly agreed, respectively. This is a good indication because at least farmers are aware of the importance of using the improved varieties and the rest is just to make a decision on whether to spend money purchasing them or not.

Likert scale analysis was conducted and results in Table 4.9 shows that minimum of the perception scale is 3 and maximum of perception scale is 5. The mean of the population sample is 4.61 and the standard error is 0.050. Standard error shows the reliability of the mean. The smaller the standard error the more accurate the results are. Therefore this shows that our results are reliable since standard error is small.

Table 4.9: Likert scale results

Question	N	Minimum	Maximum	Mean		Std dev
	Statistics	Statistics	Statistics	Statistics	Std error	Statistics
Do you believe that with the use of improved bean seed varieties your productivity can increase?	132	3	5	4.61	0.050	0.576

Source: Author (2012)

Standard deviation shows how spread the responses are. Results shows that standard deviation of our responses is 0.576 meaning the responses are on average slighly above mean.

4.4 FARMER BEAN SEED PRODUCTION

4.4.1 Main cash crop

Results from the survey shows that 40.9% farmers stated that beans are their main source of revenue whilst 59.1% grow beans as a supplement to their income base.

Table 4.10: Beans as a Main Cash Crop

Bean cash crop	N	Percent
Yes	54	40.9
No	78	59.1
Total	**132**	**100.0**

Source: Author (2012)

The common bean is one of the major staples in eastern and southern Africa. The crop is rated as the second most important source of human dietary protein and comes third as the most important source of calories (Wortmann *et al.*, 1998). Beans are a major food crop and provide a cheap source of vegetable protein compared to animal protein like fish and meat. The protein content of beans is 22% and this makes it the main dietary complement to starchy staples like maize, cassava, rice and bananas, the most basic diet of most Malawians (Kalyebara *et al.*, 2008). This explains why the majority of farmers responded that beans are not their main cash crop. The other crops which are grown in the study areas include maize, cassava, soybeans, cowpeas, sorghum, rice, groundnuts, tobacco, cotton, tomatoes and onions.

The main cash crop mostly grown by farmers varies across districts. Most farmers in Kwhose main cash crop is not beans in Kasungu are growing soybeans. As shown in Figure 4.3, 43.59% of these farmers mentioned soybeans followed by 38.46% whose main cash crop is tobacco. Tobacco used to be the main cash crop for the majority of farmers in Kasungu, but due to poor tobacco pricing and high production costs, farmers are now opting for legumes, which do not need inorganic fertilisers. Due to the geographical position of Dedza district, the most of farmers produce perishable crops and export them to the city (Lilongwe), as it is seen that 65.79% of the respondents from Dedza, whose main cash crop is not beans, are producing tomatoes for sale. Soybeans are also preferred by most farmers, for the same reasons as those in Kasungu.

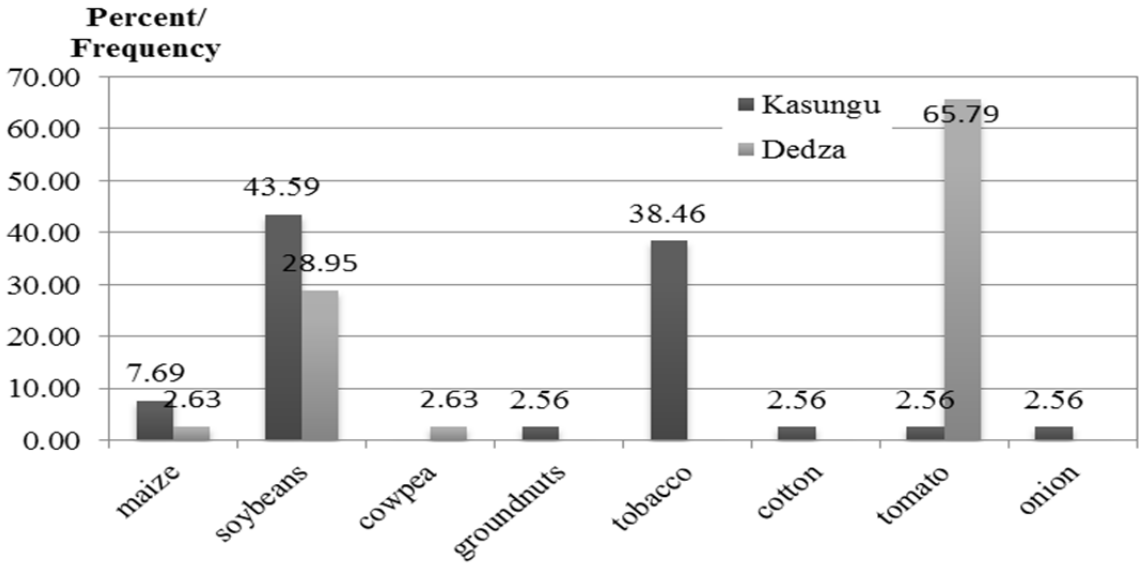

Figure 4.3: Main Cash Crops across Districts[8]
Source: Author (2012)

A chi-square test[9] was conducted and the results show that there is a significant difference among the districts and crops they grow. The chi-square results mean that a farmer will choose a cash crop depending on the district he/she is residing from.

4.4.2 Varieties of common beans grown

The Department of Agricultural Research Services (DARS) in collaboration with the Bunda Collage of Agriculture developed and released several improved bean varieties with various Improved Bean Management Technologies (IBMTs) (Kalyebara *et al.*, 2008). Dissemination of information and the varieties has always been a major setback to this development. Nevertheless, the study found that almost 99% of the common bean farmers in the study areas know at least one of the improved varieties. This shows that there are somehow effective information dissemination channels as far as variety publicity is concerned.

A study on farm level impacts and adoption of improved bean varieties in Malawi reported that farmers in the bean growing areas of Malawi grew at least one of the improved varieties released

[8] Farmers in Kasungu have soybeans as their main cash crop whilst in Dedza they have tomatoes as their main cash crop.

[9] $x^2 = 43.43$, $p = 0.000$, hence statistically significant.

between 1985 and 2005 (Kalyebara *et al.*, 2008). Chi-square test[10] results from this study confirm that there is a significant difference in the choice of growing these varieties among farmers at a 5% significance level. Some varieties are grown more widely than others.

Table 4.11 shows a list of improved varieties farmers have planted or are growing in the study areas. From this table, CAL 143 and Kholophete are the varieties which appear to be grown most widely by farmers. Of the 99% of farmers who are aware of the existence of improved varieties, 85.5% have grown at least one of the varieties they know off and 14.5% only know of the varieties but have never grown them.

Table 4.11: List of Improved Varieties Farmers Have Planted

List of improved varieties you know	Number of Farmers Ever Planted the Variety		Number of Farmers Who Only Know the Variety and Never Planted		Total	
	N	%	N	%	N	%
Mkhalira (A344)	12	9.2	6	4.6	18	13.7
Nagaga	3	2.3	0	0.0	3	2.3
NUA (45)	1	0.8	1	0.8	2	1.5
NUA (59)	10	7.6	0	0.0	10	7.6
Kambidzi (A286)	1	0.8	1	0.8	2	1.5
VTTT 924/4-4	3	2.3	0	0.0	3	2.3
Sapatsika (DRK 57)	5	3.8	1	0.8	6	4.6
Kabalabala (UBR (92) 25)	9	6.9	3	2.3	12	9.2
Napilira (CAL 143)	31	23.7	0	0.0	31	23.7
Maluwa (CAL 113)	7	5.3	1	0.8	8	6.1
Kholophete	30	22.9	6	4.6	36	27.5
Total	**112**	**85.5**	**19**	**14.5**	**131**	**100.0**

Source: Author (2012)

The reasons mentioned by farmers who have never grown these varieties despite being aware of them include: preference for the local varieties, lack of seed and that they would rather use the land for other crops. The major problem mentioned by most farmers was lack of seed and this has been a continuing problem for years. Similar reports are shown in studies by Phiri *et al.*, (2004). Chirwa and Aggarwal, (2000) and Kalyebara *et al.* (2008), but no proper strategy has been put in place. There is an urgent need for the DARS and supporting organisations to come up with sustainable strategies to overcome this crisis if seed security is to be achieved.

[10] $x^2 = 18.435$, $p = 0.048$

4.4.3 Varieties preferred by farmers

Consumer demand is an important factor as far as adoption of a new technology is concerned. Many scientists invent technologies and impose them on farmers. This may not be the smartest move if the intervention is to be sustainable. Farmers need to be exposed to technologies they are comfortable using and that they think will help them. It is therefore important to involve farmers, who are end-users of the technology, at the early stages of technology development. In this regard, farmers were asked to choose their preferred varieties out of the several released varieties. The results in Figure 4.4 show that Kholophete and CAL 143 are the popular varieties with respectively 39.4% and 21.2% of respondents choosing them. The other promising varieties include CAL 113, UBR (92) 25, A344 and NUA 59 of the remainder. NUA 45 was not mentioned at all and A286v seems to be the least preferred.

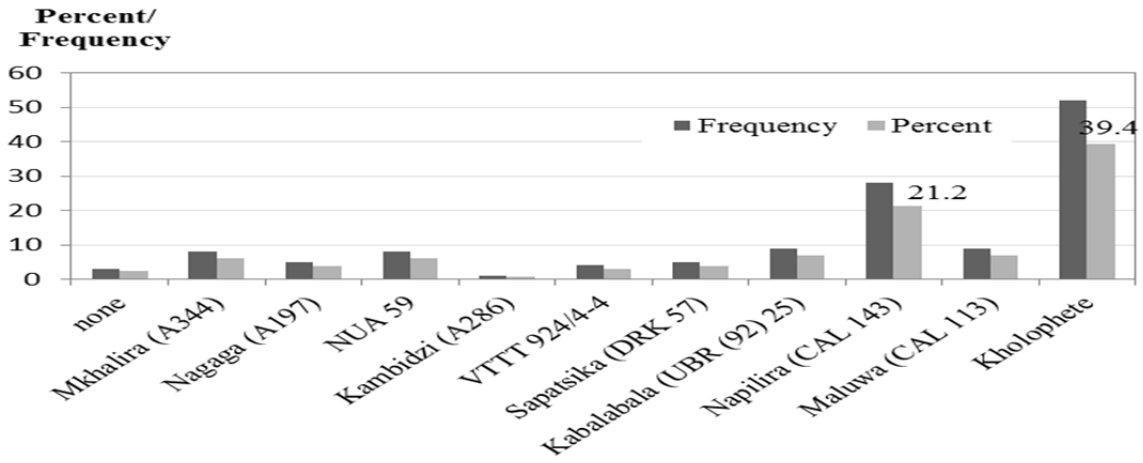

Figure 4.4: Varieties Preferred by Farmers

Source: Author (2012)

The criteria used by farmers in selecting the preferred varieties are based on the attributes attached to these varieties. Figure 4.5 shows the different attributes mentioned by farmers to justify their preference for the improved varieties. The majority of farmers (43 %) mentioned high yield as a factor influencing their choice. Marketability is next most important factor that influences choice with 23 % of respondents indicating this to be the deciding factor. Other important factors include early maturity, disease resistance, palatability, cooking time, resistance to drought, good grain colour, good leaf texture and large seed size. This study did not investigate which varieties carry what attributes.

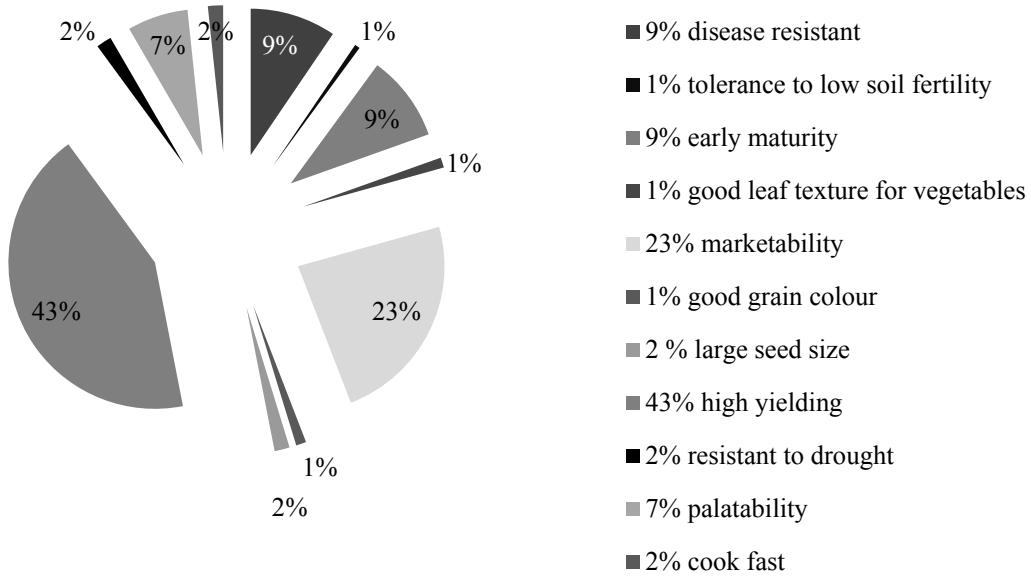

Figure 4.5: Criteria for Choosing Preferred Varieties

Source: Author (2012)

Although some studies have related preference of bean varieties to gender (women choose a variety because it cooks fast whilst men go for traits like marketability), this study did not observe any gender specific bias. The majority of the respondents were female and the most desirable trait which was mentioned by both genders is high yield.

4.4.4 Farming experience

Figure 4.6 shows the number of years farmers have been growing improved common beans. Farmer's mean number of years of growing the improved varieties is 5.23 and the longest period some farmers have been growing beans is 15 years. This shows that the majority of farmers have at least some experience on how to produce improved common beans.

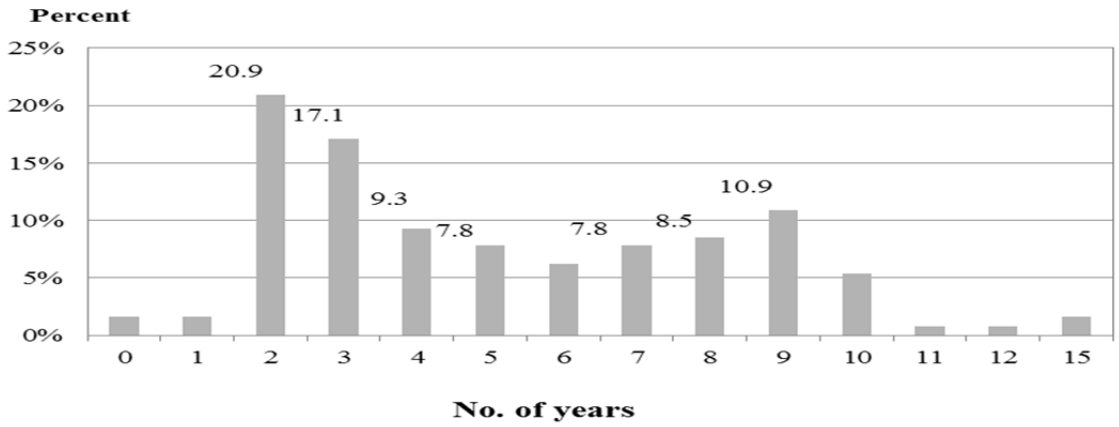

Figure 4.6: No. of Years of Growing Common Beans
Source: Author (2012)

Experience in farming is a factor often highlighted as playing an important role in the adoption of an innovation. Farmers will be more comfortable in using an innovation with which they are more familiar.

4.5 LAND RESOURCES

The total land holding size for households in the study areas is 665.85 acres (269.46 ha), of which the mean land holding size for a household is 5.0443 acres (2.04 ha). This is double the average land holding size for an average smallholder farmer in Malawi. About 84% of the agricultural outputs in the country come from smallholder farmers who cultivate on less than 1 ha farms and the remaining 16% have from medium to large estates and produce cash crops (World Bank, 2003).

In the study areas, the total land allocated to common beans is 156.60 acres (63.4 ha). This means on average that land allocated to common beans by a household is 1.19 acres (0.48 ha) of their total land. There are varied cropping systems the farmers use in the study areas as shown in Table 4.12. The majority of the respondents (54.3%) are growing beans on their own (mono cropping). Intercropping with maize only seems also to be the second best option in the study areas as about 42.5% of the farmers are practising it. The other mentioned cropping systems include intercropping with maize plus other legumes and intercropping with other legumes.

Table 4.12: Cropping Systems of Households

Type of cropping pattern	N	Percentage
Intercropping with maize only	54	42.5
Intercropping with maize and other legumes	2	1.6
Intercropping with other legumes	2	1.6
Mono-cropping	69	54.3
Total	**127**	**100.0**

Source: Author (2012)

The importance of legumes in today's agriculture cannot be overemphasised. Legumes, more specifically beans, are superior nitrogen fixers and enhance the availability of phosphorus in the soil not only for itself but also to subsequent crops, for example, maize which is commonly intercropped with beans in the study areas (Kerr *et al.*, 2007). It is proven that legumes have a long-term soil fertility enhancement and improve the quality of the environment due to their nature of fixing nitrogen in the soil which can result in a cropping system using minimal or no conventional inorganic fertilisers (Poudel *et al.*, 2001).

4.6 SEED ACQUISITION

4.6.1 Seed source

To ensure availability and accessibility of improved common bean varieties among smallholder farmers, BIP initiated a lot of strategies, including multiplication of seed through smallholder farmers, seed distribution through NGOs, health clinics, government extension agents, rural traders and grocery shops. Publications such as posters, leaflets, brochures and radio messages have also been used to promote the use of the improved varieties (Muthoni *et al*, 2009). Despite all the effort made by the government and NGOs in promoting improved bean seed, the availability and accessibility of improved varieties to smallholder farmers is still questionable.

In analysing how farmers in the study areas access seed, almost all the strategies put in place by BIP to promote the use of improved cultivars were mentioned by farmers, though some strategies are used more than others. Figure 4.7 shows the sources from which farmers' access seed in the study area. One of the important mentioned seed sources is own saved (33%) for which the original strategy was smallholder seed multiplication. A shortcoming of this

strategy is that farmers tend to recycle seed for a long time until it loses its vigour. Also, the adverse climatic conditions resulting in poor harvests, coupled with poor income-earning opportunities, and the need to feed their families generally lead to families being short of seed stock for the next planting season because needs surpass the long-term goal of saving seed for planting. The other mentioned ways of seed access include NGOs, the Ministry of Agriculture through extension workers, gifts from friends and family, bought from local market, other farmers/traders and from ADMARC.

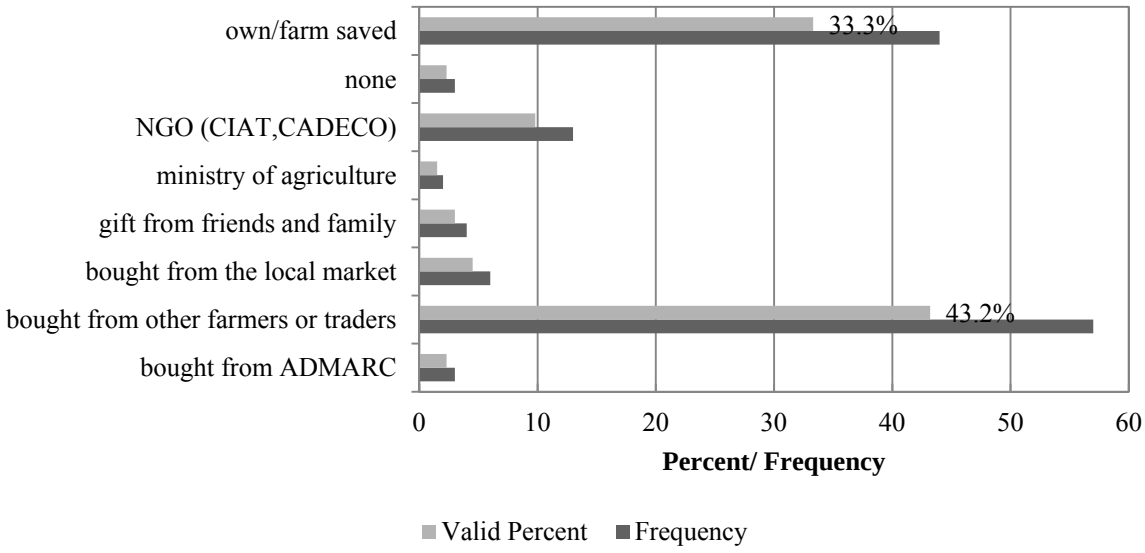

Figure 4.7: Seed Source[11]

Source: Author (2012)

The initial source of seed is important since it determines the quality of produce. Every farmer knows the importance of planting good seed because without it you are assured of a poor harvest. It is common knowledge that a good seed contains a gene that is true to its type and this will reproduce true over time. Findings from the survey displayed in Figure 4.8 show that the majority of farmers (41.7% and 37.8%) got their initial seed through buying from traders and NGOs respectively. The other significant sources mentioned are gifts from family and friends and Ministry of Agriculture. In the last cropping season (2010/11), about 54% of the farmers got their seed from savings of previous harvest whilst about 27% bought from traders.

[11] Forty-three percent of the respondents access their seed by buying from other farmers or traders whilst 33% of the respondents mentioned that they save from previous harvests as shown in Figure 4.7.

The other responses are NGOs, gift from friends, government and bought from seed companies. The other responses were from respondents who were not sure of how they acquired the seed hence indicated none.

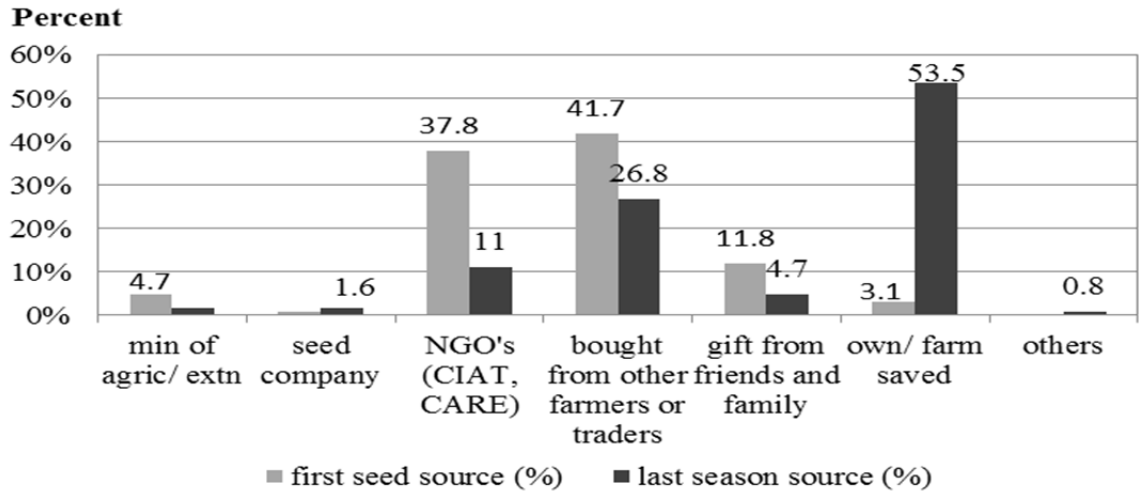

Figure 4.8: Source of First Seed Cultivars against Last Cropping Season's Source
Source: Author (2012)

Buying from traders seems to be an important source of seed for farmers. It is therefore the aim of this study to investigate further the channels that supply seed to the end user, which is the farmer.

4.6.2 Problems faced in acquiring seed

Farmers were asked about their perceived problems in acquiring seed and Table 4.13 shows these results. Although the majority of farmers admitted to have problem with seed access, a big proportion (34.8%) of farmers reported not to have problems. They access seed whenever they need it either by buying at the market or from traders, asking from friends and family or sometimes using their own saved seed. Whilst some farmers do not have problems, about 34.8% mentioned money as their number one problem. With a low per capita GDP, money would obviously be a problem especially among the resource-poor farmers. The second most mentioned problem (22%) is that of unavailability of seed at the market. The other mentioned problems are high transaction costs (5.3%), no reliable seed markets (1.5%) and travelling long distances in search of seed (1.5%).

Table 4.13: Problems Faced in Acquiring Seed

Problem	N	Percent
Lack of money	46	34.8
Unavailability of seed at the market	29	22.0
High transportation costs	7	5.3
No reliable seed market	2	1.5
Long distance in search of seed	2	1.5
None	46	34.8
Total	**132**	**100.0**

Source: Author (2012)

"It is one thing to have common beans at the market and it is another to have common bean improved bean seed in that market". This is what most farmers said when probed on the problem of availability of seed at the market. They said that beans are often available at the market but seed is not always available and sometimes there is no guarantee that the beans that are sold are actually seed beans. It is again important to note that the structural constraints to seed acquisition are compounded by farmers' poverty, as most complained that they did not have money to purchase the seed.

4.7 History of Adoption of Other Improved Crops

Past experiences can trigger future decisions at times. If a farmer was open to new technologies in the past and they were helpful, the chances are in future he/she will be more receptive to new innovations. This is why the study decided to look at multivariate adoption decisions of farmers on various improved varieties introduced in their areas either by government, through extension workers or NGOs or just by hearing about them from family and neighbours. The results in Table 4.14 show that apart from beans, improved maize varieties had the highest adoption rate of 71.2%, which is not surprising since it is the staple food in Malawi. Sweet potatoes had also a significant adoption rate (54.5%) since they are widely used for breakfast in Malawi.

Table 4.14: Past Experiences on Adoption

Have you ever adopted improved varieties of the following crops	Adoption		Non- adoption		Total
	Yes	%	No	%	
Beans[12]	115	87.1	17	12.9	132
Maize	94	71.2	38	28.8	132
Cassava	34	25.8	98	74.2	132
Sweet potato	72	54.5	60	45.5	132
Irish potato	16	12.1	116	87.9	132

Source: Author (2012)

Farmers seemed more receptive to crops like common beans, maize and sweet potatoes, with an adoption rate of more than 50% compared to cassava and Irish potatoes whose adoption rates are below 50%. The conclusion can be made that the farmers in the study areas seem to be receptive to all the new varieties ever introduced to their areas and the chances are that they will do the same to with improved bean varieties. The fact that two crops had low adoption rates cannot lead us to concluding that farmers will not be receptive to other technologies introduced. Failure to widely adopt these crops can be due to several reasons, like the crops not adapting to the soil, the fact that they are not the main cash crops of the area, and also that the results are from two districts which are in different ecological zones. For example, Dedza grows more Irish potatoes than Kasungu, which had most of the respondents; hence the results may be biased.

4.8 EXTENSION SERVICES

Generally, for an innovation to be adopted, extension workers need to support the farmers by providing guidelines on how to go about with the innovation and also enlighten the farmers on the importance of the innovation among other things. In the study areas, 99% of the respondents are aware of the existence of the extension worker in their areas. Only 0.8% responded that they were not aware that there is an extension worker in their respective areas.

Almost all respondents are aware of existence of the extension workers in the area, with 96.2% reporting that they have been visited by an extension worker. Table 4.15 shows that farmers who indicated that they have been visited by an extension worker stated that 37.1% of

[12] Improved varieties of beans have been there since time immemorial and scientists keep on breeding new improved varieties so this bean is referred to old improved varieties.

them got visited weekly, 34.8% indicated once a fortnight, 21% responded that it was probably once a month and the remaining 9% indicated that it was not regular over the year. This can be due to the high extension worker to farmer ratio.

Table 4.15: Willingness-to-Pay against Frequency of Extension Worker Visits

Frequency of EW visit	Farmers WTP for Improved Bean Varieties				Total	
	Yes	%	No	%	N	%
Every week	48	36.4	1	0.8	49	37.1
Once a fortnight	37	28.0	9	6.8	46	34.8
Once a month	24	18.2	4	3.0	28	21.2
Not regularly over the year	8	6.1	1	0.8	9	6.8
Total	**117**	**88.6**	**15**	**11.4**	**132**	**100.0**

Source: Author (2012)

Looking at the relationship between frequency of visits by extension workers and willingness-to-pay, the results show that farmers who were visited weekly are more willing to pay for the improved varieties compared to those visited once a fortnight or once a month. After running a statistical test, the results were statistically significant.[13] This just confirms the point that extension workers are supposed to support a technology for it to be widely adopted by farmers. Therefore, the more the visits by the extension worker, the more encouraged the farmers will be to adopt the technology.

4.9 HOUSEHOLDS' WILLINGNESS TO PAY FOR IMPROVED VARIETIES OF COMMON BEANS

4.9.1 Descriptive Statistics for Discrete Responses

As the contingent valuation method is gaining popularity in agribusiness, the question still remains about the appropriate method of asking the valuation question. The study adopted the bidding game method. The bidding game method is a method in which an interviewer poses an initial bid to a respondent. If the respondent is willing to pay for the initial bid, then the

[13] $x^2_{(3,\ 0.05)} = 7.538^a$, $p = 0.057$, hence statistically significant.

interviewer pushes the second bid upwards until a negative response is received. A negative response to the initial bid will mean the interviewer pushes the second bid down until an acceptable amount is reached (Boyle *et al.*, 1985).

The bids for contingent valuation question were included in the questionnaire. The initial and second bids were obtained during the pilot survey. Table 4.16 summarises the 'yes' and 'no' responses with the first row summarising all the 'yes' responses and the second row the 'no' responses. The initial bid was set at MK 380 per kg of improved beans. The prices were worked out after consulting the CIAT. The price was calculated from adding the production costs of improved seed varieties to the market cost of the bean grain, the one used for household consumption. The hypothesis is that the cost of improved bean seed is expected to be higher than that of the bean grain.

The initial bid of MK 380 per kg of improved seed resulted in 117 'yes' responses and 15 'no' responses. Out of the 117 'yes' responses (Bid 1 = 380), the follow-up bid (Bid 2 = 760) yielded 47 'yes' responses and 70 'no' responses. And from the 15 'no' responses (Bid 1 = 380), the follow-up bid (Bid 2 = 190) resulted in 11 'yes' responses and 4 'no' responses as shown in Table 4.16.

Table 4.16: Summary of Discrete Responses to the Double-Bounded Questions

Bid 1 Initial Price	**Bid 2 Follow up Price**	**First question (Bid 1)**		**Second question (Bid 2)**	
		# of 'yes'	**# of 'no'**	**# of 'yes'**	**# of 'no'**
380	760	117	0	47	70
380	190	0	15	11	4
Total[14]		**117**	**15**	**58**	**74**

Source: Author, (2012)

In general, 47 respondents were willing to spend double the initial price of the improved seed whilst 4 respondents were willing to spend less than half the initial price. In total, 264 responses were obtained from the double bounded dichotomous questions for analysis.

[14] Total # of responses = 264

Household's willingness-to-pay was also analysed based on the respondents' joint responses to the first and second bids. From Table 4.17, the results show that 35.61% of respondents said 'yes' to both the initial (Bid 1 = 380) and follow-up bids (Bid 2 = 760). The respondents who said 'yes' to the initial bid (Bid1 = 380) then 'no' to the follow-up bid (Bid 2 = 760) were 53.03%. On the other hand, 8.33% of the respondents said 'no' to the initial bid (Bid 1 = 380) and 'yes' to the follow-up bid (Bid 2 = 190). Whilst most (96.97%) said 'yes' to either both bids or one of the offered bids, 3.03% of the respondents said 'no' to both the initial bid (Bid 1 = 380) and follow-up bid (Bid 2 = 190).

Table 4.17: Frequency Distribution of Willingness-to-Pay

WTP category	N	Percent
Yes–Yes	47	35.61
Yes–No	70	53.03
No–Yes	11	8.33
No–No	4	3.03
Total	**132**	**100.00**

Source: Author (2012)

Results from the table above show that most of the respondents are in the Yes–No category meaning they said 'yes' to the initial bid (Bid1 = 380) and 'no' to the follow-up bid (Bid2 = 760). The least common category was the No–No, where respondents said 'no' to both initial (Bid1 = 380) and follow-up bids (Bid 2 = 190). The results show that most of the farmers in the study areas are willing to pay for the improved varieties of beans, though a few are still resistant.

4.9.2 Estimation of Average Willingness to Pay

From the dichotomous double bound questions, Table 4.18 shows the summary descriptive statistics of the household's willingness-to-pay. The mean willingness-to-pay for the initial bid (Bid1) is MK 358. 41 per kg of improved bean seed whilst mean willingness-to-pay for follow-up bid (Bid2) is MK 487.95 per kg of improved bean seed.

Table 4.18: Descriptive of Mean Willingness to Pay for the bids

Variable	N	Mean	Std. Dev	Std. Error	Min	Max
Bid1	132	358.41	60.53	5.27	190	380
Bid2	132	487.95	217.96	18.97	0	760
VBid1	132	0.87	0.32	0.03	0	1
Vbid2	132	0.44	0.50	0.04	0	1

Source: Author (2012)

The mean willingness-to-pay of MK 358.41 is calculated from all the 'yes' and 'no' values from the first bid and MK 487.95, which is the mean for the follow-up bid, is calculated from all the 'yes' and 'no' values from second bid. This means that the mean for the initial bid is lower than the initial bid itself. Farmers would like to pay less than the set price for the improved varieties of beans.

4.10 Analysis of Results of Open-Ended Format

The open-ended question involved asking respondents for the maximum amount they are willing to pay for the improved bean varieties. From the pre-test, it was observed that most farmers could not state the maximum amount they were willing to pay. Then when carrying out the survey, various offers were made to farmers in some cases in order to probe the maximum amount they were willing to spend for their preferred varieties. From Table 4.18, 96.97% of the respondents were willing to pay some amount for the improved varieties and only 3.03% were not willing to spend money on the improved varieties.

Table 4.19: Analysis of Willingness to Pay for Open-ended Format

WTP for HH	N	Per cent
Willing to Pay (> 0)	128	96.97
Not Willing to Pay (0)	4	3.03
Total	**132**	**100**

Source: Research findings (2012)

The amount of money that the farmers would spend to obtain the seed ranges from MK 0 to MK 760. Table 4.20 presents the frequency distribution of farm household's willingness-to-pay in Malawi Kwacha currency.

From the frequency distribution in Table 4.20, it is in line with table 4.19 that about 3% of the respondents are not willing to spend any money for the improved varieties. The average

maximum amount respondents were willing to pay for improved varieties of bean seed was MK 549.47 and the maximum amount they were willing to pay was MK 760.

Table 4.20: Frequency Distribution from the Open-ended Question

Amount (MK)	N	Per cent
0	4	3
95	3	2.3
190	1	0.8
305	7	5.3
380	22	16.7
475	26	19.7
570	12	9.1
665	10	7.6
760	47	35.6
Total	132	100

Source: Author (2012)

Results displayed in Table 4.21 are from the confidence interval analysis and they are showing both descriptive and inferential statistics whilst Table 4.22 shows the inferential statistics of the willingness to pay. Both the confidence interval and t test analysis found that farmers mean willingness to pay for the improved varieties of bean seed was MK 559.85.

Table 4.21: Results of Confidence Interval Analysis

Maximum amount farmers are willing to pay at 95% CI		Statistics	Std. Error
Mean		559.85	16.211
95% Confidence Interval for Mean	Lower bound	527.78	
	Upper Bound	591.92	
5% Trimmed Mean		571.09	
Median		570.00	
Variance		34689.290	
Std. Deviation		186.251	
Minimum		95	
Maximum		760	
Range		665	
Interquartile Range		380	
Skewness		-.412	.211
Kurtosis		-.840	.419

In t test analysis, the hypothesised test mean was set to be MK 500. The cut off for the test for significance was set at 0.05 hence any p value of less than 0.05 is statistically significant. Results in Table 4.22 shows that the p-value is less than 0.05 therefore a conclusion can be made that the price of improved bean seed is significantly different from MK 500.

Table 4.22: Results of One Sample T-Test

	Test value= 500					
	t	df	Sig. (2-tailed)	Mean difference	95% Confidence interval of the difference	
					Lower	Upper
Max WTP	3.692	131	.000	59.848	27.78	91.92

Source: Author (2012)

Comparing the test value to the mean value displayed in Table 4.21 which MK 559.85, it is clear that the average price of the sample is significantly higher that the prices in general. The mean difference in Table 4.22 is positive meaning that the price is significantly higher than the average.

Confidence interval explains the kind of differences to be expected in a population. In conclusion, from the confidence interval analysis, the study 95% confident that mean price of all improved common bean seed is between MK 527.78 and MK 591.92. These results are in line with t test results which states that the study is 95% confident that mean price of common beans is at least MK 27.78 above MK 500 and at most MK 91.92 above Mk 500.

4.10.1 Reasons for willing-to-pay or not willing-to-pay for improved bean varieties

Respondents were asked the reasons why they were willing to pay for the improved varieties. Multiple responses were allowed since some respondents had two or more reasons. From the initial bid (Bid 1 = 380), 115 out of 132 respondents (87%) were willing to pay MK 380 per kg of improved varieties.

In Table 4.23, results show that most (40.16%) of the respondents are willing to pay for improved varieties because the varieties are worth the amount. Farmers attach value to the varieties and feel it's worth spending money on them. The second popular reason mentioned (30.33%) was the fact that bean seed is scarce so farmers are willing to pay money if it means availability of seed. Some farmers (23.77%) mentioned that they can afford to pay for the improved varieties thus they are willing to pay. The least mentioned reason (5.74%) is that the use of improved varieties increases productivity of the beans, hence profits are increased.

Table 4.23: Reasons for Willingness to Pay for Improved Bean Seed varieties

Reasons for willing-to-pay	N	Percent
The variety is worth the amount (value attaching to variety)	49	40.16
Because you can afford	29	23.77
Farmer wants to access good seed	37	30.33
Increased profit	7	5.74
Total	**122**[15]	**100**

Source: Author (2012)

Out of the 16% who were not willing to pay for the improved varieties from the initial bid, reasons were given for why they feel so. Of the proportion of those not willing to pay, 62% mentioned that it is due to the fact that they do not want to spend that much on the improved varieties. Whilst most of the respondents not willing to pay do not wish to spend that much on the varieties, 19% agreed with them and said the varieties are not worth the amount. The value these not willing-to-pay farmers are placing on improved varieties does not tally with the cost.

Table 4.24: Reasons for not Willing to Pay for Improved Bean Seed Varieties

Reasons for not WTP	N	Percent
The variety is not worth that amount (value attaching to variety)	3	18.8
Do not want to spend money on improved varieties	10	62.5
Farmer can still access seed from friends and relatives	1	6.2
Expensive, cannot afford	2	12.5
Total	**16**	**100.0**

Source: Author (2012)

About 13% of those not willing-to-pay MK 380 per kg of improved bean seed mentioned that the seed is too expensive and they cannot afford to buy it whilst 6.2% of the not willing-to-pay mentioned that it is not worth spending their money on seed since they can still access it from friends and family. In summary, with reference to Table 4.16, out of the 15 respondents who were not willing to pay in the final bid, about 27% do not want to spend any money on the improved varieties.

[15] N = 122 due to multiple responses

CHAPTER 5

TRADER SURVEY RESULTS

5.1 INTRODUCTION

The chapter outlines the results of the traders' survey. Traders from the surrounding markets of the study areas where the common bean farmers are located were purposively selected and interviewed to assess the effectiveness of the existing dissemination channels of common bean seed. Socio-economic characteristics of traders are discussed to understand their background. Later in the chapter various marketing channels for bean seed are determined then analysed and conclusions are also made from the analysis.

5.2 PROFILE OF TRADERS

The surveyed traders are from the two districts where the study was conducted, which are Kasungu and Dedza. The survey interviewed 47.4% of the traders from Kasungu and 52.6% were from Dedza. Table 5.1 summarises the socio-economic characteristics of the trader households. Results show that the traders are split equally on the basis of gender. The majority of traders are married (63.2%) compared to the married farmers (82.6%, table 4.1).

Table 5.1: Summary of Respondents and Headship

Sex of Respondents	**N**	**%**
Male	10	52.6
Female	9	47.4
Total	**19**	**100.0**
Marital Status	**N**	**%**
Married	12	63.2
Separated	1	5.3
Widowed	3	15.8
Single	3	15.8
Total	**19**	**100.0**

Source: Author, (2012)

The probable reason why there are more married people in farming than in trading can be due to fact that farming is generally an activity of married people as opposed to trading commodities (Abu *et al.*, 2011). Traders are usually travelling in search of markets and products to sell and this has a stereotype of instability attached to it hence some married people tend to refrain from this profession, especially women. Again, married people usually have children which limit their ability to travel.

5.3 TRADERS' HOUSEHOLD CHARACTERISTICS

The average age of traders is 37 years old which is lower than that of farmers, which is 46 years as shown in Table 5.2. The two tailed t-test with unequal variance shows that there is a significant difference between the ages of traders and farmers, with the age of farmers being significantly higher. Further, Table 5.2 shows the average household size of traders as 6.37. This is slightly higher than the mean household size of farmers and Malawi as a whole, which is 5.27 and 4.6 respectively (NSO, 2011). This shows that traders in study areas have big households hence need broad income bases.

Table 5.2: Household Characteristics of Traders

Household Characteristic	N	Mean of traders	Mean of farmers	t-stat[16]
Age of Household Head	19	37.00	45.90	1.979**
Total Household Size	19	6.37	5.27	2.004**
Education of Household Head	19	8.53	6.12	2.005**

Source: Author (2012)

The mean education level of traders was found to be 8 years of schooling. This shows that most of traders are literate; they have at least attained primary or basic education. The statistical results show a significant difference between the average education level of the farmers and traders with that of traders significantly higher. Education is important especially in the business world.

[16] * Significant at 10 % level; ** Significant at 5 % level; *** Significant at 1% level

Table 5.3 shows information on the primary occupation of traders. Most (94.7%) traders' primary occupation is business/ trading agricultural produce. Only 5.3% mentioned that their primary occupation is farming.

Table 5.3: Primary Occupation of Traders

Occupation	N	Percent
Business	18	94.7
Farming	1	5.3
Total	**19**	**100.0**

Source: Author (2012)

Almost all traders in the study areas are also involved in agriculture since the majority of rural Malawians obtain their livelihood from farming, whilst their primary source of income is business.

5.4 BUSINESS CHARACTERISTICS OF TRADERS

Sole trading, which the study refers to as sole business owning, is preferred by the majority of traders in the study area. Results in Table 5.4 show that 90% of the surveyed traders were trading independently. Only 10% were found to be in partnership, which means two or more people own the business.

Table 5.4: Type of Traders

Type of Trader	N	Percentage
Sole	17	89.5
Partnership	2	10.5
Total	**19**	**100**

Source: Author (2012)

The study found that in the common bean seed trade, there are three types of traders: retailers, wholesalers and private traders/middlemen who in most cases are involved in both retail and wholesale business, as shown in Figure 5.1. Retailers dominate the common bean seed trade with 58% market share whilst wholesalers and middlemen have 21% market share each.

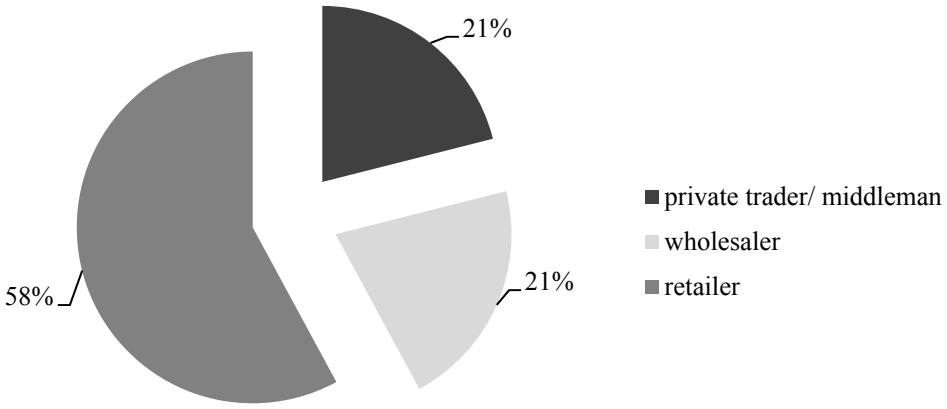

Figure 5.1: Classification of the Businesses

Source: Author (2012)

Similar results were reported in a study which was done across Malawi to assess the common bean market where the results showed that out of 60 traders who were interviewed, 65% were retailers whilst wholesalers and traders who doubled up wholesale and retail were 20% and 15% respectively (Muthoni *et al.*, 2007).

5.5 TRADER'S SOCIAL CAPITAL

One of the valuable resources which has become increasingly important in today's modern business world is the goodwill that people have towards others, i.e. social capital. The Organization for Economic Co-operation and Development (OECD) defined social capital as "*networks together with shared norms, values and understanding that facilitates co-operation within or among groups"*. Mostly, "*people build trust in and network to others and come to cooperate with them"* and this becomes advantageous to everybody. The advantages of social capital include: inter-unit resource exchange and product innovation, reduced turnover rates and strengthening of supplier relations (Adler & Kwon, 2002).

In this regard, the study assessed the social capital of traders in the study area. The aspects of social capital which were looked at are trust, networking and cooperation. This was assessed through looking at the family unit, traders' membership to associations, their access to information and access to credit facilities.

5.5.1 Family members

As mentioned earlier, there was no significant difference in terms of male and female involvement in trade in the sampled households. In terms of experience in business, Table 5.5 shows that the mean number of years in trade is 8.32; hence traders have long experience in trade.

Table 5.5: Family Members of Traders Households

Family characteristics	N	Mean	Stan. Deviation	Median
Average family size	19	6.37	2.22	6.00
Average no. of adults	19	3.68	1.73	3.00
Average no. of children	19	2.68	1.67	3.00

Source: Author (2012)

The mean number of adults in a family was approximately 4 with a minimum of 1 adult in a family and a maximum of 6 adults in a household. This is compared to the mean of children in the households which is approximately 3. This shows that there are more adults in the trader households of the study areas compared to children, which can be advantageous in a way that the adults can help with some business activities and information flow.

5.5.2 Traders' membership of associations

In terms of associative life, Table 5.6 illustrates that the majority of traders (84%) are not affiliated to any traders' association, compared to 16% who are a member of at least one association. Out of these 16% who are in association, two (11%) joined at least one traders' association and one is a member of at least two traders' associations.

Table 5.6: Affiliation to Association

Association	N	Percent
Yes	3	15.8
No	16	84.2
Total	19	100.0

Source: Author (2012)

Males and females of the study areas differ in the extent of associative life with more female group members as compared to male. This is evidenced when the study found that the mean number of males in the traders' association was one compared to 26.67% of women.

Whilst there are a lot of perceived advantages of joining an association, the stated type of information gained from the affiliations include: credit access and savings, risk sharing or safety nets, counseling on various issues and nutrition education. From this, it can be concluded that traders are not being social enough to network.

5.5.3 Access to information

Access to marketing information is important for price formation, encouragement of transparency hence maintenance of order in the market, consumer satisfaction and many other advantages. Therefore, it is vital for traders to network and access information on marketing their produce. There are various networks where traders access information in a market as shown in Figure 5.2. It was found that almost all the traders have a network or two which helps them find out about useful information in the market. If these traders have trust in other people and are able to network, then there will be co-operation, hence social capital.

Figure 5.2: Source of Information on Improved Varieties[17]

Source: Author (2012)

[17] Multiple responses are considered.

Some of the mentioned information receive through the networks is on: accessibility of credit facilities, flow and ceiling prices of improved varieties, buying and selling markets, grades and standards and new improved varieties which are in demand. Most of the traders (84%) seem to be satisfied with the way information flows in their markets and the minority who are not satisfied mentioned that possible solutions to effective information flow in the market is through government intervention and strengthening of marketing committees so that important information should be channeled through these committees.

5.5.4 Access to credit

Most common bean seed traders in the study areas are not licensed to sell seed. This can be due to the fact that the seed business is not really popular in the country and due to scarcity of seed in the market there is no control regarding who ventures into the business. This is not good practice because it can encourage circulation of seed which is not true to its type, for instance, mixed varieties and trading of grain as seed which leads to poor harvests on the part of farmers. Upon asking the traders on the availability of credit facilities to support trading of common bean seed, Table 5.7 shows that only 32% of the interviewed traders have access to credit facilities from micro-financing institutions. The study found that external financing to enhance trade in common bean improved varieties is extremely limited and this seems to be a general problem among Malawian traders.

Table 5.7: License and Credit Facility Availability

Variable	Yes		No	
	N	%	N	%
Licensed trader	3	16	16	84
Credit facility	6	32	13	68

Source: Author (2012)

Some authors reported that of the large mass of traders, only a minority benefit from the rare loans offered by financial institutions (Fafchamps & Gebre-Madlin, 2002:8). Credit facilities enhance productivity of agricultural production thus making the whole seed enterprise attractive. The common bean seed industry in Malawi is not attractive in the country and one of the causes is low profit margins (Chirwa *et al.*, 2007). In this regard, the introduction of

microfinance to traders can act as an incentive to promote seed trading, which would mean higher margins in the industry.

5.6 PHYSICAL ASSETS OWNED BY THE TRADERS

It is generally difficult to get information on how much money people have or spend, so in this case, owning of physical assets was used as a proxy to gauge the income category of these traders. Those who own big assets like shops, vehicles, and warehouses were rated as high income, those with a house, winnower, bicycle and phone were categorised into middle income, and lastly the ones which did not afford anything were put in the low income category. The results in Figure 5.3 show that 34% of the traders own bicycles. Most people usually keep produce for sale in their houses hence do not see the need for a warehouse. The second popular asset owned by 25% of the interviewed traders is a cellular phone. This shows that information is really important to traders since a cellular phone is the only reliable and fast source of communication in rural areas.

Shelter is a basic need for human beings, according to Maslow's hierarchy of needs. In the study area, only 13% of the traders reported to have their own houses, the rest were either renting or putting up with relatives. Another 13% mentioned owning a winnower for winnowing the common bean seed. This is an important asset for cleaning and sorting the seed. Figure 5.3 further shows that 3% of the respondents reported to that they have no assets whilst 6% said they have a shop and another 6% have weighing facilities.

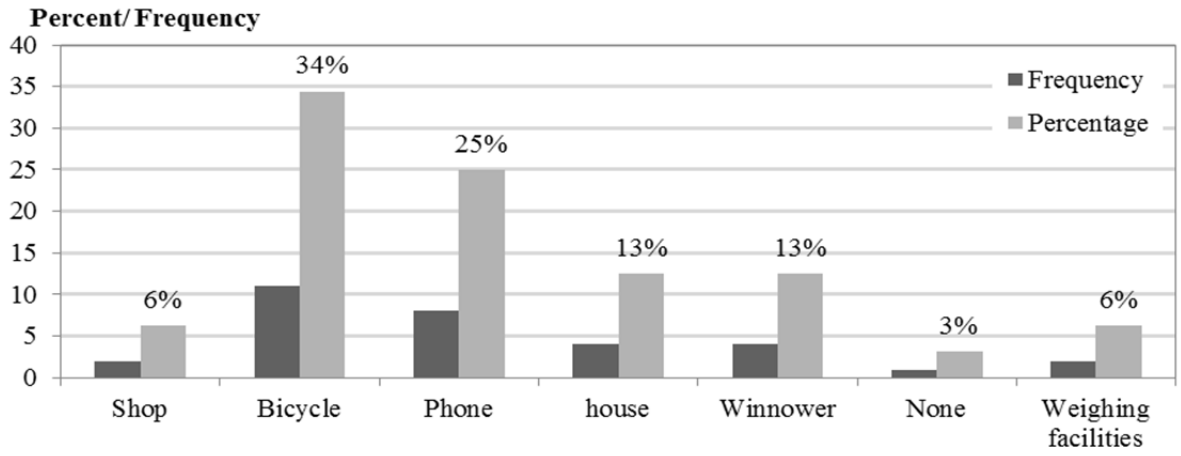

Figure 5.3: Physical Assets Owned by Traders18

Source: Author (2012)

Most traders do not own big assets as none of the traders in the study area were reported to own facilities for transporting commodities in bulk and storage space and yet these are the most important assets in any trading of agricultural goods. These findings are in accordance with those of Fafchamps and Gebre-Madlin, (2002:11), who reported that the majority of traders in Malawi do not own transportation, weighing equipment or storage facilities. They mostly hire a car to transport their commodities or if it is a bag or two, they use bicycles. Therefore, it can be concluded that the majority of traders in the study areas belong to the medium to low income groups.

5.7 TYPES OF IMPROVED VARIETIES COMMONLY TRADED

It was observed that the majority of traders in the markets who were interviewed do not specialise in their products of trade. They sell both common bean grain and seed. This can be confusing to them and also to farmers, as some traders did not even know the difference between grain and seed. Some traders did not even know the local names of some of the

[18] Multiple response is considered N = 32.

improved varieties they trade, so enumerators had to use pictures from the fliers for demonstration.

The bean seed varieties which are traded in the surrounding markets as presented in Figure 5.4 include: nagaga, NUA 59, VTTT 924/4-4, sapatsika (DRK 57), kabalabala (UBR (92)25), napilira (CAL 143), maluwa (CAL 113) and kholophethe. The most popular variety is napilira (CAL 143) with 26% of the respondents mentioning it, followed by kholophethe, which was mentioned by 24% of the respondents. Sapatsika (DRK 57) is also a bit more popular then maluwa (CAL 113), and VTTT 924/4-4 is preferred to nagaga and NUA 59.

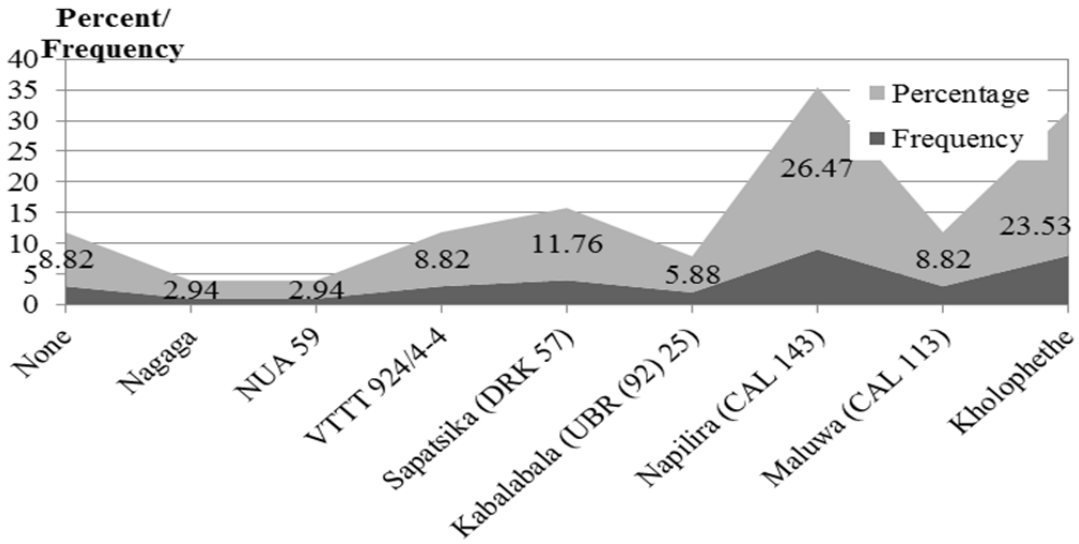

Figure 5.4: Type of Improved Varieties Mostly Stocked by Traders[19]
Source: Author (2012)

These results correspond to farmer's responses as to preferred varieties. Napilira (CAL 143) and kholophethe, which are the most traded varieties, happened to be the most preferred varieties among farmers. This really just proves the fact that the majority of farmers get their seed from the market.

[19] N = 34 multiple responses are considered.

5.8 THE BUYING AND SELLING MARKETS

5.8.1 The buying market

The sellers of common bean seed around the study areas are: farm gate, which is at the farmers' local market, where traders buy from wholesalers and sell at retail; middlemen or other traders; institutions like NGOs or research institutions and seed company depots. At the time of study, most of the seed company depots visited did not have seed in stock and reported that they hardly receive stock of legume seed over the year. On the other hand, institutions are located very far from the farmers or traders and it would be costly to travel all the way in search of seed, so that this is not a reliable source.

Major source of improved seed varieties traded: There are a few places where traders around the study areas source their seed. Figure 5.5 show that 63% of the sampled traders responded that they source their seed at the local market. This means that traders will buy at wholesale from the producers who trade at the market and later sell it at retail prices on the same market or a different market. The second popular place where traders source their seed is through middlemen or other traders, as 21% of the respondents mentioned. And lastly, 16% mentioned that they buy their commodity at the farm gate. This is the least preferred source among traders and the most probable reason behind this may be that they avoid the transaction costs involved in transporting the commodity from the farm gate to the market.

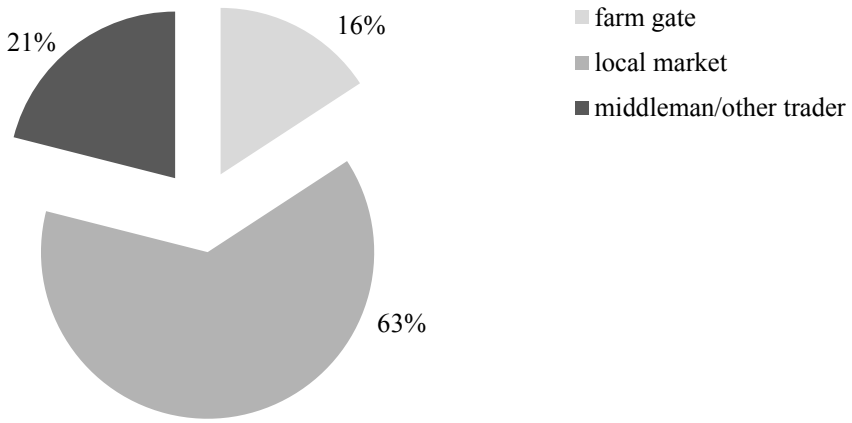

Figure 5.5: Source of Seed Traded[20]

Source: Author (2012)

Other researchers have found that the majority of traders source their seed from producers, which is at the farm gate. The most common reason why most traders choose their buying markets is because of the low prices which make it possible to break even after selling their product (Longwe *et al.*, 2010). On average, traders buy their bean seed at MK 195 ($ 1.17) per kilogram, with the prices ranging from MK 56 ($ 0.34) to MK 316 ($ 1.89). These prices are mostly determined by market forces, thus the law of demand and supply takes its course, meaning that the higher the price of the commodity the lower the demand and the lower the price of the commodity, the higher the demand. Some respondents mentioned that sometimes prices are negotiated during the course of trade (bargaining). Prices can also be seasonal, for instance when produce is in season, prices tend to go down and when out of season, prices go up.

Traders also mentioned that at times farmers can come up with a floor price for the season. The Agricultural Development and Market Corporation (ADMARC) at times intervene and formulate prices for farmers but this comes as a last resolution. The quality of a product can also the determine price of a commodity. Grading of the seed is done visually; they look at the beans to judge their quality and then decide on the grade and price, which can create bias. The average price traders are willing to pay for the improved varieties of common bean seed is MK 150 ($ 0.90) per kilogram with a price range of MK 80 ($ 0.48) to MK 250 ($ 1.50).

[20] 1$ = MK 167

A good proportion (68%) of the traders said that the seed is always available at the buying market and they always buy the quantities they want. If this is the case, then where is the cycle getting distorted in the seed system?

5.8.2 The selling market

The major selling markets for common beans are the local markets and middlemen who sell them to farmers or other traders, as presented in Figure 5.6. It was found that 84% of the traders sell their seed at the markets and 11% sell their seed to middlemen. The other 5% sell to various people, which can be local people.

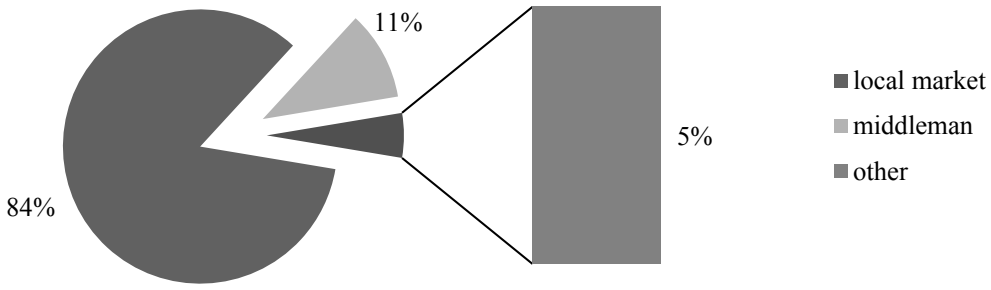

Figure 5.6: Selling Market for Common Bean Seed
Source: Author (2012)

The results from this study show that farmers generally use the market for seed trade. The problem still remains that no comprehensive approach has been put in place to develop rural markets with a focus on smallholder farmers (Longwe *et al.*, 2010).

The major buyers at the market: A study conducted by Muthoni *et al.* (2009) reveals that at the market most bean seed is purchased by households, local traders, institutions and exporters, whilst Longwe *et al.* (2010) reported that the major bean seed buyers at the market are NGOs and private traders. In this study, Figure 5.7 shows that the purchasers of bean seed at the market are local farmers (67%), middlemen (24%), companies (5%) and institutions (5%). These results are in line with farmers' responses as to where they source their seed. Most farmers said they buy at the market and several reasons were given to why they prefer

selling their seed at the market but the most popular one was due to the fact that they can sell at both retail and wholesale. The market does not have a restriction on how they can sell their commodity. The other reason was that it's fast cash at the market and also the prices are good since they agree with the traders on how much to sell their seed for.

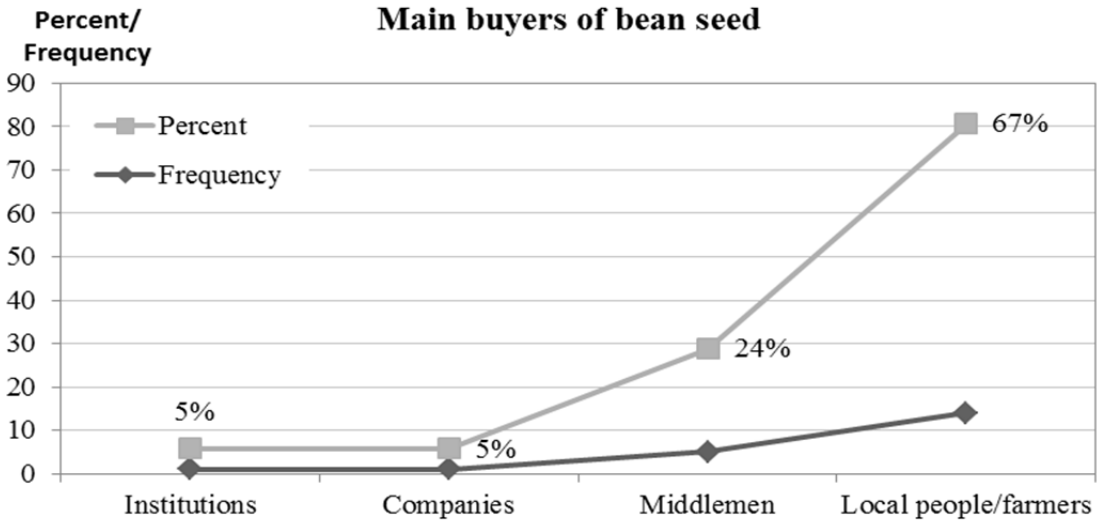

Figure 5.7: The Buyers of Bean Seed at the Market[21]

Source: Author (2012)

As much as the forces of demand and supply play a role in selling price determination at the market, sometimes due to seasonal changes the commodity price gets really low and in this case the traders' associations to sit down and come up with a selling price according to estimated cost incurred, i.e. purchasing plus transaction costs are considered. When traders were asked if they meet buyers' demands on quantity, 84% responded 'yes' and only 16% said 'no, it is seasonal'. If the traders report that they meet farmers' demands for improved bean seed, then why is seed availability still a major concern among farmers? This shows that there should be an information distortion somewhere.

[21] Multiple response considered, n = 21

5.9 MARKETING PROBLEMS FACED BY TRADERS AT THE BUYING AND SELLING MARKETS

The most mentioned problems that traders encounter in marketing the common bean seed, as shown in Table 5.8, are poor road networks to transport the seed and limited credit opportunities. Most producers are located far from the main road and the poor roads in the rural areas mean that it takes a long time to reach the market and is also costly, which is a barrier to the marketing of beans. Furthermore, there are few credit facilities which focus on traders. Most of these interventions target farmers as opposed to traders, making the trading business unattractive and promoting corrupt practices.

Table 5.8: Marketing problems

Problems faced when buying common beans	Percentage
Poor roads	16.7
Limited credit opportunity	16.7
Seasonal production	8.3
Lack of market information	8.3
High transportation costs	8.3
High producer prices	8.3
Low quality production	8.3
Late time of buying	8.3
Poor relationship between buyers and sellers	8.3
Unreliable market	8.3
Total	**100**

Source: Research findings (2012)

Apart from the above mentioned problems, the respondents also mentioned a couple of others, namely: high producer prices involved with the seed create high selling prices which most farmers cannot afford; low quality production of the seed by farmers; seasonal production makes for an unreliable supply at the market; and lack of market information, which is common problem in most markets. Several suggestions were mentioned by traders on how to overcome these buying market constraints and some of the solutions suggested were as follows. First and foremost, the traders mentioned that there is a need for farmer training on seed production and quality assurance, since most farmers sell poor quality seed. Strategies to multiply seed should be put in place, for example, the introduction of winter cropping. Secondly, microfinance institutions need to be introduced among traders so that they can

afford to access good quality seed and at all times. Thirdly, the information flow at the market needs to be improved. Traders need to share information on what is happening on the market.

Again, there is a need for government intervention when it comes to seed price formation since there is no proper price determination in place. During the time of survey, the country was hit by fuel shortages; hence it was felt that government also needs to intervene on the issue since it is beyond the traders' control.

5.10 DISSEMINATION CHANNELS FOR COMMON BEAN SEED

In order to come up with the marketing/dissemination channels for bean seed, farmers who are also producers were asked where they source their improved varieties of bean seed. Since farmers' biggest source is from traders, traders were similarly asked where they bought and/or sold the seed they trade in. The information collected about this practice was used to come up with the following bean seed marketing channels:

- Breeder → NGO/ Govt → Producer → Trader → Consumer (Channel 1)
- Breeder → NGO/Govt → Producer → Friends/Recycle (Channel 2)
- Producer → Trader → Consumer (Channel 3)

The three figures above show the dissemination channels for bean seed to the final consumer. It has been observed that the marketing channel for bean seed is a cycle: seed will come from the producers who are also farmers and the same farmers will access it at the market. As discussed earlier, the longer the marketing channel the more costly the product becomes and this explains why most farmers complain about seed being expensive despite its higher production cost.

Channel 1. As mentioned by farmers, one of the sources of their foundation seed is from institutions like research stations, organisations like CIAT and CARE. These institutions mostly get their supplies from the breeders and distribute to farmers for further multiplication.

When the farmers multiply the seed, they sell it to traders/middlemen who will later take it to the market where the final consumers access it.

Channel 2. In the second scenario the seed is still from the organisations but when the producer multiplies it further, he either shares some seed with his relatives and friends or recycles for his own use during the following season.

Channel 3. Lastly, the producer might acquire the seed from various sources, which can be the market or other farmers, then multiplies it and sells to traders who later take it to market where the end users access it. This is the shortest and most straightforward channel but not necessarily the safest because the source is not reliable.

5.11 CONCLUSION

Analysing the traders leads to conclude that improved common bean seed is a non-market good since there is no formal outlet of the seed. The seed market for improved common bean is not reliable and is vulnerable to manipulation. In most cases, traders sell both grain and seed, so in times of shortage of seed they might get tempted to mix up the two. There is no regulation with regard to the trade of bean seed and most traders are not licensed. Another observation made was that the seed which is traded is not certified by seed services. This is really a problem because most farmers rely on local markets due to scarcity of certified seed in the formal markets.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 SUMMARY

The first objective of this study was to assess the knowledge/awareness, attitude and perception of seed production entities with regard to improved varieties of common bean seed. This objective was hypothesized that production entities (farmers and traders) with adequate information disseminated to them and have positive perception with regard to the use of improved varieties of bean seed will have a positive influence on willingness to pay. This objective was tackled by using a psychometric response scale known as likert scale. This was employed to evaluate the farmers' perception towards improved varieties of beans.

Second objective was to assess farmers' willingness to pay for their choice of improved bean seed varieties. The objective was in line with the hypothesis that farmers would be willing to pay for the seed despite its higher price because of the benefits accrued with the use of the improved seed. The objective was answered by adopting a contingent valuation method (CVM) which was used to assess farmer's willingness to pay for improved varieties of common beans seed. CVM is a survey-based evaluation method where individuals are asked to state directly their willingness to pay to obtain the benefits of using that status quo.

Lastly, dissemination of bean seed to farmers is perceived as a problem in the country. Therefore, the study sought to analyse the marketing channels through which the common bean seed passes through to consumer. This objective was in line with the hypothesis that reliable and shorter channels are cost-effective hence can have a positive effect on farmer's willingness to pay. Current dissemination channels were identified and assessed their efficiency.

6.2 CONCLUSION

Adoption of improved varieties especially in high-potential areas is very significant. However, compared to total seed supply, the share of the formal seed sector in legume crops is minimal. Therefore the study dwelled on the drivers of adoption of improved bean seed varieties by smallholder farmers in Kasungu and Dedza districts of Malawi. The literature says that farmers will not adopt a technology if they do not have full information about the technology. Further, affordable production costs are said to be one of the major problems in new technology ventures, hence farmer's awareness, attitudes and perceptions with regard to adopting improved varieties of bean seed need to be assessed. Consumer acceptance through willingness to pay for the improved varieties is also considered in the study to gauge if farmers are willing to pay for these high cost seed varieties.

Results from the study show that most of the farmers are aware of the existence of improved bean seed varieties and have heard of them through the NGOs that work in their communities. In addition, farmers in the study areas perceive the improved varieties of common beans as high yielding and acknowledge that with the use of the improved seed varieties, productivity of common beans can increase and add to food security in their households. This shows that the farmers have a positive attitude towards new improved seed varieties and tend to be open to their adoption.

In analysing farmers' willingness to pay for the improved seed varieties, the contingent valuation results show that most of the farmers acknowledge the value of the improved varieties of seed and hence are willing to spend money in order to access the improved seed. The one factor that is hindering farmers to access improved seed is lack of certified seed on the market. This problem is due to lack of formal output and input markets. Farmers do not have formal markets to access improved bean seed and if they get a chance to receive hand-out seed from NGOs for multiplication or use, there is no formal selling market for their output and they end up selling the seed at a low price and hence do not realise much from the production. The situation is made worse by the private companies' lack of interest in venturing into the legume seed multiplication business.

To make concrete conclusions on the marketing problems, the study also researched the existing marketing channels of improved common bean seed. Traders were interviewed to come up with the marketing information. The study found that the majority of traders involved in the improved bean seed trade are sole business owners who are not licensed or affiliated to any traders' association group. Many traders, if not all, do not have access to credit hence their businesses are still in the class of small to medium enterprises (SMEs). The traders seem to be well informed on the type of seed varieties most farmers prefer as well the varieties they stock and normally trade. Most of the traders source their seed at the market from wholesalers and re-sell it at local markets on retail. The main buyers of seed at the market are the local people, mostly farmers. Poor roads to transport their commodities to market and limited access to credit facilities were mentioned by traders as the major constraints to trading common bean seed.

The study identified three major dissemination channels for improved common bean seed. Channels 1 & 2 are the longest and long respectively and the third channel is the shortest of all. The study concluded that channels 1 & 3 might not be the ideal dissemination channels although channel 3 seems to be the shortest. This is because channels 1 and 3 have middlemen participating in the marketing chain from producer to end user, which disadvantages the producer/ farmer who gets exploited by the middlemen who usually buy the commodities at lower prices than if the farmer had access to sell directly to the end user. Again, the source of seed from producers in the third channel is questionable. Therefore, there is a need to reduce the gap between the producer and final user to limit the involvement of traders who exploit farmers. Farmers/producers are better off with the second channel since it does not have intermediaries in between. The only control measure to the third channel is to limit the number of cycles of the seed usage and that instead of sharing the seed with friends and family, farmers should start selling it.

6.3 RECOMMENDATIONS

Following the conclusions made in the study, several recommendations can be made:

1. It is the recommendation of the study that the government should strengthen the quality control measures in order to enhance production and dissemination of certified seed of improved varieties of beans.
2. There is a need for government and NGOs to work together to ensure formal seed supply systems of improved common bean seed, characterised by vertically organised production and distribution of tested and approved seed varieties using seed services with strict quality control. Incentives should be put in place to attract private companies to venture into the legume seed business.
3. NGOs and donor support programmes that introduce innovations in the communities need to have sustainable measures for the projects they introduce in the areas and need to put in place good exit strategies so that farmers can continue sustaining the innovations in their absence. If possible, link farmers to markets where they can supply their commodities at a good price. This recommendation came about due to the improved seed varieties which were brought about in these communities but no strategy was put in place for their sustainability.
4. There is a need to strengthen the farmers and traders' associations through capacity building and promotion of systems for market information sharing. The introduction of more associations would help facilitate group production, which can be helpful among smallholder farmers through bargaining for good seed prices, market research, quality of the product and transportation. In this way, production of improved common bean seed varieties can meet the demand for the seed.

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APPENDIX I

COMMON BEAN SEED FARMERS QUESTIONNAIRE

IMPORTANT NOTICE: Before you start the interview, explain to the respondent the objectives of this study and ask for the respondent's consent to be interviewed. **ALSO** explain to the respondent that information collected shall be private, confidential and only used for the purpose and benefit of the study. If the respondent is not willing to be interviewed respect her/his decision.

I. IDENTIFICATION

Name of respondent: ..... Sex: M.....F.....

Date of interview: .....

Village: ..... EPA: .....

T/A: ..... District: .....

II. SOCIO-ECONOMIC AND DEMOGRAPHIC INFORMATION

(tick your answer in the box where applicable)

1. Sex of household head

0	Male
1	Female

2. Marital status

1	Married
2	Separated
3	Widowed
4	Single
4	Divorced

3. Age of household head

1	20 to 29 years
2	30 to 39 years
3	40 to 49 years
4	50 to 59 years
5	Above 60 years

4. Main occupation of household head

1	Farming
2	Business
3	Permanent employment
4	Craft work
5	Other, specify……

5. Education level of household head

0	No education
1	Std 1-5 (junior primary)
2	Std 6-8 (Senior primary)
3	Secondary education

6. Household size:

	Adults
	Children (15 yrs and below)

7. How many in your family, including yourself, are gainfully employed? ☐

III. INCOME

8. What is the monthly income expenditure on food and non-food items in your family. (*Please be assured that the information you will reveal is for research purposes only*)

Code	Type of Expenditure	Monthly spending (MK)	Annual Spending (MK)
1	Food items		
2	Assets/Household items		
3	Education		
4	Health (Pills & hospital fees)		
5	Clothing		
6	Transport		
7	Housing		
8	Farm input & labour		
9	Land rentals		
10	All other expenses		
11	Savings/ borrowed		

IV. BEAN SEED PRODUCTION AND HISTORY OF ADOPTION

9. Are beans your main cash crop?

0	Yes
1	No

10. If no, what is your main cash crop? ☐

1. Maize 2. Cassava 3. Soybeans 4. Cowpeas 5. Sorghum 6. Rice 7. Groundnuts 8. Tobacco 9. Cotton 10. Other (specify).....

11. Have you ever heard of improved common bean seed varieties?

0	Yes
1	No

12. How did you hear about improved common bean seed varieties?

1	Read a flier
2	Heard from friends or neighbours
3	Community organisations like CIAT
4	Radio
5	Other, specify.....

13. Please provide information on adoption of improved varieties of major crop varieties

List of varieties you know	**Have you ever planted improved varieties?** **0. Yes** **1. No**	**If no, why not?** **1. Lack of seed** **2. Lack of cash for seed** **3. Local varieties are better** **4. Other (specific)**	**If yes, how many years ago did you first plant the improved varieties?**	**If yes, did you plant any improved variety (s) last season?** **0. Yes** **1. No**	**If no, why not?** **1. Lack of seed** **2. Lack of cash for seed** **3. Local varieties are better** **4. Other (specific)**	**Improved bean varieties, preferred growing? (Rank by order of preference)**	**Reason for choosing the variety (Rank by order of preference)**

Codes for list of varieties

1. Mkhalira (A344) 2. Nagaga 3. NUA 45 4. NUA 59 5. Kambidzi (A286) 6. VTTT 924/4-4 7. Sapatsika (DRK 57) 8. Kabalabala (UBR (92) 25) 9. Napilira (CAL 143) 10. Maluwa (CAL 113) 11. Kholophete

Codes for reason of choosing the variety

1. Disease resistance 2. Tolerance to low soil fertility 3. Early maturity 4. Good leaf texture for vegetable 5. Marketability 6. Good grin colour 7. Large seed size 8. High yielding 9. Resistant to drought 9. Other, specify ……..

14. How long have you been growing the improved variety of bean seed? .....years

15. Please provide information on the historical profile of adoption of improved varieties

Item	**Improved variety of**				
	Beans	**Maize**	**cassava**	**Sweet potato**	**Other (specify) …….**
Name of the improved variety					
Area of first planting (acres)					
Source of seed for first planting (code A)					
Source of seed last cropping season (code A)					
Trends in area under the variety (code B)					
Have you ever given improved seed to others? Yes 2. No					

Code_A

1. *Min of Agric/ Extn*
2. *Seed company*
3. *NGOs (CIAT, CARE, etc.)*
4. *Bought from other farmers or traders*
5. *Gift from friends and family*
6. *Own/ farm saved*
7. *Other (specify).....*

Code B

1. Increased
2. Decreased
3. Same

V. PERCEPTION

16. Do you agree that with the use of improved varieties productivity can increase?

1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

VI. FARM LABOUR AND SIZE

17. What is the total household size and how many contribute to labour force on farm?

Name of family member	Age	Sex	Approx. No of hrs working on the farm per day

Key: 0. Male 1. Female

18. Apart from family labour, do you have hired labour or non-family members working on the farm?

0	Yes
1	No

19. If yes, how do you hire them?

1	Each year
2	Occasionally

20. How does this help solve your labour shortage?

1	Able to cultivate more land
2	Able to have more farm enterprises
3	Other, specify……..

21. How much land does the household have?

Plot No.	Total size of the plot	Type of planting pattern	Approx. land allocated to beans

Key: Type of planting patterns

1. *Inter-cropping with maize only*
2. *Inter-cropping with maize and other legumes*
3. *Mono- cropping*
4. *Inter-cropping with other legumes such as groundnuts, bambara nuts, mucuna*
5. *Other, specify……..*

VII. OUTPUT AND OUTPUT COSTS

22. How many bags of bean seed did you realise? ……50 kg/bags

23. How many bags of bean seed did you sell? ……50 kg/bags

24. At what cost were you selling the beans seed?

Price variation of common beans across different periods

March 2011 (MK/kg)	August2011 (MK/kg)	March 2012 (MK/kg)	Average price (MK/kg)

VIII. MARKET ACCESS AND AVAILABILITY OF COMMODITIES

25. How do you access improved bean seed?

1	Purchase
2	Gift from friends/ relatives
3	Saved from previous season
4	Given free by CIAT or any other NGO
5	Other, specify.....

26. If purchased, where do you buy it?

	ADMARC
	Other farmers
	Pass on programmes
	NGO
	Other, specify.....

27. How far is the seed access point from your home? …….km

28. Do you have any problem in acquiring seed?

0	No
1	Yes

29. If yes, what are the problems? .....

.....

.....

30. What are the factors affecting successful selling of common bean seed? Rank according to importance

	Low prices
	Poor quality production
	Unreliable buying market
	Lack of market information
	Other (specify).....

IX. EXTENSION SERVICES

31. Are there extension workers in your area? (can be seed inspectors)

0	Yes
1	No

32. If no, why not?

……

……

33. Has the extension worker/seed inspector ever visited you?

0	Yes
1	No

34. If yes, how often do they visit?

1	Every week
2	After every 2 weeks
3	Once a month
4	Not regularly over the year

35. Do extension workers tell you anything about use of improved varieties of common beans?

0	Yes
1	No

36. If yes, do you follow the advice?

0	Yes
1	No

37. If no, why not?

……

……

X. ASSESSMENT OF THE WILLINGNESS-TO-PAY FOR IMPROVED COMMON BEAN VARIETIES

Scenario of common bean seed

38. It is a known fact that common beans are an important cash and food crop for most farmers in Malawi. As a way of promoting the crop, breeders from Bunda College of Agriculture and NARS have come up with quite a number of improved varieties with desirable characteristics like drought resistance, disease resistance, high yielding, marketable, fast cooking traits, just to mention a few. The whole breeding programme is now being decentralised by involving farmers in participatory varietal selection so that they can come up with varieties they prefer so that breeders should base their breeding programmes on that instead of old system of imposing the varieties scientists think are good on farmers. Farmers have different sources of accessing this seed, mostly informal, and end up getting poor quality seed and low yields. If all farmers could access seed produced by seed companies through traders, and given that money is not a problem, the researcher wants to assess the value farmers attach to their preferred variety.

39. It should be noted that the information to be collected here is for research purposes only, meaning we are not going to sell any seed here and you are not going to pay anything.

40. Would you be willing to pay MK 360 for your preferred variety?

0	Yes
1	No

Higher price if yes to 1

41. Are you still willing to pay MK …….. for this preferred variety?

0	Yes
1	No

Table

% change	+25%	+50%	+75%	+100%
Price asked				

Lower price if no to 1

42. If no in question 2, can be willing to pay K..... For this preferred variety?

0	Yes
1	No

Table

% change	−25%	−50%	−75%	−100%
Price asked				

43. How much are you willing to pay for your preferred improved variety? MK.....

44. Why are you willing to pay for such money for this variety?

1	The variety is worth that amount (Value attaching to variety)
2	Because you can afford it
3	You want to access good seed
4	Other reasons (specify).....

45. If not willing to pay any amount, please state the reason

1	The variety is not worth any amount of money
2	You just don't want to spend money on the improved varieties
3	You can still access seed from friends
4	Other reasons (specify).....

Thank you taking your time out to answer the questionnaire

APPENDIX II

COMMON BEAN SEED TRADERS QUESTIONNAIRE

IMPORTANT NOTICE: Before you start the interview, explain to the respondent the objectives of this study and ask for the respondent's consent to be interviewed. **ALSO** explain to the respondent that information collected shall be private, confidential and only used for the purpose and benefit of the study. If the respondent is not willing to be interviewed respect her/his decision.

I. IDENTIFICATION

Name of respondent: ..... Sex: ..... 0. Male 1. Female

Date of interview: ..... Village: ..... EPA: ..... District: .....

II. HOUSEHOLD CHARACTERISTICS OF A TRADER

1. Sex.....

0	Male
1	Female

2. Marital status of the trader

1	Married
2	Separated
3	Widowed
4	Single
4	Divorced

3. Age of the trader

1	20 to 29 years
2	30 to 39 years
3	40 to 49 years
4	50 to 59 years
5	Above 60 years

4. Main occupation of household head

1	Farming
2	Business
3	Permanent employment
4	Craft work
5	Other, specify……

5. Education level (Number of years of formal schooling).....

0	No education
1	Std 1-5 (junior primary)
2	Std 6-8 (Senior primary)
3	Secondary education

6. Household size: ..... Adults

..... Children (15 yrs and below)

7. Who owns the business?

	Father
	Mother
	Close relative (like brother, sister, uncle or aunt)
	Other, specify …….

8. What type of a trader are you?

1	Sole
2	Partnership
3	Other, specify ……..

III. BUSINESS CHARACTERISTICS

9. What is the classification of the business?

1	Private trader
2	Wholesaler
3	Retailer
4	Seed company depot
5	Other.....

10. How many years have you been in this business? ……..years

11. Are you a licensed trader of common bean or legume seed?

0	Yes
1	No

12. Are you a sole owner of the business?

0	Yes
1	No

13. Did you get any credit facility in order to run this business?

0	Yes
1	No

14. If yes, where did you get it?

1	Microfinance institutions
2	Bank
3	Friend/ relatives
4	Other, specify.....

15. What business assets do you have? [ ]

1. *Shop 2. Car 3. Bicycle 4. Warehouse 5. Phone 6. T.V.7. Other*.....

IV. PERCEPTION ON COMMON BEAN SEED

16. Do you agree that with the use of improved varieties, farmers can increase their productivity?

1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

17. Of these improved bean seed varieties, which varieties do you keep in stock?

1	Mkhalira (A344)	7	Sapatsika (DRK 57)
2	Nagaga	8	Kabalabala (UBR (92) 25)
3	NUA 45	9	Napilira (CAL 143)
4	NUA 59	10	Maluwa (CAL 113)
5	Kambidzi (A286)	11	Kholophete
6	VTTT 924/4-4	12	Other, specify……

V. BUYING MARKET

18. Common bean source, distance, quantity purchased

Source of produce 1=Farm gate; 2=Local market 3=seed company depot 4=Middleman/other trader; 5. Other (specify)	**Distance of source from base (km)**	**Number of suppliers last season (2010/11)**	**Quantity purchased last season (2010/11)**	**Amount of money spent (MK)**	**How much did you buy your seed last season (MK/kg)**

19. Purchasing price variation across different periods

March 2011 (MK/kg)	August 2011 (MK/kg)	March 2012 (MK/kg)	Average price (MK/kg)

20. Who are the major sellers of common bean seed and why?

Major Seller 1=Farm gate; 2=Local market 3=seed company depot 4=Middleman/other trader; 5. Other (specify)	**Reason**

21. `How price, grading are decided and the buying methods

How prices are decided	**Criteria used to grade produce** Size Color Appearance Quality Other (specify)	**What grading equipment is used?** Visual Other (specify)	**Is produce available when wanted?**	**Is produce available in adequate amount?**

22. What are the problems faced when buying common bean seed? (Rank them)

	High producer prices
	Low quality production
	Seasonal production
	Lack of market information
	High transportation costs
	Poor roads
	Scarcity of seed (due to low production)
	Limited credit opportunity
	Other (specify).....

23. What can you suggest in order to overcome the problems?

.....

.....

.....

24. How much are you willing to pay for a good quality common bean seed?

MK/kg.....

VI. SELLING MARKET

25. Where do you sell your produce and how far it is?

State your selling market 1=Local market; 2=Middleman/other trader; 5=Institutions; 7=Roadside 8=other (specify)	**Distance from your base (km)**	**Amount sold last season (km)**	**Income from sales last season (MK)**	**How much did you sell your seed last season (MK/kg)**

26. Selling price variation across periods

March 2011 (MK/kg)	**August 2011(MK/kg)**	**March 2012(MK/kg)**	**Average price (MK/kg)**

27. Who are your major buyers and why?

Preferred buyers	Reason

28. Pricing, grading and selling methods

How are selling prices decided?	**Criteria used to grade produce** Size Color Appearance Quality Other (specify)	**What grading equipment is used?** Visual Other (specify)	**Is produce available when wanted?**	**Is produce available in adequate amount?**

29. What are the factors affecting successful selling of common bean seed? Rank according to importance

	Low prices
	Poor quality production
	Unreliable buying market
	Lack of market information
	Other (specify).....

30. How much are you willing to sell a good quality improved common bean seed?

MK/kg.....

VII. MARKET INFORMATION FLOW

31. What are your sources of information on improved bean seed varieties?

1	Friends/ relatives	5	Trade fairs
2	Customers	6	Internet
3	Other traders	7	Print media (Newspapers, etc.)
4	Government agencies	8	Other (specify)……

32. What type of information do you receive?

1	Credit facilities
2	Prices
3	Markets
4	Grades and standards
5	Other, specify …….

33. Are you satisfied with the information flow system?

0	Yes
1	No

34. If no, suggest possible solutions

.....

.....

VIII. TRADER GROUPS

35. Do you belong to any trader's group, club, association or cooperative?

0	Yes
1	No

36. If yes, please provide information on the important groups you've joined

Name of grp/ club/ assoctn	Number of members		Services provided`(Code A)
	M	F	
1.			
2.			
3.			

Code A

1. *Input-output market*
2. *Safety net (risk sharing)*
3. *Credit and savings*
4. *Counselling/ nutrition education*
5. *Other (specify).....*

Thanks for your cooperation.....

APPENDIX III:

DETERMINATION OF SAMPLE SIZE

To come up with a representative sample size (n) the following mathematical formula was used.

$$n = \frac{t^2 * (q) * (1-p)}{d^2}$$ (Bartlett *et al.*, 2001)

Where:

n = sample size

t = value of selected alpha level (e.g. 1.96 for 95% confidence level)

P& *q* = percentage of picking a choice expressed as decimal (e.g. 0.5)

q = 1-*p*

d = percentage error in a given confidence interval (e.g. 0.05= ± 5%)

The sample size was calculated as follows:

$$n = \frac{t^2 * (q) * (1-p)}{d^2}$$

$$= \frac{1.96^2 * (.5) * (1-.5)}{0.05^2}$$

$$= 3.8416(.25) / 0.0025$$

$$= 384.16$$

$$\cong 384$$

A 10% of the calculated sample will be added to sample size to take care of traders who also need to be interviewed. Therefore the sample size will be:

$$= 384 + (.10 * 384)$$

$$= 383 + (38.4)$$

$$= 422.4$$

$$\cong 422$$

Due to time, money constraints and also after data cleaning, the sample was reduced to 132 farmers and 20 traders. In parametric analysis, any sample above 30 is statistically representative therefore a sample size of 152 is statistically justifiable.