FACTORS INFLUENCING ON-FARM COMMON BEAN PROFITABILITY: THE CASE OF SMALLHOLDER BEAN FARMERS IN BABATI DISTRICT, TANZANIA

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A Thesis Submitted to the Graduate School in Partial Fulfilment of the Requirements of the Master of Science Degree in Agricultural Economics of Egerton University

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DECLARATION AND APPROVAL

DECLARATION

I declare that this thesis is my original work and has not been submitted in this or any other university for the award of a Degree, Diploma or Certificate.

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APPROVAL

This work has been submitted to the Graduate School for examination with our approval as university supervisors.

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DEDICATION

I dedicate this thesis to my lovely wife Catherine Vicent Lazaro; mother Lonnah Mbaganile Kilindu; my young brother Geoffrey and sisters; Rehema, Severina and Fatuma for their love and genuine support. Sincerely, I love you all, God bless you.

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ABSTRACT

Legumes are important food and cash crops in developing countries. In Tanzania, more than half the farmers grow several species of grain legumes which include common bean, groundnut, pigeon pea, cowpea, chickpea, peas and soybean. However, productivity of all grain legumes is still low and far below potential and this has impacted on profitability. The aim of this study was to contribute to common bean improved profitability facts for income and food security in Tanzania. The specific objectives were; to measure the common bean on-farm gross margin realized by smallholder farmers, examine the socio-economic factors determining common bean on-farm level gross margin and to determine factors influencing the household common bean supply to the market. Multistage sampling procedure was used to select the respondents from the four divisions in Babati district (Babati, Gorowa, Mbugwe and Bashnet). The first stage involved a purposive selection of two divisions from the four divisions mentioned. The second stage entailed the selection of six wards from the two divisions, using purposive sampling technique; four from Bashnet division and two from Babati division. The fourth stage entailed purposive selection of 9 villages from the six wards basing on bean production dominance. Then the final stage employed systematic random sampling technique to select 200 bean farmers from the nine villages. Primary data was collected from the field using a structured interview schedule method. Secondary data such as national and world common bean production trend; Tanzania common bean export and import were obtained from published literature from Babati district council, Sokoine National Agricultural Library and Egerton University main library. In analysis of data; objective one was analysed using Gross Margin Analysis procedure. Moreover, objective two was analysed using Multiple Regression Analysis approach. Lastly, objective three was analyzed using Logistic Regression method. The study results showed that, at farm level, a gross margin of TZS 133,710.20/= (US$63.67) and TZS 307,283.70/= (US$146.33) for local and improved variety respectively was generated per acre per season. Moreover, age of respondents; gender; yield; selling price (farm-gate price); access to credit; and off-farm income affected the gross margin realized by smallholder farmers. Similarly, age of respondents; gender; family size; education level (years of schooling); farm-gate price; distance to the market; and off-farm income influenced the quantity of bean supplied to the market. This implies that, if this study is positively recognized by bean industry stakeholders, it may significantly contribute as a source of information for improving bean profitability and food security.

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LIST OF ABBREVIATIONS

AFSP	Accelerated Food Security Project
AGRA	Alliance for Green Revolution in Agriculture
ARI	Agriculture Research Institute
ASDP/S	Agriculture Sector Development Programme/Strategy
CAADP	Comprehensive Africa Agriculture Development Programme
CIAT	*Centro Internacional de Agricultura Tropical* (International Centre for tropical Agriculture)
CRSP	Collaborative Research Support Programme
ECABREN	East and Central African Bean Research Network
FAOSTAT	Food and Agricultural Organization Statistics
FEWS NET	Farmers' early warning network
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
MVIWAMO	MVIWATA in Monduli and Longido
NAFSN	New Alliance for Food Security and Nutrition
NAIVS	National Agriculture Input Voucher Scheme
NARS	National Agricultural Research Systems
NFRA	National Food Reserve Agency
NSGRP	National Strategy for Growth and Reduction of Poverty
QDS	Quality Declared Seed
SACCOS	Savings and Credit Cooperative Organizations
SAGCOT	Southern Africa Growth Corridor of Tanzania
SIMLESA	Sustainable Intensification of Maize-Legume cropping systems for Food security in Eastern and Southern Africa
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TDV	Tanzania Development Vision
UAC	Uyole Agricultural Centre
VSLA	Village Savings and Loan Association

CHAPTER ONE
INTRODUCTION

1.1 Background information

Agriculture plays a fundamentally important role in the economic growth and development prospects of a vast majority of developing countries including Tanzania (WTO, 2000). The sector contributes almost a quarter of Gross Domestic Product (24.1%) and employs 75% of the active labour force in Tanzania (Economic Survey, 2011 and URT, 2013). Amongst the important agricultural subsectors in Tanzania are livestock, fishery, agro-forestry and crops (URT, 2013). The major food crops in the country include maize, sorghum, millet, rice, wheat, cassava, potatoes, bananas and legumes (OECD/ADB, 2012). Moreover, the principal export crops include coffee, tea, cotton, cashew nuts, sisal, oil seeds, horticultural crops, pyrethrum, fresh cut flowers, cloves and spices (UNESCO, 2011).

Legumes represent an important component of agricultural food crops in developing countries as they complement cereal crops as a source of protein and minerals especially in Sub-Saharan Africa (Akibode, 2011). Grain legumes also serve as rotation crops with cereals, reducing soil pathogens and supplying nitrogen to the cereal crop (Beebe, undated). Food legume crops are considered vital crops for achieving food and nutritional security for both poor producers and consumers (ICRISAT, 2012). Food legumes as well play an important role as a source of animal feed in smallholder livestock systems (*ibid*). Food legumes moreover have higher prices, compared to cereals, and are increasingly grown to supplement farmers' incomes (Gowda *et al*., 2009 and Giller, 2012).

One of the important legume crops grown in Tanzania is common bean. Common bean (*Phaseolus vulgaris L.)* is the most important food legume for direct consumption and as a source of farm income in Tanzania (NBS, 2012). In the country, beans are often cultivated by smallholder farmers for food consumption without the use of fertilizers where quarter to one-third of the households sell their beans (Ndakidemi *et al*., 2006), with around 20% surplus being marketed (FAO, 2005). Common bean is a popular crop among small-scale farmers because beans are a short duration crop (2.5-4 months) which permits production even when rainfall is erratic (CIAT, 2008). This helps in shortening the hunger periods as well as for providing quick cash (*ibid*).

The average bean productivity in Tanzania is around 662 kg/ha (Ndakidemi *et al*., 2006). However, the potential productivity under reliable rain-fed conditions, using improved varieties under proper crop and land husbandry is 1,500–3,000 kg/ha (*ibid*). Table 1 below shows that in 2013 the country produced 1,150,000 MT on 1,300,000 Ha of land (FAO, 2014).

Table 1: Trend in common bean area and quantity produced in Tanzania as compared to other producers in East and South Africa: 2004 – 2013

Common Bean area harvested (Ha) ('000')										
Country/Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Ethiopia	241	241	164	223	231	244	237	332	367	151
Kenya	787	1,034	995	846	642	961	689	1,037	1,059	1,000
Malawi	211	234	243	260	260	274	290	280	311	307
Tanzania	811	895	895	919	750	868	1,209	738	1,330	1,300
Common Bean Quantity Produced (MT) ('000')										
Country/Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Ethiopia	172	211	138	223	241	363	340	388	463	149
Kenya	278	382	532	430	265	465	391	578	614	529
Malawi	77	86	117	129	125	165	154	177	186	189
Tanzania	448	626	708	889	571	774	868	676	1,199	1,150

Source: FAO (2015)

Tanzania has been among the top twenty largest producers of common bean in the world and the first largest producer in Sub-Saharan Africa, in the last ten years (FAO, 2014). Furthermore, the area under common bean in the country, as shown in Table 1, has been fairly increasing in the period of last ten years. Figure 1 and 2 depict the trend in common bean area and quantity produced in Tanzania as compared to other producers in East and South Africa from 2004 to 2013.

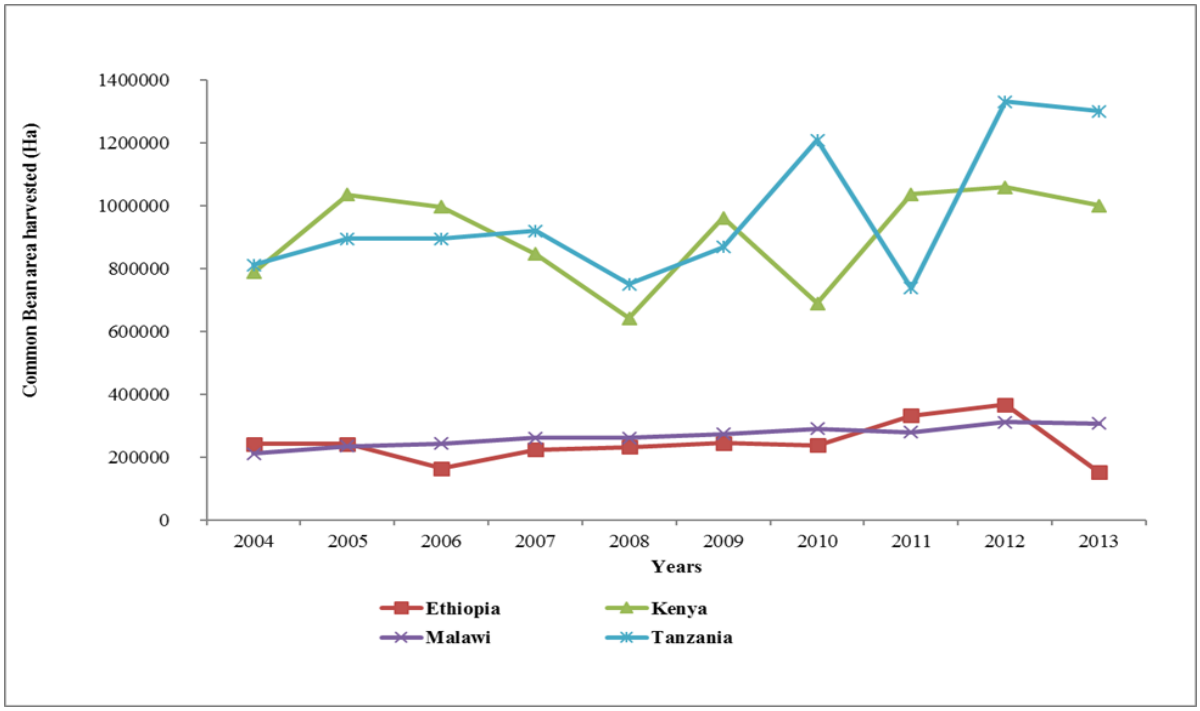


Figure 1: Tanzania: Common bean trend in area vis-à-vis other producers in East and South Africa (2004 – 2013)

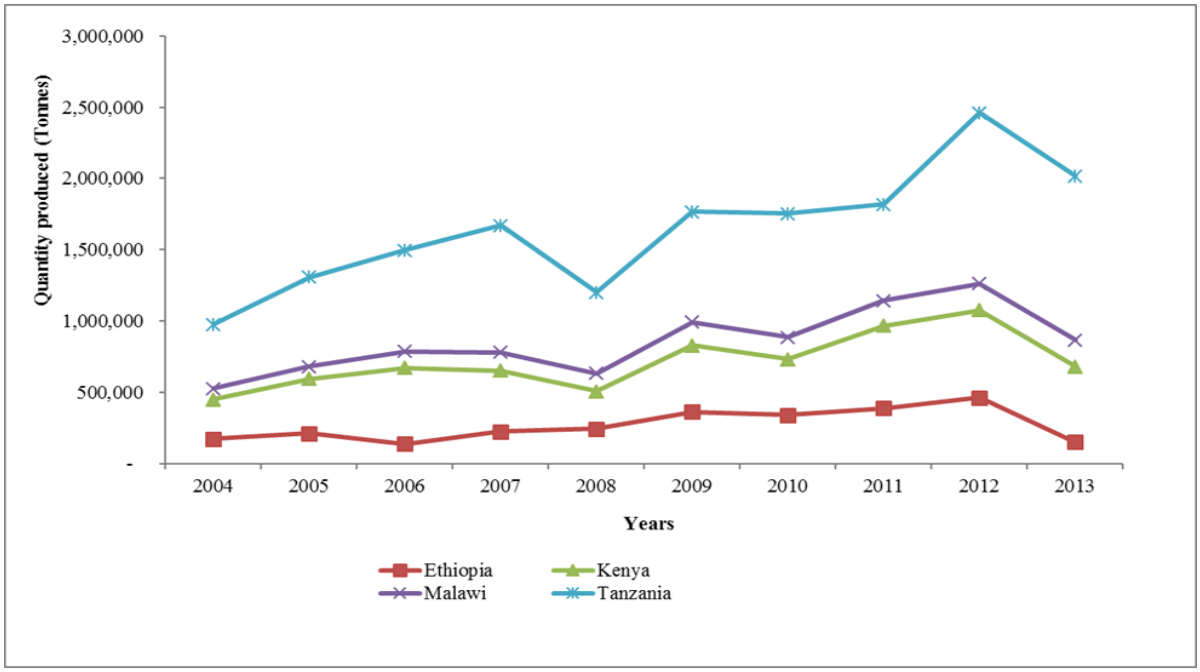


Figure 2: Tanzania: Common bean trend in quantity produced vis-à-vis other producers in East and South Africa (2004 – 2013)

Source: FAOSTAT (2014)

Since Tanzania is one of the lowest cost producers of common bean in East Africa, the country is well placed to increase export to neighbouring countries (FAO, 2015). However, the quantities exported and imported have been fluctuating season after season (FAO, 2015). Table 2 indicates that, Tanzania exported 16,064 tonnes of common bean in 2010 which fetched USD7.5 Million. Table 2 further shows that, in 2010, Tanzania was just behind Uganda in terms of quantity of bean exported. Uganda exported 18,773 tonnes, earning USD7.3 Million in this year (FAO, 2015).

Table 2: Common Bean export and import in selected East and Central Africa countries (2004 –2011)

KENYA	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Export (Tonnes)	1060	1960	1022	5716	9529	836	3599	7264
Import (Tonnes)	5454	11707	14256	93116	30848	52870	40284	51697
Export value (1000$)	395	792	832	2738	8822	464	2110	5804
Import value (1000$)	2268	3581	3782	18026	8174	7853	11721	28589
MALAWI	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Export (Tonnes)	1173	567	3062	1255	2785	8244	7254	15855
Import (Tonnes)	1650	4900	4065	2950	434	738	34	9
Export value (1000$)	407	232	1623	641	1942	16181	6700	7902
Import value (1000$)	930	3450	2567	2200	380	700	32	12
UGANDA	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Export (Tonnes)	13090	22531	25269	8382	30084	30114	18773	28014
Import (Tonnes)	24600	7500	1256	32	8271	1626	376	886
Export value (1000$)	4097	6526	7735	2498	13125	11568	7292	15920
Import value (1000$)	12750	4200	699	10	4200	1300	164	147
TANZANIA	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Export (Tonnes)	5443	10056	13813	3521	2844	11235	16064	11944
Import (Tonnes)	4975	12750	619	2183	698	4097	468	832
Export value (1000$)	4110	4567	7852	1642	4416	5919	7523	3673
Import value (1000$)	2400	5100	293	958	526	2800	61	184
ZAMBIA	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Export (Tonnes)	276	300	903	392	1504	1362	1423	55
Import (Tonnes)	10800	15000	5714	49	168	348	261	333
Export value (1000$)	231	234	411	196	291	809	548	44
Import value (1000$)	5200	3600	2000	51	97	240	172	303

Source: FAO (2015)

Common bean is a crop whose production and marketing could be a potential pathway for improving rural livelihoods through countering chronic food shortages and under-nutrition (MAFSC, 2010, Birachi *et al*., 2011, Tanzania Feed the Future, 2011). However, smallholder

farmers encounter multiple constraints such as poor storage facilities, high post-harvest losses, inadequate capital, poor seed quality, poor performance of the local landraces because of their susceptibility to pests and diseases, poor access to improved germplasm, poor marketing infrastructure, low soil fertility, drought, poor crop management such as late weeding, low labour productivity and unreliable climatic conditions (ECABREN, 2000 and Ndakidemi *et al*., 2006).

In Manyara region, beans dominate the production of pulse crops (URT, 2003). In 2002/2003 season, the total area planted with pulses was 47,099 ha out of which 45,851 ha (97%) were planted with beans, followed by 530 ha (1%) chick peas, 455 ha, (1%) cowpeas and 225 ha (0.5%) bambara nuts. Likewise, the total production of pulses was 16,831 tonnes. Beans were the most cultivated crop producing 16,377 tonnes which accounted for 97.3% of the total pulse production. This was followed by chick peas at 286 tonnes (1.7%), cow peas 82tonnes (0.5%), bambara nuts 58 tonnes (0.3%), field peas 23 tonnes (0.1%) and green gram 5 tonnes (0.03%).

The production of beans among other legumes is much higher in Babati than in other districts in the region. The planted area using improved seeds was 41,071 ha in 2002/2003 season, which represented 15% of the total planted area with the annual crops and vegetables (URT, 2013). Moreover, the use of fertilizers on annual crops was very low with the application of fertilisers to a planted area of only 87,132 ha (33%) against 178,129 ha (67%) without fertilizer (*ibid*). The number of households who were reported to be selling common bean in 2010/2011 season was 88,121 (58.6%), of the total number of crop growing households (NPS, 2011). The percentage of crops growing households selling common bean was highest in Babati (81%) followed by Kiteto (55%), Hanang (52%), Mbulu (48%), and Simanjiro at 23% (ibid).

1.2 Statement of the problem

In Tanzania, progress in the agriculture sector has been made through adopting a more coordinated sectoral approach. Agricultural policies are being implemented through a myriad of programs and projects. One of the programs is aimed at increasing bean production by smallholders for income and food security. Despite this effort, both volume and value of common bean exports from Tanzania have been highly fluctuating. Moreover, common bean in the country is grown perpetually as a routine activity by smallholder farmers. It is not known if these smallholder farmers break-even. Moreover, little is known about the profitability of common bean production in Tanzania. There is also a dearth of information concerning the factors that may have an effect on the gross margin of common bean production at farm level.

This research generally aspires to understand the factors influencing Tanzanian legume on-farm gross margin under the current policy regime.

1.3 Research objectives

1.3.1 General objective

The overall objective of the study was to contribute to common bean improved profitability facts for income and food security in Tanzania.

1.3.2 Specific objectives

The specific objectives of the study were as follows;

i. To measure the common bean on-farm gross margin realized by smallholder farmers.
ii. To examine the socio-economic factors determining common bean on-farm level gross margin.
iii. To determine factors influencing the household common bean supply to the market.

1.3.3 Research questions

i. What is the common bean on-farm gross margin realized by smallholder farmers in the study area?
ii. What are the socio-economic factors determining common bean on-farm level gross margin in Babati district?
iii. What factors influence household common bean supplies to the market in Babati district?

1.4 Justification of the study

Common bean (*Phaseolus vulgaris* L.) is the Tanzania's most important food legume for direct human consumption. High in nutrients and commercial potential, common bean holds great promise for fighting hunger, increasing income and improving soil fertility in the country. Bean provides a rich combination of carbohydrates (60-65%), proteins (21-25%), fats (less than 2%), vitamins and minerals. In fact, with increasing health concerns, most people especially the urban population are reducing consumption of animal proteins, and instead they are turning to pulses such as common bean due to its low-fat content. Hence the rationale for emphasis in more common bean research is self-evident.

Common bean is often grown by women farmers mainly for subsistence and markets. Despite the great importance, the growth in common bean productivity has been slow because of both

social and physical environments in which the crop is grown. The International Centre for Tropical Agriculture (CIAT) in collaboration with the national agricultural research systems in East Africa has been, through PABRA, conducting research on bean improvement in Tanzania. Several research and development initiatives have been developed and continue to emerge. These include: 1) improve bean varieties; and 2) enhance the functioning of the seed systems and fast diffusion of associated technologies. In 2007, CIAT joined a consortium of three international organizations (i.e. International Center for Tropical agriculture (CIAT), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and International Institute of Tropical Agriculture (IITA) to design and implement a project aimed at increasing productivity of tropical legumes including common bean to reduce poverty in Tanzania. Despite this effort, both volume and value of common bean exports from Tanzania have been highly fluctuating. Understanding whether common bean smallholder farmers in Tanzania are breaking-even under the existing policy regime is imperative.

Empirical evidence from this study will contribute to the National Strategy for Growth and Reduction of Poverty (NSGRP), Tanzanian Vision 2025 and SDGs 1 and 2. The study results will be useful to agriculture sector particularly the legume sub-sector in planning appropriate and consistent strategies which will create a comprehensive awareness to stakeholders, such as policy makers, smallholder farmers, researchers, NGOs, input suppliers, buyers, transporters, among others to join hands in ensuring extreme poverty and hunger in the country is alleviated. It also adds to the body of knowledge on bean production that assists government and non-governmental agencies (not only in Tanzania, but also in the wider to improve the productivity of beans, and to find solutions to other technical problems in smallholder agriculture. This will be possible, if this study will be considered positively, and therefore highly contribute to pro-poor farmers' policies in agriculture, through influencing, and re-orienting the common bean industry stakeholders' decision making towards benefiting these poor farmers.

1.5 Scope and limitation of the study

The study was carried out in Babati District of Manyara Region, and can be generalized to other areas with similar agro-ecological characteristics. The farmer households focused on in this study were those involved in common bean cultivation. The data collected was limited mainly to the 2013/2014 season; where soil-related and climatic factors were not considered in the study. Furthermore, the information provided by smallholder farmers in Babati district depended much

on their memory capacity, as most of them do not keep farm records. The later was conquered through probing more on questions seeking quantitative data, and highly relying on enumerators from the study area.

1.6 Definition of terms

Gross Margin: Gross Margin in this context will be defined as the gross income from an enterprise less the variable costs incurred in achieving it, divided by revenue, expressed as a percentage. This number will represent the proportion of each shilling of revenue that the smallholder farmer retains as gross profit.

Legume: This is a seed and or pod plant with compound leaves and roots bearing nodules containing nitrogen-fixing bacteria such as common bean, groundnuts, soybeans, pigeon peas, cowpeas and chickpeas used as food for both human being and animals. In the context of this study, legume and pulses will be used interchangeably.

Policy: Is a program of actions or set of principles which is the shrewdness or prudence adopted by a farmer, farmer groups, cooperatives, agribusinesses, government and non-government organizations and all other stakeholders in agriculture. The word policy in this context means agriculture and food policy.

Profitability: Is the quality of affording gain, benefit or profit determined by subtracting all the related expenses from sales. Profitability can also be determined through profit margin which is established by taking gross income from an enterprise less the variable costs incurred in achieving it.

Smallholder farmer: Is somebody who owns and or operates an area of land where particular legume crops are raised for commercial, food and seed purposes. A small-scale farmer in this context is somebody who owns and or operates an area of land less than or equal to 2 hectares.

Variable costs: In this study, variable costs will be those expenses directly attributable to the smallholder farmer, and which vary in proportion to the size of an enterprise. For example, if the area of bean sown doubles, then the variable costs associated with growing it, such as seed, chemicals and fertilizers will roughly double. Variable costs in this study will not include fixed or overhead costs such as depreciation, interest payments rates, or permanent labour.

CHAPTER TWO
LITERATURE REVIEW

2.1 Trend of common bean production in the world

Common bean is grown in 128 countries on more than 27 million Ha of land across the world with nearly 20 million MT being produced annually (ICRISAT, 2012). The world average yield is 723 kg per ha (*ibid*). World area, yield, and production grew by about 20.19%, 19.28%, and 27.12%, respectively in 2013 (FAOSTAT, 2014). Figure 3 below shows the world common bean production trends. The world gap between production and area has narrowed starting in the late 1990s as a result of increase in productivity (ICRISAT *et al*., 2012). The largest producers of common beans in the world are India, Brazil, Myanmar, China, USA, Mexico, Kenya, Tanzania, Uganda, Indonesia and Canada (ICRISAT, 2011).

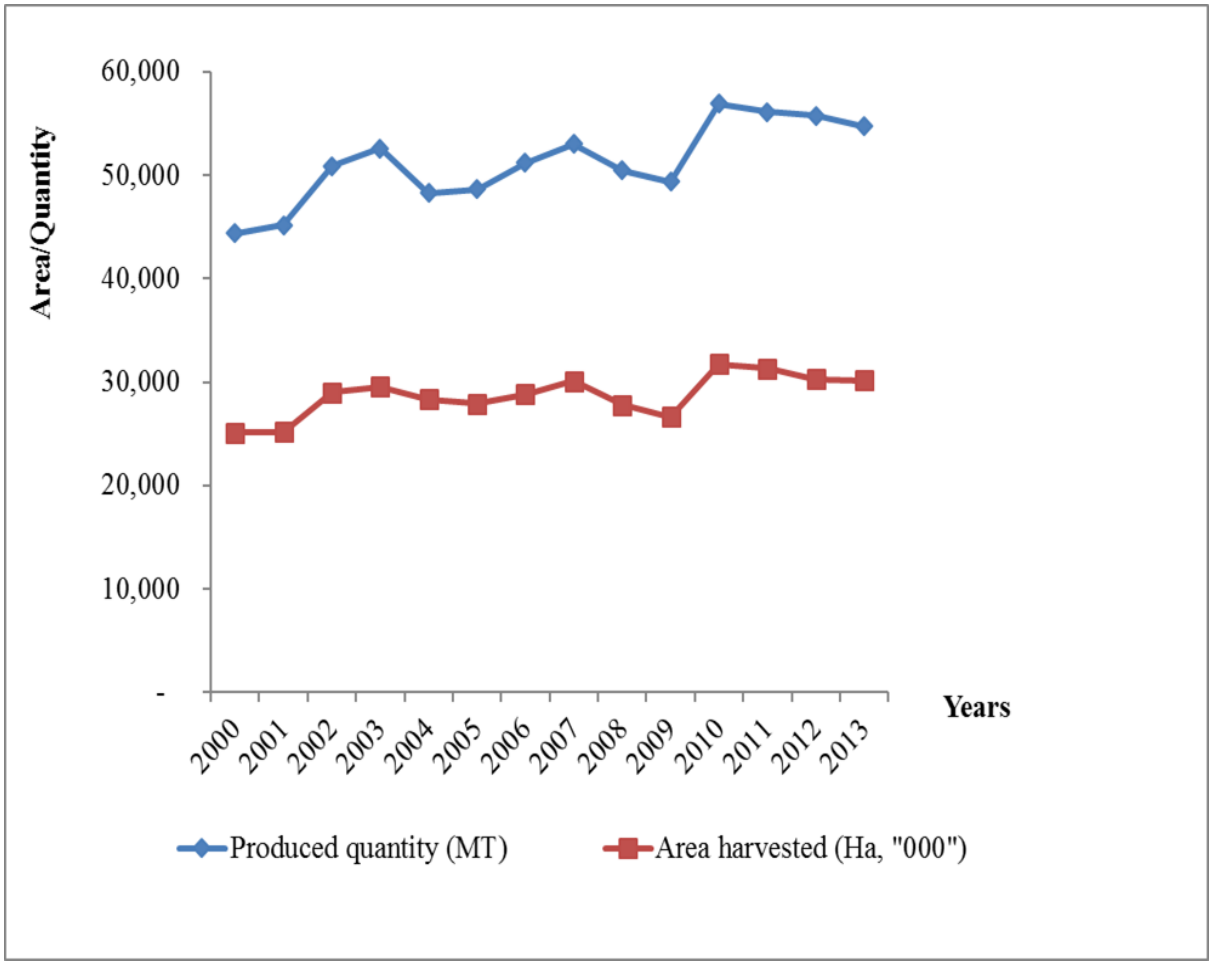


Figure 3: World common bean production trend

Source: FAOSTAT (2014)

In Africa, there is a concern on the variability of the production statistics on common beans (Birachi, 2012). This is because the available data from different sources fluctuate and in some cases, it is difficult to interpret (CIAT, 2012). A comparative picture of bean production in these African countries is summarized in Table 3 below. The figures indicate that in the 9 selected countries, the average area under common bean each year is more than 3 million hectares and production is above 2 million MT per year.

Table 3: Area, production and yield of common bean in selected African countries, 2012

Country	Area (ha)	Production (MT)	Yield (kg/ha)	Population regularly consuming beans (million)
Burundi	380,000	298,000	902	6.2
D.R Congo	510,000	305,000	760	26.5
Ethiopia	239,000	120,000	500	8.4
Kenya	687,000	485,000	705	19.7
Madagascar	36,000	25,000	700	1.7
Rwanda	320,000	226,000	738	7.5
Sudan	70,000	49,000	700	1.7
Tanzania	465,000	288,000	662	22.5
Uganda	400,000	352,000	880	15.0
Total/Average	3,107,000	2,148,000	727	109.2

Source: CIAT (2012)

In some of the selected African countries, there has been an increasing trend in the total area under beans and total bean productivity over the last 10-15 years (Birachi, 2012). In others, there has been a declining trend in the area under beans but with total productivity remaining constant. Consequently, the amount of land under beans per household is constant or decreasing in land scarce countries for instance Burundi and Madagascar but in countries with relative land abundance such as D. R Congo and Tanzania, the trend is gradually increasing (Table 3). Population increase is considered as a major reason for the increase in the farmland allocated to common beans (ICRISAT, 2012). This is because the increase in population increases the demand for common bean (CIAT, 2012). The increase in yields is attributed to the adoption of improved bean varieties developed over the last two decades (*ibid*).

In the case of Tanzania where common bean yields were relatively low, this was attributed to limited diffusion of improved varieties, declining soil fertility, drought, pests and diseases (Birachi, 2012). Limited diffusion is due to unavailability of seed, high seed prices and lack of

understanding about the qualities of the improved varieties (CIAT, 2012). In the case of Ethiopia, poor road infrastructure is believed to add enormously to the cost of transportation making the final price of seed to the farmer beyond reach (Birachi, 2012). In all selected African countries, literature show that there was an increasing trend in the per hectare cost of bean production because of the increasing prices of inputs (CIAT, 2012).

According to ICRISAT (2012), the general salient constraints on on-farm common bean production in Africa include; poor government policies, lack of improved seed, lack of appropriate production technologies; high post-harvest losses and poor knowledge among the farmers because there is no training, soil infertility and lack of fertilizers, lack of credit, limited labour availability, erratic weather patterns, pest and disease infestation especially the rain-fed crop, lack of markets, limited extension services along with high input costs. It is difficult to achieve the desired production targets under these constraints. Across the selected African countries, high post-harvest losses, seeds, credit as well as inadequate extension services are common constraints. Markets and credit rank highly for Zambia and Tanzania while drought, pests and diseases are particularly serious problems for Tanzania.

2.2 Common bean production in Tanzania

2.2.1 Common bean production trend

The common bean or *Phaseolus vulgaris L.* is the most important food legume for direct consumption and as a source of farm income in Tanzania (NBS, 2012). Although beans are a non-traditional crop in the country, they are widely produced after maize and cassava. Beans are the third largest produced crop in terms of area planted. Main production areas are in the Northern Zone (particularly Arusha, Kilimanjaro and Manyara regions), the Great Lakes region in the West and the Southern Highlands (Hillocks *et al*., 2006). In the country, beans are often cultivated by smallholder farmers for food consumption without the use of fertilizers (Ndakidemi *et al.,* 2006). In Iringa, Kilimanjaro, Arusha and Manyara regions, commercial bean production for export takes place because the climate is suitable (Hillocks *et al.,* 2006; Lewis *et al.,* 2008 and Stahley *et al.,* 2012). Sole crops of beans are common in this region (Hillocks *et al.,* 2006).

Common bean production levels in Tanzania have been increasing gradually. The increase in production was proportional to the area harvested between 2000 and 2012 (Figure 4), and reached 950 thousand tonnes in 2010 (Stahley *et al.,* 2012 and FAOSTAT, 2014). This growth is driven by growing domestic demand due to population growth. The common bean grown

includes many different varieties which differ by colour, shape, size and properties such as cooking time and digestibility (Stahley *et al.*, 2012).

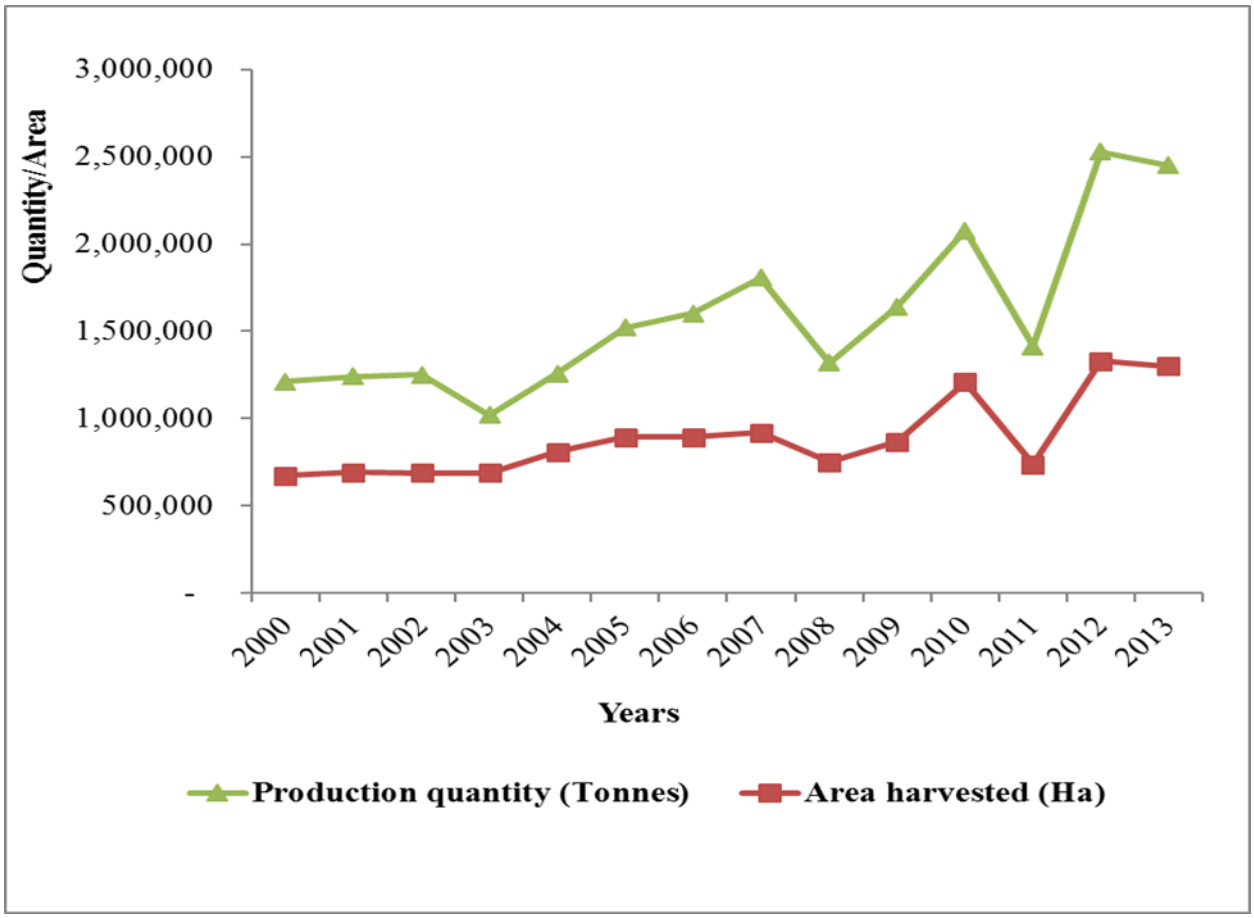


Figure 4: Tanzanian common bean production trend

Source: FAOSTAT (2014)

2.2.2 Role of common beans in farm household strategies

According to CIAT (2012) and ICRISAT *et al*. (2012), the importance of common bean in generating incomes for farm families cannot be gainsaid. Beans are considered as a cash crop in many parts of Tanzania. Common bean brings in incomes earliest compared to other crops and thus act as bridging source of incomes before the main crops. This is because beans mature earlier and can also be sold at various stages as green leaves, fresh pods and dry grains.

Common bean is considered as a crop that can mitigate hunger in Tanzania. Hunger recurs almost every year in most parts of the country given the cropping cycles (CIAT, 2012). Consequently, families require stop gap measures for food as they wait for the main food crops

such as maize. Beans play this role better as they are considered as a dependable and complete meal by families. Beans can be planted up to 2-3 times a year (CIAT, 2012). Beans take a shorter time to mature and have multiple consumptions before the grain is harvested. Thus, beans increase better chances of mitigating food security problems. On most occasions beans are served as one of the more affordable foods freely to complement cereals and thus can greatly benefit children and the poor in the society (CIAT, 2012).

Beans contribute to the sustainable intensification of production systems since they reduce the amount of fertilizer that can be used on maize if planted consecutively with maize. Beans consequently provide a self-sustaining system as they sustain soil fertility, use less water resources and thus fit well in the efforts to counter the negative effects of climate change. Several projects like N2Africa and SIMLESA promoted beans as a soil fertility improvement initiative in the country. This is because among others, common bean biomass can improve soil structure (ICRISAT *et al*., 2012).

Participation of men and women in common bean activities varies across the country depending on the production systems. In coffee growing areas for instance, men involve themselves with coffee while women are involved with beans and other crops. Mostly, men focus on most income generating crops and on larger scale. Common bean is considered a communal crop with benefits extending to others in the society while other cash crops' benefits are usually restricted to respective families (ICRISAT *et al*., 2012). In areas where land is scarce such as Kilimanjaro and parts of Mbeya, men are more likely to involve themselves in all crops grown on farms, including beans. Additionally, in regions where the focus of households is to generate incomes, men tend to dominate irrespective of the crop.

2.2.3 Variations in common bean quantity traded over seasons

There are seasonal variations on quantities of common bean traded over the years (CIAT, 2012). The variations are dependent on the cropping seasons and harvest times (Birachi, 2012). During harvest times, intermediaries enter the villages to buy beans. Common bean prices are lowest in April to June which is the harvesting period (CIAT, 2012). On the other hand, seeds are mostly grown in the rainy season because grains are usually rain-fed. Prices are highest in September to December which is the planting period. In between June to August, prices are normal. Prices drop during the harvest time because most of the farmers need immediate cash to cover their needs and thus sell at the prevailing lower market prices. The other reason is, most producers

also do not store beans as they fear post-harvest losses and would rather sell and buy later on for consumption (Birachi, 2012). Most intermediaries buy and keep beans for other bigger buyers. Farmers usually look for beans to plant in addition to their regular consumption needs in highest price months (CIAT, 2012).

2.3 An overview of common bean trade in Tanzania

Tanzania is currently a significant net exporter of common bean in the region with minimal export in the international market, but the country has a potential for exporting common bean to South Africa and India (Spilsbury *et al.*, 2004 and Tchale, 2002). Common bean from Tanzania are mainly exported to Kenya, Malawi, Zambia and the democratic Republic of Congo (Tchale, 2002). Common bean production in these countries shows a stagnant or a declining trend (*ibid*). This implies that the gap between production and per capita availability will continue to widen, increasing their common bean import demand. Thus, the demand for exports from Tanzania by these countries is expected to increase in the medium term (Spilsbury *et al.*, 2004). The current political crisis in the Democratic Republic of Congo and the frequent drought in the central and eastern Kenya are other factors that are likely to favour exports of common bean from Tanzania (Spilsbury *et al.*, 2004 and Tchale, 2002).

2.4 The current Tanzanian Agricultural policy framework

Tanzania has Country Development Vision (TCDV) 2025 to guide long-term agriculture development. The vision aims to achieve high agricultural productivity and profitability. Moreover, the vision acknowledges agriculture as the backbone of the economy. It also highlights the role of the private sector in attaining a modernized, commercial, highly productive and profitable agriculture sector in general which includes the common bean industry. At the national level, there are two medium-term strategies for implementing TCDV 2025; the National Strategy for Growth and Reduction of Poverty (NSGRP) and the Tanzania Five-Year Development Plan (FYDP).

The NSGRP strategy outlines three clusters of activities for TDV 2025: i) growth and reduction of income poverty; ii) social services and well-being; and iii) good governance. The contribution of the agriculture sector focuses on the first cluster; growth and reduction of income poverty and defines five priority areas for driving growth in agriculture. The implementation review of TCDV 2025 states that agriculture's potential contribution to national development has not been

sufficiently explored (President's Office, Planning Commission, 2011). FYDP was developed to reflect the global economic crisis and national capacity for managing such shocks. Delineating key functions and strategies to generate the momentum for economic growth, the plan considers agriculture as one of the key priority areas for which strategic interventions are needed in order to stimulate productivity and profitability.

The ASDS was adopted in 2001 to support the realization of TCDV 2025 and achieve the sectoral policy objectives of NSGRP. The strategic objectives of ASDS are to: i) create an enabling and favourable environment for improving productivity and profitability in the agriculture sector; and ii) increase farm incomes to reduce rural poverty and ensure household food security.

To serve these objectives of improving agricultural productivity and profitability, five strategic areas were identified: i) strengthening the institutional framework for agricultural development; ii) creating a favourable environment for agricultural marketing activities; iii) enhancing public–private roles in strengthening supporting services such as credit, supply of inputs, collection of output, agricultural extension and training services and technology iv) facilitating marketing efficiency for inputs and outputs; and v) mainstreaming planning for agricultural development in other sectors. ASDS is the main policy framework for agriculture and is accompanied by a set of sub-sectoral policies (ESRF, 2010). Some of the policy components are Cooperative Development Policy for creating an enabling environment for cooperatives to operate efficiently in the liberalized economy; Agricultural Marketing Policy of 2008; National Irrigation Policy of 2010 and the National Agricultural Policy of 2011.

ASDS is implemented through ASDP, a sector-wide investment programme launched in 2006. The main objective of ASDP is to increase productivity, profitability and farm incomes including legumes such as common bean; pigeon peas; groundnuts and soybeans among others by: i) facilitating farmers' access to and use of agricultural knowledge, technologies, marketing systems and infrastructure; and ii) promoting private sector investment in agriculture, based on an improved regulatory and policy environment. ASDP has five key operational components: i) policy, regulatory and institutional arrangements; ii) agricultural services which are research, advisory and technical services, and training; iii) public investment; iv) private sector development, market development and agriculture finance; and v) cross-cutting and cross-sectoral issues, such as gender mainstreaming and implementation of land acts. The Ministry of

Agriculture, Food Security and Cooperatives has drafted a second ASDP for the period 2013–2020.

For agricultural investment, *Kilimo Kwanza* which is a public–private plan launched in 2009 aims to achieve a green revolution and boost private sector participation by increasing concessionary lending to agriculture, empowering agricultural cooperatives, creating commodity exchanges, removing market barriers to agricultural commodities, enhancing trade integration, promoting public–private partnerships for investment in agriculture related infrastructure and agricultural services delivery, improving access to and use of agricultural knowledge and technologies, and accelerating land reform. Several programmes are in line with the government's increased emphasis on food markets and mainstreaming of agriculture related interventions across ministries. For instance, to boost financial institutional development under *Kilimo Kwanza*, the Tanzania Agricultural Development Bank was established, and the Tanzania Investment Bank has helped to increase the budgetary allocation for agriculture. Other measures include strengthening the role of National Food Reserve Agency (NFRA). These programmes are calling for the maintenance of stable food stocks; ensure market stability; discouraging exports of raw materials through encouraging value addition to realize higher agricultural produce prices ultimately relatively higher profits; government procurement of local products; encouraging local processing; and input subsidies.

Moreover, following Tanzania signing of the compact for implementation of the African Union's Comprehensive Africa Agriculture Development Programme (CAADP) in 2010, Tanzania Agriculture and Food Security Investment Plan (TAFSIP) was launched in 2011 to achieve the CAADP target of 6% annual growth in agricultural GDP (GoT, 2011). TAFSIP aims to be the financing mechanism and framework for ASDP. Other projects, developed under the ASDP framework include the AFSP for achieving greater food security through increasing food production, productivity and profitability; National Agriculture Input Voucher Scheme (NAIVS) aiming at providing input subsidies for seeds and fertilizer; Participatory Agricultural Development and Empowerment Project (PADEP) aspiring to provide grants to communities and farmers' groups for investment in agricultural development project activities. Moreover, the Tanzania Social Action Fund (TASAF) of the President's Office supports the implementation of projects related to food security, education, roads, water, health, training and environment; Rural Energy Fund (REF) is implemented by the Ministry of Energy and Minerals and invests in rural roads. The latest commitment for agricultural policy in Tanzania is the G8 New Alliance for

Food Security and Nutrition (NAFSN). The URT joined the alliance in 2012. NAFSN aims at increasing private investment in agriculture to achieve sustainable food security and reduce poverty through accelerating TAFSIP implementation.

The Southern Africa Growth Corridor of Tanzania (SAGCOT), initiated in 2010 as an international public–private partnership, also aims to promote private investment, particularly in increasing agricultural productivity and developing commercial and more profitable agriculture of cereals and legumes including common bean in the Southern Corridor. SAGCOT approach is based on clusters of commercial farms and agribusinesses in areas with high agricultural potential and access to supporting infrastructure. An average farm size of 2 ha is preferred, fostering close cooperation with small-scale farmers. SAGCOT is seen as an excellent way of promoting food security in the country, Africa and at the global level (Cooksey, 2013).

2.5 Empirical studies on factors influencing profitability in agriculture

Several factors have been identified to influence agricultural profitability at farm level (Samboko, 2011). These include; the farm gate price, government price policies, farm location, production costs, variety of seed used, yield, farm size, tillage practices, land tenure which also influences yield, experience in production of crop which impacts on yield, education level of the household head, age of household head, gender of household head, household size, off-farm income received, extension services, and distance to market (Rearden *et al.,* 1997). For farmers in Africa and elsewhere, net productivity is critically dependent on crop prices, level of output, and production costs (Odhiambo *et al.*, 1996).

Erbaugh *et al.* (2008) found that farm size, production costs, farm location, interaction between production costs and farm gate price as well as the interaction between the varieties used and fertilizer applied were significant in explaining the observed sorghum gross margins. However, contrary to literature, farm size was found to negatively influence the gross margins. Their view on the relationship between farm size and gross margins contrasted with findings elsewhere such as those by Sulumbe *et al.* (2010) and Ibro, (2008) who found positive relationships between gross margins and farm size. The interaction between production cost and farm gate price was found to be positive and significant while the farm gate price alone was insignificant. The findings also showed that the variety used, tillage method, and the application of fertilizer were not significant but the interaction between variety used and fertilizer application was significant

and positive. In another study, Sulumbe *et al*. (2010) looked at the profitability of cotton production under sole-cropping in Nigeria; they reported that, family size, income and extension were positively related to cotton output. Farming experience, was, however negatively related to the cotton output.

Moreover, in a study by Mishra *et al.* (1999), the factors affecting farm profitability were investigated by using weighted least squares model. Profitability in this study was measured by net farm income and operators' labour and management income. The results of the study showed that profitability was associated with farm operator's age, soil productivity, debt-to-asset ratio, and ratios of variable and fixed costs of production to value of agricultural production and the profitability of other small farms were related to operator's age, farm size, farm diversification, and crop insurance.

Furthermore, Plumley and Hornbaker (1991) divided cash operating expense to value of farm production to calculate farm profitability in a study investigating the characteristics of successful and less successful Illinois grain farms. They demonstrated that successful farms had a balanced composition of assets, lower debt, and higher profitability. In another study in Illinois on grain farmers, Net Farm Income was assumed as proxy of farm profitability and the effect of different farm sizes in three different time periods. It was concluded that in periods of poor to moderate profitability driven by low to moderate commodity prices, operations with more than 500 acres tended to be more profitable than farms with less than 500 acres (Kern and Paulson, 2011).

In addition, Burton and Abderrezak (1988) examined the relationships between expected profit and farm characteristics using Ordinary Least Squares (OLS) regression model in western Kansas. They also used Net Farm Income as measure of profitability in their model as the dependent variable. The findings showed that expected profit may be enhanced by increasing farm size, lease or rental of intermediate and long-term assets, using production and financial inputs efficiently, and hedging. In a similar study, Jirgi *et al*. (2010) investigated the profitability and resources use efficiency of millet/cowpea mixed farmers' production in Niger state, Nigeria by farm budgeting technique and exponential production function. The results of the regression with Net Farm Income as the dependent variable indicated that although these enterprises are profitable, farmers should use more seed, family labour, agrochemicals, less of hired labour and land to gain more profits.

In a study that was conducted by Ibro, (2008) on the value chain of cowpeas in Nigeria, it was found that businesses operating at a greater scale, earned more per input. Neither experience nor education was found to be a strong predictor of profitability. However, in this study, Ibro focused on the vendors and not the producers of cowpeas.

Moreover, Zulu (2011) analyzed the profitability of cowpea farmers in Zambia. He used Gross Margin as the measure of farm profitability as dependent variable and concluded that yields, land tenure and farm gate price had a positive influence on profitability whereas production costs and area had a negative influence on profitability. In a similar study, Olujenyo (2008) investigated the determinants of maize farms' profitability in Ondo State, Nigeria. The results of regression with Gross Margin analysis showed that maize farming is profitable in the region and farmers should apply more fertilizers to improve their land quality and gain more profits.

2.6 Common Methods of Profitability Analysis

There are many methods that can be used to determine the profitability of an enterprise as well as identify the factors that influence profitability. Some of these methods include Gross Margin Analysis (GMA), value of production, total revenue, Partial Budgeting Analysis (PBA), Cost Effective Analysis (CEA), Cost Utility Analysis (CUA) and Cost-Benefit Analysis (CBA) (Dijkhuizen and Huirne, 1997; Zweifel *et al*., 2009). However, gross margin analysis appears to be a common method used to determine profitability and has been used in many studies.

2.6.1 Gross Margin Analysis

Ahmad (2004), in studying the factors affecting the profitability and yield of carrot production in two districts of Punjab included a partial budgeting model that was used to determine profitability of carrot growing. This methodology included a gross margin analysis which was used to determine the costs of various inputs and the profitability of carrot cultivation. According to Ahmad (2004), gross margin was used because of its accuracy in estimating profit. Factors affecting yield in this study were determined by carrying out a regression analysis using a Cobb-Douglas production function which was used due to its ease in computation and interpretation. In another research that was done on the profitability of sorghum farming in Tanzania, a gross margin analysis was also used to determine the profitability of sorghum. In this study, gross margin analysis was done in which the total variable costs were subtracted from the total revenue (Erbaugh, 2008). A regression model was then carried out in this study in order to test factors

that might have influenced gross margin and hence profitability of sorghum production. The gross margin variable was regressed on the farm size used to produce sorghum, farm gate price, farm production costs, farm location, the interaction between production costs and farm gate prices, seed variety used, technology used such as fertilizer, the interaction between seed variety and fertilizer applied and production technology used.

In another study that was conducted on the performance and profitability of the banana sub-sector in Uganda, a gross margin analysis was used to determine the profitability of banana production. The gross margin analysis involved cost-benefit trade-offs where total variable costs were subtracted from total revenue. In this study, Budgeting techniques were used to measure comparative advantage of various crops to the farmer in terms of income earned and return to family labour. Regression analysis was used to determine the factors affecting banana productivity and profitability in the study area. Yield of bananas was regressed against variables thought to influence farmers 'decisions to invest in agricultural production. Thus, yield of bananas was regressed on the total farm size, total farm income, off-farm income, age of the farmer, weevil damage, interaction with government extension agents, gender of the farmer, distance from the farm to the tarmac, years spent in school and number of cattle owned (Bagamba, 1998).

Gilbert (2001) carried out a study in which he compared gross margin analysis to total revenue in terms of which method was better in estimating profit. He concluded that gross margin was a more accurate estimate of profit compared to total revenue.

From these studies the most accurate and common method of estimating profits is gross margin analysis, whereas the most common method of identifying factors that influence profitability is multiple regression in which gross margin is regressed on different factors expected to affect profitability.

2.6.2 Uses of Gross Margin Analysis

The many purposes for which gross margin estimates are developed broadly include farm-level decision making, policy and government program analysis, performance analysis and the study of resource allocation issues (AAEA, 1998). Farm-level decision analysis examines options for a given farm in the coming year, and for longer-range periods using projected information. Policy analysis often uses historical cost information for a group of farms producing the same commodity, to analyse the likely impacts of a proposed policy change. The study of efficiency of

resource allocation usually involves details on the components of cost and returns for a composite of farms. Economic or financial performance of a particular enterprise can involve both historical and projected cost information for a single farm and/or a group of farms. To address these various information requirements, gross margin estimates are prepared to provide measures of the costs of producing a unit of a commodity for a specific farm, for a representative farm in a region, or for a representative farm in a country (AAEA, 1998).

2.6.3 Limitations of Gross Margin Analysis as an indicator of enterprise profitability

Gross margins should only be compared with figures from farms with similar characteristics and production systems. With this reservation in mind, the comparisons can give a useful indication of the production and economic efficiency of an enterprise. Comparison of gross margins between enterprises with different fixed cost structures can be misleading (Firth, 2002). In this study, common bean smallholder farmers had similar characteristics and production systems. The gross margin does not measure net profit of an enterprise as it only takes variable costs into account. Therefore, it should be clearly stated that the results obtained in the current study are gross margins and not net profits, even though the former is a good measure of enterprise profitability. Labour can be difficult to allocate as most businesses have permanent labour and casual labour. In a gross margin analysis of common bean, the tendency is to focus on the casual labour associated with that particular project such as weeding, harvesting, spraying, fertilizer application among others (Firth, 2002).

2.7 Market Valuation Methodology

In market valuations, a number of studies have been conducted in the Agricultural sector. In the determination of the profitability of an enterprise, the common method involves a gross margin analysis in which variable costs of production are deducted from the total revenue (Sulumbe *et al.,* 2010, Erbaugh *et al.*, 2008, Olayiwoola, 2008, Tschering, 2002 and Ishikawa, 1999). In these studies, gross margins served as proxies for profitability. To identify factors influencing profitability, two methods stand out; the first approach involves regression of the observed yields on a set of hypothesized explanatory variables (Olayiwoola 2008 and Bagamba, 1998). Another approach involves regression of the computed gross margin on a set of hypothesized variables (Sulumbe *et al.,* 2010, Erbaugh *et al.,* 2008, Tschering, 2002 and Ishikawa, 1999).

2.8 Theoretical Framework

At the core of this study is the assumption of producers' optimization behaviour in which they attempt to maximize some objective function subject to a set of constraints. This study used the theory of profit maximization to explain the behaviour of business owners. In this case, the business owners are common bean smallholder farmers. The theory of profit maximization is based on the rational concept that people attempt to get highest utility given the constraints facing them. Business owners will attempt to manage their businesses so as to improve their profit. In a situation where competition is high, farmers will improve their profits by paying attention to the units sold to generate revenues, tangible and intangible costs.

This study adopted the Gross Margin Analysis (GMA) approach to measure on-farm level profitability of common bean in the study area. Gross margin analysis is used to determine which crops are more profitable than others. For a farm enterprise, it is one measure of profitability which is a useful tool for cash flow planning and determining the relative profitability of farm enterprises (Farm Gross Margin and Enterprise Planning Guide, 2013). It can also be used to assist in assessing the opportunity to develop new farm enterprises. One can derive the Gross margin profit through the gross margin analysis. Gross margin profit could be regarded as the difference between the annual gross income for that enterprise and the variable costs directly associated with the enterprise. Variable costs are those costs directly attributable to the enterprise, and which vary in proportion to the size of this enterprise. For example, if the area of bean sown doubles, then the variable costs associated with growing it, such as seed, chemicals and fertilizers will roughly double. Variable costs in this study will not consider fixed or overhead costs such as depreciation, interest payments rates, or permanent labour. The gross margin of common bean will be calculated by considering gross revenue generated less variable costs incurred. Conceptually, gross margin is the difference between the total revenue and the total variable costs of production, and reflects the returns to the factors of production (Phiri, 1991; Johansen, 2003).

The common bean smallholder farmers as part of the economic agents maximize net revenue with respect to levels of products and factors, subject to constraints that are market determined fixed factors and technology. This can be expressed as:

$$Max\ \pi = P_a Q_a - P_x X - WL \quad \text{..... ....} \quad (1)$$

Where,

Q_a is the quantity of bean that the farmer harvest from his farm

P_a is the price of the unit quantity of bean in this case the price of common bean.

Two variable factors: '*X'* with price p_x. These factors may include fertilizer, agrochemicals, seeds and extension expenses, common bean transportation costs and costs of signing contracts. *L* (Labour) with price '*W*'. Fixed factors and farm characteristics*:* z^q (fixed capital, farm size).

In this case, the farmers' revenue is income he/she gets from the sale of common bean at the given market price. He/she has also to minimize the costs incurred in the production and sale of the bean in order to realize profit. The inputs *'X'* is a vector of a number of inputs like fertilizer, agrochemicals, seeds and extension expenses, common bean transportation costs and costs of signing contracts. According to Sadoulet and Janvry (1995), these inputs valued at their different market prices are the costs incurred;

Subject to;

Production function: $g(Q_x, X, L; \mathbf{Z}^q) = 0$..... ....(2)

Supply function: $q_a = q_a(P_a, P_x, W, \mathbf{Z}^q)$..... ....(3)

Factor demands: $x = x(P_a, P_x, W, \mathbf{Z}^q)$..... ....(4)

Labour = $l(P_a, W, \mathbf{Z}^q)$..... ....(5)

Maximum Profit: $\pi^* = \pi^*(P_a, P_x, W, \mathbf{Z}^q)$..... ....(6)

Thus, the smallholder farmers will be maximizing profits from sale of the common bean subject to the constraints he/she is facing which may be management, institutional and financial constraints. This can be represented as:

Maximum Profit: $\pi^* = \pi^*(P_x, X, Y, Z)$..... ....(7)

P_a is the price of common bean, 'X' represents institutional constraints and these include information availability, customer search costs, length of supply chain, cost of contracts, groups, opportunity cost of time, standards of measurement, 'y' stands for financial constraints which include debt, debt asset ratio, asset base and financial records. 'Z' signifies managerial constraints which include the enterprise size, farmer characteristics, cropping and fertilizer application system, and common bean variety type.

$\pi = \beta_i X_i + \beta_j X_j + \beta_k X_k + \varepsilon$..... ....(8)

Where;

‘π’ represents profitability

‘X_i’are institutional constraints for the i^{th} farmer

‘X_j’ are financial constraints for the j^{th} farmer

‘X_k’ are managerial constraints for the k^{th} farmer

2.9 Conceptual Framework

Figure 5 depicts various factors affecting bean gross margin as a proxy variable for profitability. The two sets of factors have an indirectly impact on the common bean gross margin. Technological and socio-economic factors influence total variable costs and productivity of an agribusiness. The variable costs and bean productivity determine the value of the crop grown, in this case, the common bean at the given market price. Moreover, the total bean enterprise variable costs and productivity will determine the price per unit and the quantity marketed. The price per unit received and total quantity availed for selling will determine the revenue earned by smallholder bean farmers. The amount of revenue earned from bean enterprises determines the amount of gross margin as a proxy of profitability reaped by the farmers’ households. In Figure 5, it is further conceptualized that for common bean smallholder farmers to realize reasonable profits as measured by the gross margin, there must be reliable domestic and international markets. The existing policies on seed varieties, fertilizer, pesticides, common bean research and extension must be pro-common bean stakeholders, favouring almost all partners in the common bean industry. Furthermore, the objective of smallholder common bean producers is therefore to maximize on-farm profits as measured by gross margins (or minimize costs). To achieve this objective, farmers will not only seek to improve their productivity, they will also try to improve market suitability of their outputs. Literature suggests that farmers may be motivated to produce based on their attitude towards risk, the utility derived from production, and for profit reasons (Knight, 1923 and Bioca, 1997). It is assumed that farmers differ in their farm and physical characteristics. These characteristics are expected to impact on the profits through their impact on the volume of production, price received per unit of a commodity and the cost structure as depicted in Figure 5.

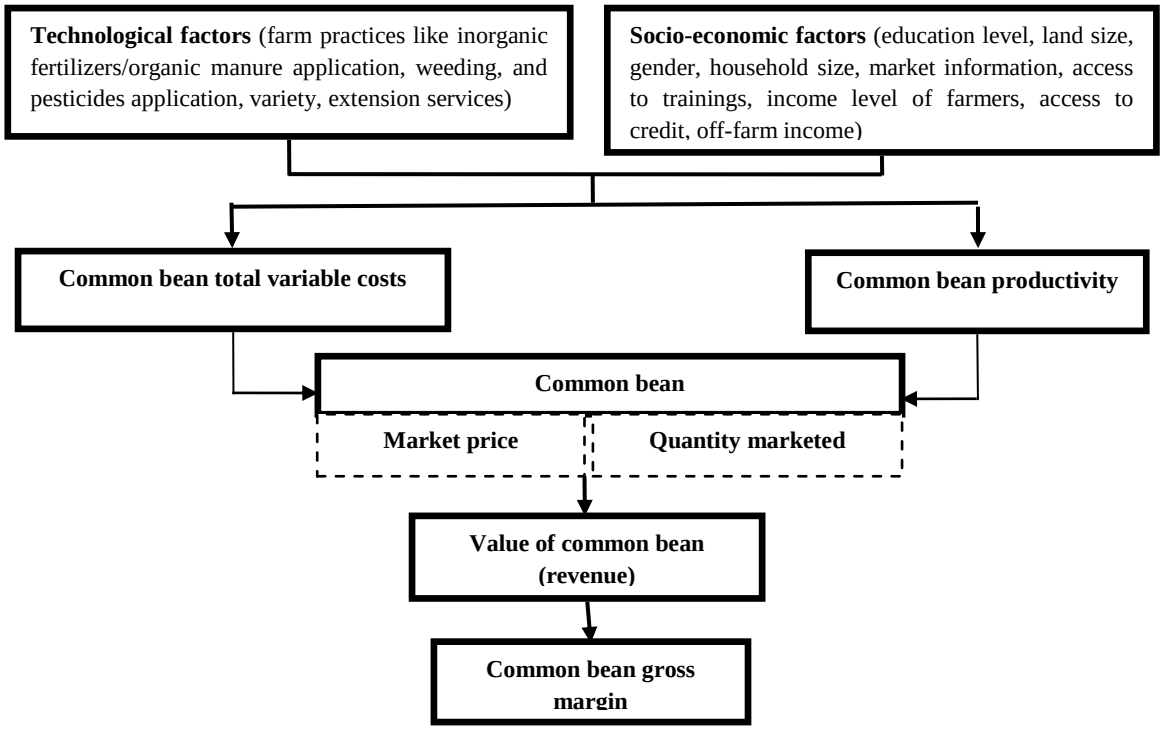


Figure 5: The relationship between various factors affecting on-farm common bean gross margin

Source: Modified from Engel, (2000).

There are several reasons that have been advanced to explain why profitability varies amongst producers in a particular enterprise (Samboko, 2011). These include aversion to risk and uncertainty; social networks and organization; age, gender, tillage practices, mechanization, household size and education; such variables may influence the costs of production, volume of production, bargaining ability, and one's ability to comprehend technologies (*ibid*).

The head of a household is assumed to be responsible for the co-ordination of the household activities and as such, it is important to include attributes such as gender, age and education of the household head in the specification of the model for factors influencing profitability (Makhura, 2001). In addition, the age of the household head can often be indicative of farming experience as well as the ability to comprehend new technologies (Matungul *et al.,* 2001). It is expected that younger household heads have the ability to comprehend new technologies and will therefore readily adopt them thus improving timeliness of operations as well as reducing costs of production. Furthermore, it is expected that older and more experienced household heads have greater contacts allowing trading opportunities to be discovered at lower cost. The age of

the head of the household is also important since he/she determines whether the household benefits from the experience of an older person, or has to base its decisions on the risk-taking attitude of a younger farmer (Makhura, 2001).

The level of education of the farmer is expected to have an effect on the profitability of bean production in that; the more educated the farmer is, the more likely they are to make informed decisions. A more educated farmer will be able to comprehend and understand what is involved in the credit scheme. With respect to tillage practices, conservation farming practices have shown to increase volume of production and consequently profits. It is thus expected that households using conservational tillage practices would record more profit than those using conventional tillage (Kabwe *et al.*, 2006 and 2011).

A large household size indicates that a large number of family members can avail their labour to farm activities and thus labour constraints wouldn't be a problem. In addition, a large household size could be an indication of a household's ability to have several information sources thus positively impacting on profits. However, in some instances, despite a large household size, profitability may be negatively impacted upon in that some family members may not take part in the production activities or due to diminishing marginal returns to labour (Ahuja, 2000).

With respect to yield, it is expected that other things being equal, households with more kilograms of beans harvested per unit area would record more profits. In the same respect, through the impact on yield, it is expected that households that use hybrid seed varieties would record more volume of production and consequently higher profits (Samboko, 2011).
Mechanization through its effect on timeliness of operations is also expected to lead to higher profits, it is also expected that households with large farms would spread production costs across a large output leading to economies of scale (Ahuja, 2000). The value of off-farm income a household receives is also another factor that may affect the profitability of bean production. Due to the seasonality of agricultural production, it is expected that the prices received for produce will vary in a year with the price being highest during the period towards planting and lowest immediately after production. Consequently, it is expected that households that have other income sources will store their produce and only sell when the prices start rising, in this instance storage acts as some form of value addition and therefore is expected to impact positively on profits.

CHAPTER THREE
METHODOLOGY

3.1 Study area

The study was carried out in Babati District of Manyara region in Tanzania located at 4°14'08.2"S 35°30'46.0"E. The region was conveniently chosen because of its potential in grain legumes production among other factors which favoured this study.

The main economic activities in Manyara Region are agricultural production, livestock keeping and mining. Agricultural production is dominated by peasant farming. The major food crops and cash crops that are cultivated by smallholder farmers include maize, common beans, pigeon peas, sunflower, onions, garlic, coffee, paddy and finger millet (URT, 2003). Maize, common beans, pigeon peas, wheat and sunflower are the major contributors to the region's economy. Manyara region has great potential for using animal power in agricultural operations. About 39.9% of tillage operations are done using animal power, 39.5% by tractors 0.45% by power tillers and the rest is drudgery hand hoe practiced by few individuals. Maize dominates the production of cereal crop in the region. The production of beans among other pulses in Babati is much higher than in other districts in the region, with a planted area of more than 9,726 ha.

The administrative capital of Babati district is Babati town, 172 Km (107 Miles) south of Arusha. The district covers an area of 6,069 Km^2 (2,343 Sq Miles), a large proportion (640 Sq Km) of which is covered by the water bodies of Lake Babati, Lake Burunge and Lake Manyara. The district is bordered to the North by Arusha Region, to the South-East by Simanjiro District, to the South by Dodoma Region, to the South-West by Hanang District, and to the North-West by Mbulu District. According to the 2012 Tanzania National Census, the population of the Babati District was 405,500.

Babati District is located below the Equator between 04°13' S and 035°45' E. The land surface is characterized by a number of undulating hills and mountains as part of the East Africa Rift Valley Highlands. Babati District is divided by the Dabil-Dareda escarpment of the Rift Valley, providing diverse climatic and agro-ecological conditions due to a wide range of altitudes from 950 to 2,450 meters. Most of the soils are of volcanic origin and range from sandy loam to clay alluvial soils. In the lower flat lands, like around Lakes Babati and Manyara, alkaline soils predominate.

Moreover, about 85% of the population of Babati District live in the rural areas and depend on agriculture and livestock for their livelihood. Mixed crop-livestock, mostly maize-based systems are widely found in the district that are intercropped with varying species, such as common bean, pigeon peas and sunflowers, according to altitude and rainfall availability. In the lowlands, paddy is cultivated where irrigation is available.

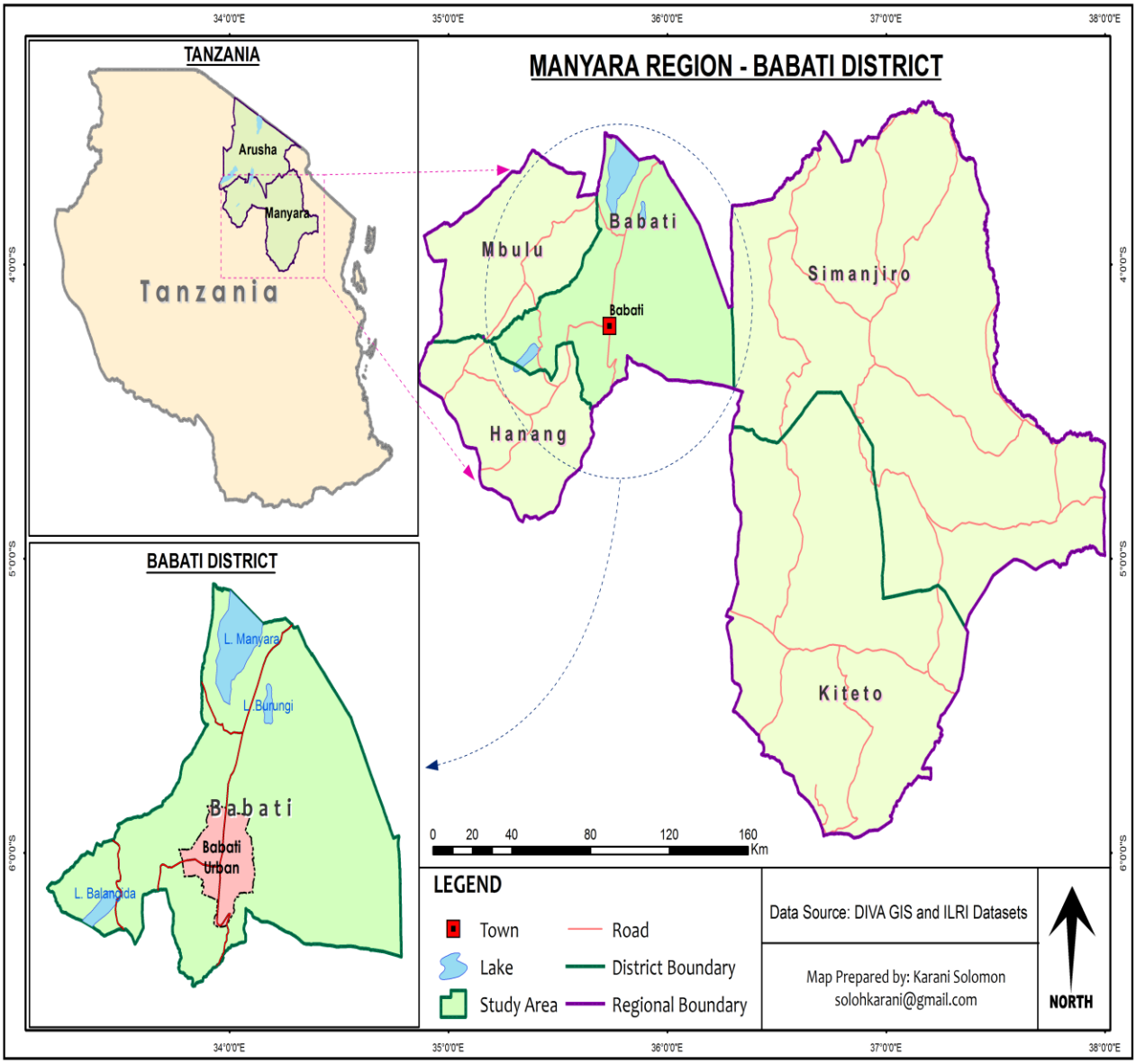


Figure 6: Map of study area

3.2 Sampling design and sample size

Multistage sampling procedure was used to select respondents from four divisions of Babati district (Babati, Gorowa, Mbugwe and Bashnet). The first stage involved a purposive selection of Babati and Bashnet divisions on the basis that they are the top producers of beans in the district. The second stage entailed the selection of Bashnet, Nar, Dareda and Ayalagaya wards from Bashnet division using purposive sampling technique. Moreover, also at this stage Gallapo and Qashi wards were chosen from Babati division applying the same technique. The fourth stage engaged the selection of 9 villages from the six wards. The selected villages, wards in bracket, were Bashnet and Long (Bashnet), Gabadaw (Nar), Seloto (Dareda), Hayesam (Ayalagaya, old Dareda), Tsamas and Ng'wang'weli (Qashi), Gallapo and Endanoga (Gallapo). Then, the final stage employed systematic sampling technique to select the number of bean household farmers from each of the nine villages. A sample of 200 households was selected from the population of the bean smallholder farmers in the study area. The required sample size was determined proportionately to the number of households sampling methodology as per Anderson *et al*., 2008 as follows;

$$n = \frac{(Z_{\alpha/2})^2 (P)(1-P)}{E^2} \quad \text{.....(9)}$$

Where n is the minimum sample size; $Z_{\alpha/2}$ is 1.96 at 95% confidence level; P is the population proportion i.e. the proportion of grain legume smallholder farmers in study area which is 85%; E is the margin of error (tolerable error) which is assumed to be 0.05 and (1-P) is a weighting variable.

Now, using the formula above;

$$n = \frac{(1.96)^2 (0.85)(0.15)}{(0.05)^2}$$

$$n = 195.9216$$

Accordingly, a minimum sample size was 196 households as shown above. The sample size was increased to 200 for simplifying enumeration in the field and catering for incomplete data and attrition. The population was smallholder farmers with less than or equal to two hectares under common bean. The sampling units were the households from the sampled villages in the study area.

Moreover, because common bean smallholder farmers were evenly distributed among the two selected divisions, 100 farmers from each division were sampled to make a targeted total sample size of 200 farmers. In Bashnet division; out of 11 wards, the sample was drawn from Bashnet, Nar, Dareda and Ayalagaya. Specifically, farmers forming the sample were residing in the villages Long and Bashnet in Bashnet ward. Respectively, 30 and 10 households from Long and Bashnet villages were systematically selected from a farmers' sampling frame. 10 households were conveniently sampled from Gabadaw village, which is among the only 2 villages in Nar ward. On the other hand, Seloto among 3 villages in Dareda ward was purposively selected. From this village, 25 households were sampled. Hayesam village, among 3 villages in Ayalagaya ward was conveniently selected, where 25 households were sampled to complete a list of 100 households from Bashnet division.

In addition, from Babati division, Gallapo and Qashi wards were purposively selected. Gallapo and Endanoga villages among 5 in Gallapo ward were subsequently selected basing on the same approach. 20 households from each village were sampled. Tsamas and Ng'wang'weli villages were purposively selected amongst 6 villages in Qashi ward. 40 and 20 households, respectively, were sampled from these two villages. This is because, according to Ms Manzi, the public extension officer and the sampling frame, there were more common bean farmers in Tsamas as compared to Ng'wang'weli. 40 and 60 households sampled from Gallapo and Qashi wards respectively made another 100 household to complete a total sample size of 200 households. Table 4 recapitulates the number of households sampled from the study area.

Table 4: Common bean sampled households

District	Division	Wards	Village(s)	Household sampled
Babati	Bashnet	Bashnet	Bashnet	10
			Long	30
		Nar	Gabadaw	10
		Dareda	Seloto	25
		Ayalagaya	Hayesam	25
	Babati	Gallapo	Gallapo	20
			Endanoga	20
		Qashi	Tsamas	40
			Ng'wang'weli	20
Total				**200**

3.3 Data collection

Primary data such as social-economic status of households and institutional characteristics like farmer's age, gender, years of schooling, farming experience, main occupation, household size, the income profiles, distance to the market, extension contacts, group membership, credits, cropping and farming characteristics were collected from the smallholder farmers in the field using structured interview schedules method. Moreover, secondary data such as district production estimates and costs including average input prices, yearly quantities of seeds produced along with the supply of fertilizers and agro-chemicals was obtained from published literature and key informants from Selian Agriculture Research Institute (SARI) and Babati district council in the agriculture department. Published literature such as books, journals and articles were reviewed from Sokoine National Agricultural Library, Egerton University main library and the internet to get robust information related to this study.

3.4 Data Analysis Techniques

To achieve the objectives of the study, several statistical techniques and methodologies were employed including descriptive statistics, Gross Margin analysis and empirical models. The descriptive statistics and analysis of Gross margin were done on MS Excel while the empirical models were run in SPSS (version 22) and STATA computer software.

3.4.1 The common bean on-farm gross margin realized by smallholder farmers

The common bean on-farm gross margin realized by smallholder farmers in the study area was analysed using the Gross Margin Analysis approach. Variable Costs were estimated based on costs incurred by the smallholder farmer during production and marketing of common bean. Gross margin which entailed estimation of total variable costs and returns were calculated for each smallholder farmer using Microsoft Excel spreadsheets. Then, these gross margins from individual farmers' enterprises were used to calculate on-farm gross margin of common bean as mean revenues less mean variable costs using a formula described by Mburu *et al*. (2007), as shown in equation 10.

$$\text{GrossMargi n} = (\text{BeanUnitPr ice(TZS/Kg)})\text{x}(\text{BeanQuanti ty(Kg) }) - (\text{TotalVaria bleCosts(T ZS)}) \quad \text{.....(1 0)}$$

Variable costs consisted of the costs of seeds, fertilizer, labour, pesticides and marketing expenses such as transport bags, cess and storage costs. The cost of labour included cost of hired labour for farm activities related to common bean such as weeding, harvesting, shelling, and transporting. Fixed costs on land and permanent labour were ignored since they were unrelated

to higher levels of common bean production and do not affect the optimal combination of the variable inputs. For example, land could not be appraised because, according to the Tanzanian Land Act of 1999, all land shall continue to be public land and remain vested in the president as trustee for and on behalf of all the citizens. Moreover, common bean smallholder farmers were not paying any rentals or land rates. Permanent labour was not computed because the respondents did not employ workers on a permanent basis. Other studies like that conducted by Mburu *et al*. (2007), included opportunity cost on family labour as permanent labour, but in the context of this study, it was difficult due to lack of accurate methods of valuating opportunity costs of family labour which was used by many farmers. Conceptually, gross margin is the difference between the total revenue and the total variable costs of production, and reflects the returns to the factors of production (Phiri, 1991; Johansen, 2003).

3.4.2 Socio-economic factors determining common bean on-farm level gross margin

Evaluation of the determinants of the gross margin realized by bean farmers was conducted using multiple regression analysis. Gross Margin analysis stated in the form of a multiple regression model was used. The empirical literature on common bean profitability reflect the investigation of the factors affecting gross margin as a proxy for profitability by means of multiple regression methods (Olubiyo *et al*., 2009). Studies conducted by Nchinda and Mendi (2008); Otieno *et al*. (2009) and Chagunda *et al*. (2006) have demonstrated the effects of age, gender, education level, household size and distance to the market on relative profitability of smallholder farmers' enterprises by use of multiple regression models. This formed the basis of inclusion of the socio-economic explanatory variables in the study. Annual gross margin was used as a dependent variable (Y) and nine socio-economic factors of the respondents as explanatory variables (X). The explanatory variables modelled were gender, education level, household size, farm-gate price, land size, yield, off-farm income, market information and farming experience. Categorical variables like gender and level of education were converted to dummy variables so that they could be included into the linear regression model.

The model was specified as;

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \mu_i \text{.....} \quad (11)$$

Where: Y_i = is profitability of bean production, measured by gross margins per acre, β_0 = constant, β_i = estimated coefficients of the explanatory variables, Xi = explanatory variables, μ_i = disturbance term

The description of the explanatory variables and their expected relationships with the dependent variable are presented in Table 5 below.

Table 5: Description of the independent variables used in the common bean profitability and supply models

Variables	Measurement	Category
X_1 = Age of the farmer	Number of years	Continuous
X_2 = Sex of the farmer	1 if male, 0 if female	Dummy
X_3 = Farmer education level	1 if literate, 0 if illiterate	Dummy
X_4 = Experience	No. of years in farming	Continuous
X_5 = Total land under beans	Number of acres	Continuous
X_6 = Access to Market information	1 if access, otherwise 0	Dummy
X_7 = Access to extension services	1 if access, otherwise 0	Dummy
X_8 = Access to credit	1 if access, otherwise 0	Dummy
X_9 = Distance to market	Number of Kilometres	Continuous
X_{10} = Household size	Number of family members	Continuous
X_{11} = Off-farm income	1 if with off-farm income, 0 if without off-farm income	Dummy
X_{12} = Supply to the market	1 if YES, 0 if NO	Dummy

An increase in the farmer's age was expected to negatively affect the profitability of beans. Nwaru and Iwuji (2005) reported that entrepreneurship gradually becomes less as the age of the entrepreneur increases. This is because the innovativeness and optimism of the entrepreneur as well as his mental capacity to cope with the challenges of his business activities and his mental and physical abilities to do manual work decrease with age. Thus, age was expected to be negatively associated with profitability. The sex of the farmer had no *a priori* expectations, whilst education was believed to be important as it enlightens farmers on how best to strategise and to adapt to better marketing conditions. Experience in bean farming was expected to have a positive influence on profitability. As farmers become more experienced in production and marketing of beans through their involvement, their probability to participate in economic transactions will be higher, thus becoming more profitable.

The amount of land cultivated under beans is expected to be positively associated with profitability. The more land put under production, the higher would be the profitability of bean because of possible economies of scale. Access to market information was set as a dummy variable, where a farmer having access to market information would take the value one and no access to information would take a value of zero. Access to information was assumed to

positively influence profitability, and similarly, access to extension services was set as a dummy variable equal to one if a farmer had access to extension service, otherwise zero. The aim of the extension service is to introduce farmers to new and improved agricultural inputs in order to improve production and productivity in turn increase marketable supply which has a positive effect on profitability. Access to credit was set as a dummy variable taking the value of one if a farmer had access to credit and zero otherwise.

Access to credit enhances the financial capacity of the farmer to purchase the necessary inputs. Therefore, it was hypothesised that access to credit would have positive influence on profitability. The further away the production area is to the market, the lesser would be the probability to participate in commercial beans production, hence poor profits because of high transport costs. Therefore, it was expected that the variable would negatively affect profitability. Quality requirements and sustainable beans production necessitate the adoption of labour intensive production and harvesting practices (Wollni *et. al*., 2008). Therefore, households with large family sizes may cultivate more land, mainly because of the use of family members, who provide cheap labour force. Hence, this variable is expected to have a positive relationship with profitability. Marketing channel used by the bean farmer is assigned the value one if the farmer sells beans through contractual arrangements, otherwise zero. This variable is expected to have a positive influence on profitability.

3.4.3 Factors mostly influencing the household supply of common bean to the market

Factors affecting supply of common bean to the market, by the household, were examined using Logistic Regression model. This model was adopted since the dependent variable was a dummy variable. The dependent variable was a dummy, which was 0 if the farmer did not sell the common bean and 1 otherwise. The regression the model independent variables were age of respondents, gender of the household head, family size, education level of the respondents, distance to the market, farm gate price, and quantity produced, along with market information. Through logistic regression model, maximum likelihood procedure was employed to estimate the probability of market supply. The marginal effect of variables was used to estimate the extent of the effect and probability of each variable change on the dependent variable. The model was specified as in the equation (12);

$$Logit\ (Y_1) = \ln\left[\frac{P(Y_1 = 1)}{1 - P(Y_1 = 1)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + ... + \beta_k X_k + \varepsilon ....(12)$$

Where,

$P(Y_1 = 1)$ Was the probability of supplying the product to the market, and $1 - P(Y_1 = 1)$ was the probability of not supplying the product to the market of the i^{th} observation

$Y_1 = 1$ If involved in selling common bean, and 0 if otherwise

β_0 = Constant coefficient

X_1-X_k = Variables

$\beta_1 - \beta_k$ = Parameters

ε = Disturbance term

3.4.4 Major constraints affecting household common bean supply to the market

This objective was analyzed using descriptive statistics and content analysis technique. The descriptive statistics included frequency counts and percentage. Content descriptive techniques focused on textual information given by key informants under the guide of charts. The results of the analysis were discussed in line with ‘’key words of the key informants in the context’’. According to Kimberly (2002), the researcher uses highest percentage of key words from key informants to discuss the results of analysis. Variables like perception of post-harvest losses of common bean by farmers, cost of transporting the common bean to the market, average distance between the farm and the market, cost of loading, marketing experience in years, storage period measured in number of days and cost of storage were studied.

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter discusses the empirical findings of the study. The section starts with unveiling the characteristics of the smallholder bean farmers in Babati district which is followed by Business Development Services (BDS) received by these farmers. In addition, the chapter discusses about the average on-farm gross margin received by farmers in the study area calculated using the Gross Margin Analysis approach. Moreover, the section considers the results of the Multiple Regression Analysis used to examine the socio-economic factors determining the on-farm level common bean gross margin. Also, the chapter discusses the factors mostly influencing the household common bean supply to the market as determined by the Binary Logistic Regression modelling. Finally, the chapter presents the major constraints affecting common bean supply to the market in Babati district.

4.2 Descriptive analysis of socio-economic characteristics of smallholder farmers

4.2.1 Results on gender, age, education level, farming and marketing experience of respondents

Table 6 gives the results of gender, age, education level, farming and marketing experience of respondents. The study sampled 200 households. Among the interviewed farmers, 81.4% were male and 18.6% were female, this indicates that, common bean business has preponderantly attracted male farmers and generates significant income. Men are attracted to agricultural activities which generate sizeable income. Often for a crop cultivated by a large number of women, the produce is consumed at home or sold to generate family income. This observation concurs with that of ICRISAT and CIAT, (2012) who reported that, men tend to concentrate on higher-income generating projects.

The study revealed that, the majority (52.5%) of common bean farmers, as shown in Table 6, were aged between 40 to 60 years. This indicates that common bean is a traditional crop cultivated by both young and old farmers. Moreover, based on the Tanzanian education system, 73% of respondents had primary school education. This means that farmers have basic education and can be considered literate. Education can be considered to be important as it makes a farmer innovative and also easily understand concepts that are taught in the trainings and consequently

adopt new technologies with ease. This observation in education level coincides with that reported by Chisoni (2012) who found out that, most of smallholder dairy farmers had primary education level.

The average farming experience was found to be 18 years. On the other hand, the common bean farming experience of the household head was 17 years while common bean marketing experience was found to be 14 years. These findings concur with those by Birachi (2006) where he found the mean experience of farmers to be fifteen years of operation. Experience can have an influence in improving decision making and resource allocation as a result of learning curve effect.

Table 6: Results on land distribution, activities performed by gender and bean production system in the study area

Age	**N**	**Percentage**
20-40	67	32.8
40-60	107	52.5
60-90	30	14.7
Gender	**N**	**Percentage**
Male	166	81.4
Female	38	18.6
Years of schooling	**N**	**Percentage**
Between 0 and 8	149	73.0
Between 9 and 12	38	18.6
Between 13 and 14	12	5.9
Between 15 and 25	4	2.0
Others	1	0.5
Farming/marketing experience	**N**	**Years**
Household head average farming experience	204	18
Household head average bean farming experience	204	17
Household head average bean marketing experience	195	14

4.3 Results on land distribution, activities performed by gender and common bean production system

4.3.1 Land distribution

The average land owned by sampled smallholder farmers was found to be 2.48 hectares. This land was allocated to different enterprises as indicated in Table 7. The findings indicate that 43% of the land was allocated to cereals while 29% and 14% was allocated to beans and other legumes respectively. Household homestead and others were allotted 9% of the total land, while horticultural seasonal vegetables and fruits were planted on 3% and 2% of the total land correspondingly. This implies that, smallholder farmers in Babati district consider common bean as second most important crop after cereals (mainly maize) when allocating land. Birachi (2011) found that increasing the proportion of land under beans in Burundi was likely to enhance bean production and consequently marketable surplus. Moreover, Edriss and Simtowe (2002) working in Malawi on groundnuts production argued that, more land should be allocated to crops to increase output. This, therefore, implies that allocation of more land to bean production by smallholder farmers in Babati district would increase their output and amounts marketed.

Table 7: Percentage household land distribution

Category	Area (Ha)	Percentage
Land under common bean	147.60	29%
Land under other legumes	70.26	14%
Land under cereals	219.36	43%
Land under fruits	8.14	2%
Land under horticultural crops	15.70	3%
Land under homestead and others	46.06	9%
Total	**507.13**	**100%**

4.3.2 Activities performed by gender

Figure 7 shows the farm activities performed by gender. Study results show that, the average working hours for men is 5 while that for women is 7 hours a day. This means that, about 58% of common bean labour force in the household is offered by women in the study area. Land preparation, sowing and weeding activities are mostly done by women, at 54%. In addition,

harvesting, threshing and transportation of threshed bean to home activities are equally done by both male and female at 32%. Furthermore, storage and marketing activities are mostly done by men at 53% compared to only 16% by women. This is because, most of common bean produced by women are grown on smaller plots of land and only consumed at home. This observation coincides with the findings by CIAT (2010), where it was reported that, in common bean farming, a large proportion of labour is offered by women while marketing is mostly done by men. Furthermore, the findings concur with the study by Katungi *et al*. (2010) who found that, plots managed by women are those allocated to the production of the cooking type beans for home consumption, and occupy a meagre amount of land compared to the canning type meant for sale.

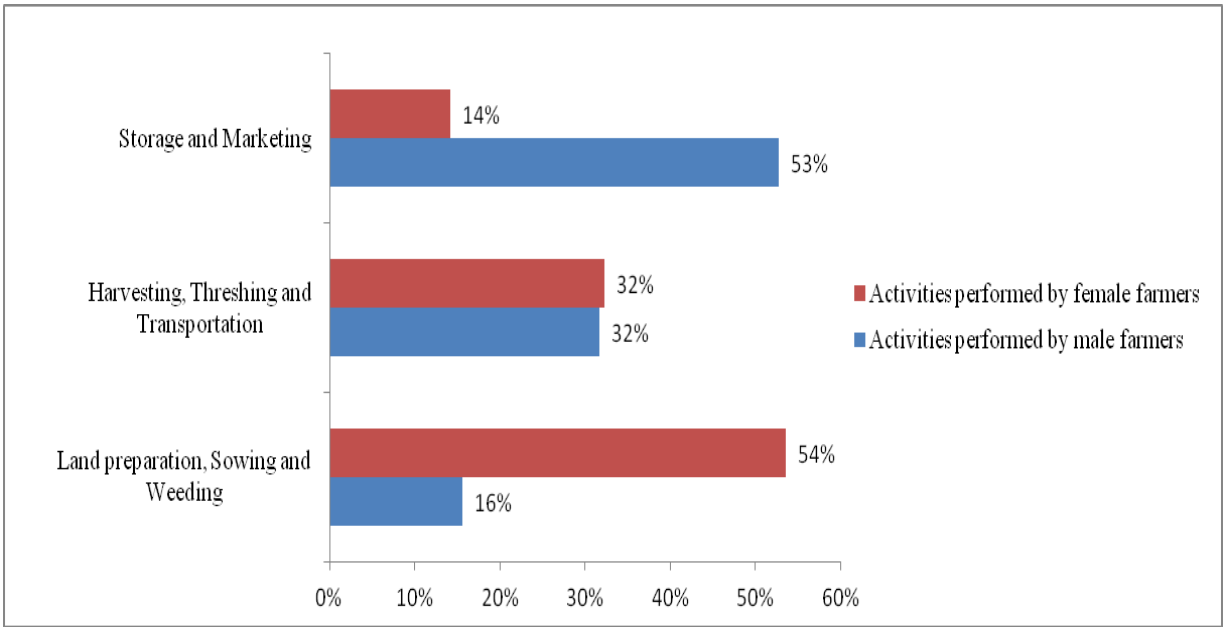


Figure 7: Farm activities performed by gender of sampled smallholder farmers

4.3.3 Common Bean Production System

Common bean in Babati district was largely intercropped with maize. As indicated in Figure 8, 55% of respondents growing local bean variety and 74% growing improved bean variety, intercropped with maize. Local and improved bean varieties were mono-cropped by only 38% and 20% of smallholder bean farmers respectively. On the other hand, 7% of respondents growing local and improved bean variety used both cropping systems. Smallholder farmers in the study area preferred intercropping to other systems because, common bean, as other legumes fix soil nitrogen which caters as fertilizer for cereals like maize. These findings agree with the study

by Fenandez-Aparicio *et al*. 2007 who established that, intercropping is highly practised because of soil conservation; weed control, lodging resistance and yield increment and legume root parasite infection control.

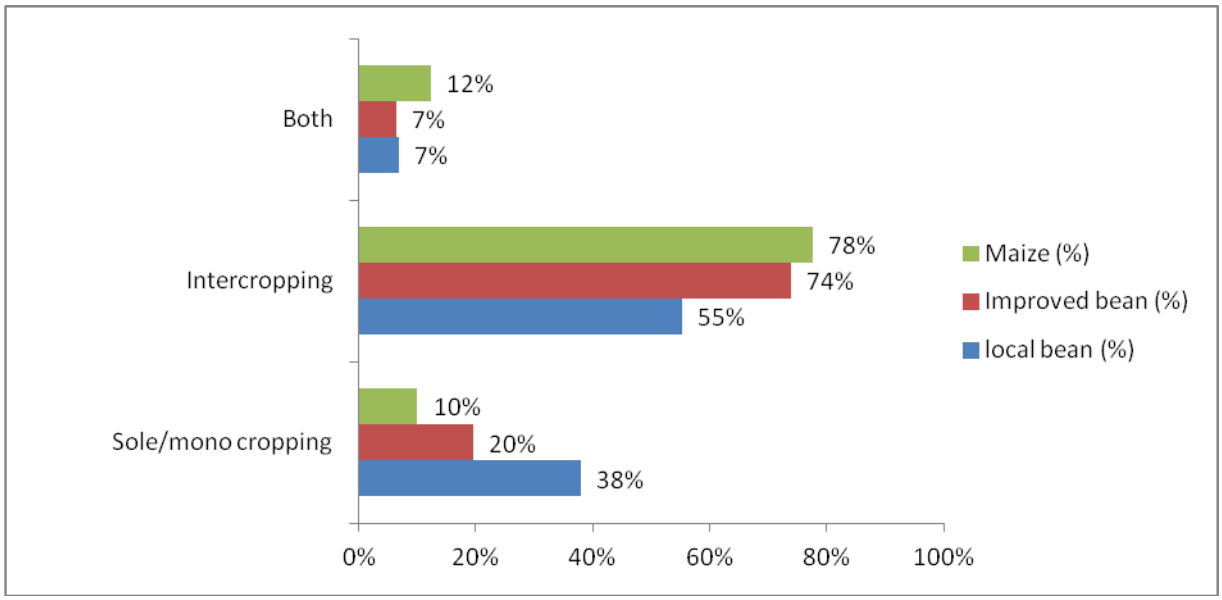


Figure 8: Common bean production systems

4.4 Smallholder farmers' Common bean productivity and Off-farm income generating activities

4.4.1 Common bean productivity

The study found out that, the average productivity of local and improved bean variety was 594.45 Kg/Ha and 695.44 Kg/Ha respectively. This showed that, a farmer who produced improved bean variety harvested 100.99 Kg more on land of the same size as compared to the counterpart producing local bean variety. These findings concur with those reported by Mediatrice (2011) who asserted that improved bean seeds are highly productive therefore stand as principle vehicles to high agricultural productivity, improved income and also in fighting hunger in Rwanda.

Table 8: Bean, maize and vegetables productivity

Crop grown	Total Area(Ha)	Total yield (Kg, crates)	Productivity (Kg, crates/Ha)
Local bean variety	123.45	73,385	594.45
Improved bean variety	21.20	14,740	695.44
Maize	262.37	552,195	2,104.64
Vegetables (crates)	5.31	62	11.66

4.4.2 Smallholder farmers' off-farm income generating activities

Figure 9 gives the off-farm activities of the sampled households. In the study area, 47% of common bean farmers had off-farm income generating activities as opposed to 53% who did not. The majority (64%) of those smallholder farmers who had off farm income generating activities were traders, 17% labourers, 7% carpenters, and 4% civil servants. The possible reason for this is that smallholder farmers distribute risk through investing in trading activities which are more liquid thus a reliable insurance during hunger periods. Only 4% were civil servants, probably because of the low level of education among smallholder farmers.

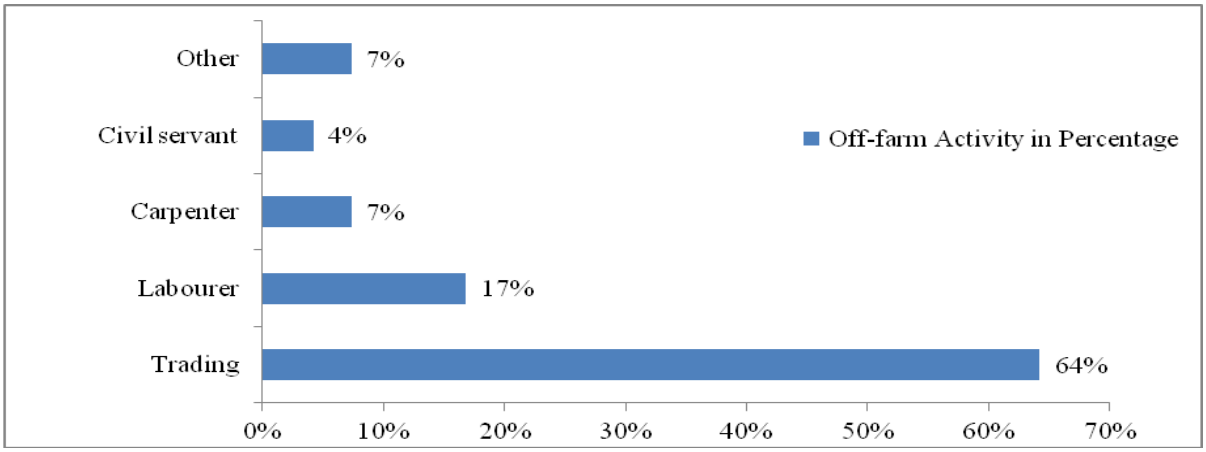


Figure 9: Common bean smallholder farmers' off-farm income generating activities

4.5 Smallholder farmers' Access to Business Development Services

4.5.1 Access to markets and associated transport costs

Table 9 gives results on distance to the market as well as transport costs. In Babati district, the average distance to the nearest market was 2.88 Km, 6.20 Km to the most visited market and 10.51 Km to the most preferred market. The transport cost was TZS 24/Kg to the nearest and most visited markets while TZS 26/Kg was the cost of transporting common bean to the most

preferred market. The markets most preferred were offering relatively higher prices of common bean. Due to the farmers' low common bean volumes and long distance to the most preferred market, most farmers could not access these markets. The findings of this study concur with those by Mutukumira *et al*. (1996) who stated that, long distance to produce collection centres is a hindrance to a viable common bean enterprise**.** The longer the distance to the bean markets the less the number of smallholder farmers delivering bean, hence the less the profit and vice versa. This is because the shorter the distance to the market, the more is the likelihood of the farmer delivering common bean with little or no marketing costs such as transport, storage, and transport bags, among others hence making more profit than the one staying far who will only deliver when he/she has transport.

Table 9: Average market distance and transport cost

Item	Average distance to market (Km)	Transport cost(TZS/Kg)
Market most visited	6.20	24
Market nearest	2.88	24
Market most preferred	10.51	26

1 US$ ~ TZS 2,100

4.5.1.1 Common bean markets in the study area

In Babati district, the majority of small scale common bean producers consume their produce within their households. Nevertheless, to a great extent, most of these farmers sell their surplus either on-farm, local village markets, main road, and district market or to city markets depending on the quantity of produce and producer's access to the market. In the study area, three types of markets were observed. These included; the local village markets, district/regional markets and national markets.

The local village markets are small, and cater for a limited number of near-by households. The markets are informal and emerge at cross-roads or rural trading centre with small concentrations of households to facilitate the exchange of products among local farmers using money as a means of exchange. The traders at the village markets are rural assemblers with well-established small sources of income. The access to the local market is easy but the supply at the market is very limited and fluctuates according to the seasons thus these local markets cannot be reliable. Local traders are most often women or young men from the same area who collect the products from local producers and sell them to their established circles of customers on retail basis. Even

though larger markets would be accessible to these traders, social benefits at the local market outweigh the modest economic benefit of engaging with the regional market.

District/Regional markets are located in the town centres of the region providing a variety of food crop products and other items. These markets are in towns of Babati, Dodoma, Arusha and Kilimanjaro and are often the largest markets available to the consumers and offer what village markets do not supply. The supply at the market is more reliable than at the local village markets even though temporary shortage of goods may arise during the year. The producers may come to the markets to sell their products but most often the trade is run by professional traders who collect the products from the local farmers (either at the farm gate or at the village market).

The national market collects products from all regions to be sold mostly in Dar es Salaam city. The market is large and operates by scale actors working with smaller, medium and large scale facilitators. The market can be characterized by many small-scale producers and local traders.

4.5.1.2 Common bean buyers and modes of transport to the market in the study area

Table 10 below presents the common means of transport used by common bean farmers in Babati district. The most common modes of transport to the markets were vehicles (34%) and animal carts (31%). Other modes were head loading (16%), pack animals (10%) and motorbikes (8%). This is in agreement with the study by Mutukumira *et al*. (1996) whose findings indicated that farmers use vehicles, animal carts and bicycles as the main means of transport in Zimbabwe and indeed many other African countries.

Table 10: Common bean buyers and modes of transport to the market in the study area

Market location and means of transport					
Meeting point	**Count**	**Percentage**	**Transport to market**	**Count**	**Percentage**
Farm level	48	26%	Head loading	30	16%
Local market	105	58%	Pack animal	19	10%
Main road	25	14%	Animal cart	56	31%
District market	4	2%	Trucks	62	34%
Other	-	-	Motorbikes (other)	15	8%
Common Bean Buyers at farm and market level					
Buyer: Farm-gate	**Count**	**Percentage**	**Buyer: Market**	**Count**	**Percentage**
Wholesaler	33	24%	Wholesaler	62	50%
Retailer	80	58%	Retailer	44	35%
Direct consumer	22	16%	Direct consumer	14	11%
Cooperative	1	1%	Cooperative	1	1%
Farmers	1	1%	Farmers	3	2%

4.5.1.3 Actors in bean marketing in Babati district

Table 9 above indicates that, 26% of smallholder farmers sold their beans on-farm, 58% local market, 14% main road, and 2% district market. In all the buying points, 23% of buyers were local assemblers, 25% wholesalers, 29% retailers, 12% urban collectors, and 11% direct consumers. At farm level, buyers were dominated by retailers at 58% followed by wholesalers and direct consumers at 24% and 16% respectively. On the other hand, the market level was dominated by wholesalers at 50% followed by retailers, direct consumers, farmers and cooperatives at 35%, 11%, 2% and 1% in that order.

4.5.1.4 Prices of common bean in Babati district

The common bean average prices in the study area are shown in Table 11. At farm-gate, improved bean variety fetched an average price of TZS 1,023.68 per Kg while at the market level, 1 Kg of improved bean variety was sold at an average price of TZS 1,208.33. On the other hand, local bean variety fetched an average price of TZS 770.87 and 914.38/= per Kg at farm-gate and market level respectively. This indicates that, improved bean variety fetched TZS 252.82 and TZS 293.95 per Kg more at farm-gate and market level respectively. This is because; improved bean variety has customer desirable characteristics such as shorter cooking time, single seed colour, and pleasant taste. The findings concur with Van Veldhuizen *et al*. (1997) who reported that, farmers' common bean evaluation criteria include growth habit, yield, colour of grain, ease of threshing main uses in the diet, storage, qualities, marketability, cost, ease of sale,

desirability for home consumption, compatibility with existing practices, taste, nutritional value, cooking quality and resistance to pest. Farmers growing improved bean variety earned more than those growing local bean varieties.

Table 11: Common bean average prices

Category	Farm gate (TZS/Kg)	Farm gate (US$/Kg)	Market (TZS/Kg)	Market (US$/Kg)
Improved variety average price	1,023.68	0.49	1,208.33	0.58
Local variety average Price	770.87	0.37	914.38	0.44
Difference (TZS/Kg)	252.82	0.12	293.95	0.14

Accordingly, in search for reasonable prices, farmers have been switching buyers from time to time. 31% of the interviewed farmers changed buyers while 69% did not. 78% of farmers who switched buyers saw a significant change in prices of about TZS 319.44 (US$0.15) per Kg as opposed to 22% who have not seen any change in common bean price.

4.5.1.5 Farmers perception on prices of common bean and other cereals in past 3-4 years

The general prices of bean and cereals like maize in the last 3-4 years have been perceived differently by smallholder farmers in Babati district. As shown in Table 11, 48% of farmers perceived that bean prices had been increasing, 30% stagnant, and 22% decreasing. Moreover, 50% of these smallholder farmers thought that the prices of cereals had been increasing, 26% stagnant and 25% decreasing.

Furthermore, respondents had different perception on local and improved bean variety selling price condition. Regarding the improved bean variety price condition, 41% of farmers responded that, the price was good, 32% moderate, and 18% very good. 4% of interviewed farmers said, prices of improved bean variety were poor. 35%, 32% and 17% of the surveyed farmers believed that, the selling price for local bean varieties were moderate, poor and good respectively. As depicted in Table 12, 16% of farmers saw the prices of local bean variety being very poor as opposed to 1% who perceived that the local bean variety prices were very good.

Table 12: Farmers perception on common bean and cereals price trends in past 3-4 years

Common Bean and Cereals price trend in last 3-4 years					
Common bean price trend	Count	Percentage	Cereals price trend	Count	Percentage
Decreasing	39	22%	Decreasing	43	25%
Stagnant	53	30%	Stagnant	45	26%
Increasing	84	48%	Increasing	87	50%
Common Bean selling price condition in last 3-4 years					
Improved seed variety	Count	Percentage	Local seed variety	Count	Percentage
Very poor	9	4%	Very poor	32	16%
Poor	8	4%	Poor	65	32%
Moderate	66	32%	Moderate	71	35%
Good	84	41%	Good	34	17%
Very good	37	18%	Very good	2	1%

4.5.1.6 Farmers' perception on trend of common bean quantity marketed and market actors

Farmers perceived the common bean market trend differently. 45% of farmers remarked that the quantity of beans marketed was decreasing season after season, as opposed to 34% who felt that the quantity marketed was increasing. Figure 10 indicates that, 11% of farmers responded that, it was difficult to tell about the trend of common bean market while 9% perceived that the market was stagnant. In addition, farmers regarded buyers (retailers and wholesalers), government, farmers, brokers, consumers, input dealers, financial institutions (like SACCOS, VSLA and Banks), marketing cooperatives and transporters as prominent market actors. Perception on market actors concur with Jacques, (2011) who reported that buyers, government, producers, input dealers, financial institutions, marketing cooperatives, and research entities are among the market actors in most of crops in Africa.

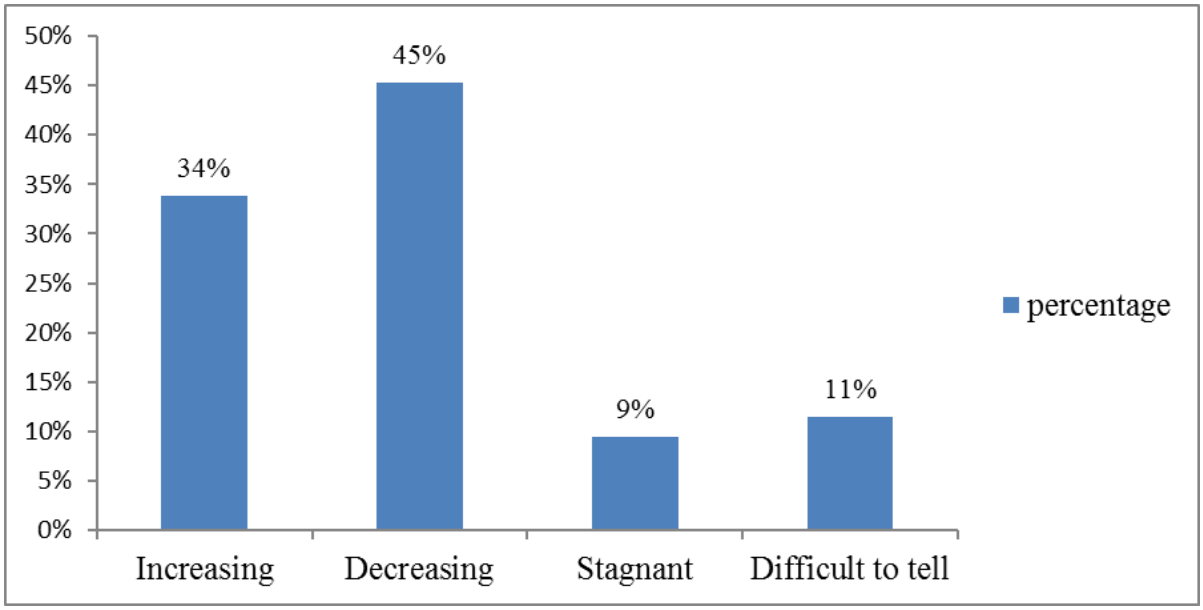


Figure 10: Farmers common bean market trend perception

4.5.2 Smallholder farmers' access to credit

In Babati district, 7% of the interviewed farmers had access to credit as opposed to 93% of farmers who did not have access. This indicates that there was a large group of farmers in Babati district who don't access this service. For those who had access to credit, the sources were mainly from the Village Savings and Lending Associations (VSLA) and the Bank. Table 13 shows that, 60% of the smallholder farmers obtained their credit from VSLA followed by 20% of farmers who obtained their credit from banks. 13% of these common bean farmers obtained credit from SACCO and 7% sourced their credit from other sources. The common bean farmers in the study area who obtained credit from banks and VSLA invested 78.2% and 66.7% of the credit in farming. On the other hand, only 42.5% and 30% of credit from SACCO and other sources was invested in farming. The stringent rules to obtaining and repaying credit determined the amount of credit to be invested in farming. Most of credit beneficiaries preferred investing their credit in crops which they may harvest in as short time as possible, crops like common bean were most preferred.

Table 13: Smallholders access to and sources of credit in the study area

Access to Credit	Count	Percentage		
Yes	15	7%		
No	187	93%		
Source of Credit	**Count**	**Percentage Credit Source**	**Average Loan Borrowed (TZS)**	**Percentage Investment in farming (%)**
Bank	3	20%	920,000	78.20%
Other	1	7%	305,000	30.00%
Sacco	2	13%	850,000	42.50%
VSLA	9	60%	2,210,959	66.70%

On the other hand, the main constraints to accessing credit were mainly due to failure in meeting the criteria of loans such as an evidence of reasonable commitments in cash or in kind. The other obstacle to farmers towards accessing credit was absence or poor business records which track their historical business information. Farmers should therefore be trained on how to comply with the criteria to obtaining credit. The training should trigger farmers to change their current behaviour, and jump-start them towards viewing 'Farming as a Business'. The training must have the component of a complete book keeping principles which will ensure farm records are well kept and managed.

4.5.3 Smallholders' access to extension services

Figure 11 indicates that 47% of the sampled smallholder farmers in the study area had access to extension services. The rest of the farmers (53%) did not have access to this service. This indicates that, extension service was still a constraint to majority of smallholder farmers in Babati district. This is due to the fact that farmers depended heavily on government extension officers who were very few and each has too large coverage area to manage, and therefore did not reach as many farmers as possible. This observation corresponds to findings reported by CIAT (2008) which asserted that common bean industry is faced with several problems, including inadequate access to extension services that reduce the productivity and commercialization of the crop in Africa.

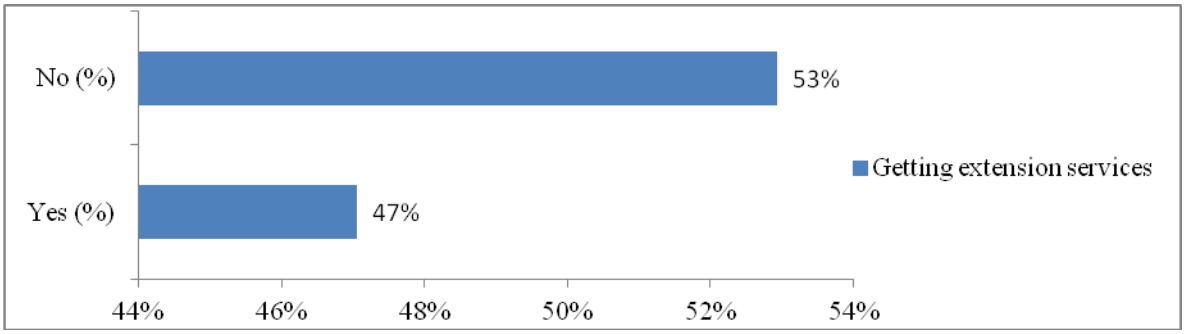
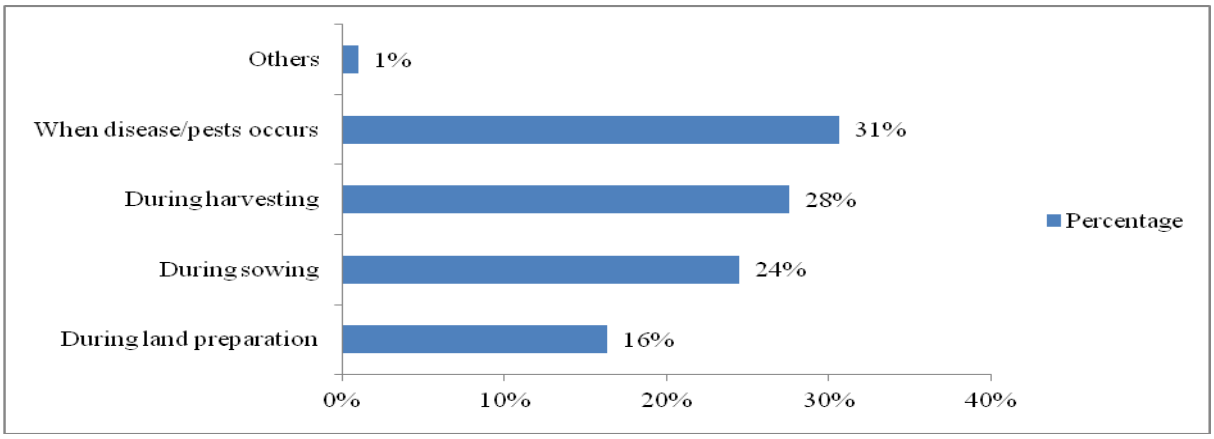


Figure 11: Smallholder farmers obtaining extension services

Furthermore, Figure 12 indicates that, for those farmers who had access to extension services, 31% of them received advisory services during the outbreak of disease and or pests. Moreover, 28% of smallholder farmers accessed extension services during harvesting while 24% got the service during sowing time. Only 16% of farmers had access to extension services during land preparation while 1% of these farmers had access to the service during other times. On the other hand, because of very few extension officers in Babati district, many farmers accessing extension services received it yearly. Only 29% of these farmers received extension services monthly. Likewise, 3% had never seen the extension officer in person so they relied on advisory services through written materials. In addition, 16% of smallholder farmers received extension services once a week while 9% received twice week.

Figure 12: Time when smallholder farmers receive extension services



Moreover, only 35% of smallholder farmers visited extension officers when encountered with a farming challenge. The remaining portions (65%), of farmers did not visit extension agents even if they were in need of this kind of service. This is because, farmers perceived that, the existing extension system was inadequate and concentrated only on special programs for non-legume crops. Similar findings were reported by CIAT in 2008. 78% of smallholder farmers frequently

visited extension officers when there was a technical problem. In addition, farmers visited extension officers during input provision to obtain inputs and during sowing for technical advice, both at 11% as shown in Figure 13.

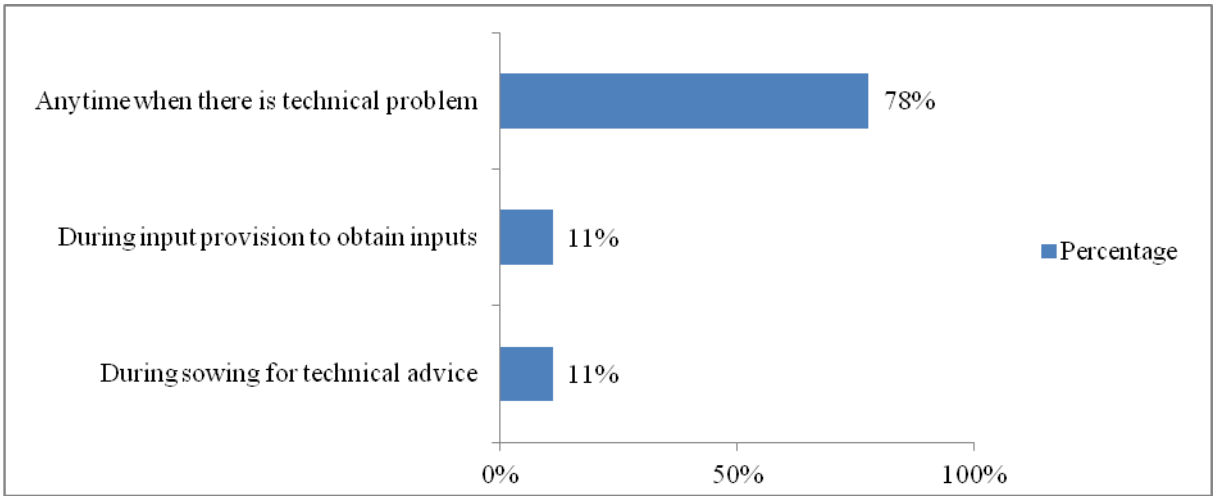


Figure 13: Time when smallholder farmers visit extension officers

4.5.4 Smallholder farmers source of bean farming related information

Common bean farmers in Babati district got farming related information from multiple sources. As depicted in Table 14, the common sources were neighbours and or friends (41%), fellow farmers (36%), researchers (29%), contact farmers (23%) and input dealers (22%). Other sources of information to farmers included NGOs (19%), public leaders (17%), agriculture professionals (16%) and farmers' cooperatives (12%). These findings suggest that; smallholder farmers had enough channels for receiving information. However, farmers were pessimistic about some sources of, and information conveyed to them especially on prices and seed quality from buyers and seed dealers respectively. Information received by common bean farmers affects decisions made, and the transaction costs. Abdulai and Birachi (2009) in a study on smallholder milk farmers in Kenya and Ouma *et al*. (2010) in a study on banana producers in Central Africa reported that, source of information has direct effects on the level of transaction costs that farmers face.

Table 14: Smallholders' source of farming related information

Source of information	N	YES (%)
Researcher	39	29%
Contact farmer	31	23%
Fellow farmer	47	36%
Public leader	23	17%
Cooperative	16	12%
Neighbours/friends	55	41%
NGO	25	19%
Input dealers	30	22%
Agricultural professionals	21	16%

Table 15 shows that, farmers in the study area got farming related information from their multiple sources specifically through demonstration plots, field visits and or days, and direct trainings. Other means of information exchange are written materials (leaflets and manuals), phones, farmers' field schools (FFS), radio, and meetings. The most common means of information exchange were field visits / days, demonstration plots and others (phones, FFS, radio and meetings).

Table 15: Smallholder farmers' mode of information exchange

Information source	Frequency	N	%	Means of information exchange	N	%
Researcher	Never	5	14	Demonstration	4	14
	Once a year	30	81	Field day/visit	16	55
	Monthly	2	5	Training	0	0
	Weekly	0	0	Written materials (leaflets, manuals)	1	3
	Daily	0	0	Others (phones, FFS, Radio, meetings)	8	28
Contact farmer	Never	4	13	Demonstration	9	38
	Once a year	22	73	Field day/visit	5	21
	Monthly	2	7	Training	1	4
	Weekly	1	3	Written materials (leaflets,	2	8

				manuals)		
	Daily	1	3	Others (phones, FFS, Radio, meetings)	7	29
Fellow farmer	Never	3	7	Demonstration	15	38
	Once a year	26	57	Field day/visit	10	26
	Monthly	10	22	Training	1	3
	Weekly	2	4	Written materials (leaflets, manuals)	2	5
	Daily	5	11	Others (phones, FFS, Radio, meetings)	11	28
Public leader	Never	13	62	Demonstration	3	21
	Once a year	5	24	Field day/visit	1	7
	Monthly	3	14	Training	0	0
	Weekly	0	0	Written materials (leaflets, manuals)	0	0
	Daily	0	0	Others (phones, FFS, Radio, meetings)	10	71
Cooperative	Never	6	43	Demonstration	3	38
	Once a year	7	50	Field day/visit	1	13
	Monthly	0	0	Training	0	0
	Weekly	1	7	Written materials (leaflets, manuals)	0	0
	Daily	0	0	Others (phones, FFS, Radio, meetings)	4	50
Neighbours/friends	Never	3	6	Demonstration	14	30
	Once a year	25	48	Field day/visit	7	15
	Monthly	14	27	Training	2	4
	Weekly	2	4	Written materials (leaflets,	0	0

				manuals)		
	Daily	8	15	Others (phones, FFS, Radio, meetings)	24	51
NGO	Never	2	8	Demonstration	1	50
	Once a year	20	83	Field day/visit	0	0
	Monthly	1	4	Training	0	0
	Weekly	0	0	Written materials (leaflets, manuals)	1	50
	Daily	1	4	Others (phones, FFS, Radio, meetings)	0	0
Input dealers	Never	5	19	Demonstration	3	13
	Once a year	15	56	Field day/visit	2	8
	Monthly	2	7	Training	2	8
	Weekly	1	4	Written materials (leaflets, manuals)	12	50
	Daily	4	15	Others (phones, FFS, Radio, meetings)	5	21
Agriculture professionals	Never	6	30	Demonstration	7	50
	Once a year	8	40	Field day/visit	3	21
	Monthly	4	20	Training	1	7
	Weekly	1	5	Written materials (leaflets, manuals)	0	0
	Daily	1	5	Others (phones, FFS, Radio, meetings)	3	21

The frequency of information received by these smallholder farmers from most of the sources was largely once a year. For instance, farmers received information from researchers and NGOs at 81% and 83% once in the year. There was a need for every market actor to improve the flow of information in the common bean industry information system.

Regarding improved bean variety, information reached smallholder farmers from multiple sources as well. The most common sources, and percentage in bracket, were fellow farmers (26%), Selian Agricultural Research Institute/*Centro Internacional de Agricultura Tropical* (SARI/CIAT) (15%), public leaders (15%), FARM AFRICA (17%) and public extension agents (12%). Other sources are as summarized in Table 16.

Table 16: Smallholder farmers' common bean improved variety sources of information

Bean variety Information source	N	Percentage
SARI/CIAT	21	15%
Fellow Farmer	37	26%
Farm Africa	24	17%
Input dealer	3	2%
Extension Agent	17	12%
Neighbour	9	6%
Africa Rising	7	5%
Public Leader	22	15%
Radio	4	3%

The information about the bean improved variety was conveyed through field days/visits (24%), demonstration plots (24%) and direct training (26%). Table 17 indicates that, through demonstration plots, different entities conveyed information to farmers in varying proportions. Specifically, these proportions were; SARI/CIAT (42%), Government (29%), other NGOs (16%) and researchers (13%). In addition, farmers get information on improved bean varieties through field days/visits from other NGOs (48%), researchers (25%), SARI/CIAT (18%) and government (9%). Farmers also got information on improved varieties through direct trainings from the government (35%), other NGOs (31%), SARI/CIAT (27%) and researchers (6%).

Table 17: Farmers participation in field visits, demonstration, training and organizers

Field day/Visit	Count	Percentage by organizer
SARI/CIAT	8	18%
Researcher	11	25%
Other NGOs	21	48%
Other (Government)	4	9%
Demonstration plot	**Count**	**Percentage by organizer**
SARI/CIAT	19	42%
Researcher	6	13%
Other NGOs	7	16%
Other (Government)	13	29%
Training	**Count**	**Percentage by organizer**
SARI/CIAT	14	27%
Researcher	3	6%
Other NGOs	16	31%
Other (Government)	18	35%

4.5.5 Smallholder farmers' group membership

In terms of group membership, only 17% of the interviewed smallholder famers belonged to farmer groups as opposed to 83% of farmers who were not members of any group. It was found that, group members to saving and credit were able to easily access credit. Moreover, those members to seed multiplication groups were able to receive extension services and collective purchase of seed varieties. Findings of this study indicate that, the role of collective action in mitigating the challenges facing farmers was still underutilized. Group membership would significantly influence the output of bean producers. Owuor *et al*. (2004) found that farmer groups were effective, especially in pooling external inputs, lobbying for favourable policies and disseminating market information in Kenya. Thus, farmers that are members to a group are likely to produce more and consequently sell more due to skills and joint learning among them compared to non-group members. Figure 14 shows that, for those farmers who were members of groups, 60% were members of saving and credit groups while 23% were members of seed multiplication group. Furthermore, 14% of farmers were members of marketing cooperatives and 3% had membership to other groups.

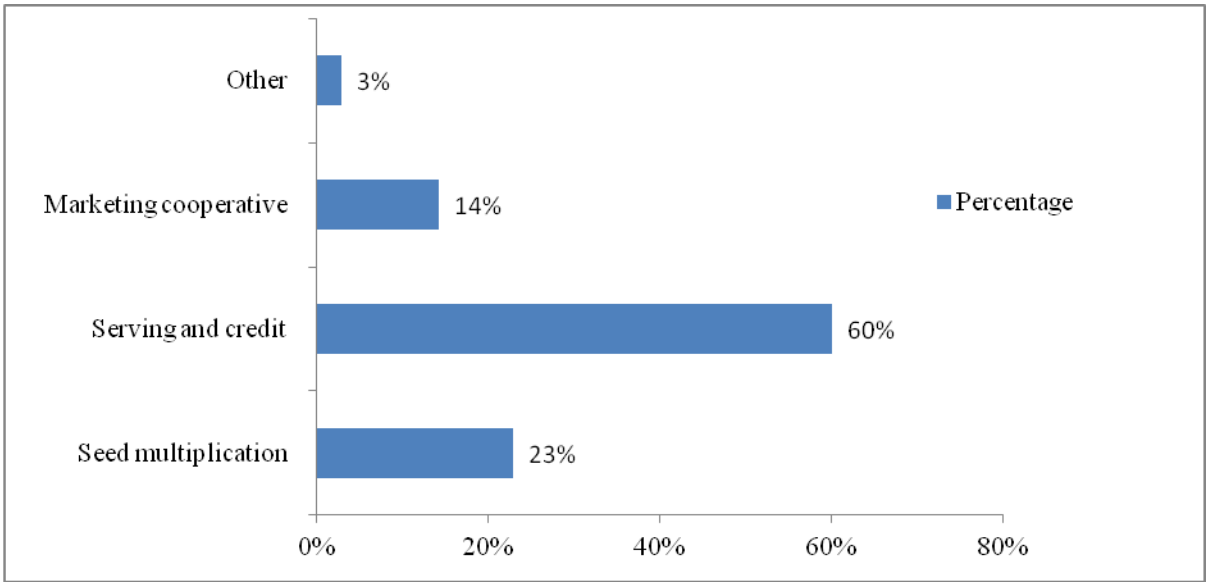


Figure 14: Smallholder farmers' group membership

4.5.6 Common bean varieties grown in the study area

In Babati district, varied range of local and improved bean varieties were grown, including those grown for research purposes. The local variety mostly grown was called '*Boo*'. On the other hand, the most common improved varieties grown in the study area comprise of Lyamungu 90 (LY 90) commonly called '*farm*', Jesca prominent by the name '*Iringa*', Selian 06 (SEL 06) also known as '*climbing beans*', Selian 94 (SEL 94), and Uyole commonly called '*soya*'. Other varieties such as LV-3, LV-2, GASIRIDA, RVR 2245, VCB 810113 and UMUBANO are planted for research purposes either on demonstration plots or small farmer owned trial plots. Smallholder farmers in Babati, season after season, when viewed necessary had been switching from one variety to another because of various reasons. Some of the reasons as shown in Table 16 included; availability of better variety, low yield, diseases and pests' problem as well as high seed prices.

Table 18: Farmers' reason(s) for switching common bean varieties

Reason for stopping to grow certain varieties	N	Percentage
Availability of better variety	48	26%
Unavailability of seed	25	14%
High purchase price	26	14%
Low yield in my field	46	25%
Diseases and pests' problem	40	22%

4.5.7 Constraints facing common bean farmers in the study area

Common bean farmers in Babati district faced various challenges. According to respondents, the major constraints in the common bean business were pests and diseases. In some villages in Babati division such as Gedamar, Ayamango, Mahalu 'Halu' and Tsamas in Gallapo ward, a number of smallholder farmers had stopped growing beans because of a disease called Early Blight. Shortage of farming land because of rapid population growth, which renders competition with other household activities including settlements was ranked as the second challenge. Moreover, poor prices of common bean especially for local bean variety, lack of credit access which could be used for buying improved variety seeds, agrochemicals among others were also cited to be hindrances to common bean production. Poor access to input supply and weak extension services were most common challenges in Endanoga village in Gallapo.

Furthermore, poor market information was another challenge. Some common bean farmers did not know where to sell their produce on one end, and to purchase improved bean variety on the other. High post-harvest losses, illegal actions by market agents who normally exploited farmers through cheating on measurements, and low fertility of their land were common in all the two divisions. Besides, poor roads and other infrastructure, poor labour availability, relatively low demand in the market especially for local varieties which have multiple colours and varying sizes were highly raised in Babati division. Lastly, shortage of water for irrigation was also pointed out as another challenge facing these smallholder farmers in the study area. Other constraints encountered by common bean farmers in Babati district are as shown in Figure 15. The findings of this study concur with those reported by Mediatrice (2011). The factors stated as main challenges to smallholder bean farmers in Rwanda were; shortage of credit, land scarcity, inadequate extension services and drought. Moreover, the findings correspond to those by Katungi *et al.* (2010), who reported that, poor availability of bean variety, poor markets, shortage of credit, drought, disease and pests, poor access to input supply, and shortage of land for farming among others as challenges to bean production in Ethiopia and Eastern Kenya.

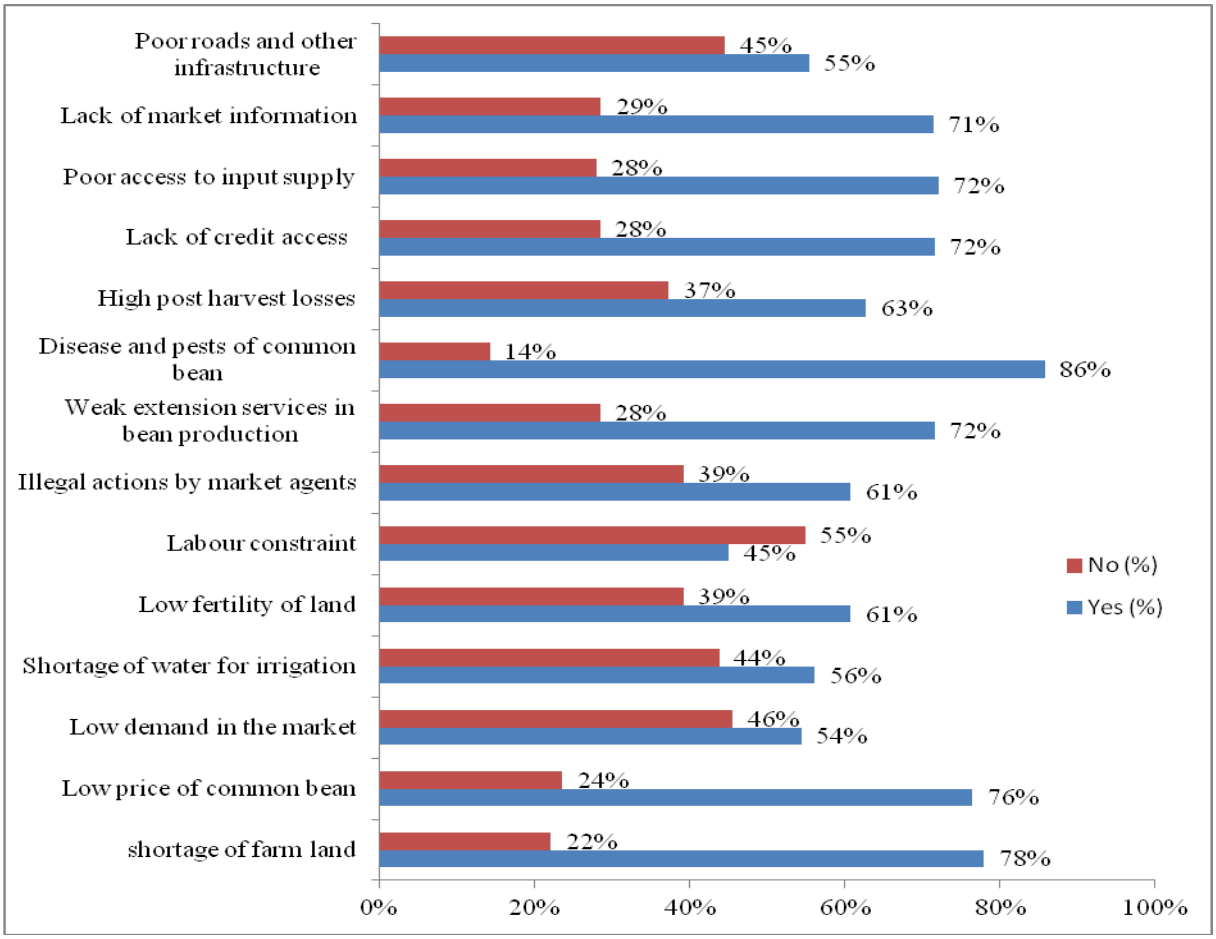


Figure 15: Constraints facing common bean farmers in the study area

4.5.8 Common bean farmers' costs of production inputs

The average common bean farmer incurred a total cost of TZS 117,401/ acre per season on average. 44% of the total cost was incurred for purchasing seeds while 41% was from paying hired labour. Pesticides and fertilizer cost 7% and 3% respectively. Common bean farmers used no or very little fertilizer in their bean farms because they were used to organic manure and crop rotation which replenished the used-up nutrients. Furthermore, most farmers did not use fertilizer because of poor access to fertilizer supplies.

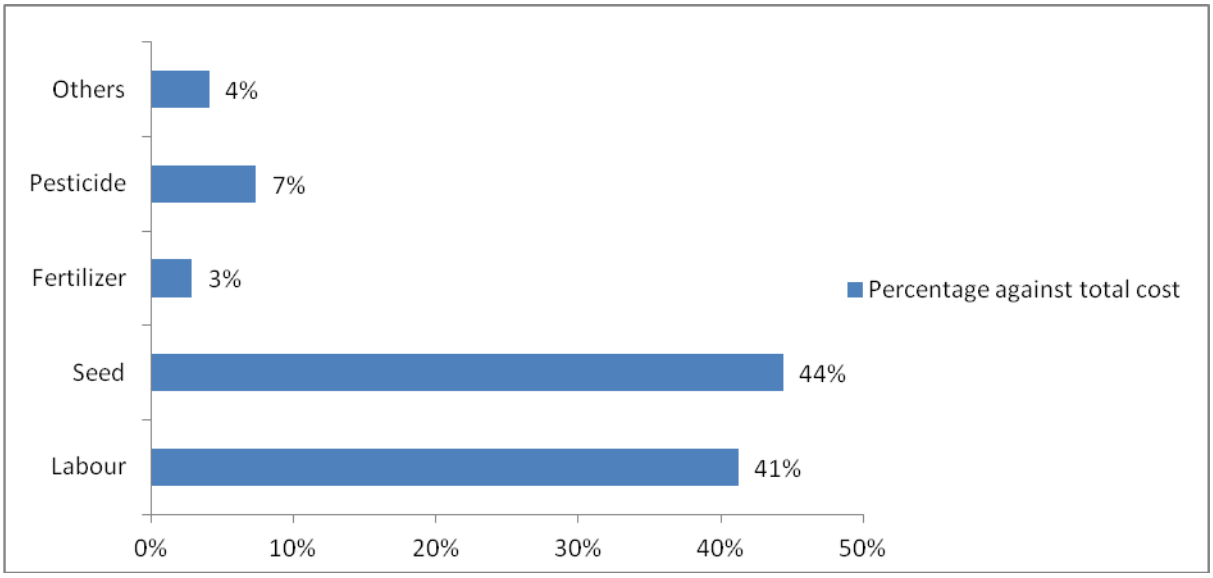


Figure 16: Percentage of each common bean input against total inputs outlay

4.5.9 Farmers' perception on bean input prices in the study area

Farmers had different perceptions of input prices in Babati district. Prices of improved seed variety, fertilizer, labour and other inputs like agrochemicals as major inputs were remarked differently. Results in Table 17 indicate that, 40% of interviewed farmers perceived that, improved bean variety was very expensive, 42% expensive, and 17% moderate. 38% of these farmers thought that, fertilizer prices were moderate, while 26% perceived the prices to be moderate. Moreover, only 17% thought that fertilizer was very expensive. On the other hand, 42% of farmers perceived that, labour was expensive as opposed to 38% who perceived that, labour costs were moderate. Furthermore, Table 19 indicated that, 16% of farmers perceived costs of labour as being very expensive while 3% not expensive, and 1% less expensive. 69%, 21% and 10% of farmers perceived other inputs like agrochemicals prices to be moderate, expensive and very expensive respectively. These findings concur with those of Katungi *et al.* (2010), who reported that, some common bean inputs such as land, fertilizer and credit in Eastern Kenya and Ethiopia were very expensive. According to Byerlee *et al.* (2007), in efforts to overcome the relative higher costs of fertilizer in Ethiopia, the government extended fertilizer credits distributed to farmers through extension.

Table 19: Farmers perception on bean input prices condition, farmers' perception

Improved seed variety	**N**	**%**	**Labour**	**N**	**%**
Very expensive	76	40%	Very expensive	31	16%
Expensive	80	42%	Expensive	80	42%
Moderate	33	17%	Moderate	72	38%
Less expensive	-	-	Less expensive	1	1%
Not expensive	-	-	Not expensive	5	3%
Fertilizer	**N**	**%**	**Others (e.g. agrochemicals)**	**N**	**%**
Very expensive	33	17%	Very expensive	3	10%
Expensive	32	17%	Expensive	6	21%
Moderate	71	38%	Moderate	20	69%
Less expensive	50	26%	Less expensive	-	-
Not expensive	3	2%	Not expensive	-	-

4.6 Farm level gross margin of common bean smallholder farmers

The results on bean production indicated an average produce of 358.70 Kg and 72.095 Kg per season, per smallholder farmer, for local and improved variety respectively. On the other hand, local and improved bean variety productivity was 240.56 Kg/Acre and 281.43 Kg/Acre respectively. The average farm-gate prices were TZS 962.18/= and TZS 1,161.67/= per Kg for local and improved variety correspondingly. The average total revenue of common bean per smallholder farmer at farm level was TZS 231,264/= (for local variety) and TZS 326,931/= (for improved variety) per acre per season. The total costs incurred during production was TZS 97,753.61/= and TZS 19,647.39 /acre/season for local and improved variety respectively. The Gross Margin (net profit margin) per acre was TZS 133,710.20/= (for local variety) and TZS 307,283.70/= (for improved variety) per season as shown in Table 20. The calculation resulted into a gross margin which is a proxy of profit. This is because some fixed costs like depreciation of implements could not be included due to lack of reliable data on their market values. This concurs with the studies carried out by Mburu *et al*. (2007) and Ouma *et al*. (2004) that had similar challenges. However, gross margins are still useful in assessing enterprise profitability and are widely used in farm management economics (Dijkhuizen and Huirne, 1997 and Firth, 2002).

The implication of relatively low profit margins earned by smallholder farmers from both local and improved varieties could be attributed to small quantities of output. Moreover, growing of local bean varieties which fetch relatively low prices and have higher total production costs per acre in a season, which deincentivise farmers; and poor access to market information especially

on demand and supply to urban areas further attribute to low profit margins realized by smallholder farmers. Poor access to market information leaves smallholder farmers with an option to sell their produce at low farm gate prices. High farmers' opportunity cost of production cannot be distributed over smaller quantities of common bean produced thus giving a low profit margin to farmers.

Table 20: The results of the profit margin of common bean at farm level

VARIABLES	LOCAL VARIETY	IMPROVED VARIETY
REVENUE		
Average produce (Kg/season/Farmer)	358.70	72.10
Total Land/Area under Beans(Acres)	305.06	52.38
Total Yield (Kgs)	73,385.00	14,740.00
Productivity (Kgs/Acre)	240.56	281.43
Average farmgate (TZS/Kg)	962.18	1,161.67
TOTAL GROSS MARGIN/ACRE/SEASON	**231,464**	**326,931**
PRODUCTION COSTS		
Labour	40,298.46	8,099.54
Seed	43,410.06	8,724.94
Fertilizer	2,831.00	569.00
Pesticides	7,225.71	1,452.29
Others	3,988.38	801.62
TOTAL COSTS/ACRE/SEASON	**97,753.61**	**19,647.39**
PROFIT MARGIN/ACRE/SEASON	**133,710.20**	**307,283.70**
Total Gross Margin/Total Variable costs per season	**1.37**	**15.64**
Net profit/Gross Margin*100	**57.77**	**93.99**
Profit Margin/Average produce	**372.76**	**4,262.21**

US$ 1~TZS 2, 100

It was however noted that, the total average gross margins per smallholder farmer could not necessarily reflect a genuine production performance at farm level. It was therefore important to consider the total gross margin in relation to the total costs in order to measure production and profit efficiency of the farm.

$$\text{Production efficiency}_{\text{(Local variety)}} = \frac{\text{Total Gross Margin}}{\text{Total Variable Cost}} = \frac{TZS\ 133,710.20}{TZS\ 97,753.61} = 1.37$$

$$\text{Production efficiency}_{\text{(Improved variety)}} = \frac{\text{Total Gross Margin}}{\text{Total Variable Cost}} = \frac{TZS\ 307,283.70}{TZS\ 19,647.39} = 15.64$$

The production efficiency of variable inputs applied in farm improvements at farm level was 1.37 and 15.64 for local and improved varieties. Production efficiency is a point at which a farmer is producing crop(s) at maximum efficiency so that s/he can only increase production of some crops by decreasing that of others. This point is realized when the farm and other inputs combination are operated along production possibility frontier. The production efficiency result of 1.37 and 15.64 literally show that farmers in the study area produced crops as much as possible without wasting resources.

$$\text{Profit efficiency}_{(\text{Local variety})} = \frac{\text{Gross Profit(Margin)}}{\text{Total Revenue}} * 100 = \frac{TZS\ 133,710.20}{TZS\ 231,464} = 57.77$$

$$\text{Profit efficiency}_{(\text{Improved variety})} = \frac{\text{Gross Profit(Margin)}}{\text{Total Revenue}} * 100 = \frac{TZS\ 307,283.70}{TZS\ 326,931} = 93.99$$

On the other hand, profit efficiency on return to total capital invested by farmer was 57.77 for local variety and 93.99 for improved variety, implying that the total capital invested by smallholder farmer was well managed to generate profit. Economically, the bigger the ratio the better profit efficiency of the firm. Therefore, with respect to the two projects, improved variety generated relatively better profit as compared to local variety.

It was further noted that the general profit margin per smallholder farmer per acre /season would not necessarily reflect genuine profit efficiency per Kg per farmer. It was therefore, important to consider general profit margin/average produce per farmer to establish profit margin per Kg per smallholder farmer at farm-gate, which was TZS 372.76/= (for local variety) and TZS 4,262.21/= (for improved variety). This implies that producers still get profit from their produce though they produce small quantities, and productivities for both local and improved varieties are still very low.

4.7 Socio-economic factors influencing smallholder farmers' profit margin

Socio-economic factors influencing the profit margin of farmers were analyzed by use of multiple regression model under STATA computer software. The results indicate that the model was statistically significant ($P<0.000$) and the adjusted R^2 value was 0.6052 (60.52%) which implies a good specification of model variables. This means that the 60.52% of the variation in dependent variable was explained by independent factors estimated in the model, with 39.48% of variation being explained by other factors not included in the model. The results show that 5 out of 12 variables affected farmers' profit margin and found to be significant at different levels. The

age of respondent was highly correlated with farming experience on one hand; while common bean yield was highly correlated with land size on the other hand. The age and land size variables were not included in the regression model. The results further indicate that some of these independent variables in the model had positive effect on dependent variable while others had negative effects. Some variables indicated positive and strong significance levels and others show a negative relationship to the dependent variable. The results of regression analysis are summarized in Table 21.

Table 21: Regression results of factors affecting common bean's gross margin

Variables	Coefficient	Standard Error	P>t
Age	-0.1107	0.03695	0.003
Gender	0.21237	0.10856	0.052
Farming experience	-0.48441	0.38595	0.211
Household size	-0.2303	0.16015	0.152
Bean yield	0.29613	0.01532	0.000
Land size	-0.19234	0.27054	0.478
Most visited market	-0.12461	0.19418	0.522
Farm-gate price	0.14054	0.01415	0.000
Access to market information	-0.06972	0.05043	0.488
Access to credit	0.32619	0.17604	0.066
Access to extension	-0.07379	0.09223	0.425
Off-farm income	-0.15378	0.0895	0.087

Number of obs = 204; F (12, 191) = 109.93; Prob > F = 0.0000; R-squared = 0.8811; Adj R-squared = 0.8731; Root MSE = 1.2e+05

The study results indicate that, age of respondents had a negative effect on profit margin. A unit increase in age led to a decrease in profit margin by 0.1107 units at 1% level of significance. This is because the innovativeness and optimism of the entrepreneur as well as his mental capacity to cope with the challenges of his business activities and his mental and physical abilities to do manual work decrease with age. The study results concur with those by Nwaru and

Iwuji (2005) who reported that entrepreneurship gradually becomes less as the age of the entrepreneur increases.

In addition, study results indicate that gender of respondents had a positive effect on profit margin. Being male would lead to an increase in profit margin by 0.21237 units at 10% level of significance. The positive effect of gender on profit margin of the producers is explained by aspects of labour provision and adoption of technologies in agricultural production. Female farmers on one hand, perform most of farm activities and work longer hours as compared to male farmers on the other hand. However, most female farmers produced common bean in small quantities for home consumption only. In addition, male farmers who mainly produced common bean in larger quantities for selling, quickly adopted new technologies as compared to female farmers because they were the ones who were mostly attending trainings, which eventually enabled men to fetch relatively more profit compared to women. Combined efforts in common bean production could reflect high produce for sale, and in return, the more the profit can be generated. This observation compares to the studies by Tesfaye *et al*. (2001) and Mesfin (2005) who reported that, gender influences adoption of technology like common bean variety in Ethiopia, which affects the total earning from the farm. They further informed that, male farmers are more likely to adopt new technology which positively influences their gross margins.

Furthermore, common bean yield had a positive effect on profit margin. A unit increase in common bean yield led to an increase in profit margin by 0.29613 units at 1% level of significance. Ideally, when smallholder farmers get more units of common bean which sells at a per unit profit, more profit is fetched from the quantity being sold. Smallholder farmers who realised higher output supplied larger proportion of their beans to the market. The results showed that farmers who increased their output increased the quantity of marketable supply. This study corresponds to Birachi *et al*. (2011) who reported that, the quantity of beans produced greatly influence the quantity marketed. Moreover, Katungi *et al*. (2010) observed that, farmers with higher bean output have the potential for commercialisation that could increase their incomes thereby enabling them purchase more inputs to increase output.

Selling price (farm-gate) had a positive effect on profit margin. A unit increase in farm-gate price led to an increase in the profit margin by 0.14054 units at 1% level of significance. A positive coefficient of selling price implies that a unit increase in selling price led to increased profit margin of smallholder farmers. Ideally, when smallholder farmers sell at high prices, more profit is fetched from the products being sold. This is in line with the study by Nekesa *et al.* (1998)

who reported that, prices offered to smallholder farmers positively impacted their incomes from bean. The report further asserts that, the attained incomes from common bean as a result of good prices offered to these farmers help in commercialization of the enterprises.

Study results show that, access to credit had a positive effect on profit margin. A unit increase in the credit accessed by common bean farmers led to an increase in the profit margin by 0.32619 units at 10% level of significance. Perfectly, credit facilitates the introduction of innovative technologies and ensures input and output marketing arrangements. The results concur with that of Reddy, 1998 who reported that, having access to credit services enable farmers to purchase improved varieties and hence increase productivity and profitability at farm level.

Off-farm income generating activities had a negative effect on profit margin. A unit increase in off-farm activities led to a decrease in profit margin by 0.15378 units at 10% level of significance. This implies that, when a smallholder farmer owns a more rewarding off-farm income generating activity, the more she/he concentrates to that business and light-touches the common bean business which leads to low and low gross margins. Preferably, when smallholder farmers have a non-farming, and most rewarding business, they tend to opt and concentrate on that business and give less priority to common bean business which leads to low gross margins realized from farming. This is contrary to the result reported by Techane (2006) who found that participation in off farm activities increases the smallholder farmers' financial capacity and profitability after investing on new technologies.

4.8 Factors influencing farmer's supply of common bean to the markets

The model having a dummy regresand (1= farmers who supplied their common bean to the market who were 133 and 0 = farmers who did not supply their common bean to the market were 71). The model summary statistic value was 18.6838 at -2 log likelihood. This indicates how best the model predicts the correlation between the regresand and regressors. The Cox and Snell R^2 was 0.433 whereas Nagelkerke R^2 was 0.5433 which implies that the model predicted correctly at 54.33% of the variables entered with 45.67% representing variables that were not entered. The results of logistic regression analysis are summarized in Table 22.

Table 22: The results of logistic regression analysis of factors influencing farmer's supply of common bean to the markets

Variables	Marginal Effect (dy/dx)	B	S. E	Wald	Sig	Exp (B)
Age (X_1)	-0.1525	-0.045	0.721	0.004	0.001	0.956
Gender (X_2)	0.0309	10.346	4.117	6.314	0.062	0.003
Household size (X_3)	0.0291	-0.032	0.012	6.900	0.085	0.969
Years of schooling (X_4)	0.0725	0.391	0.138	8.070	0.001	0.676
Farm gate price (X_5)	0.2976	1.273	0.764	2.774	0.052	3.571
Distance to market (X_6)	-0.0252	-2.254	0.021	2.269	0.001	0.724
Market information (X_8)	-0.0320	-0.052	0.692	3.333	0.12	0.816
Off-farm income (X_9)	0.0110	0.724	0.383	3.564	0.059	2.062

-2 log likelihood = 18.6838[a], Cox & Snell Square = 0.433, Nagelkerke R Square = 0.5433

The marginal effect of age (in years) of respondents was 0.1525. This indicates that, a unit increase in respondent's age would increase the farmers' probability of supplying common bean to the market by 15.25% units. This is because younger farmers do not actively participate in farming as business activities. Most of younger farmers are idlers in towns and some are in motor circles' business commonly known as '*bodaboda*' for most of hours in all farming season long. Ideally, young farmers are more active and innovative to participate in agricultural activities and marketing inclusive. However, old farmers play a vital role in production including decision making about marketing issues as opposed to young farmers. This concurs with Fasoranti (2012) who showed that variables such as age, education, labour and input costs are positively related to profitability.

The variable on gender was a dummy variable (1 = male, 0 female). The results indicate that, gender was positively related to common bean supply to the market and was statistically significant (P>0.1). The marginal effect of gender of the respondent was 0.0309. The probability of the difference in the adjusted predictions for male and female to increase the supply of common bean to the market was 3.09% kilograms. The quantity of bean supplied to the market varied when gender changes from being female into being male. Males were more likely to sell compared to female. This implies that gender consideration in agricultural activities has a strong influence towards the production and surplus for sale which depends on what has been produced. Therefore, more gender balanced agricultural activities means more productivity surpluses for sale *Ceteris Paribas*. This result agrees with that of Birachi *et al*. (2011) who reported a positive correlation between gender and quantity of bean supplied to the market.

The results further indicate that family size negatively affected the supply of common bean to the market and was statistically significant (P<0.1). The marginal effect for household size on supply of common bean to the market was 0.0291. This means, if the household size increases by one unit, the supply of common bean to the market decreases by 2.91% kilograms. This is because, the larger the household size, the larger the amount of common bean quantities consumed, therefore little surpluses available for sale to the market. The findings correspond to Birachi *et al*. (2011) who reported a negative correlation between household size and quantity of bean supplied to the market.

Education level (years of schooling) positively affected the supply of common bean to the market and was statistically significant (P<0.01). The marginal effect for education level on supply of common bean to the market was 0.0725. A unit increase in education level by one year of schooling would increase the probability of supplying common bean to the market by 7.25% kilograms. This finding could be explained by the fact that education is a very important economic factor determining how one technically performs an activity which may include marketing of common bean. This result also concurs with the study done by Fasoranti, (2012).

The farm-gate price had a positive effect on the supply of common bean to the market. The marginal effect for farm-gate price on supply of common bean to the market was 0.2976 and was statistically significant (P<0.1). This implies that, a unit increase in price of common bean by TZS 100 would increase the probability of bean supply to the market by 29.76% units. Ideally, the increase in the farm-gate price of the common bean would lead to an increase in the amount of common bean produced and marketed. Therefore, most of the common bean producers would prefer supplying large quantities of produce at higher prevailing market price than to any other prices lower than the one prevailing in the market. The finding is similar to Ojo, (2000), who concluded that higher prices offered to maize and common bean farmers are the identified causes of their high production and marketing profitability in Nigeria and Ondo State in particular. In addition, this study corresponds with the study done by Birachi *et al*. (2011), who concluded that, the variables significantly influencing the quantity of bean supplied in the market included transportation losses, bean price offered, quantity produced and quantity stored for food.

Furthermore, the logistic regression results indicate a marginal effect of 0.0252 for distance to the market (in Km) or a trading centre. The distance to the market or trading centre was negatively correlated to the supply of common bean to the market, and was statistically

significant (P<0.01). This implies that, an increase in distance to the market or trading centre by 1 kilometre would decrease the farmer's quantity of bean supplied to that market or trading centre by 2.52% kilograms. Those farmers who were near by the market or trading centre would supply 2.52% more kilograms of common bean to the market or trading centre than those far away. The implication of close proximity to the market or trading centre to smallholder farmers enables them to incur less transport cost. Ideally, the longer distance to the market does not favour smallholder farmers in the marketing process, and to a great extent leads to a very big difference in profit margin between farmers and buyers in the value chain. This result is in agreement with the study done by Mutukumira *et al*. (1996), who stated that long distance to milk and other agricultural produce selling centres is a hindrance to a viable dairy and other agriculture enterprises**.** The longer the distance to these markets the less the number of smallholder farmers delivering agriculture produce, hence less profit realized.

Finally, off-farm income had a marginal effect of 0.011 with a positive correlation to common bean supply to the market. The variable was statistically significant (P<0.1). Having a positive coefficient implies that, having an off-farm income generating activity increased the probability of supplying common bean to the market by 1.10% kilograms. Availability of off-farm income opportunity and wealth status of the head of household significantly affect the adoption of common bean technologies for improving common bean productivity, which eventually highly influence the supply of the same to the market. This concurs with the result reported by Techane (2006) who found that participation in off farm activities increases the smallholder farmers' financial capacity and probability of realizing higher profits after investing on new technologies.

4.9 Smallholder farmers' major constraints affecting common bean supply to market

Different challenges were facing common bean farmers in the study area were pointed out. The most common challenges encountered by common bean farmers in Babati district are Illegal actions by middlemen (use of re-calibrated weighing scales which steal from farmers and lying about the actual market prices), inadequate processing facilities, and counterfeit seeds. Others include; low price of common bean, low producing seeds, poor markets, poor roads, and shortage of inputs. Diseases and pests, shortages of extension services, dearth of market information are also among the constraints in the list. The results of analysis on constraints affecting common bean supply to the market were summarized in Table 23.

Table 23: The results of constraints affecting common bean supply to market

Constraint	N	Percentage
Illegal actions by middlemen, inadequate processing facilities, Counterfeit seeds	98	56%
Low price of common bean, low producing seeds, poor markets, poor roads, shortage of inputs	51	29%
Diseases and pests, climate change, shortage of extension services, shortage of market information	16	9%
Others	9	5%

CHAPTER FIVE
CONCLUSION AND RECOMMENDATION

5.1 Summary

The descriptive statistics from this study indicated that, of the total interviewed farmers, 81.4% were male and 18.6% were female. Moreover, the study revealed that, 52.5% of these farmers aged between 40 to 60 years. Based on the Tanzanian education system, 73% of respondents had primary school education. The overall average years of household head farming experience was 18 years. Above and beyond, the common bean farming experience of the household head was 17 years. The household head had an average of 14 years of common bean marketing experience. The average land owned by smallholder farmers was found to be 2.48 hectares. The study, further found out that, the average productivity of local and improved bean variety was 594.45Kg/Ha and 695.44 Kg/Ha respectively. In Babati district, the average distance to the nearest market was 2.88 Km, 6.20 Km to the most visited market and 10.51 Km to the most preferred market. The transport cost was TZS 24 (US$0.0114) /Kg to the nearest and most visited markets while TZS 26 (US$0.0124)/Kg was the cost of transporting common bean to the most preferred market. On the other hand, study results show that, at farm level, the Gross Margin (Net Profit Margin) per acre was TZS 133,710.20/= and TZS 307,283.70/= per season for local and improved variety respectively. Moreover, age of respondents; gender; yield; selling price (farm-gate price); access to credit; and off-farm income affected the gross margin realized by smallholder farmers. Similarly, age of respondents; gender; family size; education level (years of schooling); farm-gate price; distance to the market; and off-farm income influenced the quantity of bean supplied to the market. The most common challenges encountered by common bean farmers in Babati district were Illegal actions by middlemen (use of re-calibrated weighing scales which steal from farmers and lying about the actual market prices), inadequate processing facilities, and counterfeit seeds. Others included; low price of common bean, low producing seeds, poor markets, poor roads, and shortage of inputs. Diseases and pests, shortages of extension services, dearth of market information were also among the constraints in the list.

5.2 Conclusion

The Gross Margin (Net Profit Margin) per acre was TZS 133,710.20/= and TZS 307,283.70/= per season for local and improved variety respectively. This indicates that, common bean farming in Babati district is profitable and plays an important role in rural poverty reduction, through creation of employment and wealth for women, men and youth. Moreover, common bean farming in Babati enhanced household nutrition and general food security. The socio-economic factors determining common bean on-farm level gross margin were age of respondents; gender; yield; selling price (farm-gate price); access to credit; and off-farm income. Furthermore, factors influencing the household common bean supply to the market were age of respondents; gender; family size; education level (years of schooling); farm-gate price; distance to the market; and off-farm income. Therefore, this study positively contributes to improved bean profitability for income and food security as articulated in the United Nations Sustainable Development Goals I and II.

5.3 Recommendations

This study recommends that; smallholder farmers should allocate more land to production of improved bean variety; and improve on use of recommended fertilizers, at the right calibrations so as to enhance bean productivity to the potential level. Moreover, in the context of bean production, there is need for the Ministry of Agriculture, Food Security and Cooperatives (MAFSC) to take lead in interventions towards improvement of farmers' extension service and training which will be attributed as approaches for fighting killer diseases such as early-blight, and pests like aphids. Trainings suggested are on correct pesticides use; good agricultural practices including growing improved seed varieties; and record keeping. Improved varieties were relatively more productive, pests and disease resistant, and incurred less cost of production as compared to local varieties. Furthermore, the National Beans Programmes carrying out research in the country are advised to have proper mechanisms of disseminating and monitoring new seed varieties in the industry. This is because, most of farmers either have not heard about the improved variety, which are relatively highly producing, or fail to differentiate between QDS normally improved and counterfeit.

Additionally, there is need for common bean smallholder farmers to be trained on business diversification. Off-farm income was revealed to have a positive correlation with the common bean supply to the market. This implies that, having an off-farm income generating activity

positively influences the common bean business through reinvesting the profit earned from these off-farm activities, and assets synergise efforts to fighting poverty and food insecurity. This initiative will also reduce over-dependence on farm produce and microfinance institutions for farming credits, and provide alternative employment to women and youth. Smallholder farmers can be trained on piggery, raising poultry and small ruminants such as rabbits and goats. To append, there is also a need for the MAFSC, Tanzania Agriculture Development Bank (TADB) and other partners to come up with more reliable initiatives for farmers to access credit. One of the suggested models is formalizing and strengthening the existing Village Saving and Lending Associations (VSLAs), through which needy smallholder farmers can timely access adequate microcredit facilities at affordable interest rates without too much collaterals. This will enable these smallholder farmers to invest more in farming which will eventually increase their profitability through commercialization. Smallholder farmers should also be encouraged to form and or join effective producer groups, associations and networks which will help improve their bargaining power when purchasing inputs, accessing extension services, lobbying for favourable policies as well as borrowing farming loans and marketing their common bean and other crops produce.

5.4 Areas of further study

Although this study only covered common bean varieties, it is also equally important for future researchers to dwell on other varieties such as Selian 06 (SEL 06) also known as '*climbing'* beans. The study also concentrated only on on-farm profitability of common bean farmers, future studies may consider any other subsequent level (s) of the common bean value chain not only in Tanzania but also in other bean producing countries.

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APPENDICES

APPENDIX 1: DATA ENUMERATION QUESTIONNAIRE

FACTORS INFLUENCING ON-FARM LEGUME PROFITABILITY - THE CASE OF SMALLHOLDER BEAN FARMERS IN BABATI DISTRICT, TANZANIA

Dear respondent

This questionnaire is prepared to get background information concerning the factors influencing on-farm legume profitability along the value chain of common bean. Your responses will be treated as confidential and used for the intended purpose only. Please answer the questions freely; you cannot be identified from the information you provide and no information about individuals will be given to any organization.

Interview schedule **GPS reading** ----------

Start time ----------

Date of interview ----------

Number (code) ----------

Name of enumerator ----------

1. Farmer characteristics

1.1. Name of the respondent: ----------

1.2. Age of the respondent ----------

1.3. Sex 1 male □ 2 Female □

1.4. Years of schooling... 1 between 0-8 □ 2 between 9-12 □ 3 between 13-14 □ 4 between 15-25 □ 5 other □ Please, specify.....

1.5. Total Farming experience of the household head in years ----------

1.6. Common bean Farming experience of the household head in years----------

1.7 Common bean marketing experience of the household head in years----------

1.8. Household demographic characteristics;

SN	List of family member	Sex	Age	Education level

2. Household Ownership

2.1. Land size in 2013/2014

Land allocation	**Land size (Acre)**
Acreage of land for common bean	
Land acreage by other legumes	
Land acreage by cereals	
Land acreage by fruits	
Land acreage by horticultural crops	
Land acreage by homestead and others	
Total	

2.2. Household labor availability in 2013/2014

Age category	**Male #**	**Female #**	***Activities participated in common bean production**	**Working Hrs a day**
<15years				
16-65 years				
>65 years				
* Common bean production activities includes: - 1) Land preparation 2) sowing 3) Weeding 4) Harvesting 5) Threshing 6) Transportation 7) Storage 8) Marketing 9) others (specify).....				

3. Economic variables

3.1 Crop production by the household in 2013/2014 production season

Crop grown	**Area (acre)**	**Yield (Kg/acre)**	**Total yield**	***Type of production**
Local bean variety				
Improved bean variety				
Maize				
Vegetables				

Fruits				
Others				
*Type of production 1) Sole/mono/ cropping 2) intercropping 3) both				

3.2. List the type of costs and the amount of expenses you incur in producing 1 Tin = 20kg/ of common bean

Type of cost	**Cost in TZS**	**Type of cost**	**Cost in TZS**
1.Labor			
2.Seed			
3.fertilizer			
4.Pesticide			
5.Others			

3.3 What are the constraints you are facing in producing common bean?

3.3.1 Shortage of farm land 1. Yes [ ] 2. No [ ]

3.3.2 Low price of common bean in the market 1. Yes [ ] 2.No [ ]

3.3.3 Low demand in the market 1.Yes [ ] 2. No[ ]

3.3.4 Shortage of water for irrigation 1.Yes [ ] 2.No [ ]

3.3.5 Low fertility of the land 1. Yes [ ] 2.No [ ]

3.3.6 Labor constraint 1. Yes [ ] 2.No [ ]

3.3.7 Some illegal actions created by marketing agents 1. Yes, [ ] 2. No [ ]

3.3.8 Weak extension service in bean production 1.Yes [ ] 2. No [ ]

3.3.9 Disease and pests of common bean 1.Yes [ ] 2. No [ ]

3.4.0 If yes, what are disease and pests common in bean?

i)…… ii)…… iii)…… iv)……..

3.4.1 High post-harvest losses 1. Yes [ ] 2. No [ ]

3.4.2 Lack of credit access to buy inputs for production 1. Yes [ ] 2. No [ ]

3.4.3 Poor access to input supply 1. Yes [ ] 2. No [ ]

3.4.4 Lack of market information 1. Yes [ ] 2. No [ ]

3.4.5 Poor roads and other infrastructure 1. Yes [ ] 2. No [ ]

3.4.6 Others……

3.5 Household's annual farm income from sale of crops 2013/2014 in TZS

Types of crop grown	**Average Annual harvest (Kg)**	**Consumed (Kg)**	**Gift (Kg)**	**Sold**		**Total sales**
				Amount	**Unit price**	
Local bean variety						
Improved bean variety						
Maize						
Other pulses						
Vegetables						
Fruits						
Others						
Total						

4. Income from participation in off-farm activities

4.1. Do you have off-farm activities? Yes = 1 □ No = 0 □

4.2. If yes, type of work: Trading = 1□ Labourer = 2 □ Carpenter 3 □ Civil servant = 4 □ other = 5 □ (specify) _____

4.3. What was the amount in TZS of off farm income for the year? _____

4.4. For what purpose do you use the income from off-farm activities? Purchase household items = 1 □ Purchase farm inputs = 2 □ Settle debts = 3 □ Buy food = 4 □ other = 5 □ (specify) _____

5. Access to services

5.1 Market centres accessible to you

Name of the market	Distance (Km)	Mode of transport	Transport cost (TZS/QTY)	Cost of loading (TZS/QTY)	Commodities sold at market place
Mode of transport; 1=feet 2= motor vehicle `Commodity; 1 = cereals 2= Common bean 3=coffee 4 = fruits & vegetables 5=others					

6. Credit access

6.1. Have you obtained credit for common bean production in the last three years? Yes = 1□ No = 0 □

6.2. If yes, from where did you get and how much did you get?

Source ---------- Amount (in TZS) ----------

6.3. For what purpose did you use the credit? For purchasing fertilizer = 1 □ For purchasing improved seeds = 2 □ For purchasing Agro-chemicals = 3□ Other purpose = 4 (Specify) ----------

6.4. Have you obtained and used improved common bean as credit in kind?

Yes =1 □ No = 2 □

6.5. If yes, from where did you get from and how much?

Source ---------- Amount (in Kg) ----------

7. Extension services

7.1. Do you get advisory services from extension agents? Yes = 1 □ No = 2 □

7.2. How frequently do the extension agents visit you? Never = 0 □ Once in a week = 1 □ Twice in a week = 2 □ Monthly = 3 □ Yearly = 4□

7.3. When does extension agent visit you? a) During land preparation □

b) During sowing□ c) When disease/ pest occurs □ d) during harvesting □ e) others (Specify).....

7.4. Do you visit extension agent? Yes =1 □ No = 2 □

7.5. If yes, when do you visit? During sowing for technical advice =1□ During input provision to obtain inputs = 2 □ It depends (any time when there is technical problem) = 4 □

7.6. What are your other sources of information and how often you use/ have contact with them?

Source of information	How often					*Means of information exchange
	Never (1)	Once a year (2)	Monthly (3)	Weekly (4)	Daily (5)	
Researcher						
Contact farmer						
Fellow farmer						
Public leader						
Cooperative						
Neighbours/ friends						

NGO						
Input dealers						
Agricultural professionals						
*Means of information exchange: 1) Demonstration 2) Field day/visit 3) Training 4) Written materials (leaflets, manuals, and so on) 5) Others (Specify) ----------						

7.7. When have you first heard of improved variety of common bean? _____

7.8. From who/ which source? _____

7.9. Which improved variety of common bean have you first grown? 1) ---------- 2) ----------3) ----------4) others (specify) ----------

7.10. Why did you choose this particular variety first? ----------

7.11. Which improved varieties of common bean you have grown so far? When you have grown them?

Variety name	First year grown	Duration of use (Years)		* Reason for stopping if not using now
		From	To	
* Reason for stopping 1) Availability of better variety 2) Unavailability of seeds 3) High seed purchase price 4) Low yield in my field 5) disease and pest problem 6) Others (Specify) ----------				

7.12. Have you participated in field day/ visit in the last five years?

Yes = 1 □ No = 2 □ If yes, how many times ---------- Who arranged for you? CIAT = 1 □ Researcher = 2 □ NGO = 3 □ 4) Others = 4 □ (Specify).....

7.13. Have you ever received training in common bean production in the last five years?

Yes = 1 □ No = 0 □ If yes, how many times ---------- Who arranged for you? CIAT = 1 □ Researcher = 2 □ NGO = 3 □ 4) Others = 4 □ (Specify).....

7.14. Have you conducted demonstration in the last five years? Yes = 1 □ No = 0 □ If yes, how many times ---------- With whom you conducted demonstration? 1) CIAT = 1 □ Researcher = 2 □ NGO = 3 □ 4) Others = 4 □ (Specify).....

8. Membership of farmer's association

8.1 In which of the following organization are you member and/or leader?

Organization	Membership 1=member 0= non Member	Committee member (2) 1= yes, 0= No	Leader (3) 1 = yes, 0 = No
Seed multiplication group			
Saving and credit group			
Marketing cooperative			
Other/specify			

9. Market related variables

9.1 How is the trend of revenue for common bean for the last 5 years?

1. Increasing [ ] 2. Decreasing [ ]
3. Stagnant [ ] 4. Difficult to tell [ ]

9.2 Who are the major actors in the market chain of common bean?

i)……..ii)……iii)……..iv)……..

10. Mode of transport, buyers and place of supplying

How do you transport bean from farm to market?	To whom are you supplying your bean?	Where could (did) you get them?
1. Head loading [ ] 2.Pack animals [ ] 3. Animal cart [ ] 4. Trucks [ ] 5.Others ……	1.Local assemblers [ ] 2.Wholesalers[ ] 3.Retailers[ ] 4.Urban collectors[ ] 5.Consumers[ ] 6.Other/specify……	1. farm level [ ] 2. local market [ ] 3. main road [ ] 4. district market [ ] 5.Others/specify ……

10.1. What was the average market price of the common bean last year?

Type of common bean	**Price at**		***To whom did you sell the product**
	Farm-gate	**Market**	
*To whom 1) to whole seller 2) to retailer 3) to direct consumers 4) cooperative 5/farmers			

10.2. What are marketing costs you incur when you take your produce to the market?

Items	Cost (TZS)	Remark
Sales tax		
Sorting cost		
Transport bags		
Packing		
Others		

10.3. Have you changed to whom you sell the seed of common bean in the last 2-3 years? Yes = 1 □ No = 0 □

10.4. If yes, is there change in price? Yes = 1 □ No = 2 □

10.5. What was the change? ----------

10.6. What is the trend in price in the last 3-4 years? Decreasing = 1 □ Stagnant = 2 □ Increasing = 3 □

10.7. In that light, how does it compare with alternative crops that you can grow? ----------

10.8. In your view how do you see the selling price of the common bean? ----------

Common bean type	Price condition				
	Very poor (1)	Poor (2)	Moderate (3)	Good (4)	Very good (5)
Improved seed					
Local seed					

10.9. In your view how do you see the prices of inputs used for common bean production in relation to the income generated by bean produced/sale?

Input	Price condition					Remark
	Very Expensive (1)	Expensive (2)	Moderate (3)	Less expensive (4)	Not expensive (5)	
Improved varieties						
Fertilizer						
Labor						
Others; specify						

11.0. What do you think are the major marketing problems/challenges with regard to common bean?

i).....ii).....iii).....

iv).....v)..... vi).....

12. Post-harvest techniques

12.1. What is your perception on Post-harvest loss in your bean production business? Post-harvest loss is very high = 1 □ Post-harvest loss is somewhat medium = 2 □ Post-harvest loss is very low = 3 □ I don't know anything about post-harvest loss = 4 □

12.2. What types of post-harvest losses do you experience in your bean production business?

i).....ii).....iii).....iv).....v)..

.....

12.3. What are your current post-harvest grain management systems?

1= Storage (in grain pits, Bags, Earthen pots, Granaries, using chemicals) □ 2 = Shelling by animals trampling □ 3 = Hand sorting □ 4 = Machine processing □ 5 = Packaging □ 6 = Winnowing □ 7 = Transporting (On head, animal carts, motorbikes and vehicle) □ 8 = others □ Specify.....

12.4 What are causes of Post-harvest loss from the farm to the market?

i).....ii).....iii).....iv).....

v).....vi)..... vii).....

12.5 What are the common traditional loss minimization strategies you always use?

1 = Timely harvesting □ 2 = Using locally made shelling machine □ 3 = Drying in the yard □ 4 = Covering during sunny and rains □ 5 = Closed storage (in traditional granaries, Hermetic bins, household metallic or mud silos, pits) □ 6 = Use of chemicals □ 7 = Smoking □ 8 = other □ Specify.....

12.6. Do you normally store your common bean to sell in the future? Yes = 1 □ No = 2 □

12.7. If yes in 12.6 above; ask where do you normally store your bean?

i)..... ii)..... iii).....

12.8. If yes in 12.6 above, how many days do you store your produces? .....

12.9. What is the cost of storage per unit in TZS? .....

12.9. What are the storage and preservation methods are you using?

i).....ii).....iii).....iv).....

Thank you for your response!

APPENDIX 2: CORRELATION AND VARIANCE INFLATING FACTORS (VIF) AMONG VARIABLES USED IN THE MODELS

	Yieldb~n	farmexp	female1	yearsc~l	HHsize	mostvi~k	farmga~e	offfar~c	access~o	access~t	supply~k	landbean	access~n
Yieldbean	1.0000												
farmexp	0.0380	1.0000											
female1	-0.2224	0.0959	1.0000										
yearschool	-0.0647	0.0171	-0.0437	1.0000									
HHsize	-0.0213	0.1154	0.1070	0.0721	1.0000								
mostvistmark	-0.0650	-0.0366	0.0787	-0.0466	-0.0062	1.0000							
farmgatepr~e	-0.0669	-0.0238	-0.0034	0.0822	0.1121	-0.0266	1.0000						
offfarminc	0.0242	-0.1246	0.0077	0.0361	-0.0319	-0.0819	-0.0597	1.0000					
accessmark~o	0.1024	0.0987	0.0588	0.0862	0.1609	-0.0718	0.0907	-0.0190	1.0000				
accesscredit	0.1600	0.0902	0.1064	0.1100	-0.0037	-0.0299	-0.1240	0.0006	0.0839	1.0000			
supplymark	0.4363	-0.2148	-0.2055	-0.1110	-0.1808	-0.1380	0.0481	0.1251	0.0048	0.0087	1.0000		
landbean	0.3920	-0.0502	-0.1082	-0.0092	-0.0312	-0.0817	-0.0584	0.0867	0.0447	0.0049	0.2487	1.0000	
accessexte~n	-0.0180	-0.0712	0.0282	0.0444	0.0236	-0.0860	0.1188	0.2420	0.0537	-0.0398	-0.0121	0.1366	1.0000

Variable	VIF	1/VIF
supplymark	1.45	0.691824
Yieldbean	1.38	0.726396
Gender	1.12	0.889356
farmexp	1.11	0.897699
offfarminc	1.11	0.901986
accessexte~n	1.10	0.909360
accesscredit	1.10	0.912781
HHsize	1.09	0.915994
farmgatepr~e	1.08	0.923797
accessmark~o	1.07	0.931640
yearschool	1.06	0.942595
mostvistmark	1.05	0.953836
Mean VIF	1.14	