EXPANDING PULSE PRODUCTION IN MOZAMBIQUE: IDENTIFYING CONSTRAINTS AND NEW STRATEGIES

by

Ana Lidia Gungulo

Submitted in partial fulfilment of the requirements for the degree

MSc (Agric): Agricultural Economics

Department of Agricultural Economics, Extension and Rural Development
Faculty of Natural and Agricultural Sciences

University of Pretoria
Pretoria

Supervisor: Dr F.H. Meyer

Co-supervisor: Mrs M. Labuschagne

March 2013

DECLARATION

I declare that this dissertation, which I hereby submit for a Master's Degree in Agricultural Economics at the University of Pretoria, is my own work and has not previously been submitted for a degree at any other tertiary institution.

SIGNATURE…….. DATE: 2013

In memory of my father, Mateus Gungulo

This dissertation is dedicated to:

My son, José Manuel, and my daughter, Liana

ACKNOWLEDGEMENTS

I would like to thank Professor Johan Kirsten for allowing me to pursue my degree and for all his guidance throughout my study. I am also grateful to my supervisors, Dr Ferdinand Meyer and Mrs Marlene Labuschagne, for their extraordinary guidance, excellent advice and constructive criticism.

I would like to acknowledge Dr Cynthia Donovan for her patient guidance, support and advice, as well as Michigan State University (MSU) under the Pulse Collaborative Research Support Program (Pulse CRSP), with funding from the Bureau for Food Security of USAID, which made this study possible.

My special thanks go to all the staff at IIAM, particularly those in the Socio-Economic Studies Centre (CESE), and especially Eng Mazuze for his support and guidance. I am also grateful to the professors, staff and colleagues in the Department of Agricultural Economics, Extension and Rural Development, as well as Dr Gilead Mlay for his unwavering support.

Last, but not least, a very special word of thanks goes to my husband Manuel, my mother Amelia, my brothers and all my friends, particularly Nadia.

Expanding pulse production in Mozambique: Identifying constraints and new strategies

By

Ana Lidia Gungulo

Degree	MSc (Agric): Agricultural Economics
Department:	Agricultural Economics, Extension and Rural Development
Supervisor:	Dr F.H. Meyer
Co-supervisor	Mrs M. Labuschagne

ABSTRACT

Pulses (common beans and cowpeas) provide a major alternative source of protein, and the rapid rise in food prices has led to an increase in the consumption of inexpensive pulses. The slow growth in pulse production has, however, led to a decline in availability. Thus, to overcome this decline in production, this study concern in expanding pulse production in Mozambique by using the agricultural research survey known as TIA. In addition, this study identified and analysed the critical drivers influencing production, as well as constraints and opportunities to expand pulse production in Mozambique.

In studying the participation of smallholder farmers in pulse markets, the Heckman two-step approach was applied to avoid sample selection bias. In the first step a Probit model was estimated to capture the household's decision of whether or not to participate in the market. The second step comprised of an OLS estimation to determine the significance of variables that contribute to the level of pulse sold.

At national level, results indicate that the majority of households receive price information, but few households receive information on fertilizers and improved seed use. Most households also have poor access to credit and improved extension services, and low levels of membership of agricultural associations. A very small percentage of household farmers are engaged in pulse production, with male farmers more dedicated to the production of common beans and female farmers more dedicated to the production of cowpeas.

In terms of market participation, the results reveal that female-headed households are less likely to participate in pulse markets. The critical factors that discourage entry into the pulse market are distance to the market and yield loss. The factors that give incentives to smallholders to participate in the pulse market are land size, price information and pulse price.

The trade volume of common beans is relatively high and is affected by land size, pulse price and price information. In contrast, the trade volume of cowpeas is highly affected by bicycle ownership and ownership of livestock for animal traction. Cowpea prices also have a positive effect on the volume of cowpeas sold. Yield loss is a major factor that negatively affects the pulse trade, while land size has a negative effect on the volume of cowpeas sold.

Land availability and price information provide good opportunities, in Mozambique, for expanding pulse production. The expansion of pulse production is however constrained by household access to public goods and services such as extension services, credit and membership to an agricultural association. Moreover, the expansion of pulse production in the country is also constrained by the absence of the use of productive technologies such as improved seed and fertilizer.

Based on the results of the study, the recommendations are to expand extension services, improve access to improved technology, facilitate access to agricultural finance, and improve infrastructure and storage facilities. This would facilitate and give incentive to smallholder to expanding pulse production in Mozambique.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CAP	Censo Agro-Pecuario(*Agricultural and Livestock Census*)
CRSP	Collaborative Research Support Program
FAO	Food and Agriculture Organization
GPS	Global Positioning System
IIAM	Instituto de Investigação Agrária de Moçambique(*National Agricultural Research Institute)*
MINAG	Ministerio da Agricultura (*Ministry of Agriculture)*
NGO	Non-governmental Organization
OLS	Ordinary least square
PARPA	Plano de Acção para a Redução da Pobreza Absolute(*Action Plan for the Reduction of Absolute Poverty*)
PROAGRI	Agricultural Sector Public Expenditure Program
SIMA	Sistema de Informacao de Mercados Agrarios (*Market Information System)*
TIA	Trabalho de Inquérito Agrícola (*Agricultural Household Survey)*
UEM	Universidade Eduardo Mondlane (*University of Eduardo Mondlane)*

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

In Mozambique, common beans and cowpeas are the most important legume crops, second only to peanuts, and have considerable production potential in the country (Pulse CRSP, 2008). As an important source of cash for small-scale farmers, beans and cowpeas are ranked fourteenth and fifteenth respectively in terms of value of production and the generation of revenue exceeding $14.4 million for Mozambique in 2002 (Walker, Pitoro, Tomo, Sitoe, Salencia, Mahanzule, Donovan & Mazuze, 2006:17-19).

Pulses are an important food source for all income categories and are also a major source of protein for the poor and those with vegetarian diets. The rapid increase in the price of cereals in recent years has resulted in an increase in the price of protein products such as beef and chicken. As a result, the consumption of pulses has increased, since they are relatively inexpensive compared to other sources of protein (Katungi, Farrow, Chianu, Sperling & Beebe, 2009).

Unfortunately, the slow growth in common bean production compared to the large increase in demand, both in Mozambique and internationally, has led to a progressive pressure on limited supplies and thus an upward pressure on prices. An urgent increase in pulse production in Mozambique is therefore needed in order to minimise the risks of food insecurity associated with high prices. Yields are still low among smallholders famers, averaging 500 kg per hectare over 2005 to 2008 (Cachomba & Donovan, 2012), with the potential to reach 1.8 to 3 tons (IIAM & UEM, 2010). This minimal production is partially due to beans being grown in marginal areas and on small areas of farmers' total land resources. Common beans and other pulses also do not receive substantial government investment and policy attention compared to cereals (Akibode & Maredia, 2011).

The adoption of new technologies and management practices are imperative if farmers are to specialise, produce for commercial markets, and capture gains from trade (Pulse CRSP, 2008). Larger volumes of production and specialisation are encouraged by evolving markets that are increasingly characterised by lower costs of transportation, communication and capital, as well as better institutions. Furthermore, technical and institutional change and infrastructural development are critical drivers in increasing production (Dorward, Kirsten, Omano, Poulton & Vink, 2009:22-23). Studies conducted by several authors on the production of common beans and cowpeas in Africa have shown that high transaction costs are one of the key reasons for the failure of farmers to increase marketability (Katungi*et al*., 2009:42-46; Olwande & Mathenge, 2010:13-14; Ouma, Jagwe, Obare and Abele, 2009:1).

In Mozambique, there are public sector efforts to reduce transaction costs. For example, the publicly funded Agricultural Market System (SIMA) in Mozambique has been disseminating prices via radio and television, and both farmers and traders are using this information to negotiate. Financial institutions are enabling automatic teller machines in more rural centres, while all-weather road investments for primary and secondary routes are enabling lower costs and higher volumes for trucks. While these investments are occurring, minimal research has been conducted to identify constraints and opportunities or to assess the impact of investments in expanding common bean and cowpea production in Mozambique.

1.2 PROBLEM STATEMENT

The majority of farmers in Mozambique are subsistence farmers (54% of the population), living on less than one dollar per day (INE, 2010) and are at risk of food insecurity given their minimal production for both rural and urban market consumers (urban consumers being those who do not produce their own food). On the other hand, there is an increasing urban population that largely depends on production supplied by these farmers (World Bank, 2010) which results in an increasing demand of inexpensive pulse.

The increasing production of pulses, especially common beans and cowpeas, would therefore be imperative in order to increase the surplus available for trade, to ensure food security and improve nutrition. This raises questions such as:

- What constraints are hindering farmers from increasing their production of common beans and cowpeas?
- What opportunities exist for farmers to increase production?

Even with the rural to urban migration that is taking place, three quarters of the world's poorest live in rural areas and most are dependent on agriculture for their livelihoods, sometimes selling excess agricultural production to markets (Harou, 2011). Farmers' participation in commercial agriculture is important for stimulating growth, food security, development and poverty alleviation. Despite this, participation of smallholder farmers in local and regional markets remains low in Mozambique, due to a variety of constraints. There is a need to identify ways to increase common bean and cowpea production through market participation. This can only occur if the issue of providing incentives to accelerate the transformation of smallholder farmers from semi-subsistence to a commercial level is properly addressed.

1.3 PURPOSE STATEMENT

The main purpose of this research was to identify and study the critical drivers that influence the production of common beans and cowpeas and also to identify the constraints and opportunities to expand bean and cowpea production in Mozambique.

1.4 RESEARCH OBJECTIVES

The project had three objectives, namely:

- To analyse population characteristics in the production and marketing of common beans and cowpeas in Mozambique, serving as the background to the

Mozambican pulse industry and providing substantiating reasons for undertaking this study;

- To analyse the factors influencing household to participate in the common bean and cowpea markets in Mozambique, taking into account the location effect; and
- To make recommendations to relevant stakeholders (e.g. government) for accelerating the transformation of smallholder farmers from semi-subsistence to a commercial level.

1.5 JUSTIFICATION FOR THE STUDY

As noted earlier, there have been insufficient studies of pulse production in Mozambique. Moreover, information on constraints and opportunities to expand the production of common beans and cowpeas is necessary to promote trade and guide research and policy. With the recent increase in food prices, the Mozambican government identified the promotion of commercialised agriculture and agricultural exports as primary sectors for the alleviation of poverty. Expanded common bean and cowpea production could potentially play a significant role in poverty alleviation. This research is therefore expected to provide information on expanding the production of common beans and cowpeas in Mozambique so as to assist in the transformation of smallholder farmers from semi-subsistence to commercial farming and subsequently help the country achieve greater productivity and ultimately alleviate poverty.

1.6 HYPOTHESIS

This study hypothesize that household asset endowment has a positive effect on the famer participation in the common bean and cowpea markets. Hence, female headed households participate less than male headed households in pulse markets and as a result it has a negative effect on total pulse production. In addition to this, distance from farm to point of sale is also hypothesized to be one of the limitations that affect

the intensity of market participation and have a negative effect on total pulse production.

1.7 LIMITATIONS

The study was constrained by certain limitations. Firstly, it was limited to farming households growing common beans or cowpeas in Mozambique. Secondly, the data analysis was limited to 2008 as the year of the most recent Mozambique agricultural household survey, also known as TIA (*Trabalho de Inquerito Agricola*). Future research may access panel data on households to better control for the dynamics of choice crop, but this cross-sectional analysis provides a snapshot of farmers in 2008. No TIA panel data is currently available.

1.8 ORGANISATION OF THE DISSERTATION

This study is organised into six chapters. Chapter 1 provided an introduction to the study. Chapter 2 presents a literature review on market participation. Chapter 3 presents some background information on Mozambique as a country. Chapter 4 describes the Mozambican agricultural survey and the household production characteristics of common beans and cowpeas, disaggregated by region and gender. Chapter 5 presents the common bean and cowpea market participation model and the results thereof. Chapter 6 serves as a concluding summary of the main findings and draws attention to certain policy recommendations while suggesting areas for future research given the limitations of this study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The objective of this section is to review previous market participation studies in order to identify common factors affecting market participation. In addition, the review highlights the methods used to analyse market participation, which could in turn be applied to this study. Very few studies have, however, investigated the factors influencing the market participation of smallholder farmers in Africa, specifically in pulse production. As a result, the scope of this literature review is extended to other countries, other commodities.

2.2 FACTORS AFFECTING MARKET PARTICIPATION

Market participation by smallholder farmers is extremely important to economic growth and poverty alleviation. Certain factors promote market participation by smallholders, while other factors hinder such participation. Researchers have identified various constraining factors, including high transaction costs, high product market prices, poor access to production technology, poor access to public goods and services, competing household consumption needs, and low levels of private assets and other sources of revenue. These and other factors are discussed in greater detail below.

2.2.1 TRANSACTION COSTS

Smallholder farmers face certain constraints in the transaction and exchange of products. Barrett (2008), Harou (2011), Maitre, Lemeilleu and Brenabé (2011) and Makhura *et al.*, (2001) all found high transaction costs, incomplete or thin non-conducive marketing systems, high production risk, low bargaining power and lack of human and social capital to be deterrents to market participation. In addition, entry to

the market is even more difficult in more remote areas with poor transportation infrastructure and higher commercial costs, which further limit incentives to increasing productivity and generating marketable surpluses (Barrett, 2008; Mythili, 2008). Dorward *et al*. (2009), argued that infrastructural investments lead to a reduction in transportation and communication costs, which reduce transaction costs and risk. Barrett (2008), also noted that investments in building institutional and physical infrastructure on a local and regional scale are important in addressing the entry barriers associated with the high cost of commerce. Barrett (2008), Maitre *et al*. (2011) and Mythili (2008) argued that policies that reduce the transaction costs faced by smallholders are important complements to conventional trade, and for this reason improved infrastructure allows farmers to attain higher levels of production and to market surplus more efficiently. These costs can differ among households due to asymmetries in access to assets, market information, extension services and remunerative markets (Makhura *et al.*, 2001). Thus, removing some of the physical infrastructural constraints, as well as credit constraints, would go a long way towards increasing the production of agricultural commodities, including common beans and cowpeas.

Limited market access may be due to either the absence of all-weather road links or the distance involved between roads and key producer and consumer markets. Transaction costs related to the exchange of goods are the embodiment of access barriers to market participation by the resource-poor smallholder. In a study concerning market participation by smallholder farmers in Kenya, Omiti, Otieno, Nyanab and Cullough (2009) found that distance from farm to point of sale is a major constraint to the intensity of market participation in terms of numbers of farmers and volumes traded, along with higher output prices.

2.2.2 MARKET INFORMATION

Farmers often lack information about prices, potential buyers' quality requirements, key marketing periods and outlets for selling their products. They rely on informal networks among friends and local traders, with the potential for unreliable information. When farmers rely on traders for their market information, they expose

themselves to the risk of opportunistic behaviour (Maitre *et al.*, 2011). In addition, Coulibaly, Alene, Mayong, Sanogo, Abdoulaye, Chiang, Fatokun, Kamara, Tefera and Boukar (2009) highlighted a lack of marketing information systems as a major constraint in the marketing of products. The lack of reliable, adequate and freely available market information leads to risks and uncertainties. Smallholders have limited resource endowments, and tend to be highly vulnerable to market risks. Therefore, searching for and obtaining information about buyers and demand is necessary for the buyer and seller to reduce the risk of transaction failure (Kirsten, Karaan & Dorward, 2009). Research in Mozambique (Mather, 2009) has demonstrated that farmers are more likely to participate in the maize market and more likely to market larger quantities when they have access to market information.

2.2.3 PRODUCTIVE TECHNOLOGY

In his study of market participation, Barrett (2008) argued that market participation choices can be studied similarly to technology adoption choices, because market participation is "a consequence as much as a cause of development". This implies that smallholders must not only get prices right in order to induce market participation, but also must have access to productive technology in order to produce a marketable surplus, since households with higher productivity are more likely to have a crop surplus above their consumption needs. This information was confirmed by Rios, Masters and Shively (2008) in their study of linkages between market participation and productivity, finding that households with higher productivity tend to participate in the market, although the direction of causality is not clear, as better market access did not necessarily lead to higher productivity. In addition, they noted that improving infrastructure only for the purpose of inducing market access may not consistently lead to improvements in agricultural productivity; however, increasing output through investments in private assets, infrastructure and improved technology is more likely to produce a consistent impact on both productivity and market participation. As explained by Barrett, Bachke, Bellemare, Michelson, Narayanan and Walker (2011) limited productive assets may limit smallholder productivity and constrain the possibility of generating marketable surplus.

The development of new and improved technology has received substantial attention, because improved technology can increase productivity and thus improve total production and the availability of marketable surplus. Coulibaly *et al*. (2009), and Katungi *et al.* (2009), found that farmers only adopt improved technology that is available and accessible to them given their limited resources and rural locations.

Numerous studies have shown that farmers do adopt improved technology if that technology meets their expectations and if it is economically and technologically superior to the technology currently in use. Savadatti (2007) found that technology has not always been able to bring about the desired increase in production, and posits that this could be due to poor extension efforts in terms of brining such technology to farmers. According to Bias and Donovan (2003), lack of access to improved technology is the main constraint to agriculture in Mozambique, given the underinvestment in extension services and poorly developed input markets. In addition, the lack of improved varieties and high-quality seeds in the market remains the main dilemma in production expansion. This lack of improved technology leads to low land and labour productivity.

2.2.4 PRIVATE ASSETS

There is a vicious cycle regarding technology and assets for smallholder farmers in Mozambique and elsewhere. New technology requires that households earn enough money so that it is possible to save and invest, but most smallholders cannot invest due to low incomes and low asset endowment in production factors, stemming from poor productivity. Households without access to adequate assets do not engage actively in markets (Barrett, 2008). Boughton, Mather, Barrett, Benefica, Danilo, Tschirley and Cunguara (2007) found that in Mozambique, private household assets – especially labour, animal traction and landholding – are the major variables influencing household market participation decisions. Private assets, such as size of arable land, are also positively associated with participation, because larger areas of arable land provide greater opportunities for surplus production (Makhura *et al.*, 2001). Ownership of animal traction has a positive impact on market participation in the sense that larger areas of land can be cultivated with animal traction than without.

In addition, bicycle ownership affects market participation positively, because this allows households to reduce the cost of obtaining market information and transporting their products to market (Barrett, 2008). On the other hand, Rios *et al.* (2008), pointed out that ownership of a mechanism of transportation (such as a bicycle) may lead to lower sales, because owners are less dependent on agriculture for subsistence and may move into other sources of income.

2.2.5 PUBLIC GOODS AND SERVICES

Benfica, Tschirley and Boughton (2006) argued that household participation in the market is associated with endowments, technology and income diversification. In addition, public goods and services such as extension training, research participation, distance to market, and access to credit and information have been used as explanatory variables by several researchers (Boughton *et al*., 2007; Makhura *et al.*, 2001; Siziba, Nyikahadzoi, Diagre, Fatunbi & Adekunle, 2011), taking an asset-based approach and hypothesising that household participation in crop markets is associated with asset endowments.

Access to extension services has particular importance for the probability of sale, because extension agents provide information that can increase crop productivity. Accessing market information, whether through a public or other system, enables households to reduce price risk and thereby increase their bargaining power, thus overcoming the small producer's typically low bargaining power (Maitre *et al.*, 2011). Membership of an association is another variable identified in numerous market participation studies, and many associations are developed through public sector efforts or through civil society. Boughton *et al*. (2009), pointed out that membership of an agricultural association is another channel whereby relevant information may be obtained in view of improving returns on crop production and marketing.

2.2.6 HOUSEHOLD CONSUMPTION NEEDS

It has been found that households headed by females are less likely to participate in the market, with the logic behind this being that females are more likely to be

concerned about household food security. Heltberg and Tarp (2002) found that the probability of participating in market sales decreases as the age of the household head increases. Household size is also used as an explanatory variable in terms of households selling what they themselves cannot consume. An increase in household size significantly decreases the possibility of selling excess production; thus, the more members in the household, the more likely it is that most of the agricultural product will be consumed. Several studies have also found a marginal negative effect of this variable on market participation, given the need to meet consumption requirements (Makhura *et al.*, 2001; Rios *et al.,* 2008; Siziba *et al*., 2011).

2.2.7 OTHER SOURCES OF REVENUE

Income from livestock is another factor that has been analysed in previous studies. In a study of smallholder participation in the maize market in South Africa, Makhura *et al.* (2001), found that this variable increases the probability of sale. Echoing this finding is the study of Boughton *et al*. (2009), who found that in terms of participation in the maize, cotton and tobacco markets of Mozambique, ownership of livestock reduces the risk of food insecurity, since households can use livestock as an asset to be traded for food. Similarly, Benfica *et al.* (2006) found that the availability of animals increases the likelihood of farmer participation in the tobacco and cotton markets of Mozambique. In contrast, a study by Rios *et al.* (2008), of linkages between market participation and productivity, using cross-country data from Tanzania, Vietnam and Guatemala, found this variable to be negatively correlated with the volume of sale – a finding they attributed to less time being devoted to crop production and marketing, thus leading to lower production and sales.

2.3 APPROACH

A number of studies on market participation decisions have applied the Heckman two-step approach in an attempt to estimate reduced-form equations for both market participation and quantity sold (Boughton *et al*., 2007; Heltberg & Tarp, 2002). These studies have pointed out that this approach allows for a distinction between the factors that determine firstly whether or not the farmer will participate in the market,

and secondly how much output the farmer will sell. These two key decisions by smallholders are determined separately in the econometric estimation.

2.4 CONCLUSION

The majority of smallholders grow staple food mostly for their own consumption. Several studies on the determinants of market participation have concluded that the key intervention when it comes to inducing smallholder market participation is the reduction of transaction costs. It has been argued that policy aimed at improving infrastructure for the purpose of inducing market access may not produce a consistent effect. Rather, by inducing market participation through improved infrastructure, access to productive technologies and investment in smallholders' private assets, more smallholders may be persuaded to participate in the market. Smallholders need more than price information to participate in the market – they also require access to productive technologies in order to produce marketable surpluses. Besides the constraint of procuring surplus production, smallholder farmers also face barriers in terms of their entry to the market, which reduce their incentive to participate. These barriers include poor access to finance, lack of improved production technology, and insufficient private assets.

In addition to high transaction costs, there are other major factors such as household assets and household demographics that influence the likelihood of the household participating in the market. Thus, this study was also based on the expectation that household participation in crop markets is associated with asset endowments and household composition, based primarily on the work of Boughton *et al.* (2007). This expectation is tested empirically in later chapters.

CHAPTER 3

KEY ASPECTS OF MOZAMBIQUE AND THE EFFECT ON PULSE PRODUCTION

3.1 INTRODUCTION

This chapter reviews the key aspects influencing the production of common beans and cowpeas as seen against the backdrop of Mozambique's history, its physical and socio-economic characteristics, economy and agricultural sector, as well as the current dried-bean trade situation in the country. Following a discussion of these aspects in view of identifying constraints and opportunities in the production of these pulses, the chapter concludes with a summary.

3.2 HISTORY OF MOZAMBIQUE

After centuries under Portuguese colonial rule, Mozambique received its independence in 1975. The capital city of Lourenço Marques was renamed Maputo, although the official language remains Portuguese and the local currency is still known as the *metical*. The country has a turbulent history, suffering two wars – one for independence and the other a civil war lasting from 1977 to 1992 – with the country signing a general peace agreement in 1994. These two wars devastated the physical infrastructure of the country, as well as the public education and health services. The government has invested heavily in public services since the peace accords, but continues to face major obstacles in terms of trained human and financial resources to develop the economy, especially the agricultural sector. To this day, the country remains dependent on foreign assistance.

3.3 PHYSICAL CHARACTERISTICS

Mozambique has a total land area of 801 590 km^2 and is located along the east coast of southern Africa and along the Indian Ocean. The country is bordered by South Africa and Swaziland in the south, Zimbabwe and Zambia in the west, Malawi in the northwest and the United Republic of Tanzania in the north (FAO, 2010).

3.3.1 CLIMATE AND AGRO-ECOLOGICAL ZONES

Mozambique has a widely varying climate, encompassing areas classified as arid and semi-arid. This variability in climate has a significant influence on the amount, timing and frequency of rainfall, evidenced by frequent droughts and floods. Droughts generally occur every three to four years (GFDRR, 2009). The country is regarded as one of the most susceptible to risk from climate change in Africa, and the floods of 2000, 2001, 2007 and 2008, and the droughts of 2002 to 2005 and 2007 to 2008, are evidence of large variations in climatic conditions over time. Pulses, and especially cowpeas, are crops that could play a special role in addressing this situation, given their superior ability to tolerate drought.

The country is divided into three main regions, namely the northern region (which is mountainous), the central region and the southern region (both of which consist of plains). The northern region is separated from the other two by the Zambezi River. The country is also divided into eleven provinces, namely Maputo, Maputo City, Gaza, Inhambane, Manica, Sofala, Tete, Zambézia, Nampula, Niassa and Cabo Delgado, which are further sub-divided into a total of 100 districts.

There are ten different agro-ecological zones classified according to altitude level, average temperature, soil type, and dominant farming system. This is represented in the Figure 3.1 and Table 3.1.

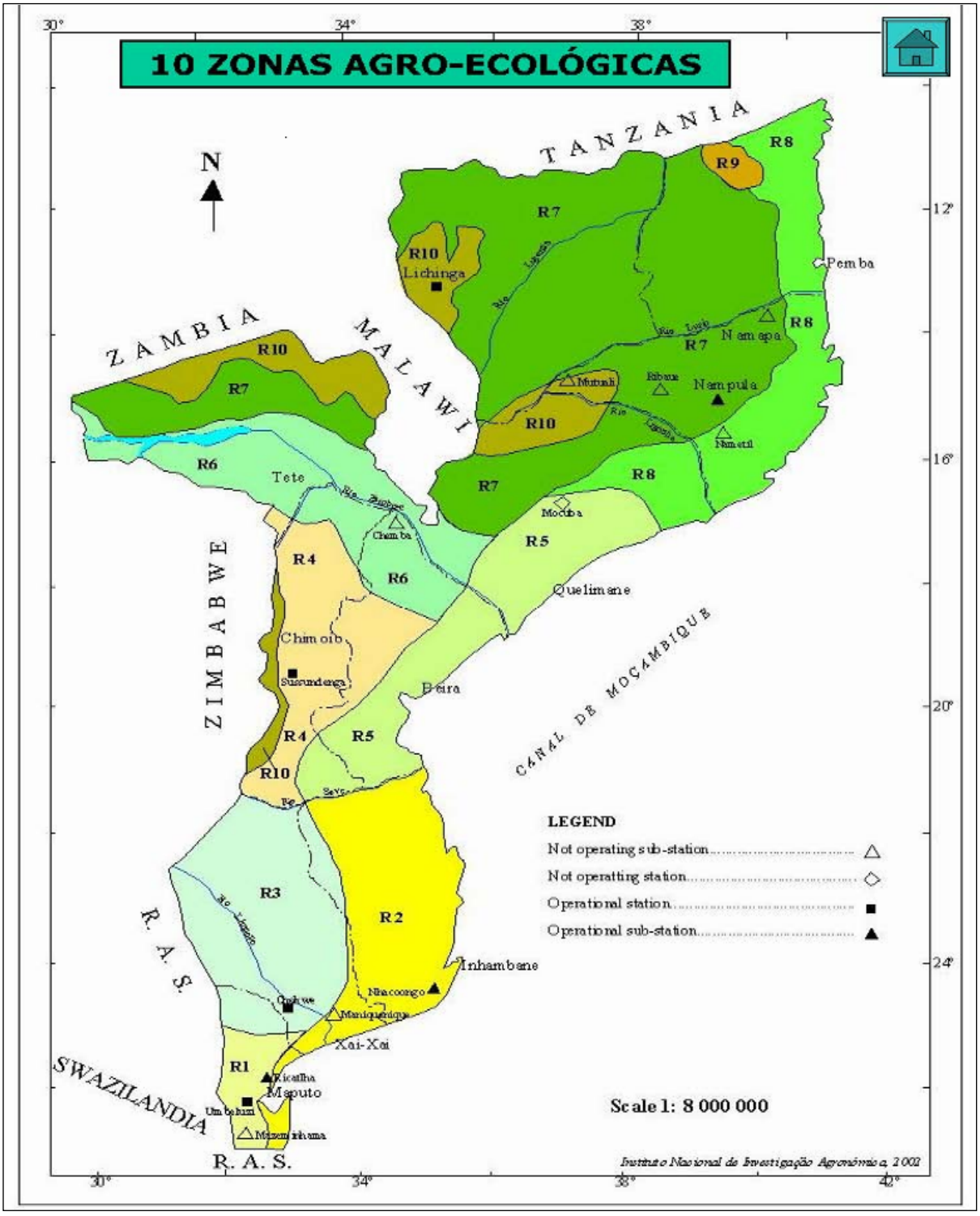

Figure 3.1: Distribution of the 10 INIA agro-ecological zones in Mozambique
Source: Adapted from the Ministry of Agriculture and Fisheries (1996)

Table 3.1: Classification of the agro-ecosystems of Mozambique

N	Agro-ecosystem	Average rainfall	Crop production	Province
1	Semi-arid	570	Cowpeas, Maize, Peanuts and Cassava	Maputo and Gaza
2	Semi-arid	500-600	Cowpeas, Maize, Groundnuts, Sweet potatoes and Cassava	Coastal region, south of the Sava River
3	Arid	400-600	Sorghum and Millet	Gaza and Inhambane
4	Mid- elevation	1,000-1,200	Cowpeas, Maize, Sorghum, Cotton and Cassava	Central Mozambique
5	Coastal	1,000-1,400	Cowpeas, Maize, Sorghum, Cotton, Millet and Cashews	Sofala and Zambezia
6	Dry semi-arid	500-800	Sorghum and Millet	Zambezi and Tete
7	Medium altitude	1,000-1,400	Cowpeas, Maize, Sorghum, and Groundnuts	Zambezia, Nampula, Tete, Niassa and Cabodelgado
8	Coastal	800-1,200	Cassava and Millet	Zambezia, Nampula and Cabo Delgado
9	Medium altitude	1,000-1,200	Cowpeas, Sorghum, Cassava Sesame and Cashews	Cabo Delgado
10	High altitude	>1,200	Common beans and Potatoes	Zambezia, Niassa, Tete and Manica

Source: Adopted from the Ministry of Agriculture and Fisheries (1996)

Agro-ecological zones 1, 2 and 3 are arid and semi-arid, with low rainfall estimated on average not to exceed 600 millimetres per year. Agro-ecological zones 4, 5, 7 and 9 receive an average rainfall of between 1 000 and 1 400 millimetres per year. Agro-ecological zone 6 is dry semi-arid, and has an average rainfall of between 500 and 800 millimetres per year. Agro-ecological zone 8 is coastally located, mostly with sandy soils and an average rainfall of between 800 and 1 200 millimetres per year. Zone 10 represents the mountainous region, with an average rainfall of more than 1 200 millimetres per year. Zone 10 is located in Manica, Tete, Zambezia and Niassa provinces and is the region where common bean cultivation is recommended (Figure 3.1 and Table 3.1) (Ministry of Agriculture and Fisheries, 1996). Cowpea production is spread throughout many of the zones in the country.

3.3.2 DEMOGRAPHIC FEATURES

Approximately 70% of the population in Mozambique lives in rural areas, with the number of females exceeding the number of males. Mozambique total population in 2011 was 23 million (Figure 3.2).

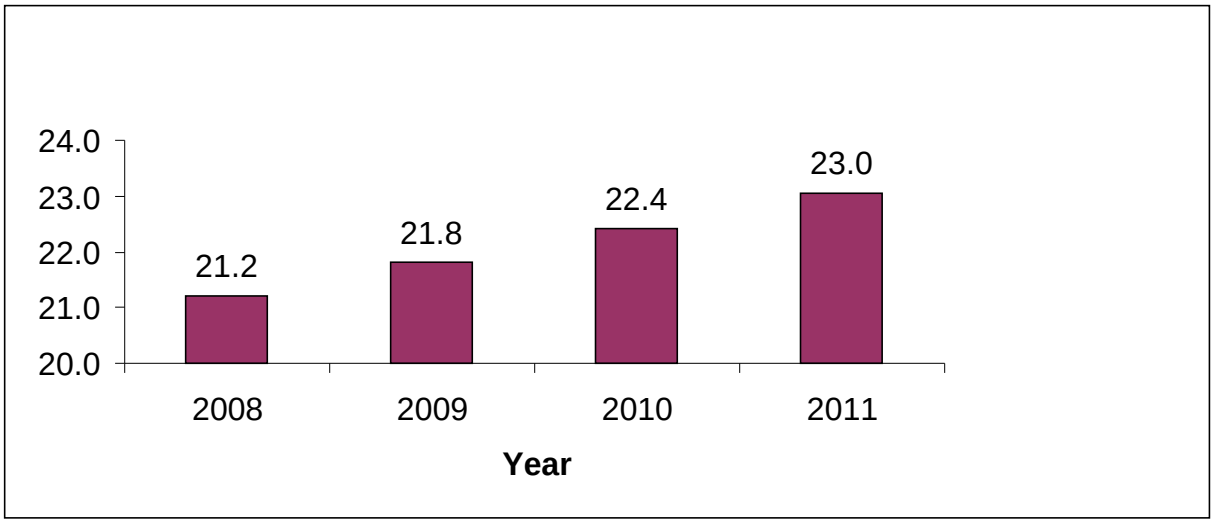

Figure 3.2: Total population of Mozambique
Source: Adapted from INE (2010)

Figure 3.2 shows that there is an increasing urban population in Mozambique. Thus, developed marketing policies are needed to help low-income urban dwellers access pulse products, which are well-suited to their urban lifestyles.

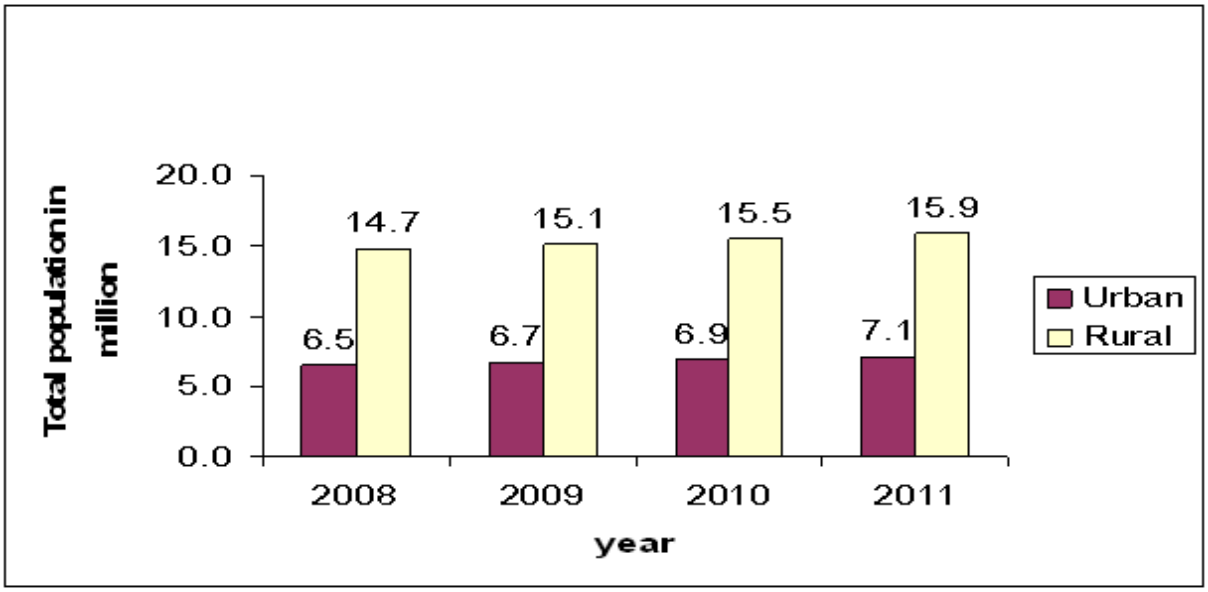

Figure 3.3: Urban and rural Mozambique population
Source: Adapted from INE (2010)

As can be seen in Figure 3.4, the most populated provinces are Zambezi and Nampula, with about 40% of the total population.

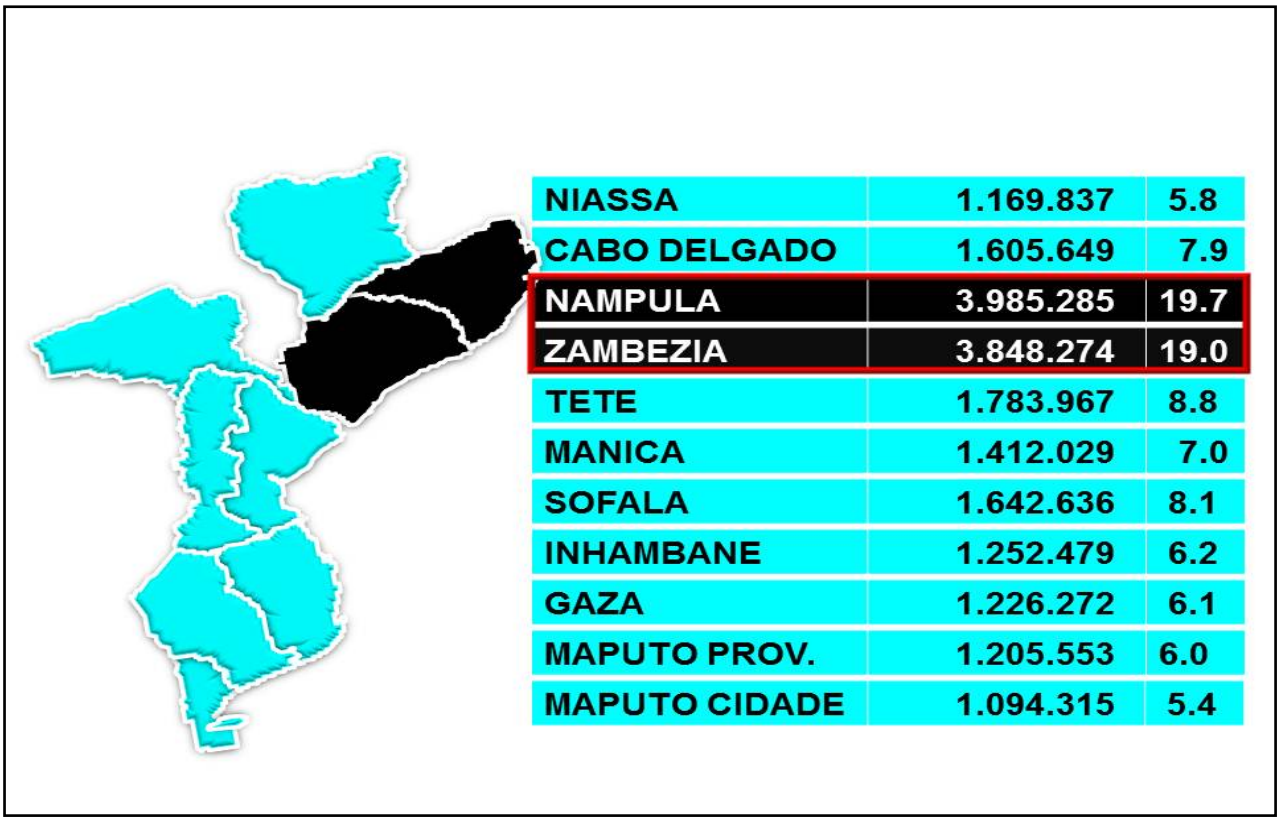

Figure 3.4: Mozambique's population, 2007 census
Source: INE (2010)

3.4 THE ECONOMY

3.4.1 MACRO-ECONOMY

The average GDP growth rate has increased significantly, from 0% in 1981 and 1992 to 8.1% in 1993 to 2008 (World Bank, 2010), making the economy of Mozambique the fastest growing in Sub-Saharan Africa. Between 2007 and 2008 the real GDP growth rate in Mozambique decreased by 0.6% annually, and increased by 0.9 % in 2010, compared to the previous year (Table 3.2). The service sector is the sub-sector with the highest contribution to GDP in the country, followed by industry and agriculture. About 54% of the population lives on less than one dollar a day (World Bank, 2010). Moreover, the inflation rate increased in 2010, compared to the

previous year. Between 2009 and 2010 the *metical* depreciated in comparison to the US dollar (FAO, 2010). *Metical* depreciation would make imports, including pulses, more expensive and export markets more attractive for domestic production.

Table 3.2: Key economic indicators within Mozambique (2006-2010)

	2006	2007	2008	2009	2010
GDP per capita in USD	362	399	478	465	473
Real GDP growth (%)	8.7	7.3	6.7	4.5	5.4
Consumer price inflation (%)	13.2	8.2	10.3	3.5	9.5
Exchange rate USD/ MZM (annual average)	25.4	25.84	24.3	27.42	30.55
Agricultural GDP growth rate	10.9	6.6	7.0	7.5	7.6

Source: Adapted from FAO (2010)

In 2009 the consumer price inflation was 3.5% meaning that in 2009 there was small changing in basic food price compared to the rest of the year.

3.4.2 ECONOMIC GROWTH SITUATION

Mozambique, after gaining independence in 1975, was one of the world's poorest countries, and this situation was aggravated by the civil war. Following independence, the abandoned Portuguese firms were nationalised, and few Mozambicans had university degrees at that time. To overcome this situation, the government of Mozambique created a strategy to develop a strong industrial, agricultural and human resources sector (ECON, 2006). In 1987, with a deteriorating economy, the government launched a series of macro-economic transformations in an attempt to stabilise the economy. These transformations included fiscal reform that improved government revenue and a monetary reform that led to the reduction of inflation. Since 1990, the government goals have been to promote the development of the private sector. Furthermore, in 2007, after more than one year of negotiation, the government gained Portugal's majority shares of the *Cahora Bassa* Hydroelectricity Company (HCB) (CIA, 2010).

The geographic position of the country allows it to take advantage of trade between its Southern and Eastern African neighbours. Today, Mozambique is rapidly growing its production of primary commodities while also becoming one of Africa's top tourist destinations.

3.4.3 INFRASTRUCTURE, TRANSPORTATION AND ELECTRICITY

Mozambican infrastructure has experienced a large influx of private investment in recent years. The transportation system in the country was severely damaged during the civil war. The transportation sector in the country is comprised of 26 235 km of classified roads, 3 000 km of railway lines, five international airports (Maputo, Beira, Nampula, Pemba and Vilanculos) and three major sea ports (Maputo, Beira and Nacala) (World Bank, 2010). Nevertheless, there is an absence of all-weather secondary and tertiary roads in the rural regions.

After the end of the civil war in 1992, the country started a period of reconstruction and reformation in the electricity sector. It was at that time that Mozambique Electricity company EDM (*Eletricidade de Mocambique*) gained the legal status of a state-owned enterprise. Service and capacity were limited such that 60% of firms indicated electricity as the major limitation to business in the past, but with heavy investments in energy, only 28% of firms consider electricity among the three most important obstacles to business as of 2009 (World Bank, 2010).

3.5 AGRICULTURE SECTOR

3.5.1 AGRICULTURAL DEVELOPMENT

Prior to independence, agricultural production was specialised across provinces. Nampula, in the northern region, was the heart of cashew nut and cotton production, while Zambezia, in the central region, produced tea, copra and sugar cane. The price of commodities was established through negotiations between the buyer and the seller.

After independence, prices were fixed by the government or parastatals at all stages of the supply chain. Between 1978 and 1982 only 10% of agricultural investment focused on the needs of smallholder farmers (ECON, 2006). Subsequent to 1987, farms and other enterprises went through a vast programme of privatisation. The political stability brought about by the end of the armed conflict in 1992 resulted in government opening up an easier process of commercialisation, on the premise that farmers could return to their land. The government then started expanding agricultural research and extension services (Alfieri, Arndt & Cirera, 2007; ECON, 2006). The share of agriculture in national GDP has been falling in recent years (FAO, 2010) as primary industries and services increase their role in the economy (Table 3.2).

Mozambique's agricultural sector is characterised by two basic classes of producers: smallholder farmers with less than five hectares of land and small livestock herds, and commercial farmers with more than five hectares of land and/or substantial herds of cattle and other livestock. Smallholder producers account for about 95% of the area under production, using low levels of inputs and producing low yields per hectare, with almost all production being rain-fed. Farm storage provisions for smallholder producers are poor and lead to high post-harvest losses. The commercial sector, on the other hand, is characterised by use of higher levels of agricultural inputs and access to irrigation, where the goal of production is to supply national and export markets (FAO, 2010).

Before 2009, there was no bridge along Zambezi River. So, to movement agricultural commodities it was done by small boat and ferryboat which was taking too much time. The opening of the bridge across the Zambezi River in 2009 facilitated the movement of agricultural commodities between the northern and the southern regions, thus improving marketing between the regions, especially for crops such as common beans, which could more easily be transported from the northern production region to the central and southern consumer regions.

3.5.2 AGRICULTURAL FINANCE

Growth in the agricultural sector has provided opportunities for banks and non-banking financial institutions to expand their services. Microfinance in Mozambique is a strong and growing sector that continues to receive support from the national government, as well as international donors and investors and non-governmental organisations (NGOs). This sector still shows considerable opportunities for growth in rural areas dominated by small-scale farmers in need of financial support.

As shown in Table 3.3 and Table 3.4, Mozambique has banking sector, although access by smallholder farmers is still limited by the lack of assets for collateral and the relatively thin coverage of rural zones.

Table 3.3: Major commercial banks operating in Mozambique

Name	Acronym	Agriculture finance
Millennium international Bank	BIM	No
Banco commercial e de investimento	BCI	Yes
MozaBank		No
Standard Bank		Yes
Barclays		No
Mauritius Commercial Bank	MCB	No
International Commercial Bank	BIC	No
Banco Terra		Yes
Banco Mercantil e de Investimento	BMI	No
African Bank Corporation	ABC	No
First National Bank	FNB	No

Source: Adapted from Christie (2009)

Table 3.4: Microfinance institutions in Mozambique

Name	Acronym	Type
Opportunity Bank Mozambique	BOM	Bank
Caixa comunitaria de Credito e poupança	CCCP	NGO
Fundo de credito Comunitario	FCC	NGO
Fundo de denselvolvimento da Mulher	FDM	NGO
Fundo de Credito Maleyeru	HLUVUKU	NGO
Novo Banco (*Mozambique New Bank*)		Bank
Sociedade de credito de Mocambique	SOCREMO	Bank
Cooperativa de credito e poupanca	TCUMA	Bank

Source: Adapted from Christie (2009)

A small number of credit institutions are operating in rural areas, specifically in the agricultural sector. According to Manganhele (2010), smallholder farmers have been marginalised by formal credit banks due to the problem of market failure in rural credit markets. Lending to agriculture in rural areas has higher costs than other commercial lending due to the poor quality of infrastructure in communication, roads, education and water facilities. Institutional problems also exist where rural financial services are provided, including the agricultural risks involved with production, yield, markets, prices and changes in domestic and international policies. Working with many smallholders also entails higher costs per amount loaned.

To facilitate the financing of smallholder farming, the government of Mozambique implemented a new district credit programme where farmers are allowed to submit a small project to be assessed, evaluated and potentially funded with a loan. The Mozambican government emphasises that they will continue to prioritise investment in agriculture in order to increase production, especially of food crops. Unfortunately, this programme has experienced low repayment rates, for a variety of reasons, and may need to be redesigned in order to ensure sustainability.

3.5.3 AGRICULTURAL LAND USE

In Mozambique, 45% of fertile land is underutilised and only 11% of fertile land is estimated to be under cultivation (FAO, 2010). However, in recent years, cultivated land has increased significantly (Table 3.5). Smallholder farming is dominated by the production of staple foods, with an average of 1.2 million hectares of land being cultivated by smallholder farmers. A maximum of 60 000 hectares are cultivated by a small number of commercial farmers. Smallholder farmers use hand implements and some ox-drawn equipment. Labour productivity is low due to urbanisation (the migration of people to city centres) and the proliferation of diseases that lead to increased death rates, such as the Human Immunodeficiency Virus (HIV), Acquired Immunodeficiency Syndrome (AIDS) and Malaria.

Table 3.5: Arable land in Mozambique

Land	1990-92	1995-97	2000-02	2004-06
Arable land (1000ha)	3 720	4 000	4 400	4 893
Share of irrigated land in total arable land (%)	2.8	2.7	2.7	2.4

Source: Adapted from FAO (2010)

3.5.4 AGRICULTURAL INPUT USE

According to Bias and Donovan (2003), the primary constraints to acquiring agricultural inputs are the lack of access to markets, enhanced technology, and credit; the elevated cost of credit; poor access to and use of land; and lack of health, trained human resources and organisational capacity in response to natural disasters. Only 5% to 10% of all seed used on small farms comes from improved varieties. Most farmers use seeds selected from previous harvests (ECON, 2006).

Today, the use of purchased inputs such as improved seed, fertilizer and pesticides is limited to a small number of commercial farmers growing cash crops and vegetables and/or who produce crops such as cotton and tobacco on contract. Approximately 4% of all farmers in the country use fertilizers (FAO, 2010).

3.5.5 WATER RESOURCES AND DISTRIBUTION

Mozambique has 104 rivers, the majority of which have a high seasonal torrential regime. The main source of water is surface water, and the main consumer of water is agriculture. Agriculture accounts for 87% of the existing water use in the country, followed by the domestic sector (household use), accounting for 11%, and the industrial sector at 2% (FAO, 2010).

3.5.6 COMMON BEANS AND COWPEAS: GENERAL OUTLOOK

3.5.5.1 Common beans

Common beans are grown in most of the northern and central provinces, with women being responsible for 80% of production (CIAT, 2004). Common beans are widely traded in and between Malawi and Mozambique. Maputo receives beans produced in

the district of Gurue (located in the province of Zambezia), the district of Angonia (located in the province of Tete), the district of Gorongosa (located in the province of Sofala), the province of Niassa, and the countries of South Africa and Swaziland. Beira receives beans from Sofala, Niassa and Tete. There is also evidence that Malawi imports beans from the Angonia and Milange districts of Mozambique (Figure 3.5) (Lowenberg, Kambewa & Filipe, 2003).

The informal cross-border bean trade from Malawi to Mozambique in the 2007/2008 season amounted to 149 metric tonnes, while in the 2008/2009 season it was 19 metric tonnes. In addition, the informal cross-border trade volume in the same period was 2 375 metric tonnes and 2 321 metric tonnes respectively (FEWS NET, 2011). From the trade volume between Malawi and Mozambique it is evident that Mozambique can be classified as a net exporter of beans.

Smallholder farmers produce and sell their beans to several markets – local, regional and international. Malawi remains the easiest to reach. According to Filipe (2007), the absence of a reliable link (roads) between the production region in the north of Mozambique and the consumer region in the south hinders trade of common beans between these regions. This situation forces the southern region to import beans from South Africa and Swaziland.

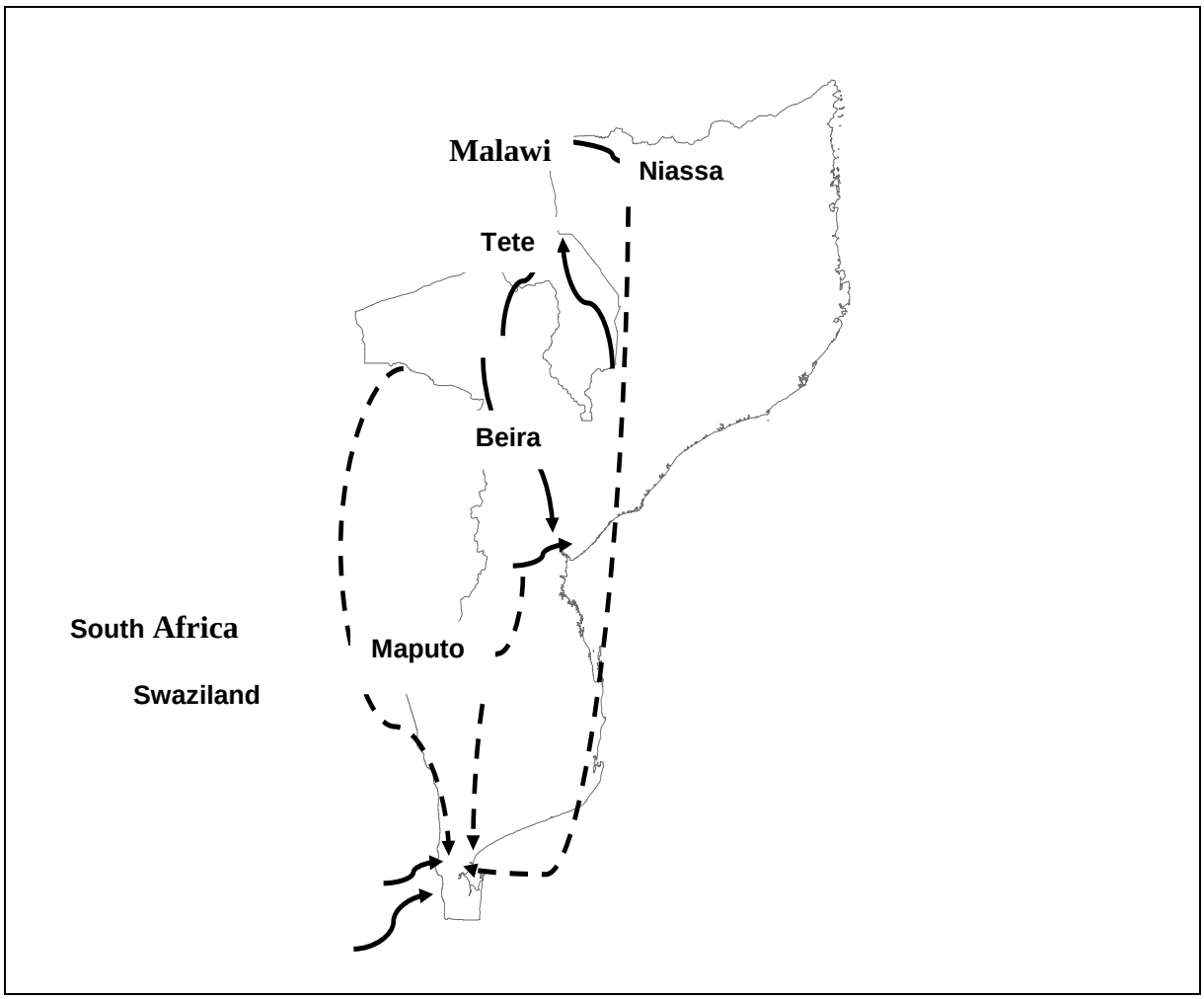

Figure 3.5: Common bean flows in Mozambique
Source: Adapted from Lowenberg*et al.* (2003)

Sugar beans and red beans are mostly preferred by consumers in Malawi. Yield is considered the first characteristic that farmers use to select varieties to grow, followed by good taste and early maturity (Manyong, Nindi, Ussaca, Rwenyendela, Gungulo, Quinhentos & Afonso, 2007).

Among the constraints to the production of pulses in Mozambique, pests and diseases were highlighted by Manyong *et al.* (2007) as the most prominent, followed by drought and the unavailability and inaccessibility of inputs. Filipe (2007) reported that simple accessibility to land by farmers creates a condition for farmers to put more effort into their own land, resulting in a labour constraint in terms of pulse production.

According to Lopes (2010), the adoption of improved common bean varieties varies greatly by region, with the central region (having the highest percentage of households) producing the most improved bean varieties. As explained by Manyong *et al.* (2007), few farmers living close to the main towns in the central region use improved technologies where farmers in the rural areas do not have access to improved varieties, there is consequently a low adoption rate of these technologies. Moreover, a major issue for the sustainability of the use of improved pulse varieties is the low percentage of seed dealers supplying pulse seeds. There are specific regions where the growth of improved pulse varieties is recommended by IIAM and UEM (2010) (Table 3.6).

Table 3.6: Common bean varieties and recommended growing regions in Mozambique

Variety (Common name)	Seed size	Yield (ton/ha)	Maturity (days)	Recommended region
Diacol Calima (Calima)	Large	2.5	80	Region of medium to high altitude, centre and north of Mozambique
Bonus (Catarina)	Medium	2	90	Region of medium to low altitude, centre and south of Mozambique.
Butter Bean (Crème)	Large	1.8	90 – 100	Region of high altitude, centre and north of Mozambique
Ica Pijao (Black)	Small	2.5	90	Region of medium to low altitude, centre and south of Mozambique
Cal 143 (Calima)	Large	3	90	Region of medium to high altitude, centre and north of Mozambique
Sugar 131 (Catarina)	Large	3	90 -100	Region of medium to high altitude, centre and north of Mozambique

Source: Adapted from IIAM and UEM (2010)

3.5.5.2 Cowpeas

Cowpeas are grown by smallholder farmers during the warm season and are usually cultivated in poor soils. Both seeds and leaves are consumed. According to Manyong *et al.* (2007) cowpeas represent the largest proportion of pulses grown in the country, with a large number of varieties. Many farmers who grow cowpeas are not even certain of the names of the different varieties.

Cowpeas are produced predominantly for subsistence living. According to Walker *et al.* (2006), the quality of cowpeas produced in Mozambique is lower than that in other Sub-Saharan countries. The production of cowpeas takes place in agro-ecological

zones 7 and 8 (Figure 3.1), corresponding to the Niassa, Cabo Delgado, Zambezi and Tete provinces. There are also specific regions where the improved cowpea varieties are recommended for production by IIAM and UEM (2010). This is represented in Figure 3.6 and Table 3.7.

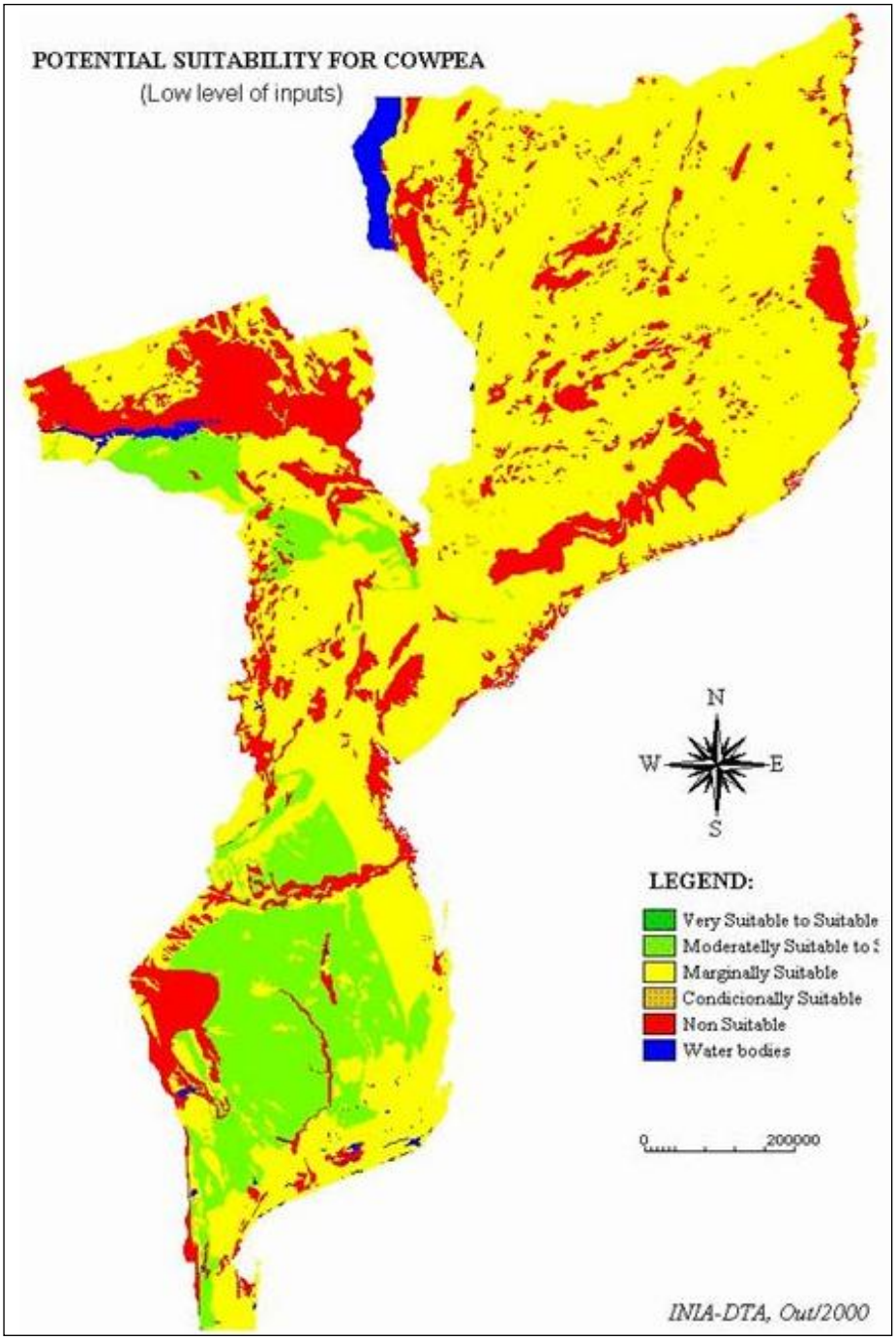

Figure 3.6: Potential regions suitable for cowpea production
Source: Adapted from INIA (2000)

Table 3.7: Cowpea varieties and recommended growing regions in Mozambique

Variety	Type of seed	Yield (ton/ha)	Maturity (days)	Recommended region
IT 18 (light brown)	Small	2	90	Region of low and medium altitude
IT 16 (cream)	Medium	2.5	90	Region of low and medium altitude
INIA 36 (cream)	High	2	100	Region of low and medium altitude
INIA 73 (red)	High	1.5	100	Region of low and medium altitude

Source: Adapted from IIAM and UEM (2010)

The cowpea varieties identified in a study by Manyong *et al.* (2007), are *Chimita*, *Ecute*, *Caqui* and IT18. According to their research, there is some misunderstanding regarding the *Ecute* variety, because it is also referred to as “cowpea” in the *Emacua* language (the local language in northern Mozambique). This has contributed to a controversy among farmers in the evaluation of legume varieties, with some classifying *Chimita* as an improved variety and others classifying it as a local variety.

Smallholder farmers have different preferences for certain varieties, depending on the characteristics of the agricultural zone, as well as yield and taste, the amount of input needed, their own eating habits, and the purpose of production (Manyong *et al.* 2007).

3.6 CURRENT DRIED-BEAN TRADE SITUATION

3.6.1 TRADE BALANCE

The trade balance for Mozambican dried beans in 2010 was US $14,091, which makes Mozambique a net exporter of dried beans. The country is ranked sixth in the world in terms of dried-bean exports (ITC, 2011). In Mozambique, dried-bean producers compete directly for market share with their contemporaries in the southern hemisphere, since their production cycles coincide and their products are disseminated within the same marketing season.

3.6.2 CHARACTERISTICS OF CURRENT IMPORT MARKETS

In 2010, the total value of dried-bean exports from Mozambique to the world was approximately US$ 14 million. Between 2006 and 2010, country exports grew by 87% per annum, which is above the 7% per annum average growth in world imports over that same period. The Mozambique share relative to global export is 0.1 % (Table 3.8).

Table 3.8: Importers of dried beans from Mozambique in 2010

Importer	Trade Indicator				
	Export value 2010 (USD '000)	Mozambique's exports share (%)	Export growth value, 2006-2010 (% p.a.)	Total import growth 2006-2010 (% p.a.)	Tariff (estimated) faced by Mozambique (%)
World	14118	100	87	7	
India	6228	44.1	82	41	29.4
UAE	2569	18.2	86	24	5
China	1335	9.5		-31	7
USA	922	6.5		9	0
SA	664	4.7	172	-40	0
Singapore	539	3.8		5	0
Malawi	409	2.9			0
Indonesia	388	2.7		18	2.5
Japan	355	2.5		1	0

Source: ITC (2011)

India consumed 44.1% of all dried beans exported by Mozambique in 2010. India is the fifth largest dried-bean importer in the world. The growth rate between 2006 and 2010 was 82% p.a., although the tariff faced by Mozambique was extremely high (29.4%).

The United Arab Emirates is the second largest importer of dried beans from Mozambique. The total import growth in value of Mozambican dried beans between 2006 and 2010 was 24% p.a., above the world import average of 7% p.a. The estimated tariff faced by Mozambique was 5%.

China is the third largest importer of dried beans exported by Mozambique. The share of Chinese imports from the rest of the world is 0% and the total import growth in value between 2006 and 2010 was negative.

The United States of America (USA) consumed 6.5% of all dried beans exported from Mozambique in 2010. The USA is the largest importer of dried beans in the world. Total import growth in value from partner countries between 2006 and 2010, was 9 % per annum, which is above the world average of 7% per annum. Moreover, with no tariffs on pulses, Mozambique has a comparative advantage in trading with the USA than trading with India, China and Indonesia because of tariffs of 2,5 to 29.6 percent that Mozambique face when trade with these countries.

South Africa consumed 4.7% of all dried beans exported from Mozambique in 2010. South Africa is the fifty-second largest importer of dried beans in the world. While Mozambique enjoys a free trade agreement with South Africa under the South African Customs Union, the import growth in value to South Africa from Mozambique was negative between 2006 and 2010. Mozambique also has free trade agreements with Singapore, Malawi and Japan.

3.6.3 INTERNATIONAL SUPPLY OF DRIED BEANS

In 2010, the USA was the leader in world exports of dried beans, with an annual growth in value of 14% between 2006 and 2010. This is above the average of 10% for world exports in the same period. Canada, Myanmar, Peru, China, Mozambique, Thailand, the United Kingdom, Argentina and the Republic of Tanzania are also among the top ten exporters of dried beans in the world. Besides the negative annual growth in value during the period 2009 to 2010, Mozambique's growth rate in exports is still above the world's annual average (Table 3.9).

Table 3.9: List of top dried-bean exporting countries in 2010

Exporters	Trade Indicators				
	Value exported in 2010 (USD thousand)	Trade balance in 2010 (USD thousand)	Annual growth in value, 2006-2010 (%)	Annual growth in value, 2009-2010 (%)	Share in world exports (%)
World	490,328	117,911	10	-1	100
USA	213,975	126,170	14	-7	43.6
Canada	102,604	81,388	5	-7	20.9
Myanmar	33,967	33,967	8	74	6.9
Peru	30,835	30,447	8	18	6.3
China	18,889	18,774	25	13	3.9
Mozambique	14,118	14,091	87	-33	2.9
Thailand	8,833	6,177	-1	19	1.8
UK	6,559	-1,499	17	-30	1.3
Argentina	6,406	6,159	8	1	1.3
Tanzania	6,373	6,349	30	13	1.3

Source: Adapted from ITC (2011)

3.6.4 MAIN SUPPLIER OF DRIED BEANS TO MOZAMBIQUE

Mozambique exports and imports dried beans, because their production is seasonal: exports and imports occur at different times during the year. South Africa is the main supplier of dried beans to Mozambique, with a total share of 96.3% (Table 3.10).

Table 3.10: List of suppliers of dried beans imported by Mozambique in 2010

Exporters	Trade Indicators						
	Imported value 2010 (USD thousand)	Trade balance 2010 (USD thousand)	Share in Mozambique's imports (%)	Imported quantity, 2010 (thousand)	Imported growth in value, 2006-2010 (% p.a.)	Imported growth in value, 2009-2010 (% p.a.)	Share of partner countries in world exports (%)
World	27	14091	100	27	-62	8	100
SA	26	638	96.3	26	16	24	0.1
China	1	1334	3.7	1			3.9

Source: Adapted from ITC (2011)

3.6.5 PROSPECTIVE AND NEW MARKET DIVERSIFICATION

The presence of sustainable demand, due to increased consumption of dried beans in foreign countries, translates into high prospects for market penetration and growth.

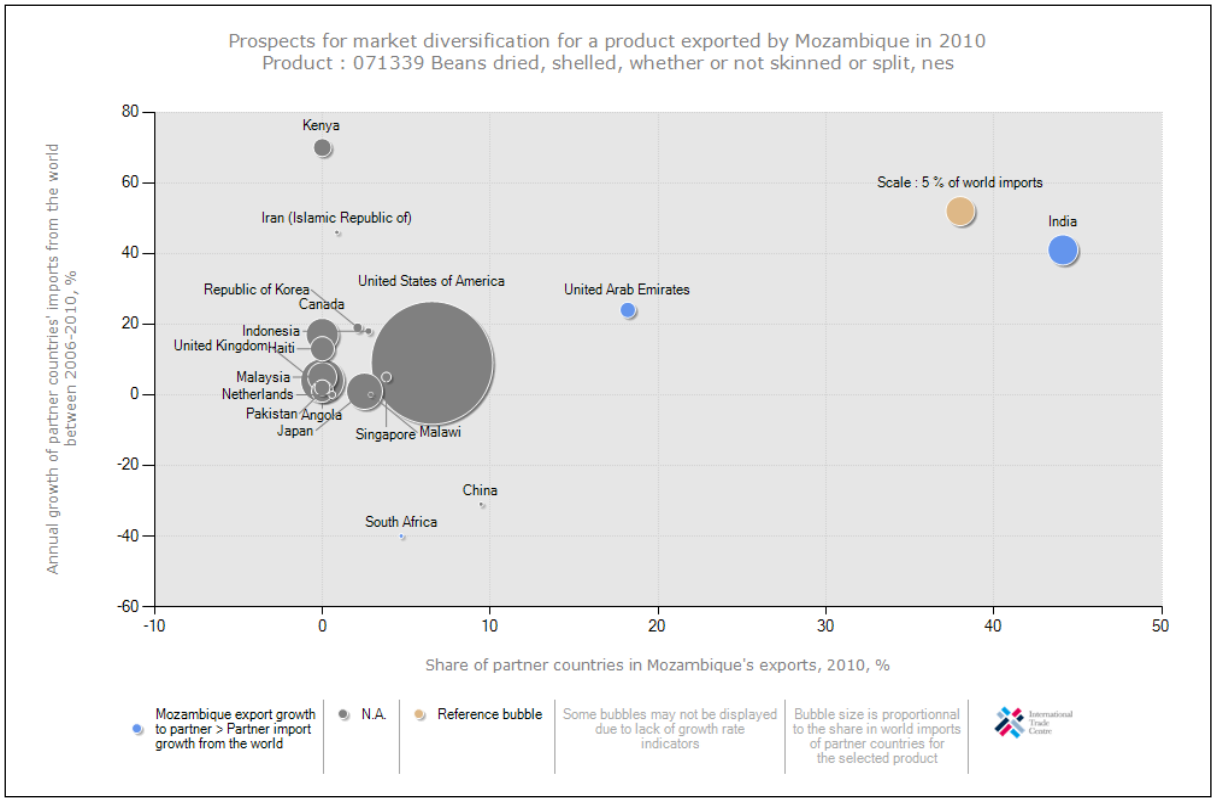

Figure 3.7: Prospects for market diversification
Source: ITC (2011)

Figure 3.7 indicates that in Mozambique, exports of dried beans are not geographically diversified, as there are few countries that import from Mozambique. Some of these countries, including India, Kenya, the USA, Canada, the United Arab Emirates, Iran, Indonesia, the Republic of Korea and Haiti, could become lucrative alternative markets for Mozambican exports, as the annual percentage import growth rate of these countries between 2006 and 2010 is higher than the average world import growth rate of 7%.

3.6.6 COMMON BEAN AND COWPEA MARKET

In 2008 Mozambique's total population was estimated at 21.2 million. From 2007 to 2008 total population grew by 4.6% while total production in the same period decreased by 3.4%. Table 3.11 shows the total population, total production and average real price by province. The northern region (Niassa, Cabo Delgado and Nampula) is the second highest populated region in the country after the central region. However, Nampula is the most populated province but has lower total common bean production levels and higher food prices than the rest of the country.in other hand, Nampula had the highest production and lowest prices of cowpeas in the country. The southern region (consumer region) is characterised by low production and lower common bean prices compared to the northern region. This is because Maputo, being considered a consumer hub, also imports beans from South Africa and Swaziland due to higher transaction costs incurred between the northern and southern regions.

Table 3.11: Total population, total production and average real price of common beans and cowpea by province in 2008

Province	Total population[1]	Total common bean production[2] (thousand ton)	Average common bean real price *Meticais*/kg[3]	Total cowpea production[2] (thousand ton)	Average cowpea real price Meticais /kg[3]
Niassa	1 259 824	22.64452	42.13	6.416267	25.31
Cabo Delgado	1 666 070	0.042323	40.16	9.626651	21.99
Nampula	4 191 210	0.82094	47.42	12.81754	16.39
Zambezia	3 994 559	6.668534	36.84	10.00866	23.26
Tete	1 885 172	15.86784	32.99	8.730754	17.02
Manica	1 493 948	3.977422	36.06	2.902043	19.08
Sofala	1 726 904	0.602961	36.41	1.943643	21.29
Inhambane	1 329 295	0.010421	46.36	4.375497	35.92
Gaza	1 256 364	1.604551	44.48	4.40467	25.51
Maputo	2 404 583	0.420643	38.13	1.122701	26.42
	21 207 929	**52.66016**	**40.10**	**62.34843**	**23.22**

[1] Source: Adapted from INE (2012).
[2] Source: Adapted from INE & TIA (2008)
[3] Source: Adapted from INE & SIMA (2008)

Mozambican food prices are set by market forces. Spatial difference in production and population distribution, as well as imports and exports, are some of the factors that influence price volatility in the country. As shown in Figure 3.8, real price of common beans fluctuated from January to December 2008 and reached a peak in March 2008. From June to September 2008 the country experienced low common-bean prices. The high volatility depicted by the figure below directly impacts household food affordability and security. Improved knowledge of spatial patterns can facilitate policy development that will lead to more stable prices, to the benefit of both producers and consumers.

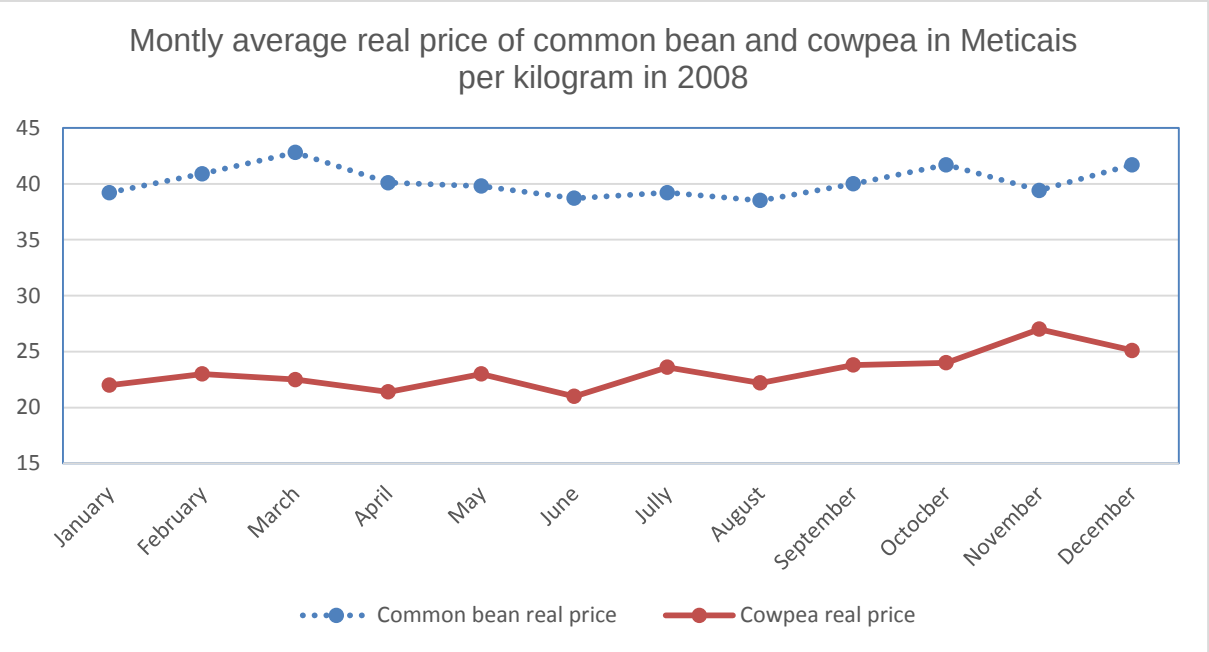

Figure 3.8: Monthly average real price of common beans and cowpea in *Meticais* per kilogram in 2008
Source: Adapted from INE SIMA (2008)

In 2008, real monthly cowpea prices were stable throughout the year. The average real price from January to October fluctuated between 20 and 25 *meticais* per kilogram, with higher prices occurring in November and December (Figure 3.8).

3.7 CHAPTER SUMMARY

Mozambique is located in Southern Africa and has a very volatile climate. The country can be classified into several agro-ecological zones. This diversity in climate enables the country to also be diversified in its agricultural production. Agro-ecological zones 7, 8 and 10, as depicted in Figure 3.1, are the areas that provide the greatest production potential for pulses. These zones correspond to the povinces Cabo Delgado, Niassa, Zambezia, Nampula, Tete and Manica. In some instances these production areas are far removed from urban consuming hubs.

Following independence, a series of macro-economic transformations has allowed the country to have the fastest growing economy in Sub-Saharan Africa. The agricultural sector plays a major role in poverty alleviation, with a large percentage of the country's population living in rural areas and depending on agriculture for a living. However, this sector is still facing many challenges, specifically in the production of common beans and cowpeas. The absence of reliable roads between supplying and demanding regions of the country, the low adoption of improved varieties among smallholders, small numbers of improved seed dealers, and uncertainty in the identification of pulse varieties have been identified as some of the greatest constraints hampering pulse production. On the one hand, cultivated land area has increased in recent years, while on the other hand the use of purchased inputs is limited to a small number of farmers.

There is no distinction between cowpeas, common beans or other pulses in the international trade database (ITC). These variables have all been grouped together as dried beans. Nonetheless, one can see that Mozambique is a net exporter of dried beans. The free trade agreements that the country enjoys with a number of other countries allow it to succeed and diversify its market opportunities.

CHAPTER 4

AGRICULTURAL SURVEY DESCRIPTION

4.1 INTRODUCTION

This study is classified as empirical due to the fact that secondary data was analysed. The strategy of secondary data analysis (SDA) uses existing data, for the most part quantitative. Moreover, SDA aims at reanalysing such data in order to test hypotheses or confirm a model. Although SDA is not able to control data collection errors, it is economical in time and cost because of the use of existing data. This study used data from the Mozambique agricultural household survey known as TIA and Heckman's two-step approach in an attempt to estimate a reduced-form equation, both for market participation and quantity sold. In addition, a probit model was applied in the econometric estimation. The methodology followed similar approach to that of Boughton*et al*. (2007) in their study of market participation by rural households in Mozambique.

4.2 SAMPLING

4.2.1 TIA DESCRIPTION

Following independence in 1975, Mozambique was characterised by a lack of information about the structure of the agrarian sector. To overcome this problem, the Ministry of Agriculture (MINAG) created an instrument to allow the development plan to facilitate information for the use of statistical analysis. In 1993, the first survey was conducted in 20 districts and is commonly referred to as the TIA.

The TIA 2002 sample is based on the *censoAgropecuario* (CAP) conducted between October 2000 and March 2001. Therefore the same households from the 80 districts involved in TIA 2002 were revised in 2005, creating the first rural household panel at national level in Mozambique. The number of districts has expanded over time, as

shown in Table 4.1. No TIA was conducted in 2004 due to the national elections (Donovan, 2008).

Table 4.1: Number of districts and households covered by TIA (2002 to 2008)

	TIA 2002	TIA 2003	TIA 2005	TIA 2006	TIA 2007	TIA 2008
Number of districts	80	80	94	94	94	128
Number of households	4908	4935	6149	6248	6075	5968

Source: Adapted from TIA (2008)

In an effort to reduce sampling errors, the TIA survey method has also changed over time. Thus, additional improvements from 2005 to the present include the use of global positioning systems (GPS) for land area measurement and the introduction of field-based data entry systems to reduce data entry time and to improve the accuracy of data collection and entry (Donovan, 2008).

The main objective of the TIA was to collect data and information about agricultural and livestock production; to improve estimates in terms of area, agricultural production and livestock; and also to collect data to monitor the National Programme for Development in Agriculture (PROAGRI) and the Action Plan for Poverty Alleviation (PARPA).

4.3 CLUSTERING AND STRATIFICATION OF TIA

The most frequently used probability sampling techniques are simple random samples (SRS), stratified random samples and cluster sampling. SRS involves the selection of samples at random from the sampling frame using either random number tables or a computer. The relative cost is higher, and it is not practical for use in a very large population. Stratified sampling is where the population is divided into two or more strata based on the attributes of each stratum, with SRS conducted in each. Stratified sampling has the advantage of guaranteeing equal representation of all the identical strata, unlike SRS. Cluster sampling is applied when the population is spread out over a large area where it is not possible to list every individual. Thus an expansive area is divided into similar small units, and subsets of the identified cluster are randomly selected (Leedy & Ormrod, 2010; Saunders, Lewis & Thornhill, 2009).

TIA 2008 constituted a new cross-sectional data set organised by MINAG in collaboration with Michigan State University (MSU) as a clustered stratified sampling method. The data set contains information on 5 968 households, including all provinces and all identified rural districts in the nation. For purposes of cost reduction and efficiency, clustering was used with selection probability proportionate to population size to identify the sample enumeration areas (UPA) for the individual clusters, with each UPA possibly being a village or zone.

Within each cluster, households were stratified based on the declared size of landholding, and during the listing phase all households were classified as small-scale, medium-scale or large-scale farmers. All medium- and large-scale farmers existing in the selected UPA were interviewed, but large-scale farmers were interviewed using a separate questionnaire. Therefore eight households (constituted by small- and medium-scale landholders) were selected in each UPA to answer the general questionnaire. In each UPA a community questionnaire, answered by the head of the community, was completed.

Thus the overall sample for TIA 2008 was compromised of 91.4% small-scale landholders and 8.6% medium-scale landholders, as presented in Table 4.2.

Stratification and clustering should be considered in the analysis of complex survey data, because the sampling variance of a survey is affected by these components (Oyeyemi, Adewara & Adeyemi, 2010). Therefore, due to common-bean and cowpea sales not being observed in all districts and clusters, this study used probability weightings to account for the stratification.

Table 4.2: TIA 2008 sample per small- and medium-scale land holder by province

Provinces	All samples	Small-scale landholders	Medium-scale landholders
Niassa	472	467	5
Cabo Delgado	556	544	12
Nampula	794	790	4
Zambezia	743	738	5
Tete	680	534	146
Manica	526	493	33
Sofala	494	465	29
Inhambane	534	508	26
Gaza	631	473	158
Maputo	538	443	95
Total	**5968**	**5455**	**513**

Sources: MINAG/TIA 2008 (Author's calculations)

4.4 DESCRIPTIVE STATISTICS

Prior to the analysis of smallholder farmers' participation in pulse markets, representations of descriptive statistics, disaggregated by region and gender of household farmers, are estimated to enable policy formulations to be region and gender specific. Therefore, because the standard deviation, *s,* is estimated from the sample, the t-statistic were also calculated to compare the means between male and female. The null hypothesis is that mean of female = mean of male.

$$t = \frac{\bar{x} - \mu}{sx} \tag{4.1}$$

Where:

$$sx = \frac{s}{\sqrt{n}} \quad \text{and,} \tag{4.2}$$

$$s = \sqrt{\frac{\sum (x - \bar{x})}{n-1}} \tag{4.3}$$

In 2008 a sample of 5 968 household farmers were interviewed, with 751 cultivating common beans and 239 participating in the common-bean market. According to the survey, the minority of households cultivating common beans were headed by females, with an average age of 44 years and with a primary school education. The majority of households had no access to public goods and services, and few were using improved technology (Table 4.3).

Table 4.3: Descriptive statistics for characteristics in the production of common beans

Definition	Obs	Unit of measurement	Mean	Std Error
Household head				
Female	751	1= yes; 0=no	0.17	0.01
Age	751	Year	44.28	0.54
Education	751	Year	2.85	0.11
Member of agricultural association	751	1=yes; 0=no	0.10	0.01
Household				
Access to extension service	751	1=yes; 0=no	0.12	0.01
Access to price information	751	1=yes; 0=no	0.42	0.02
Access to credit	751	1=yes; 0=no	0.05	0.01
Access to improved seeds	751	1=yes; 0=no	0.10	0.02
Access to fertilizer	751	1=yes; 0=no	0.12	0.01
Quantity harvested	751	Kg	135.28	9.20
Quantity sold	751	1=yes; 0=no	0.32	0.47
Quantity marketed	239	Kg	177.05	17.24
Total households producing common beans	751			
Total households in sample	5 968			

Source: TIA (2008)

In 2008, a total of 2 921 farmer households were cultivating cowpeas, with the minority being headed by females. The average age of the household head was 45 years, with an average primary school education. Few farmers had access to public services or productive technology (Table 4.4).

Table 4.4: Descriptive statistics for characteristics in the production of cowpeas

Definition	Obs	Unit of measurement	Mean	Std Error
Household head				
Female	2 921	1= yes; 0=no	0.26	0.01
Age	2 921	Year	45.33	0.28
Education	2 921	Year	2.81	0.06
Member of agricultural association	2 921	1= yes; 0=no	0.09	0.01
Household				
Access to extension services	2 921	1= yes; 0=no	0.09	0.01
Access to price information	2 921	1= yes; 0=no	1.63	0.01
Access to credit	2 921	1= yes; 0=no	0.03	0.00
Access to improved seeds	2 921	1= yes; 0=no	0.06	0.00
Access to fertilizer	2 921	1= yes; 0=no	0.04	0.02
Quantity harvested	2 921	Kg	37.72	1.51
Quantity sold	2 921	1= yes; 0=no	1.92	0.01
Quantity marketed	230	Kg	66.31	7.51
Total households producing cowpeas	**2 921**			
Total households in sample	**5 968**			

Source: TIA (2008)

4.5 POPULATION CHARACTERISTICS IN THE PRODUCTION OF COMMON BEANS

The TIA dataset from 2008 provides information on the characteristics of households involved in common-bean production. The results of the 751 common-bean farmers identified in the TIA 2008 survey are reported based on the weighted sample, which also indicates the number of households in the underlying sample. In the following sections, various characteristics are discussed based on the gender of the household head and the location of the household.

4.5.1 HOUSEHOLDS PRODUCING COMMON BEANS

The key production zones, as indicated earlier, can be found in Tete, Manica, Niassa, and Zambezia provinces. The analysis of TIA 2008 data reveals that the central region has a higher percentage of households cultivating common beans than other regions. The southern region is comprised of three provinces (Maputo, Gaza and Inhambane) and has few farmers producing common beans due to the agro-ecological conditions. The northern region includes Niassa, Cabo Delgado and

Nampula provinces, the latter two of which have low percentages of households producing common beans (Table 4.5).

Table 4.5: Common-bean-producing households by region and gender (number of households, percentage)

Common-bean production							
Northern Region		Central Region		Southern Region		Whole sample	
Male	Female	Male	Female	Male	Female	Male	Female
125 (8.67)	29 (7.61)	332 (16.79)	45 (9.66)	165 (14.18)	55 (10.20)	622 (13.58)	129 (9.31)

In 2008 the province with the highest percentage of common-bean-producing households (29%) was Niassa, followed by Tete, Gaza, Manica, Maputo, Sofala and Zambezia. The household numbers in Figure 4.1 are extrapolations, based on population weights. As mentioned earlier, common beans are suitable for growing in agro-ecological zone 10, which corresponds to Niassa, Tete, Manica and Zambezia provinces.

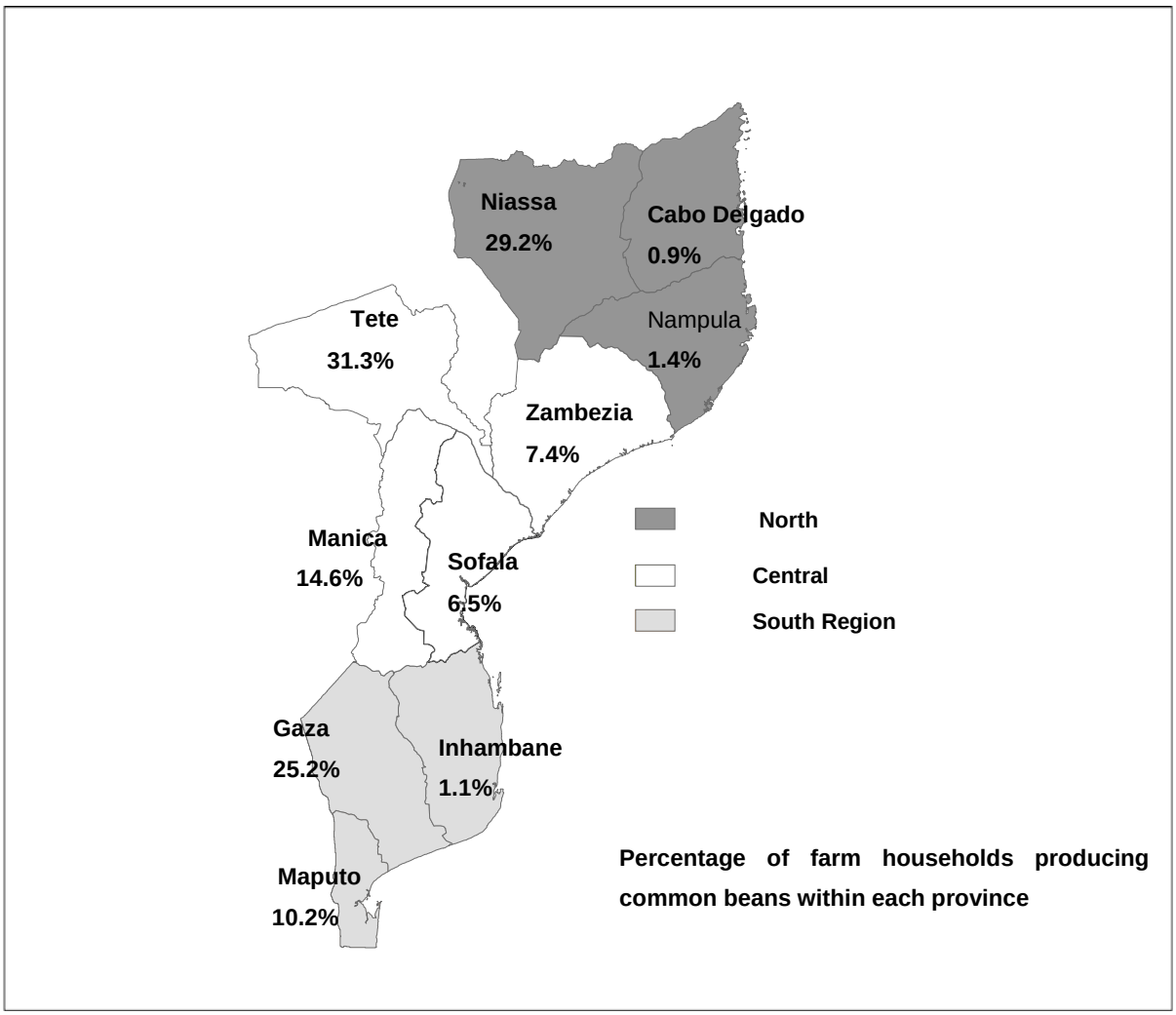

Figure 4.1: Percentage of farm households producing common beans within each province in 2008

4.5.2 HOUSEHOLD ATTRIBUTES

The results are based on household heads, and the data indicates a statistical significance in terms of differences in the average age and gender of household heads. Male household heads are, on average, five years younger than female heads (Table 4.6). Female household heads also have lower education levels (one year of schooling) than male heads (three years), a result that confirms expectations.

Table 4.6: Average age and education of heads of households producing common beans, by region and gender

	Northern Region	Central Region	Southern Region	Whole sample
Average age				
Female	48	44	52	48
Male	41	41	51	43
T statistic	-2.12**	-1.40	-0.13	-3.19***
Average education				
Female	1	2	1	1
Male	3	4	3	3
T statistic	5.44***	4.10***	6.015***	9.07***

The t-statistics are from the test of equality of means, with a null hypothesis of mean of female = mean of male. *** Significant at 1 %, ** Significant at 5 %, * Significant at 10 %.

The mean of household education in the Northern, southern and whole sample are the same. However, the t statistic differ among these region because the t statistic is affected by the sample size the sample size among region are not the same.

4.5.3 ACCESS TO PUBLIC SERVICES

Few farm households growing common beans belong to agricultural associations. Of all such households, only 10% on average belong to an agricultural association, although the percentage varies by region. A small percentage of common-bean growers have access to extension services – in 2008 this was 7% of female heads and 13.5% of male heads. Access to extension services was lowest in the northern region (Table 4.7).

Through investments by SIMA and other initiatives, common-bean farmers in Mozambique are able to access price information. As seen in Table 4.7, in the northern region 38% of male-headed households received price information, compared to 41% of female-headed households. In the central region, 45% of male-headed households and 31% of female-headed households received this information, while in the southern region, 33% of female-headed households and 44% of male-headed households received price information.

There is generally limited access to credit by farmers, and the data reveals some differences between male-headed and female-headed households in terms of access to credit, with only 5.3% of male-headed households and 2.3% of female-headed households receiving this service in 2008. The central region had a higher

percentage of farmers able to access credit in 2008, i.e. 7.5% of male-headed households and 2.2% of female-headed households.

Table 4.7: Access to public services by households producing common beans, by region and gender of head (number of households, percentage)

Northern Region		Central Region		Southern Region		Whole sample	
Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Membership of agricultural association							
7 (5.60)	2 (6.90)	30 (9.03)	5 (11.11)	26 (15.76)	6 (10.91)	63 (10.13)	13 (10.08)
Access to extension services							
11 (8.80)	1 (3.45)	54 (16.27)	4 (8.89)	19 (11.51)	4 (7.27)	84 (13.50)	9 (6.98)
Access to price information							
48 (38.4)	12 (41.38)	150 (45.18)	14 (31.11)	72 (43.64)	18 (32.73)	270 (43.41)	44 (34.11)
Access to credit							
4 (3.2)	1 (3.45)	25 (7.53)	1 (2.22)	4 (2.42)	1 (1.82)	33 (5.31)	3 (2.33)

A low percentage of smallholders, accessing public services and agricultural associations will constrain the expansion of common bean production, because membership in agricultural association is a good channel whereby relevant information may be obtained in view of improving returns on crop production and marketing. Moreover, by accessing extension services smallholders get information that could increase crop productivity and price information. The latter can, in turn, reduce price risk.

Access to credit will enable households to invest in productive technology. Very few famers however have access to credit because of the small number of credit institutions that operates in rural areas. Agricultural lending in rural areas is scarce because it has higher costs than commercial lending. This can, in turn be attributed to, poor quality of infrastructure such as roads, a low level of education and institutional problems associated with agricultural production.

4.5.4 USE OF PRODUCTIVE TECHNOLOGY IN THE PRODUCTION OF COMMON BEANS

A small percentage of households producing common beans made use of improved seeds in 2008, i.e. only 9% of male-headed households and 12% of female-headed households (Table 4.8). In the central and southern regions, a higher percentage of such households used improved seeds than in the northern region. Few farm households used fertilizer in 2008, i.e. only 13% of male-headed households and 5% of female-headed households. The central region had the highest percentage of households using fertilizer compared to the northern and southern regions. Male-headed households were found to be much more likely to use fertilizer than female-headed households.

Table 4.8: Use of productive technology by households producing common beans, by region and gender of head (number of households, percentage)

Northern Region		Central Region		Southern Region		Whole sample	
Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Use of improved seeds							
5 (4.00)	1 (3.45)	28 (8.43)	5 (11.11)	24 (14.54)	9 (16.36)	57 (9.16)	15 (11.63)
Use of fertilizer							
9 (7.2)	1 (3.45)	67 (20.18)	3 (6.67)	4 (2.42)	2 (3.64)	80 (12.86)	6 (4.65)

The production of common beans is limited by the lack of adoption of productive technology. There are a small percentage of households using improved seeds and fertilizer, due to a lack of access to these productive technologies. This has the effect of decreasing smallholder productivity and constraining the possibility of generating marketable surplus.

4.5.5 AVERAGE QUANTITY OF COMMON BEANS HARVESTED AND MARKETED

There is a statistically significant difference between male-headed and female-headed households in terms of the quantity of common beans harvested and

marketed. In 2008 the average quantity harvested by male-headed households was 158kg, compared to the average of 82kg reported for female-headed households. The average quantity harvested in the southern region was very low at 34.8kg for male-headed households and 24.9kg for female-headed households. Among the producers participating in the market in 2008, the average marketed quantity for male-headed households was 166.9kg, and 139.7kg for female-headed households. This indicates a statistically significant difference between male- and female-headed households. The average quantity marketed was higher in the northern region, which corresponds with the higher average household production seen in this region.

Table 4.9: Average quantity of common beans harvested and marketed, by gender and region

	Northern Region	Central Region	Southern Region	Whole sample
	Kg	*Kg*	*Kg*	*Kg*
Average quantity harvested				
Male	314.50	131.79	34.78	158.19
Female	208.03	69.26	24.88	81.93
T statistic	-1.21*	-3.23***	0.82	-3.30***
Average quantity marketable				
Male	222.73	142.06	148.95	166.92
Female	182.88	84.05	na	139.67
T statistic	-0.34	-1.98**	na	-0.41

The t-statistics are from the test of equality of means, with a null hypothesis of mean of female = mean of male. *** Significant at 1 %, ** Significant at 5 %, * Significant at 10 %. Mean are weighted to allow each of the data points contribute equally to the final average

4.6 POPULATION CHARACTERISTICS IN THE PRODUCTION OF COWPEAS

4.6.1 COWPEA-PRODUCING HOUSEHOLDS

In 2008, a higher percentage of female than male farmers were cultivating cowpeas (Table 4.10), which relates to cowpeas being considered a food-security crop.

Table 4.10: Cowpea production by region and gender (number of households, percentage)

Cowpea production							
Northern Region		Central Region		Southern Region		Whole sample	
Male	Female	Male	Female	Male	Female	Male	Female
593 (41.2)	143 (37.5)	814 (41.2)	213 (45.7)	767 (65.9)	391 (72.5)	2174 (47.4)	747 (53.9)

Figure 4.2 reflects the percentage of cowpea-producing households by province as follows: Gaza (21%), Inhambane (20%), Tete (19%), Maputo (16%), Nampula (16%), Zambezia (14%), Cabo Delgado (13%), Sofala (10%), Manica (9%) and Niassa (8%). As per Figure 3.7, the most suitable land for cowpea production is located in Gaza, Inhambane, Tete, and Manica provinces.

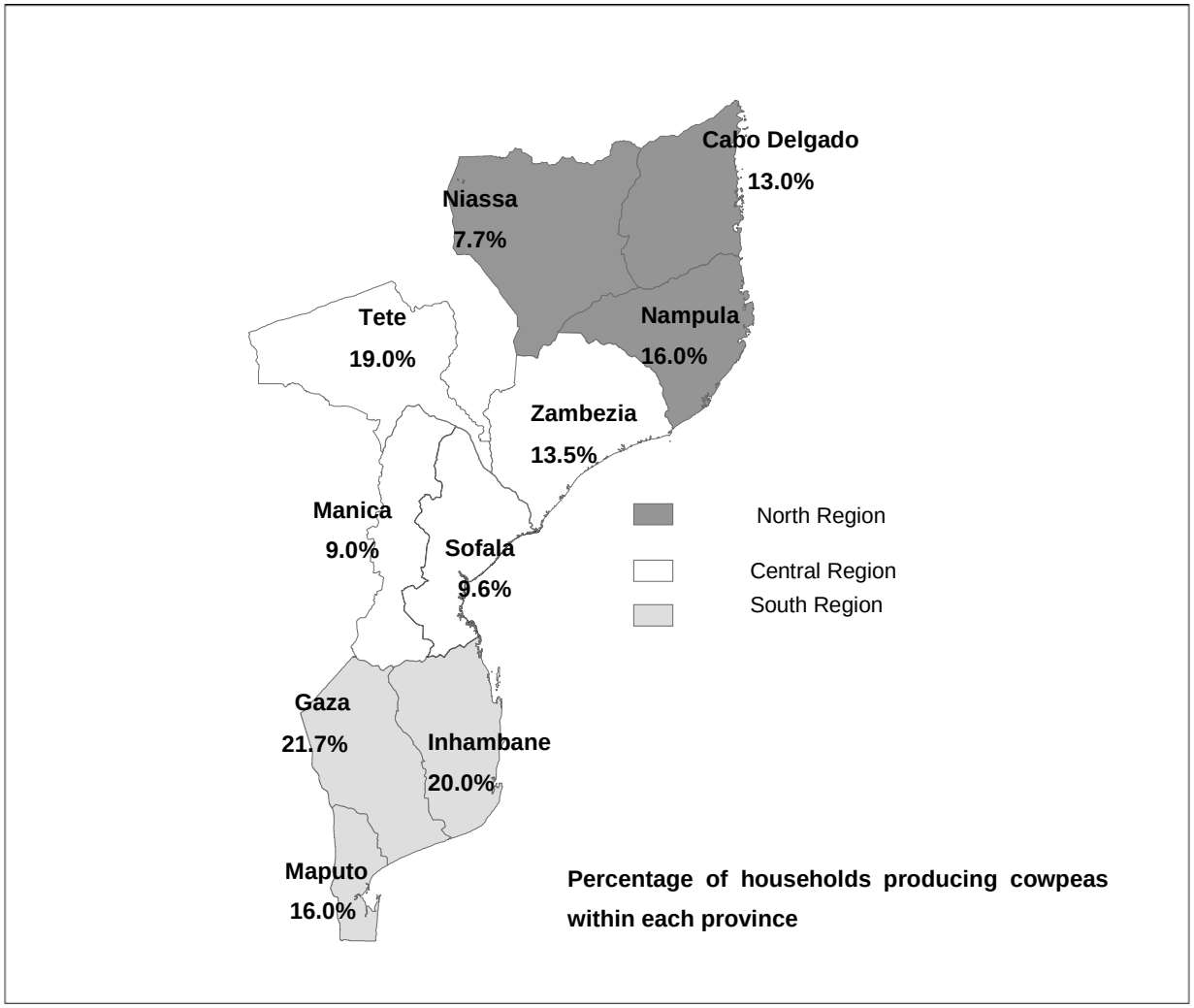

Figure 4.2: Percentage of farm households producing cowpeas within each province in 2008

4.6.2 HOUSEHOLD ATTRIBUTES

In general, there is differences between the average ages and education levels of the heads of households producing cowpeas, based on the gender of the head. The female household heads were on average older and had a lower level of education compared to the male household heads (Table 4.11). Even so, as in the case of common-bean production, education levels tend to be limited, with male household heads averaging only three years of schooling and women heads just one year.

Table 4.11: Average ages of heads of households producing cowpeas, by region and gender

	Northern Region	Central Region	Southern Region	Whole sample
Average household age				
Female	43	44	53	48
Male	41	42	49	44
t statistic	-1.10	-1.99**	-3.82***	-6.23***
Average education				
Female	1	2	1	1
Male	3	4	3	3
t statistic	5.44***	4.10***	6.015***	9.07***

The t-statistics are from the test of equality of means, with a null hypothesis of mean of female = mean of male. *** Significant at 1 %, ** Significant at 5 %, * Significant at 10 %.

4.6.3 ACCESS TO PUBLIC SERVICES

A small percentage of farm households producing cowpeas belonged to an agricultural association, with no significant difference between male- and female-headed households overall. Participation was higher, in percentage terms, in the southern region. As with association membership, a small percentage of cowpea-producing households had access to extension services, i.e. only 6.0% of female-headed households and 9.3% of male-headed households. In the northern region, households were more likely to have had contact with extension services than in the other two regions (Table 4.12).

Table 4.12: Access to public services by households producing cowpeas, by region and gender (number of households, percentage)

Northern Region		Central Region		Southern Region		Whole sample	
Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Membership of agricultural association							
43 (7.25)	9 (6.29)	53 (6.51)	12 (5.63)	94 (12.25)	42 (10.74)	190 (8.74)	63 (8.43)
Access to extension services							
56 (9.44)	13 (9.09)	96 (11.79)	14 (6.57)	51 (6.65)	18 (4.60)	203 (9.34)	45 (6.02)
Access to price information							
276 (46.54)	45 (31.47)	343 (42.14)	58 (27.23)	258 (33.64)	111 (28.39)	877 (40.34)	214 (28.65)
Access to credit							
19 (3.20)	4 (2.80)	31 (3.81)	7 (3.29)	14 (1.83)	8 (2.04)	64 (2.94)	19 (2.54)

A higher percentage of households in the northern region also had access to price information (47% of male-headed households and 32% of female-headed households). Table 4.16 shows the percentages applicable to the other two regions. Higher percentages in the northern region may reflect the investments of SIMA and other market information systems in that region.

Formal agricultural credit is another resource to which few farm households have access. Even in the regions with the highest percentage of households having access, less than 4% of cowpea producers had access to credit in 2008, with the central region having the highest percentage of 3.8% of male-headed households and 3.2% of female-headed households (Table 4.12).

4.6.4 USE OF PRODUCTIVE TECHNOLOGY IN COWPEA PRODUCTION

As shown in Table 4.13, a small percentage of cowpea-producing households used improved seeds in 2008 – at most 9% of male-headed households in the southern region, which is a key production zone. Farmers tend to save seed from their previous harvest of this food-security crop and purchase seed when necessary, after having consumed the entire previous crop. Only 5.2% of male-headed households and 1.9% of female-headed households used fertilizer to cultivate their cowpea crops in 2008.

Table 4.13: Use of productive technology by households producing cowpeas, by region and gender (number of households, percentage)

Northern Region		Central Region		Southern Region		Whole sample	
Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Use of improved seeds							
14 (2.36)	2 (1.40)	47 (5.77)	9 (4.22)	72 (9.39)	30 (7.67)	133 (6.11)	41 (5.49)
Use of fertilizer							
32 (5.40)	2 (1.40)	48 (5.90)	3 (1.41)	33 (4.30)	9 (2.30)	113 (5.19)	14 (1.87)

4.6.5 AVERAGE QUANTITY OF COWPEAS HARVESTED AND MARKETED

The average quantity of cowpeas harvested in 2008 was low at 42kg for male-headed households and 23.5kg for female-headed households (Table 4.14). However, female-headed households on average tended to grow a quantity of cowpeas than male-headed households. Furthermore, the results show a statistically significant difference in the average quantity harvested by each gender group respectively. The quantity harvested was small for both groups, which could be due to lack of use of improved seeds, small plot sizes, the fact that cowpea crops are used for food security in marginal areas, the lack of a developed market to create incentives for planting larger areas, or limited investment in inputs. The average quantity harvested was higher in the northern region. The results show a statistically significant difference between the two gender groups in terms of the average quantity of cowpeas marketed, i.e. 69kg for male-headed households and 32kg for female-headed households.

Table 4.14: Average quantity of cowpeas harvested and marketed by year, gender and region

	Northern Region	Central Region	Southern Region	Whole sample
Average quantity harvested	*Kg*	*Kg*	*Kg*	*Kg*
Male	60.1	37.5	22.7	42.0
Female	31.1	19.1	22.8	23.5
T statistic	-5.70***	-5.04***	0.03	-7.29***
Average quantity marketed				
Male	68.5	73.4	32.7	69.0
Female	36.2	22.6	50.6	31.9
T statistic	-2.88**	-3.72***	1.21	-4.69***

Note: t-statistics are from the test of equality of means, with the null hypothesis of the mean of male-headed households = mean of female-headed households. Mean are weighted to allow each of the data points contribute equally to the final average

4.7 CHAPTER SUMMARY

This study made use of secondary data from the 2008 Mozambique agricultural household survey (or TIA), involving 5 968 households, with the main objective being to collect data and information about agriculture and livestock production, and to monitor the national programme for development in agriculture and the action plan for the poverty alleviation. In 2008, 751 households were found to be cultivating common beans and 239 were participating in the market, while 2 921 households were cultivating cowpeas and 230 households were participating in the market. The majority of cowpea-producing households were found to be headed by females.

TIA 2008 data revealed that in Mozambique, farmers generally had no more than a basic primary education, and the average age of those heading the households was 41 years. On average, female household heads were found to have significantly lower levels of education. A statistically significant difference in the average quantity of common beans and cowpeas harvested and marketed was found, based on the gender of the household head. About one third of farmers had access to price information, with the northern region having the highest percentage of farmers with such access. However, only a small percentage of farm households (below 10% in almost all cases) belonged to an agricultural association, had access to extension services and credit, or used fertilizer or improved seeds. There is clearly room for investment in technology, although this dissertation does not attempt to investigate the reasons behind the low use of technology, credit and other resources. Given the theoretical connection between market incentives and investment in technology, market participation is discussed in the subsequent chapter.

CHAPTER 5

MARKET PARTICIPATION MODEL

5.1 INTRODUCTION

This chapter is divided into two distinctive parts: The first deals with the theoretical aspects of a market participation model, while the second shows the results generated by applying the model as discussed in the first section.

5.2 THEORETICAL MODEL

By referring back to the literature study presented in Chapter 2, it is apparent that the Heckman two-step procedure is the method of choice when it comes to quantifying market participation in most of the studies reviewed. The reason for its popularity stems from the fact that this method allows the researcher to account for initial sampling bias, resulting from the fact that only households that produce a certain commodity are considered when market participation is analysed. Sampling can therefore not be considered to be totally random, and if not accounted for could lead to erroneous conclusions from the results.

Step one of the Heckman procedure consists of estimating a model to capture the household's decision of whether or not to participate in the market, which is done by estimating a probit model. Step two is the estimation of an OLS function to determine the significant variables that contribute to the level of pulse sold.

A general model for market participation is presented below:

$$\Pr(Z_i = 1|w_i,\alpha) + \varepsilon_i = \Phi\big(h(w_i,\alpha)\big) + \varepsilon_i \qquad (5.1)$$

Where: Z_i=1 for households participating in the market

Φ: Standard normal cumulative distribution function

w: Vector of factors affecting market participation

α: Vector of coefficients to be estimated and

ε ~ Normal(0, σ^2)

Z_i is based on the latent marginal utility levels of the i^{th} household from pulse production. It is one when marginal utility is greater than zero, and zero otherwise. The latent utility function can be represented as follows:

$$z_1^* = \alpha w + v \tag{5.2}$$

So that

$z_i = 1 \; if \; z_1^* > 0$

$z_i = 0 \; if \; z_1^* < 0$

From the above estimation, an inverse Mills ratio can be calculated, which is then used in the second step of the estimation procedure. It is this calculation and its inclusion in the OLS estimation that corrects for sample bias. The inverse Mills ratio can be calculated as follows:

$$\lambda = \frac{\phi(h(w,\alpha))}{\Phi(w,\alpha)} \tag{5.3}$$

The second step of the Heckman approach was to estimate a regression with ordinary least squares for the observations, which rendered a result of 1 for the dependent variable in step 1 discussed above. Stated differently, a regression equation is estimated to quantify the factors that determine market participation for agents in the market that do sell pulses. A generic representation of this function is given below:

$$E(Y_i|z_i = 1) = f(x_i,\beta) + \gamma \frac{\phi(h(w,\alpha))}{\Phi(w,\alpha)} \tag{5.4}$$

Where $E(Y_i|z_i = 1)$ is the expectation of the sales function and x_i is a vector of variables affecting sales.

(5.4) can be rewritten as:

$$Y_i^* = \beta x_i + \gamma \lambda_i + u_i$$

Where Y_i^* is only observed for pulse sellers where $z_i = 1$ in which $Y_i = Y_i^*$.

5.3 EMPIRICAL MODEL

The model discussed above can now be used to derive an empirical model for participation in the cowpea and common-bean market in Mozambique.

5.3.1 SPECIFICATIONS

As mentioned above, the dependent variable is the binary response (0 and 1) dummy variable, which is an indication of whether or not farmers participated in the production of pulses (common beans and cowpea) in 2008.

Household attributes, private assets and public assets were hypothesised to have an effect on household market participation as a seller and also in terms of the level of sales. The following household attributes were considered: gender of household head, education level of household head, age of household head, and number of adults in household. Private assets – including pump or gravity irrigation, bicycle ownership, radio ownership, the use of cattle or donkeys for animal traction, the number of livestock, total land area used for pulse cultivation, and crop losses reported – were also considered. Public assets – such as the availability of price information and extension services, membership of an agricultural association, access to credit and distance to the nearest tarred road – were also included.

According to Heckman (1979), the market participation equation should contain at least one variable that is not in the level of the pulses-sold. Thus the exclusion restrictions used are similar to those applied by Boughton *et al*. (2007), in their analysis of market participation by rural household in a low -income country. The following variables are the excluded restriction variables: skilled wage income, livestock income, resource income, and other sources.

To control for spatial factors, location variables (northern, central and southern regions) were included to account for differences across regions in terms of the level of development. The location control considers region because not all provinces observe sales (see Appendix A, pp. 82-83).

Table 5.1 reflects the expected signs of the variables included in the estimated model.

Table 5.1: Specifications and hypothesised signs of variables

Dependent Variables	Explanatory Variables	Participation Decision	Participation Level
1 if HH sells pulses	**Private assets and household attributes**		
Value of pulses sold	HH head female	-	-
	Education of HH head (years)	+/-	+/-
	Education of HH head, squared (years)	+/-	+/-
	Age of HH head (years)	+	+/-
	Age of HH head, squared (years)	+	+/-
	Number of adults in HH (aged 15-59)	-	+/-
	Number of adults in HH, squared	-	+/-
	HH has pump or gravity irrigation	+	+
	HH owns animals for animal traction	+	+
	HH owns bicycle	+	+
	HH owns radio	+	+
	HH has purchased seed	+	+
	Number of livestock	+	+
	Number of livestock, squared	+	+
	Total area (ha)	+	+
	Total area, squared (ha)	+	+
	HH has reported yield loss	-	-
	Median pulse price (mt/kg) in district	+	+
	Public assets and services		
	HH is member of agricultural association	+	+
	Distance to nearest tarred road (km)	-	-
	Village received price information	+	+
	Village received price information* HH owns radio	+	+
	HH received information from extension agent	+	+
	HH had access to credit	+	+
	Exclusion restriction variables		
	HH has skilled wage income	+/-	
	HH has livestock income	+/-	
	HH has other source of income	+/-	
	HH has resource extraction income	+/-	

The negative sign in the participation decision implies that a unit increase in the explanatory variable leads to a decrease in the probability of selling pulses. On the other hand, a positive sign mean that a unit increase in the explanatory variable leads to an increase in the probability of selling pulses. In the case of the level of pulses sold, the positive sign mean that a unit increase in the explanatory variable leads to an increase in the quantity sold, while the negative sign means that a unit increase in the explanatory variable will cause a decrease in the quantity sold. It should also be noted that continuous variables, such as the education level and age, of the household head, number of adults in household, number of livestock and total land area were squared, as advocated by Boughton *et al.* (2007), in order to account for simple non-linear effects.

Before representing the estimation results, it is worthwhile to look at the summary statistics for sellers versus non-sellers of pulses. This serves two purposes – firstly to substantiate the hypothesised signs as represented in Table 5.1 and secondly to formally test the difference between the means of variables for households participating in the market and households not participating in the market. The results for common beans and cowpeas are summarised in Table 5.2 and Table 5.3 respectively.

As expected, there is a statistically significant difference between the means of households selling common beans and households not selling common beans with regard to female heads, number of adults per household, yield loss and distance to the nearest tarred road. For all the variables mentioned above, the mean is greater for households not selling common beans than for households that do sell common beans.

There is also a statistically significant difference in the means of seller households and non-seller households with regard to ownership of a bicycle, ownership of a radio, total land area cultivated, the price of pulses, and access to price information. For this group of variables, the mean for seller versus non-seller is greater in all instances. This confirms the expectation that a household that is well endowed with

private assets and which has access to price information would be more likely to participate in the market.

Table 5.2: Summary of statistics of model variables for common-bean production

	Seller		Non-seller		t statistic
Variable description	**Mean**	**Std Error**	**Mean**	**Std Error**	
Value of pulses sold (Mtn)	3059	4819			
Private assets and household attributes					
HH head female	0.09	0.02	0.21	0.02	4.78***
Education of HH head (years)	2.82	0.20	2.86	0.14	0.13
Education of HH head, squared (years)	17.19	1.69	17.69	1.33	-0.23
Age of HH head (years)	39.96	0.88	46.29	0.66	5.76***
Age of HH head, squared (years)	1782.14	79.02	2361.78	64.81	5.67***
Number of adults in HH (age 15-59)	2.79	0.09	3.44	0.09	5.12**
Number of adults in HH, squared	9.79	0.79	15.85	0.94	4.80***
HH has pump or gravity irrigation	0.03	0.01	0.02	0.01	-0.61
HH owns animals for animal traction	0.17	0.02	0.35	0.02	5.51***
HH owns bicycle	0.71	0.02	0.57	0.02	-3.74***
HH owns radio	0.71	0.03	0.66	0.02	-1.53
Number of livestock	11.74	1.05	16.79	0.93	3.60***
Number of livestock, squared	399.6	71.98	725.51	88.27	2.86**
Total area (ha)	2.61	0.14	2.29	0.09	-1.92*
Total area squared	11.53	2.00	9.04	0.86	-1.13
HH reported yield loss	0.50	0.03	0.76	0.02	6.87***
Median pulse price (Mt/kg) in district	17.84	3.70	17.47	4.48	-1.06
Public assets and services					
HH is member of agricultural association	0.10	0.02	0.10	0.01	0.31
Distance to nearest tarred road (km)	50.29	4.39	47.24	4.37	-0.49
Village received price information	0.51	0.03	0.38	0.02	-3.49***
Village received price information* HH owns radio	0.41	0.03	0.27	0.02	-3.86***
HH received information from extension agent	0.15	0.02	0.11	0.01	-1.23
HH had access to credit	0.07	0.01	0.04	0.01	-1.82*
Exclusion restriction variables					
HH has skilled wage income	0.43	0.03	0.45	0.02	0.42
HH has livestock income	0.75	0.03	0.83	0.02	2.24**
HH has resource extraction income	0.36	0.03	0.25	0.02	-2.95**
HH has other source of income	0.46	0.03	0.34	0.02	-3.34***
Observation	239			512	

Source: TIA, 2008

The t-statistics are from the test of equality of means, with a null hypothesis of mean of sellers = mean of non-sellers. *** Significant at 1 %, ** Significant at 5 %, * Significant at 10 %. Robust standard error in brackets. Means are weighted.

The differences in the mean level of the variables considered for cowpea sellers and non-sellers are summarised in Table 5.3. It is apparent from the table that only 12.54% of households entered the cowpea market in 2008. There is a statistically significant difference between the means of seller and non-seller households with regard to gender of the household head, number of adults per household, age of household head, yield loss, use of animal traction, livestock units, and distance to the nearest tarred road. The means of non-sellers are greater than the means of sellers for this group of variables. A result that does not conform to prior expectations is the fact that the mean number of livestock for non-seller households was greater than those for seller households. This could possibly be attributed to the fact that ownership of a greater number of livestock units takes time away from pulse production, since livestock requires tending and leaves less time for the production of pulses, which in turn leads to reduced market participation. There is also a statistically significant difference between the means of seller and non-seller households with regard to ownership of a bicycle, total area, distance to the nearest tarred road and price information. Here the means of the seller group surpassed that of the non-seller group. For the seller group, the mean distance to the nearest tarred road was found to be greater than for the non-seller group, despite the fact that the opposite was expected.

Table 5.3: Summary of statistics of model variables for cowpea production

	Seller		Non seller		t statistic
Variable description	**Mean**	**Std Error**	**Mean**	**Std Error**	
Value of pulses sold	690.35	130.41			
Private assets and household attributes					
HH head female	0.14	0.02	0.27	0.01	-4.94***
Education of HH head (years)	3.00	0.21	2.79	0.06	0.99
Education of HH head, squared (years)	18.83	1.76	16.70	0.52	1.16
Age of HH head (years)	40.77	0.91	45.72	0.29	-5.18***
Age of HH head, squared (years)	1851.84	84.92	2313.25	28.42	-5.15***
Number of adults in HH (age 15-59)	2.60	0.09	2.99	0.03	-3.96***
Number of adults in HH, squared	8.63	0.83	12.18	0.43	-3.80***
HH has pump or gravity irrigation	0.14	0.02	0.14	0.01	-0.07
HH owns animals for animal traction	0.10	0.02	0.19	0.01	-4.28***
HH owns bicycle	0.64	0.03	0.48	0.01	4.79***
HH owns radio	1.38	0.03	1.43	0.01	-1.53
Number of livestock	10.04	0.88	13.12	0.46	-3.09***
Number of livestock, squared	278.56	47.12	738.86	229.323	-1.97**
Total area (ha)	2.20	0.10	1.75	0.03	4.10***
Total area, squared (ha)	7.32	0.83	5.47	0.26	2.11**
HH reported yield loss	0.54	0.03	0.76	0.01	-6.27***
Median pulse price (mt/kg) in district	9.77	0.32	11.46	0.17	-4.62***
Public assets and services					
HH is member of agricultural association	0.08	0.02	0.09	0.01	-0.23
Distance to nearest tarred road (km)	62.94	6.23	45.20	1.59	2.76***
Village received price information	1.48	0.03	1.64	0.01	-4.55***
Village received price information* HH owns radio	2.10	0.07	2.38	0.02	-3.66***
HH received information from extension agent	0.10	0.02	0.08	0.01	1.01
HH had access to credit	0.05	0.02	0.03	0.00	1.71*
Exclusion restriction variables					
HH has skilled wage income	0.32	0.03	0.41	0.01	-2.83***
HH has livestock income	0.77	0.03	0.80	0.01	-1.14
HH has resource extraction income	0.96	0.02	0.98	0.01	-0.87
HH has other source of income	0.51	0.03	0.47	0.01	1.11
Observation	230		2691		

Source: TIA, 2008

The t-statistics are from the test of equality of means, with a null hypothesis of mean of sellers = mean of non-sellers. *** Significant at 1%, ** Significant at 5%, *Significant at 10%. (Means are weighted).

5.3.2 ESTIMATION

The table below gives the estimation results for both steps of the Heckman approach with the variables as specified and discussed above. In addition to the market participation issues analysed, dummy variables were also included to capture the spatial differences in market participation. For this, Mozambique was divided into three regions, namely the northern, central and southern regions. In the case of common beans, two dummies were used, with the southern region serving as the

"base" region. For cowpeas, two dummies were also used, but with the northern region as the "base" region.

Table 5.4: Model results(Probit – Selling decision, OLS – Value of pulse sold)

	Common beans		Cowpea	
Variable description	***Probit*** **1= HH selling common beans**	***OLS*** **ln (value of common beans sold)**	***Probit*** **1= HH selling cowpeas**	***OLS*** **ln (value of cowpeas sold)**
Private assets and HH attributes				
HH head female	-0.5633***	0.0148	-0.1812	-0.2352
	(0.1786)	(0.3520)	(0.1171)	(0.2980)
Education of HH head (years)	-0.0225	-0.0265	-0.0203	0.0244
	(0.0506)	(0.0803)	(0.0355)	(0.0765)
Education of HH head, squared (years)	-0.0028	0.0023	0.0023	-0.0054
	(0.0053)	(0.0090)	(0.0037)	(0.0080)
Age of HH head (years)	-0.0631***	-0.0218	-0.0130	-0.0241
	(0.0236)	(0.0506)	(0.0153)	(0.0385)
Age of HH head, squared (years)	0.0006***	-0.0001	0.0001	0.0002
	(0.0002)	(0.0005)	(0.0002)	(0.0004)
Number of adults in HH (age 15-59)	0.0135	-0.1165	-0.0501	0.0714
	(0.1203)	(0.2208)	(0.0549)	(0.1687)
Number of adults in HH, squared	-0.0048	0.0163	0.0034	-0.0088
	(0.0106)	(0.0220)	(0.0030)	(0.0136)
HH has pump or gravity irrigation	0.1116	-0.2509	0.0133	-0.2729
	(0.4104)	(0.5180)	(0.1269)	(0.2266)
HH owns livestock for animal traction	-0.0903	-0.1207	0.0924	0.9043**
	(0.1942)	(0.2927)	(0.1516)	(0.3637)
HH owns bicycle	0.0668	0.2718	-0.1072	0.3564*
	(0.1329)	(0.1968)	(0.0955)	(0.2003)
HH owns radio	-0.0408	0.3403	0.2442	0.1779
	(0.1794)	(0.2764)	(0.2794)	(0.5998)
Number of livestock	-0.0007	0.0071	0.0011	0.0012
	(0.0125)	(0.0145)	(0.0074)	(0.0149)
Number of livestock, squared	0.0001	-0.0001	-0.0001	-0.0009
	(0.0002)	(0.0002)	(0.0001)	(0.0002)
Total area (ha)	0.2128***	0.2491**	0.2820***	-0.3416
	(0.0648)	(0.1161)	(0.0701)	(0.3195)
Total area, squared (ha)	-0.0102**	-0.0033	-0.0215**	0.0516*
	(0.0049)	(0.0052)	(0.0090)	(0.0271)
HH reported yield loss	-0.3653***	-0.3639*	-0.2218**	-0.0218
	(0.1218)	(0.2230)	(0.0856)	(0.2886)
Median pulse price (mt/kg) in district	0.0202	0.0647**	-0.0146**	0.0569**
	(0.0145)	(0.0252)	(0.0074)	(0.0246)
Public assets and services				
HH is member of agricultural association	-0.0197	-0.0678	-0.0161	-0.5097
	(0.2072)	(0.3244)	(0.1622)	(0.3234)
Distance to nearest tarred road (km)	-0.0012*	-0.0001	-0.0001	0.0004
	(0.0006)	(0.0016)	(0.0001)	(0.0007)
Village received price	0.1132	0.7671**	-0.4401*	-0.0676

	Common beans		Cowpea	
Variable description	***Probit*** **1= HH selling common beans**	***OLS*** **ln (value of common beans sold)**	***Probit*** **1= HH selling cowpeas**	***OLS*** **ln (value of cowpeas sold)**
information				
	(0.2247)	(0.3529)	(0.2489)	(0.6903)
Village received price information*HH owns radio	0.2672	-0.5069	0.1133	0.0917
	(0.2617)	(0.4182)	(0.1701)	(0.3579)
HH received information from extension agent	-0.1126	0.2911	-0.0686	-0.4769
	(0.1867)	(0.2878)	(0.1454)	(0.3066)
HH had access to credit	0.1972	-0.3905	0.2894	-0.1879
	(0.2601)	(0.3678)	(0.2015)	(0.4663)
Exclusion restriction variables				
HH has skilled wage income	0.3598***		-0.1080	
	(0.1328)		(0.0891)	
HH has livestock income	0.1044		-0.1353	
	(0.1822)		(0.1153)	
HH has resource extraction income	-0.0892		0.0561	
	(0.1470)		(0.0718)	
HH has other source of income	0.2239*		0.0335	
	(0.1220)		(0.0824)	
Regional effect				
Northern region	1.6899***	0.6159	*dropped*	*dropped*
	(0.2959)	(0.9068)		
Central region	1.1459***	-0.2084	-0.1688*	-0.2188
	(0.2373)	(0.7311)	(0.0946)	(0.2783)
Southern region	*dropped*	*Dropped*	-0.5984***	0.6964
			(0.1554)	(0.7621)
LAMBDA		0.5227		-0.7736
		(0.6603)		(1.3356)
Constant	-0.5272	5.4359***	-0.1322	6.9115***
	(0.6463)	(1.2499)	(0.4274)	(1.5112)
Join test HH attributes (p value)	0.0000	0.0034	0.0000	0.0174
Join test private assets (p value)	0.0000	0.0000	0.0000	0.0006
Join testpublic assets and services (p value)	0.0092	0.0017	0.0000	0.0047
Join test exclusion restriction variables (p value)	0.0002		0.0000	
R-square		0.21		0.24
Observation	751	239	2921	230

5.3.3 ESTIMATION RESULTS

Common Beans: Probit Model – Stage 1

The results (Table 5.4) suggest that households headed by females are less likely to participate in the common-bean market, as opposed to households headed by men. The coefficient of age of household head is significant and negative. Thus, as the age of the household head increases, the likelihood of market participation decreases. The coefficient for total area had a positive sign and was significantly different from zero, indicating that if more land is available for cowpea production, the probability of market participation will increase. Yield losses were statistically significant and negative. This indicates that as households experience yield losses, they produce lower quantities of surplus, which in turn reduces trade. As explained by Savadatti (2006), yield losses and unstable yields prevent farmers from realising reasonable returns on their outputs. Moreover, yield losses act as a disincentive for farmers to cultivate pulses or increase the quantity for trade. Distance to the nearest tarred road was found to be statistically significant with a negative sign. This indicates that as distance increases, the probability of selling to the market decreases. This can possibly be attributed to an increase in transaction costs, as a result of the longer distances involved. Barrett (2008) explained that high transaction costs are one of the entry barriers to commerce that smallholders are facing due to poor infrastructure. This results in a further reduction in the incentive to produce a marketable surplus. Skilled wage income also has a positive statistically significant influence on participation in the common-bean market. One possible explanation is that households with a skilled wage income are more willing to bring their products to market, since they can satisfy their consumption not only with what they produce, but also by using their income as a form of exchange for other goods. This is also the case with those who have other sources of income, since the coefficient was found to be statistically and positively correlated with participation in the common-bean market.

After controlling for spatial factor among the different regions in Mozambique, the result suggests that there is a significant difference in the participation location effect,

with the northern and central regions being more willing to participate in the marketing of common beans compared to the southern region.

Common Beans: OLS Model – Stage 2

The inverse Mills ratio (Lambda) is not significant, indicating that a sample selection bias would not have resulted if the level of common-bean sales had been estimated without considering the decision to sell.

The above results also suggest that an increase in arable land by one hectare would lead to a 25% increase in the value of quantities sold among households selling common beans. However, the sales volume is expected to decrease (by about 36%) for households experiencing a loss in yield.

The common-bean price coefficient is also statistically significant and positively related to the value of common beans sold. In addition, the price information is statistically significant and has a positive effect on the quantity of common beans sold. As pointed out by Omiti *et al.* (2009), output price and market information are the key incentives for increased sales.

For regional matters, the result suggests that there is no significant regional effect in terms of the level of common-bean sales.

Cowpeas: Probit Model – Stage 1

With regard to the decision to participate in the market, the results shown in Table 5.4 also reveal that households headed by females are less likely to participate in the market than male-headed households. In addition, the coefficient of the total area, i.e. size of arable land, was statistically significantly and positively related to the decision to participate in the cowpea market.

The coefficient of households reporting yield losses was negative and significantly different from zero. Thus, households that have experienced yield losses are less

likely to participate in the market. The cowpea price was also statistically significant and negatively correlated with the probability of selling, since households participate in the market after satisfying their consumption needs. In addition, the negative effect of prices in the decision to participate in the market could be due to the high transaction costs faced by smallholder farmers and their limited access to inputs and product markets. As explained by Barrett (2008), smallholders must not only get prices right in order to induce market participation, but they should also have access to productive technology in order to produce a marketable surplus. The coefficient of price information was also significantly and positively correlated to the probability of households participating in the cowpea market as sellers.

To account for location control, the result suggests that there is a statistically significant difference in terms of the participation location effect, with the central and southern regions being less likely to participate in the market than the northern region.

Cowpeas: OLS Model – Stage 2

The coefficient of the inverse Mills ratio (Lambda) is not significant and indicates that a bias would not have resulted if cowpea sales had been estimated without first considering the decision to sell cowpeas.

The results further reveal that private assets are positively related to the value of cowpeas sold. The coefficient of households owning a bicycle is positive and statistically significant. This also applies to the coefficient of households owning livestock for animal traction. The ownership of animal traction increases the quantity of cowpeas sold, because a larger area can be cultivated and a higher yield can be expected with the availability of animal traction. The negative sign on the coefficient of the total area shows that the availability of land for cowpea production does not guarantee higher production, since households are currently facing labour constraints and as such are not able to cultivate all their land. This can be overcome by the use of animal traction, as discussed previously. Mythili (2008) argued that farmers may increase production by adopting better production technologies without increasing

their land area, or by adopting intensive cultivation methods and using more or better quality inputs, leading to increased production. Households with higher production levels are more likely to have crop surpluses above their consumption needs. However, Walker *et al.* (2006), pointed that the quality of cowpeas produced in Mozambique is lower compared to other Sub-Saharan countries, since farmers in the rural areas do not have access to productive technology in order to produce a good-quality, marketable surplus. This is substantiated by Manyong *et al.* (2007), who found that a low supply of pulse seeds by seed dealers is a major issue in the use of improved pulse varieties. Thus, without any incentives, most smallholders are engaging in the production of cowpeas for subsistence purposes, using poor production technologies. Moreover, the cowpea price was also positive and significant in affecting the level of cowpeas sold. In terms of regional issues, the results correspond to those found for common beans.

5.3.4 INTERPRETATION OF RESULTS

Since the model is estimated in two stages, the results are also discussed in two stages. The first stage pertains to the factors influencing the probability of a pulse producer participating in the market or deciding to participate. The second stage quantifies the level of market participation in how the level of participation will change based on the explanatory variables considered. From the estimation results above, the following factors were identified as possible factors that facilitate the decision to participate in the common-bean market:

- Increase in total land area
- Increase in common-bean price
- Availability of skilled wage income
- Availability of other sources of income

The major factors that discourage entry to the common-bean market are:

- Yield losses

- Distance to the nearest tarred road

Factors that increase the *level* of common-bean sales are:

- Land size
- Common-bean prices
- Availability of price information

In contrast, yield loss is the major factor decreasing the *level* of common-bean sales.

Removing some of the physical infrastructural constraints and addressing yield loss would go a long way towards persuading households to participate in the market and also increase the quantities sold.

From analysing the cowpea data set, it is evident that assets such as land will persuade households to participate in the market as sellers, while households experiencing yield losses, low prices and a lack of price information are discouraged from participating in the market.

The quantity of cowpeas sold is highly affected by assets such as bicycle ownership and ownership of livestock for animal traction. The cowpea price also has a positive effect on the quantities of cowpeas sold. However, land size has a negative effect on the quantity of cowpeas sold.

CHAPTER 6

CONCLUSION

6.1 INTRODUCTION

The objective of this study was to identify the opportunities and constraints that pulse producers in Mozambique experience in terms of participating in the market. The current local and international market environment allows for a growth in trade, which could ultimately lead to opportunities for poverty alleviation. Mozambique's current export markets of Kenya, Canada, Iran, Republic of Korea and Haiti could also prove lucrative, given that the annual import growth of these countries is higher than the world import growth. Opportunities can, however, only be exploited if Mozambique can generate enough surplus production. Despite the above-mentioned favourable market conditions, numerous common-bean and cowpea producers are still producing solely for their own consumption.

6.2 MAIN FINDINGS

6.2.1 CURRENT STATE OF THE INDUSTRY

There seems to be a gender difference in terms of education level, access to extension services, access to price information, access to credit, membership of an agricultural association and use of fertilizer. In addition, a large proportion of farmers only have access to price information, while the other factors under consideration remain neglected. Only a few farmers use fertilizer, belong to an agricultural association, have access to extension services and enjoy access to credit. This situation creates a disincentive for farmers to produce.

A small number of credit institutions operate in the agricultural sector in Mozambique. Small farmers have been marginalised with respect to access to credit due to the absence of reliable roads, low education levels and high risk in agricultural

production. The central region has a higher percentage of farmers with access to credit compared to other regions. This region also has a higher percentage of farmers with access to extension services and fertilizer.

The adoption of improved varieties also influences production patterns. Most farmers use seed selected from previous harvests, resulting in low yield. The gender differential patterns are also prevalent in pulse production patterns. Male-headed households are more involved in the production of common beans, and female-headed households in the production of cowpeas. The percentage of cowpea-producing households has decreased over the past few years, which could be due in part to urbanisation and the effects of diseases such as Malaria, HIV and AIDS.

In general, common-bean and cowpea sellers are characterised by male-headed household, bicycle and radio ownership, more land than their non-selling counterparts, and access to price information. On the other hand, non-sellers of common beans and cowpeas are mostly characterised by female-headed households consisting of more members and a high level of yield loss.

6.2.2 FINDINGS OF THE ESTIMATED MODEL

This study found yield losses and the distance to the nearest tarred road as the two main factors preventing farmers from participating in the market. Factors that serve as n incentive for market participation are high common-bean prices and the availability of additional income to the household. The level of participation is in turn negatively influenced by yield losses and positively influenced by land size, price, and the availability of price information.

In terms of cowpeas, the results more or less correspond to those of common beans, with two main exceptions: The first is that cowpea producers rely heavily on assets, more specifically animal traction; the second is that cowpea prices have a negative impact on the probability of a household selling this product. The reason for this could be that households regard food security in terms of the stocks available to them, rather than the income that could be generated, and therefore they may decide not to

sell in times of high prices. Another reason could be that price information is not always available.

6.2.3 SPATIAL FINDINGS

Overall, the central region has a higher percentage of common-bean producers. Niassa is the province with the highest number of producing households and the highest total production of all provinces in the country. Higher average quantities harvested result in a higher marketable quantity. The use of improved seeds in this province is still low, however, which leaves room for improvement.

The southern region has the most cowpea producers, mainly situated in the Gaza and Inhambane provinces. The average marketable cowpea harvest is low in the southern region.

There is a statistically significant difference in terms of market participation by households in the northern and central regions, which are more likely to participate in the common-bean market than households in the southern region. In addition, households located in the southern and central regions are less likely to participate in the cowpea market compared to households in the northern region. Moreover, there is no significant difference in the level of pulses sold among the different regions.

6.3 LIMITATIONS OF THE STUDY AND FUTURE RESEARCH

The main goal of this study was to identify the constraints and opportunities associated with pulse production in Mozambique. The study was based on secondary data from the TIA database. In order to fully understand the production and supply of pulses in Mozambique, a supply response study would have been ideal, but this was not possible due to the nature of the data. In addition, the transaction costs involved in the marketing of pulses were not considered due to the unavailability of information in this regard. It is therefore recommended that frequent time-series data on pulse

prices, production, trade and transaction costs is collected in view of facilitating future policy analysis.

The unavailability of reliable roads to link the southern region (consumer region) to the northern region (production region) was minimised with the construction of a new bridge across the Zambezi River in 2009. This could possibly have a favourable impact on the market participation of pulse producers. A duplicate study could be done to see determine whether the improved infrastructure has, in fact, facilitated market participation. The fact that the country has 104 rivers, 87 % of which are used for agricultural purposes, led to the conclusion that water is not a constraint when it comes to the use of irrigation systems for pulse production in Mozambique. However, Mozambique is regarded as one of the African countries most at risk for drought due to climate change within the next three to four years. Policymakers should therefore take cognisance of water-related issues when implementing current policies. As data on the effects of climate change becomes available, it might be worthwhile to include the information in future studies relating to market participation and supply response with regard to pulses.

6.4 POLICY RECOMMENDATIONS

This section presents the most important mechanisms for farmers and policymakers to ensure access to agricultural markets in Mozambique.

Recommendations to farmers:

The results of the study have shown that membership of an agricultural association has a negative and insignificant effect on the probability of farmers entering the market and increasing the quantity of surplus for trade. However, the researcher believes that membership of such an organisation could play a central role in increasing market participation. By acting collectively, farmers would be better positioned to reduce transaction costs for their market exchanges, obtain basic market information and secure access to new technologies. Due to volatility in pulse

prices, farmers could also create conditions in which to store pulses and sell their product post-harvest, thus minimising marketing risk.

Education was also shown to have a negative effect on the probability of farmers participating in the market and increasing the quantity of surplus for trade. Farmers should, however, invest in the education of their children in order to avoid the persistent problem of farmers being marginalised from formal credit extension by banks due to low levels of education.

Recommendations to policymakers

Policymakers should develop and implement policies that create incentives for co-operation among stakeholders. For example, better collaboration among input suppliers and smallholder farmers could result in improved access to agricultural markets and increased production and surplus for trade. While the results reveal that distance from the farmer to the nearest tarred road is the main constraint to the marketing of pulses, policies that improve the provision of public goods and services – such as infrastructure in rural areas, extension services and agricultural finance – are also essential.

The use of productive technologies such as fertilizer and the adoption of improved pulse seeds are important. Policymakers should create incentive for farmers to invest in new technologies and develop strategies in order to facilitate the registration and regulation of enterprises working in the seed and fertilizer market.

Yield losses have a negative and significant effect on the decision to participate in the market. The results suggest that yield loss acts as a disincentive for farmers to participate in agricultural markets, thus necessitating policies related to the development and promotion of research in agriculture, especially in terms of improving storage facilities.

As mentioned earlier, the majority of farmers have access to price information, and this has a positive and significant effect on market participation. The results suggest

that the price-information provider should improve the quality of such information and expand the service to more farmers. Improving price information alone is not sufficient to persuade households to participate in the market, but this policy should be implemented together with the provision of information on market demand.

7 LIST OF REFERENCES

Alfieri, A.; Arndt, C. &Cirera, X. 2007.Distortion to agricultural incentives in Mozambique.*Working Paper No. 54*. Maputo, Mozambique.

Akibode, S. &Maredia, M. 2011. Global and regional trends in production: Trade and consumption of food legume crops. Department of Agricultural Resources economic.Michigan State University.

Barrett, C. B. 2008. Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy,* (33) 299-317.

Barrett, C.B.; Bachke, M.E.; Bellemare, M.F.; Michelson,H.C.; Narayanan, S. &Walker, T.F. 2011.*Smallholder participation in contract farming: Comparative evidence from five countries.*World Development.

Benfica, R.; Tschirley, D. &Boughton, D. 2006. Interlinked transactions in cash cropping economies: The determinants of farmer participation and performance in the Zambezi River Valley of Mozambique. *MINAG Research Report No. 63E*. Maputo, Mozambique.

Bias, C. & Donovan, C. 2003.Gaps and opportunity for agricultural sector development in Mozambique.*Ministry Of Agriculture and Rural Development, Directorate of Economy, Research Report No. 54E*. Maputo, Mozambique.

Boughton, D.; Mather, D.; Barrett, C.B.; Benefica, R.; Danilo, A.; Tschirley, D. &Cunguara, B. 2007. Market Participation by Rural Households in a Low-IncomeCountry: An Asset Based Approach Applied to Mozambique*. Faith and Economics*, 50: 64-101.

Cachomba, I. & Donovan, C. 2012*. Pulse in Mozambique*. Draft report.

Christie, T. 2009. *Mozambique Economy*.

CIA (Central Intelligence Agency). 2010. *Mozambique 2010*. [Online] Available from: http://www.theodora.com/wfbcurrent/mozambique/mozambique_economy.html [Accessed 2011-05-19].

CIAT (International Centre for Tropical Agriculture). 2004. *Socio Economic Aspects of Bean Production*.

Coulibaly, O.; Alene, A.D.; Mayong, V.; Sanogo, D.; Abdoulaye, T.; Chiang, J.; Fatokun, C.; Kamara, A.; Tefera, H. &Boukar, O. 2009. *Situation and outlook for cowpea and soybean in sub Saharan Africa.*

Donovan, C. 2008. *Agricultural statistics in Mozambique: Institutional organization and performance*. US: Michigan State University.

Dorward, A.R.; Kirsten, J.F.; Omano, S.W.; Poulton, C. &Vink, N. 2009. Institutions and agricultural development challenges in Africa. In: J.F. Kristen, A.R. Dorward, C. Poulton& N. Vink (Eds.). *Institutional economic perspectives on African agricultural development*. Washington, D.C.: Michigan University Press.

ECON. 2006. *Agricultural Intensification in Mozambique: Infrastructure, policy and institutional framework*. ECON Policy Research Group, Maputo: Mozambique.

FAO (Food and Agriculture Organization). 2010. [Online] Available from: http://www.fao.org/corp/statistics/en/ [Accessed: 2011-03-04].

FEWS NET. 2011. *Informal Cross Border Food Trade In Southern Africa*. USAID.

Filipe, M. 2007. *Bean supply response for Mozambique*. Unpublished Doctoral These. Pursue University, West Lafayette, Indiana.

GFDRR (Global Facility for Disaster Reduction and Recovery). 2009. *Economic Vulnerability and Disaster Risk Assessment in Malawi and Mozambique: Measuring Economic Risks of Droughts and Floods*. GFDRR.

Harou, A. 2011.*Smallholder Market Access*.Cornell University.

Heltberg, R. & Tarp, F. 2002.Agricultural Supply Response and Poverty in Mozambique.*Food Policy*.

Heckman, J. 1979. Sample Selection Bias as a Specification Error. *Econometric*.

IIAM & UEM. 2010. *Fichas Técnicas de Culturas*. Maputo: Pátria – Serigrafia.

INE (Instituto Nacional de Estatistica). 2012*. Mozambique total population in 2008*. Maputo, Mozambique.

INE (Instituto Nacional de Estatistica), SIMA (Agricultural Market System). 2008. *Common Bean price in Mozambique in 2008*.Maputo,Mozambique: Instituto Nacional de Estatistica.

INE (Instituto Nacional de Estatistica), TIA (Mozambique agricultural household survey). 2008.*Total common bean production in Mozambique in 2008*. Maputo,Mozambique: InstitutoNacional de Estatistica.

INE (Instituto Nacional de Estatistica). 2010. *Mozambique statistic database*. [Online] Available from: www.ine.gov.mz. [Accessed: 2011-06-21].

INIA. 2000. *Potential regions suitable for cowpea production in Mozambique*. Maputo

ITC (International Trade Centre). 2009. Available from: http://www.Intracen.org

Katungi, E.; Farrow, A.; Chianu, J.; Sperling, L. & Beebe, S. 2009. *Common beans in Eastern and Southern Africa: A situation and outlook analysis*.

Kirsten, J.F.; Karaan, A.S.M. &Dorward, A.R. 2009. Introduction to the economics of institutions. In: J.F. Kristen, A.R. Dorward, C. Poulton& N. Vink (Eds.). *Institutional Economics Perspectives on African Agricultural Development*. Washington, D.C.: Michigan University Press.

Leedy, P.D. &Omrod, J.E. 2010. *Practical research: planning and design*. 9th international ed. Boston: Pearson Education.

Lopes, H. 2010. *Adoption of improved maize and common bean varieties in Mozambique*. Unpublished Master's Dissertation. Michigan State University.

Lowenberg, J.; Kambewa, P. & Filipe, M. 2003. *Trip Report to Malawi and Mozambique*, Purdue University: Department of Agricultural Economics; [Online] Available from: http://www.entm.purdue.edu/NGICA/reports/Malawi.pdf [Accessed: 2011-02-19].

Maitre, D.E.; Lemeilleu, S. & Brenabé, E. 2011. *Linking Smallholders to Efficient Markets*. Third European Forum on Rural Development, Palencia: Spain, 29 March - 1 April.

Makhura, M.N.; Kirsten, J. & Delgado, C. 2001. *Transaction cost and smallholder participation in the maize market in the Northern Province of South Africa*. Paper presented at the Seventh Eastern and Southern Africa Regional Maize Conference, 11-15 February: 463-467.

Manganhele, A.T. 2010. *Improving access for smallholder farmers in Mozambique: lesson from government efforts in developing countries of Africa and Asia.* Unpublished Master's Dissertation. Pretoria: Department of Agricultural Economic, University of Pretoria.

Manyong, V.M.; Nindi, S.J.; Ussaca, S.F.; Rwenyendela, V.J.; Gungulo, A.L.; Quinhentos, M. &Afonso, A. 2007. *Baseline Study on Enhanced Soil Management*

Practices For Improved Productivity Of Legume Systems In The Beira And Nacala Corridor In Mozambique. IITA, Mozambique.

Mather, D. 2009. *Measuring the impact of public and private assets on household crop income in rural Mozambique 2002-2005.* Ministry Of Agriculture and Rural Development, Directorate of Economy, Research Report No. 67E. Maputo, Mozambique.

Ministry of Agriculture and Fisheries. 1996. *Agro Ecological Zones and Production Systems*. Maputo, Mozambique: Ministry of Agriculture and Fisheries.

Mythili, G. 2008. *Acreage and Yield Response for major crops in the pre and post reform periods in India: A dynamic Panel data approach*. Mumbai: Indira Gandhi Institute of Development Research.

Olwande, J. &Mathenge, M. 2010. *Market Participation among Poor Rural Households in Kenya*. Nairobi:Edgerton University.

Omiti, J.; Otieno, D.; Nyanab, T. &Cullough, E. 2009.*Factors influencing the intensity of market participation by smallholder farmers: a case study of rural and peri-urban areas of Kenya*.

Ouma, E.; Jagwe, J.; Obare, A. & Abele, S. 2009. Determinants of smallholder farmers' participation in banana markets in Central Africa: the role of transaction costs*.Agricultural Economics,* 41:111–122.

Oyeyemi, G.M.; Adewara, A.A. &Adeyemi, R.A. 2010. Complex Survey Data Analysis: A Comparison of SAS, SPSS and STATA. *Asian Journal of Mathematics & Statistics*, 3: 33-39.

Pulse CPRS. 2008. Dry grain pulse collaborative research support program [Online] Availablefrom:http://pulsecrsp.msu.edu/ProjectInformation/PIMSU2MichiganStateUniversiy/tabid/106/Default.aspx [Accessed: 2010-02-10].

Rios, R.A.; Masters, A.W. & Shively, G.E. 2008. *Linkages between Market Participation and Productivity: Results from a Multi-Country Farm Household Sample*. Department of Agricultural Economics: Purdue University.

Saunders, M.; Lewis, P. &Thornhill, A. 2009. *Research methodology for business students*. 5th ed. Harlow: Pearson Education.

Savadatti, P.M. 2007. Econometric Analysis of Demand and Supply Response of Pulses in India. *Karnataka Journal of Agriculture,* 20(3):545-550.

Siziba, S.; Nyikahadzoi, K.; Diagne, A.; Fatunbi, A.O. &Adekunle, A.A. 2010. Determinants of cereal market participation by sub-Saharan Africa smallholder farmers. *Journal of Agriculture and Environmental Studies,* 2 (1):180-193.

TIA (Trabalho de Inqierito Agricola), Instituto Nacional de estatistica (INE), Maputo 2008

Walker, T.; Pitoro, R.; Tomo, A.; Sitoe, I.; Salencia, C.; Mahanzule, R.; Donovan, C. &Mazuze, F. 2006. Priority Setting for Public-Sector Agricultural Research in Mozambique with the National Agricultural Survey Data. *Research Report No. 3E*. Maputo, Mozambique: CESE -DFDTT, IIAM.

World Bank. 2010. *Country data report for Mozambique, 1996-2009*: Washington DC: World Bank.

APPENDIX A

SPATIAL PATTERNS IN PULSE PRODUCTION AND MARKETING IN MOZAMBIQUE

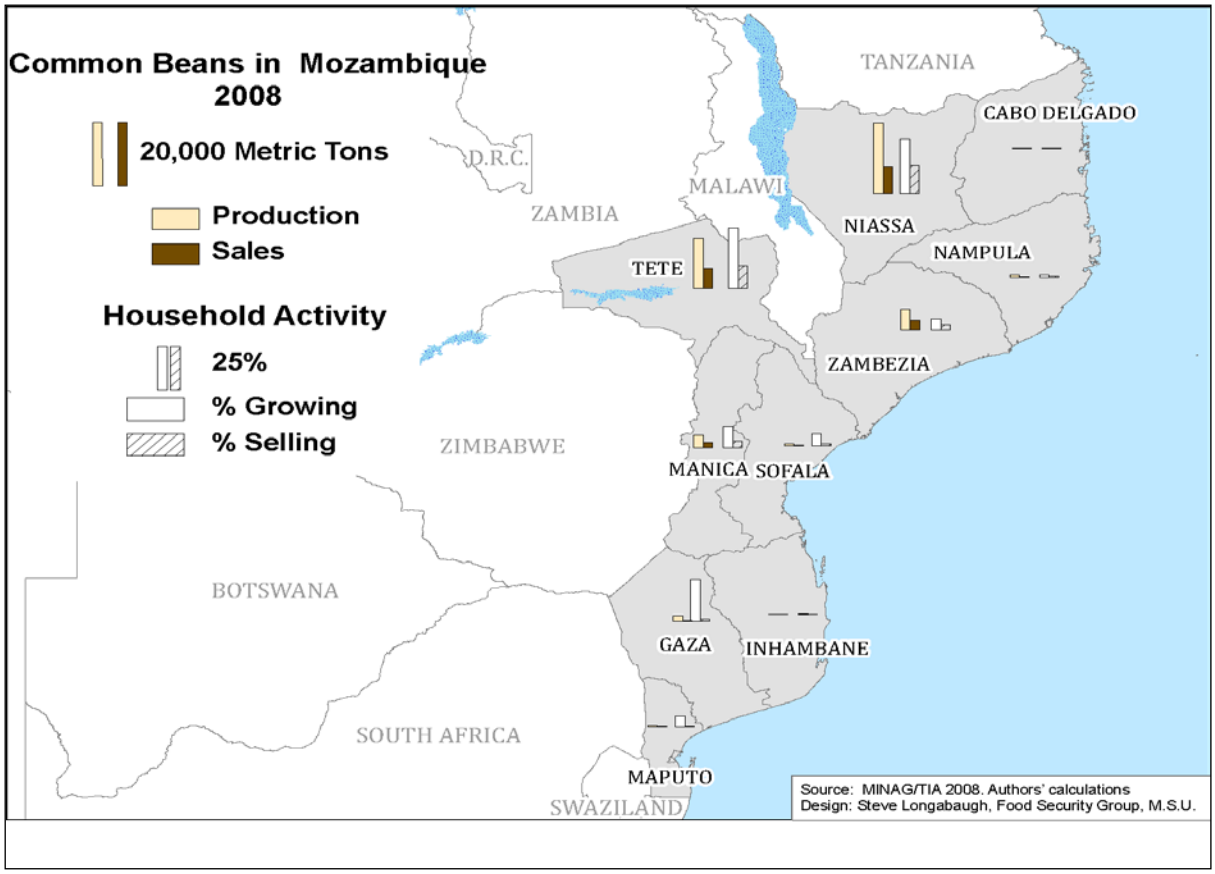

Figure A1: Spatial patterns in common-bean production and marketing in Mozambique

Source: TIA (2008)

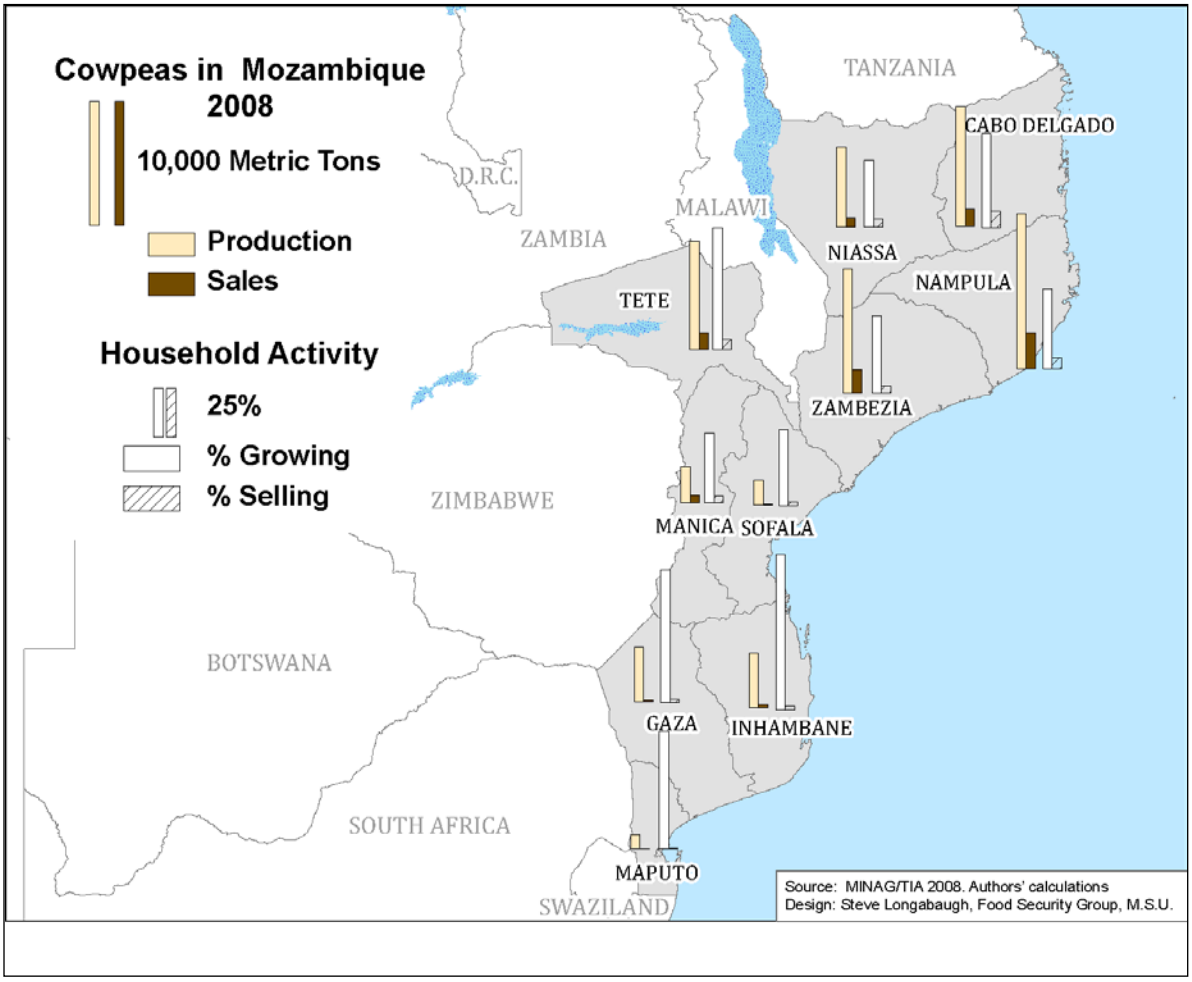

Figure A2: Spatial patterns in cowpea production and marketing in Mozambique

Source: TIA (2008)