SUPPLY CHAIN PARTICIPATION OF COWPEA PRODUCERS IN ZAMBIA

A Research Report Presented To The Department Of Agricultural Economics And Extension Education Of The University Of Zambia

By Edna Ngoma

In Partial Fulfillment Of The Requirements For The Degree Of Bachelor of Agricultural Sciences

ACKNOWLEDGEMENTS

The successful completion of this report was made possible by the contributions of various individuals and organizations. I wish to thank and acknowledge first and foremost Dr. Gelson Tembo, for his steady supervision and guidance throughout the compilation of this report. The demand for hard work and diligence he placed upon me taught me that the sky is not the limit and inculcated positive lifelong lessons that will definitely have long lasting impact. Secondly I thank my mother and the rest of my family, for the continued confidence they have had in me, and the unending financial support given to me throughout my academic life. Your contributions have simply been priceless. To all my academic peers, I salute you, for every day of hard work shared with you gave me strength to press on toward the goal. I also thank ZARI, AMIC, CSO, FEWS net, FAO and many other organizations for their support in information provision and guidance. Finally, I give thanks to the One True Everlasting God, for His grace, which has enabled me to reach this far.

I dedicate this report to my late sister, Mary Choba Ngoma. You are always in my thoughts and heart. I truly miss you. MYSRIP.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS/ABBREVIATIONS

MACO	Ministry of Agriculture and Cooperatives
CSO	Central Statistical Office
FAO	Food and Agriculture Organisation
FNDP	Fifth National Development Plan
NAP	National Agricultural Policy
CDP	Cooperative Development Policy
PART	Supply Chain Participation
FGA	Farmer Group Affiliation
ZARI	Zambia Agriculture Research Institute
USAID	United States Aid
ZDHS	Zambia Demographic Health Survey
CRSP	Collaborative Research Support Programme
ASIP	Agricultural Sector Investment Programme

ABSTRACT

SUPPLY CHAIN PARTICIPATION OF COWPEA PRODUCERS IN ZAMBIA

Edna Ngoma
UNZA, 2011.

Supervisors:
Ms. M. Mwiinga
Dr. G. Tembo

Cowpeas are an important food legume. They are drought tolerant with the potential to minimize income and yield risks, as well as meet nutritional demands. Despite these benefits, the pulse industry has offered a limited line of cowpea products. There is a dearth in information on cowpeas supply chain participation, and knowledge with regard to the determinants of the growers' participation in the cowpeas supply chains is unclear. Using data from the third Supplemental Survey to the 1999/2000 Post Harvest Survey carried out in 2008 by CSO and FSRP, this paper consolidates information on cowpea production and supply chain participation determinants in Zambia. The empirical estimation was carried out by use of the probit model.

Southern Province accounts for the highest proportion (55%) of cowpea producers, followed by Central province with a proportion of 12% of the producers. The probit results indicated that the following factors were statistically significant in determining supply chain participation; price of output ($p=0.06$), mechanization (0.00), land under cultivation(0.06), ownership of vehicular transport(0.01) and total income(0.01).

Development of appropriate, simple and cheap technologies can enhance supply chain participation, and also value addition possibilities should be explored to create new markets and raise income generated from cowpeas production. The use of improved seed varieties and production practices can be considered (as an alternative to increasing the land under cowpeas cultivation) to achieve larger outputs which ultimately affect supply chain participation positively.

CHAPTER ONE: INTRODUCTION

1.1 Background

Pulse crops are important food legumes in many parts of the world. They are a relatively inexpensive source of high-quality protein for both human and livestock consumption. They are also more drought tolerant than most other crops – being able to mature on as little as 300mm of rainfall – rendering them an effective means to minimize farmers' yield and income risks. They also have the added advantage of fixing soil nitrogen and, thus, contributing to soil improvement.

Worldwide, an estimated 3.7 million metric tons (MT) of cowpeas is produced annually on about 8.7 million hectares. About 87% of that area is in Africa, 10% in the Americas and the rest in Europe and Asia (Langyintuo et al., 2003). Zambia produced 35,000 MT during the 2003-2004 cropping season (CSO, 2004), with the Southern Province accounting for 58% of total production (PVCI-Z work plan, 2010).

Pulse-based foods have the potential to avert food and nutrition security problems, which are issues of great concern for a less developed country such as Zambia. Malnutrition for instance is particularly prevalent and the Zambia Demographic Health Survey (ZDHS) shows that the prevalence of Protein-Energy malnutrition and micronutrient deficiency problems is as follows:

Table 1 Prevalence of Protein-Energy Malnutrition and Micronutrient Deficiency Problems

Problem	Percent (%)	Year
Under weight	28	2002
Stunting	45.4	2007
Iron deficiency anaemia:		
-children under 5	66.5	1998
-women reproductive age	26	1998
Vitamin A deficiency	66.5	1997

Source: CSO, 2006.

Apart from the food and nutrition security issues, agriculture in itself is a risky business venture accompanied by the possibility of production, price, or essentially income risks. It is expected then that the industry and market for important crops such as cowpeas, which are able to curb malnutrition problems and reduce yield risk (due to their agronomic attributes), should have well established supply and/or value chains in which its farmers fully participate.

Value/supply chains of agricultural commodities are a key concept in development, addressing issues of nutrition and economic empowerment both at farm level and for many other stakeholders. In line with this, development policy agendas have over the years indicated increasing consideration over the influences that social and institutional factors, cultures and many other socio-economic aspects, may have on value chain development and benefit distribution. For instance horizontal alliances facilitate farmer group action and have the potential to greatly reduce marketing costs faced within supply chains. Therefore cooperative development and enhancement is commonly considered in policy reforms as a means of providing a conducive institutional environment that facilitates trade. Social factors such as gender have frequently been observed to affect

benefit distribution. Men carry out most of the product marketing activities (Lubbock, 2009) and consequently have control over the returns generated. Therefore it is vital that these crosscutting issues linked to value chain development and participation are considered in value chain-related interventions in order to facilitate the development of inclusive value chains that benefit both women and men.

1.2 Problem Statement

The Zambian food industry has offered a very limited line of processed cowpea products, in spite of the crop's potential to meet the high nutritional demands, as well as reduce income/yield risk. A few product lines already on the market include meal products, products from a recently developed canning industry and livestock feed mixtures, but most commonly, cowpeas are sold in their raw form. This identified the need to understand the supply chain and factors influencing its stakeholder's participation.

There is a dearth in knowledge with regard to the influence of farm and farmer characteristics on cowpea growers' participation in the crop's supply chains. Notable local studies undertaken on cowpeas, mostly by public institutions such as the Zambia Agriculture Research Institute (ZARI), are mainly agronomic with the goal to improve production practices and efficiency (Munyinda, 2000; 2003; 2008). In these studies, seed variety development and improvements were carried out through seed gene mutations and other techniques. Other efforts involve the development of new and/or improved farming practices. Thus as much as there is reasonably rich agronomic information on cowpeas, there is a serious dearth of information on post-production chain activities. International research as well, has neglected to look at the interplay between farmer characteristics, such as gender, and cowpeas market participation. To a great extent, such demographic factors are merely used to describe the characteristics of survey participants or the population, without further investigating the significant influence these factors may have on pulse producer supply chain participation (Faye 2006, Langyintuo 2005;2006). Langyintuo et.al, (2003 and 2004) focused on examining the effects of cowpea grain characteristics on prices, and consumer preferences as regards cowpea cultivars. In as much as the results of these studies were essential in promoting trade and the

development of varieties with the characteristics suited for the market preferences, the knowledge gap on pulse producer supply chain participation was still not filled.

Further research efforts on cowpeas, involved detailed entomological studies as well as creation and dissemination of post harvest technologies, aimed at improving the management of post-harvest insect pests (Murdock et al., 2003). Similar to local research, international research has also dedicated the bulk of their studies towards cowpea cultivar and germplasm development under the Bean/Cowpea Collaborative Research Support Programme (CRSP) (Beaver 2003, Hall 2003, and Kelly 2003).

There is dearth in information on cowpeas supply chain participation, and knowledge with regard to the determinants of the growers' participation in the cowpeas supply chains is unclear.

1.3 Objectives

1.3.1 General Objectives

The overall objective of the study was to determine the supply chain participation levels of cowpea producers and the determinants of this participation.

1.3.2 Specific Objectives

Specifically the study aimed to:

i. Determine the demographic characteristics of cowpea producers and sellers
ii. Identify the role of these demographics on participation of producers in the cowpea supply chains
iii. Determine the influence of ownership of assets on cowpeas supply chain participation
iv. Discover the influence of horizontal alliances or farmer group affiliation on cowpeas supply chain participation

1.4 Rationale

It was necessary to undertake this study to establish if there is a sufficient level of farmer participation in the cowpeas supply chain. It was also vital that the factors affecting farmers' decision to engage in the supply chain be established, so that appropriate recommendations may be made; beneficial policies possibly created, as well as existing policies altered, on the basis of the new knowledge to be acquired from this study. For one of the elements contributing to malnutrition prevalence in Zambia, is the sustenance of past government policies that overemphasize the production of hybrid maize at the expense of more traditional crops such as common beans, cowpeas, millet, cassava and sorghum (FAO, 2000).

Essentially therefore, the results of this study will contribute to, and build on the existing body of knowledge (on the pulse market) which currently has many ailing aspects. According to Van der Laan (1999), in Africa information on pulse marketing and trade is lacking and data on pulse production economics scattered. Particularly for Zambia, information on maize is more abundant compared to other crops such as cowpeas. Increased insight into the benefits of pulse production and marketing may lead to a wider creation and adoption of pulse-based and fortified foods in Zambia, and more so enhanced consumer health due to their balance of nutrients, which according to Phillips et al.,2003, include protein, B vitamins, fiber, etc, and a low glycemic index. Starchy legumes are almost unique in this combination of properties. Increased consumption will of course lead to increased production, distribution, and sales, benefiting the entire value-chain.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter defines the underlying key terms and reviews the institutional and policy setup surrounding the pulse industry; generally giving a picture of how the agricultural sector has evolved overtime, and the opportunities that these policy and institutional reforms pose for pulse marketing. A discussion on the conceptual framework is then presented, in which the underlying theories on market participation and/or the farmers decision making processes are highlighted, putting the supply chain and supply chain participant relationships in perspective. Finally, the foregoing leads to an elaboration of the known findings on supply chain participation issues, in which empirical evidence on market participation determinants will be given.

2.2 Definition of terminologies

Supply chains are an important aspect of the marketing process. A supply chain is a system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer (Slovick, 2006). Supply chain activities transform natural resources, raw materials, primary products and components into a finished product that is delivered to the end customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. Supply chains link value chains. The value chain is a systematic approach to examining the development of competitive advantage. It was created by M. E. Porter in his book, Competitive Advantage (1980). The chain consists of a series of activities that create and build value. They culminate in the total value delivered by an organisation.

The Zambia Ministry of Agriculture and Cooperatives (MACO) has identified two basic marketing or supply chains (MACO, 2004). First is the farmer-to-trader-to-consumer chain, in which the trader may travel to the farm, or farmer may travel to town. The second is farmer-to-consumer, in which the consumer may travel to the farm or the

farmer may travel to town. It was expected that in the actual markets, the marketing channels may be much more complicated, and may include processors, and traders that are also retailers, wholesalers and/or other marketing agents.

Household food security is defined as the access by all households at all times to sufficient food for an active and healthy life of all its members (FAO,2000), while nutrition security on the other hand is ensuring access to food that is nutritious as well as sufficient.

2.3 Institutional and Policy framework

Prior to 1990, Zambia's agricultural policies were restrictive and distortionary. This was due to the heavy government participation and intervention in the agricultural sector, as well as the dominance of maize, neglecting the more traditional crops such as the pulses. These policies did not enhance private sector participation in the marketing and processing of agricultural commodities (FNDP, 2006-10), and consequently failed to stimulate sustainable agricultural development. After 1991, many policy reforms focused on the liberalization of the agricultural sector and promotion of private sector market participation, not just in the production, but in the marketing and processing activities as well. One of the programmes implemented to enable this was the agriculture Sector Investment Programme (ASIP). Despite all this, the performance of the Agricultural sector still did not match expectations.

In present day policy reforms, beans among other drought tolerant crops, has been encouraged and targeted for increased production and productivity (FNDP, 2006-2010). This can be attributed to the growing awareness among policy formulators over the benefits of pulse based foods, and their potential to meet food and nutrition security requirements. This creates an opportunity for pulse producers to take advantage of these policy resolves, and transform pulse production into a more sustainable and viable enterprise. In addition, current institutional reforms have continued to aim at facilitating private sector led agricultural markets, coupled with the promotion of horizontal alliances or agriculture co-operatives through which socio-economic development programmes can

be delivered, particularly to the small scale producers in the rural sector. The Co-operative Development policy (CDP) facilitates the provision of an enabling institutional and legal environment for the development of autonomous and viable demand driven co-operatives (NAP, 2004-2015). This is another window of opportunity that pulse producers may take advantage of: membership into these co-operatives may enable them have access to sustainable demand driven markets, as well as obtain market information essential for trade.

For pulse trade to occur viably, it is critical that the pulse industry is well established even at production level. Efforts are needed to ensure sufficient levels of production and productivity are reached. The largest share of soils and crop research in Zambia is conducted by the public sector through the Soils and Crops Research Branch of the Ministry of Agriculture and Cooperatives (MACO, 2010). It focuses its' research activities on long term research on the more traditional crops, beans and cowpeas inclusive, which the private sector considers uneconomical but are vital to agricultural development. ZARI also has embarked on many long term researches involving seed development of these crops. This is in line with the policy reform of the Fifth National Development Plan (FNDP) of increasing productivity and production of the more drought tolerant crops. In addition to this, the Seed Control and Certification Institute (SCCI) exists to ensure seed quality control and monitors seed trade, providing coordination of the sector. Pulse producers therefore, are able to acquire good quality seed varieties, and coordinated efforts from the various institutions and aforementioned accompanying policies will ensure the pulse industry is productive even from production level.

The policy and institutional environment is reasonably favorable for pulse production and trade, with particular efforts aimed at its enhancement. It is imperative that pulse producers know the ways they can exploit these prevailing conditions to their advantage, thereby enhance their supply chain participation, and meet food and nutrition security requirements at the same time.

2.3 Conceptual Framework

Market participation is a consequence as much as a cause of development. Households choose to specialize in the production of those goods in which they are relatively skilled – i.e., hold comparative or even absolute advantage – consuming some portion and trading the surplus for other goods and services it desires but for which it holds no comparative or absolute advantage in production. That is, households seek to maximize utility through the consumption of various agricultural commodities, for which it may produce some to consume, or trade in order to obtain those it cannot produce. Therefore farm households may engage in a supplier side type of market participation, by selling of surplus that remains after consumption. But also, they may choose to participate on the demand side, in which case they would largely purchase commodities that they cannot produce. Barret (2008) used what he called a stylized model, in which different consumption requirements are accounted for and restricted within a set c_i, constituting the various food commodities which farmers produce themselves. That is, farm households seek to maximize utility by consuming a combination of commodities that yield the most utility, and each farmer is taken to be both a consumer and a producer of some of the commodities in c_i. Producers are sellers and/or buyers of the commodities they produce, and supply side participation only occurs when net sales, NS^c, are greater than one.

An alternative view of utility-based market participation is that farm households make a decision to participate in particular markets when the utility derived from returns earned from participating in one market, is greater than that derived from returns realized due to allocating resources to an alternative enterprise. However, the features that lead to utility maximization, and induce market participation, such as the welfare gains that result from choosing market-oriented production and exchange, emerge not just from welfare effects of trade (according to comparative advantage), but also even more from the opportunities that emerge from larger- scale production and dynamic technological change effects associated with increased flow of ideas due to regular trade-based interactions. In this framework, incentives to trade result from many different aspects. That is, just "getting prices right" is unlikely to induce market participation; rather, farm households must also

have access to productive technologies and adequate private and public goods in order to produce a marketable surplus. Lapar (2003) took up this approach to investigate market participation and supply decisions, which lent itself to the traditional probit and tobit estimation. The decision rule was to participate when the utility,$u(x_i)$, derived from returns realized from investing in one enterprise was greater than the utility,$v(x_i)$, derived from returns realized from investing in an alternative enterprise, using the same resources.

Another proposition is that market participation patterns vary from one farm household to another, and it is largely affected by both farm and farmer characteristics. These may have a direct effect on smallholder market participation, with characteristics such as value of earnings, farm size, other household specific characteristics and net sales volumes impacting participation either positively or negatively (Omamo, 1998; Key et al., 2000; Renkow et al., 2004),

Market participation may also be linked to institutional structures and organizational factors, such as co-operatives and other forms of farmer marketing groups or horizontal alliances, and their integration and accessibility to existing markets. Affiliation to such institutional and organizational settings may play a key role in enhancing market participation. Alene (2008) employed this approach, in which he used a probit analysis to model maize producer market participation and supply, given the various determinants of transaction costs and market accessibility as well as household specific characteristics

In another view, taxation, policy uncertainty and administrative issues may be inevitably linked to smallholder participation in certain markets, especially with regard to high value enterprises. The existence of one or more of these aspects in a particular industry may very well determine farm household market participation. Administrative issues have been raised as a major impediment to trade (Young et al., 2000; Tisdell et al., 2001) with much of the constraints arising from the lengthy and costly processes of administration. Also, frequent agricultural policy changes influenced by political biases, as much as may be ignored, may act as a key determinant in market participation

decisions. Taxation also affects producer willingness to participate in markets. Bjornlund, (2003) in his study adopted this approach, in which he used a tobit model to investigate to what extent taxation, policy uncertainty and administrative issues affects smallholder participation in the water markets.

This study adopted the proposition that market participation is largely affected by a producer's socio-economic as well as production characteristics, such as household composition and size, income, age, farmer group association, ownership of production assets and so on. As noted by Renkow et.al (2004), these variables have a more direct effect on supply chain participation. Their nature also renders them easily observable and measureable, ensuring accuracy in the attribution of causality. On the other hand, factors such as administrative or taxation issues may have indirect effects on market participation, in which other economic variables first have to be affected before the influence on market participation is realized. Consequently, more complex frameworks are required to capture these intermediary effects and to model the market participation phenomenon.

2.4 Known findings on Supply Chain Participation

Interventions aimed at facilitating smallholder organization, reducing the transaction costs, and improving poorer households' access to improved technologies and productive assets are central to stimulating smallholder market participation and elimination of the semi-subsistence poverty traps. These productive assets may include land, farming equipment and improved seed varieties. Other assets that may pose an incentive to trade include on-farm transport equipment and storage technology, with labour also being a critical factor in producing a marketable surplus.

Institutional innovations—such as group marketing associations and cooperatives—are emerging to mitigate the costs of accessing markets. Farmers' affiliation to such settings increases their accessibility to market information, as well as input and output markets, increasing the probability of market participation. On the other hand, output price has no effect on output market entry and only provides incentives for increased supply by

sellers. In addition, both price and non-price factors have significant influence on adoption and intensity of input use. Macroeconomic and trade policy tools as well appear less useful in inducing market participation by poor smallholders. Aside from this, producer and market proximity is critical in facilitating market participation. Most producers along the line of rail, and therefore closer to markets are more likely to engage in, and gain from trade.

Household specific characteristics in many instances have proved to be significant determinants of market participation as well. With regard to gender, female-headed households have a greater likelihood of participating in output markets than male-headed households, and in addition to this, age as well has significant effects on the willingness to trade. Market participation declines with age, indicating that characteristics of older farmers such as that of risk aversion and reluctance to adopt technology renders their inability to produce for the market and to trade at lower costs. Other aspects such as higher educational attainment may imply reduced search costs, due a producer's ability to find relevant market information and translate it, such as which markets are more suitable to trade in and so on.

Empirical evidence consolidates these issues, and the following studies show how certain variables affect transaction costs and essentially market participation; Alene et al.,(2008) in their study on staple food grains discovered that ownership of transport equipment by farm households has a positive and highly significant effect on market participation, for it reduces transaction costs by reducing transport cost and facilitates product transportation or delivery . In the same study, output supply and market participation declined with distance to product markets; the results showed that farmers located far from the maize markets supplied 73% less maize than farmers living closer to these markets. Group marketing as well had a positive and significant impact on marketed supply. Market participants who belonged to the Maize Marketing Movement supplied 56% more maize than participants who do not belong to the group.

Another study by Barret (2008) with focus on staple food grains again, indicated that there are strong associations between households' asset holdings, especially land, and

household-level market participation patterns. Farm households with the least land endowment (and other productive agricultural assets) were almost always gross purchasers in the market, but the probability of making gross purchases declined steadily as a household's land holdings increased. Conversely, the likelihood that a farm household registered any gross sales was very low – less than 20% –for farm households less endowed with land, but rose steadily, such that the best endowed of farmers exhibited a probability greater than 50% of selling to markets. Increased farmer participation was observed, with increases in labour, that is participation was noticed for farm households that employed a relatively large work force. In the same study, it was discovered that transactions costs associated with weak institutional and physical infrastructure are substantial and appear to distort production and marketing behaviors significantly, nullifying the effects of price policy and causing significant marketing and production inefficiency

Lapar et al, (2008) in their study of the livestock industry observed that average male headed households were 10% less likely to participate in trade than a female-headed household, also, a 1% increase in the number of adults increased the probability of market participation by 11%.

In as much as most of these researches that have been carried out have made critical contributions to the body of knowledge, the bulk of these studies on market or supply chain participation have largely focused on high value enterprises (such as horticulture and livestock) as well as staple food grains. Therefore there still existed a dearth in knowledge specifically on producer characteristics that determine supply chain participation for more traditional enterprises such as cowpeas.

As for the studies carried out on cowpeas in particular, included were those done by Langyintuo et al.,(2003) in which they investigated exogenous factors that constrained cowpea trade. It was discovered that among other factors exogenous to the farmer, tariffs, taxes and fees constrained trade. Another study by Fang et al. (2007) showed that improvements in productivity of small-holder agriculture are key components of reducing both rural and urban poverty in sub-Saharan Africa. In West Africa, cowpea yields are

very low, averaging about 250 kg/ha, or about one tenth of the biological yield potential, and five times less than yields commonly achieved in on-station and well managed on-farm trials. Most losses in yield potential were due to insect pests, but drought and poor soil fertility are also important. Low yields distort supply chain participation. And this study particularly focused on the efforts made to improve productivity (such as identification of new sources of genetic resource that build insect/pest resistance).

Two studies carried out, one by Wagner and Miles (2006) and Nelson (2007), showed that adoption of new Bean/Cowpea CRSP varieties was low in Malawi, primarily due to a lack of seed multiplication and dissemination systems. Farmers relied on farm produced grain purchased from local markets. As a result, farmers continued to use unimproved varieties that resulted in low production levels, and the production and consumption of new Bean/Cowpea CRSP cowpea varieties was limited. This limited production and affected supply of cowpeas to markets.

As much as results from these studies contributed to smoothing out supply and enhancing supply chain participation, a dearth in knowledge still existed. That is, these studies on cow peas focused on supply chain participation determinants that are external (exogenous) to the farmer such as output prices. Also much of this research dwelt on productivity issues, involving creation of new and improved pulse varieties, assessment of their adoption rates, adoption of preservation techniques and/or technology, and entomological research aimed at mitigating pest damage on cowpeas. Little was done to discover and model the relationship between demographic factors and market participation. Therefore, a gap in knowledge on the socio-economic factors that determine market participation was still left unfilled.

CHAPTER 3: METHODS AND PROCEDURES

3.1 Introduction

This chapter begins with a discussion on the probit, which was the model used to estimate the results of this study and further on gives a discussion on the expected effects of the identified variables on supply chain participation. An elaboration on the data sources, study area and tools used for data analysis such as STATA, excel and PowerPoint will also be given. The chapter will end with a discussion of the limitations faced during this research study.

3.2 The Probit Model

We use the probit model to represent and estimate the smallholder market participation decisions. Economic literature reveals that the probit model is an appropriate estimation method developed for the investigation of the effects of explanatory variables on dichotomous dependent variables (Amemiya, 1981). The term probit and its probability unit were coined by Chester Bliss in the 1930s. The probit model is a popular specification for a binary link function. The model avoids negative dependent variables and assumes non-linear effects of the explanatory variables. Therefore, the model discriminates better near median potency (i.e. probability of response) and is more appropriate when the binary dependent variable is assumed to represent a normal distribution. This model is a popular specification of a generalized linear model, using the probit link function (or a latent variable).

Probability models such as the probit bound the probability of success to between 0 and 1 while forcing the disturbance term to be homoscedastic (Silwana and Lucas, 2001). Other than being able to determine the probabilities of the farmer participating in the supply chain, these models enable the assessment of the effects of changes of given farm and farmer attributes on participation probabilities.

The underlying model (probit) takes the following form;

$$Y_i^* = \alpha + \beta_1 X_i + e_i \,, \qquad (1)$$

with the realizations that $Y_i = 0$ if $Y_i^* \leq 0$, and $Y_i = 1$ if $Y_i^* > 0$. It follows that Prob($Y_i = 1$) = P ($Y_i^* > 0$) = Prob($\alpha + \beta_1 X_i + e_i > 0$).

The binary decision generates a non-linear response, which violates the assumption of linearity in a standard linear regression model. Hence a probability model based on a cumulative distribution function (CDF) is used, which displays a sigmoid relationship $F(Y^*)$. Via the CDF, Y^* is merely being mapped on the appropriate scale, leading to the probability of event occurrence. The marginal effect of any variable depends on the value of the probability density function, $f(Y^*)$, which in turn depends on the values of each of the explanatory variables. To obtain these marginal effects, the Y^* for the mean values of the explanatory variables are first calculated, then $f(Y^*)$, and finally $f(Y^*)\beta_i$ to obtain the marginal effect of x_i (Dougherty,2002).

The relevant variables, on which supply chain participation was regressed included social and economic factors. The variables hypothesized to explain supply chain participation identified based on the theoretical framework and on past empirical work include gender, household size, education level, age, value of earnings (income), farm size, marital status, horizontal alliance/ farmer group affiliation, price, mechanisation (ownership of production equipment/machinery), and transport (ownership of vehicular transport).

Just as literature revealed, both sociological and economic factors were expected to largely affect the probability of a producer's market participation. This was also in accordance with the study carried out by Shaikh (2002) in which he concluded that personal characteristics reflect a farmers' ability to understand farm technologies, and other market dynamics in the economy. In this research study, both of these major factors were considered in the development of the model.

The sociological factors encompassed the following characteristics of the farmer; age, level of education, number of family members (household size), sex of the farmer and

marital status. Market participation is expected to increase as the producer's age increases, and decline as it increases further (that is above 60years). Older producers are more risk averse, and may be reluctant to venture into the marketing channels which may be associated with income risks for instance (Langyintuo, 2003). On the other hand, a farmer who is younger will be more energetic in terms of farming thus will produce enough to sell to the market.

The level of education of the farmer was also expected to have an effect on the farmer's market participation. Producers with higher educational attainments are likely to have more knowledge of the economic and nutritional benefits of cowpeas, and also make more efforts in attaining information on the incentives of supply chain participation. This makes them have better understanding of market information and other cross cutting issues, and thereby reducing search costs. This ultimately enables them to make decisions that take advantage of the beneficial conditions that the market information reveals.

A large household size which is highly characteristic in the country side (rural farming sector), renders cheap family labour to a farmer, enabling production to occur at lower cost. This entails an incentive for the farmer to trade, for trade will be profitable if it occurs due to reduced production costs made possible by the available family labour. Therefore a larger household was expected to more likely participate in the supply chain.

Women undertake most of the agricultural production responsibilities, while men perform much of the marketing of this output produced (Lubbock, 2009). Therefore with regard to gender, it was expected that participation in the cowpeas supply chain (which is at the marketing stage) will be largely dominated by males. As for marital status, farmers who are married are more likely to sell their crop than those who aren't. There is a greater focus on income generation in a home with married people than one with single (unmarried) individuals, as marriage inevitably bestows the responsibility of looking after one partner by the other (as well as children if any), hence the need for income from trade. In addition, shared ideas and efforts within a couple may result in better decisions concerning income generation alternatives.

The economic factors encompassed the following characteristics: land under cultivation, price of output, level of mechanisation, ownership of vehicular transport, value of earnings/income and horizontal alliance affiliation/membership. The value of income that was considered in this study was from earnings that were apart from cowpea sales. Higher earnings enable the producer to cover the cost of transacting more effectively and to participate in markets. It also enables the farmer to make more investments into production of cowpeas, thereby increasing the quantities produced and ultimately resulting into the production and sale of a marketable surplus.

The price of a given output provides a strong and positive incentive/influence on market participation. Higher prices entail a higher pay-off for the farmer, or higher profits, given that costs are not equally increasing. And a higher profit, for a profit maximizing farmer, is an intended goal. As for the land under cultivation, larger areas of land allocated to cowpeas allow for increased production. An increased output of cowpeas provides an incentive for the farmer to sell his/her crop, as the enlarged quantities produced provide a marketable surplus or excess crop which could be sold.

Membership into cooperatives, or other farmer groups facilitates for easier access to market information, inputs and in some instances, product marketing. Therefore it was expected that farmers who were affiliated to such horizontal alliances were more likely participate in the cowpeas supply chain.

As for mechanistaion, it increases the farmer's capacity or productivity per given hectare. This increases the yields realized from production and quantities which could be enough to take on the market. Ownership of vehicular transportation enables farmers to easily access markets, and deliver the output produced. Both mechanization and ownership of transport equipment were expected to affect cowpeas supply chain participation positively.

3.3 Study Area and Sources of Data

This study use secondary data from the third supplemental survey to the 1999/2000 post-harvest survey (for small and medium scale holdings) conducted by the Central Statistical Office (CSO) in 2008, with the financial and technical support from the Food Security Research Project (FSRP). The survey captured 8094 producers dispersed in all the nine provinces, of which 209 grew cowpeas in the 2006/07 agricultural season. In addition, supplementary information was also collected (which included background information and historical trends on cowpea trade and production, information on existing supply chains, processing industries and journals or research reports on related cowpea studies) from sources such as government offices (Ministry of Agriculture and Cooperatives, Ministry of Commerce and Trade, etc.); and industry supporters (*i.e.*, NGOs such as FEWS NET, World Vision, FAO) and others, such as USAID country mission.

3.4 Data Analysis

The data analysis was done in various stages. Firstly, a check or inspection of the survey data was carried out to ensure that all the variables identified from literature as relevant in determining supply chain participation were contained within the survey data set, and their file locations also noted. Appropriate proxies were then selected to represent those variables not contained within the data set (in their exact form). For instance, farmer membership to a local agricultural radio station was the proxy for membership to horizontal alliances. This is critical for it ensures that no relevant variables are omitted, or irrelevant variables included in the specification and estimation of the modeled relationship. With the use of STATA, the data collected from new households or household members that joined the sample was appended to the data collected from the panel households, which were already included in earlier surveys. The data which was at member level was then collapsed to household level to create a household level file. The earlier noted variables located in the various files, were then merged, and saved in a single file in order to create one final operative data file. Before the probit analysis, a linear regression was first carried out for the purposes of carrying out multicollinearity, model specification and heteroscedasticity tests. The residuals were found to be

heteroskedastic, therefore robust standard errors were used in the probit analysis. However there was no detection of multicollinearity or model misspecification.

The probit analysis was run based on the variables within the final operative data file, in which the regressors were regressed on the dependant variable (that is cowpea supply chain participation) after which the marginal effects of the regressors were calculated. The probit model results and descriptive statistics were expressed in form of tables, frequencies, charts and graphs- which were formulated with the use of Excel and PowerPoint. All the information included in these graphs, tables and pie charts was derived from the analysis of the data from the third supplemental survey to the 1999/2000 post harvest survey conducted in 2008.

3.5 Limitation of the Study

A few challenges were encountered in this study, and they stemmed from the data set used to carry out the analysis. Firstly, a few observations under the price variable were missing. However, attempts were made to apply some corrective measures through appropriate computations, that is, by determining the median price, and applying this price to the households that had missing observations for price.

Secondly, identifying the appropriate proxy for farmer group association proved to be a challenge considering the available alternatives within the data set. However, membership into a local agricultural oriented media station was selected as a sufficient proxy, for it implied this organisation facilitated easy access to agricultural information- which is a significant characteristic in horizontal alliances or farmer groups.

CHAPTER FOUR: STUDY FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents a discussion on the study findings. It begins with the presentation of the demographic characteristics, in which the social economic factors were considered and compared between the supply chain participants and the non-participants. The Probit model estimates or results (in form of the variables determined to be significant and the marginal probability effects of these variables) are also presented with a discussion on them.

4.2 Demographic Characteristics

The demographic factors presented in Table 2 below only included continuous variables. The demographics that were discrete, or were transformed into discrete factors are presented independently and are also discussed later in the chapter.

Table 2 Socio-economic Characteristics of Cowpea Producing Households

	Supply Chain Participation			
	Yes (N=43)		No (N=166)	
Characteristics	**mean**	**std dev**	**mean**	**std dev**
Age	48	13	51	15
Total income	300,000	743,632	686,404	2,009,205
Hactares	0.3	0.2	0.3	0.3
Distance	2.5	7	0	0
Total HH size	8	3	9	5
Price	11700	4460		

Source: survey data, 2008.

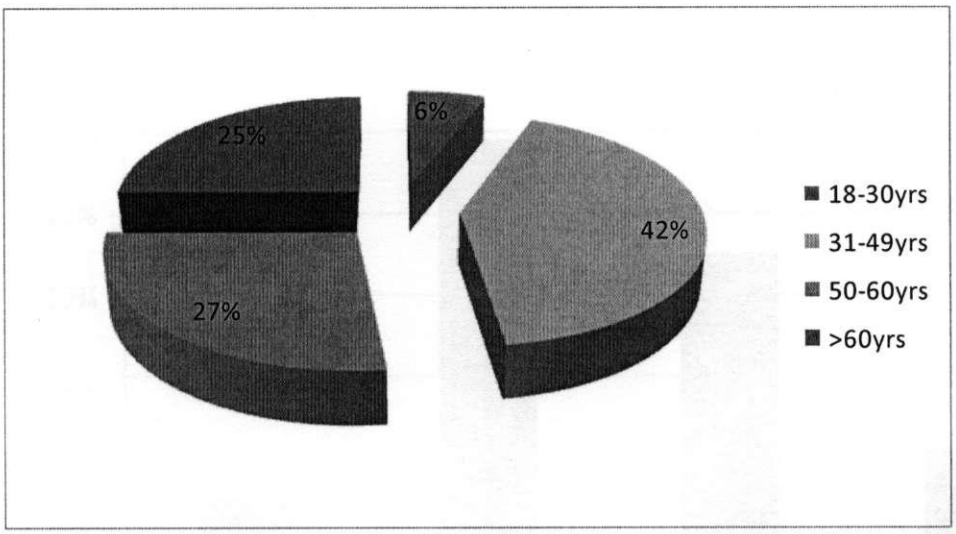
As can be seen, those who participate in cowpeas selling on average earn even lower incomes than those who do not, recording an average total income of K300,000, compared to the non participants who earn K690,000, which is about twice as much as

those who sell cowpeas. It was discovered that cowpea producers tend to engage more of their time and resources in selling other crops that they grow, such as maize and beans (that have a ready market) as their income increases. That is, increased income enables them meet marketing costs more effectively, and they substitute selling cowpeas for selling other crops with an already established market. In addition, it can be noted that those who do sell their cowpeas, offer their crop to markets or areas that are close to their homesteads, covering an average distance of 2.5km. Considering their low income, this was expected as their minimal resources may not enable them to cover marketing costs such as the costs of transporting their produce. However, about the same area under cultivation, 0.3 hactares is allocated to cowpeas production for both participants and non-participants of the supply chain.

On average, relatively large households (with about 9 members) constitute the household size for both market and non-markets participants. The crop is a cheap source of high quality protein, enabling households with many members, which are mainly resource poor, to have easy access to nutritious foods. Large households grow this crop for it easily (at a lower cost) meets the nutritional needs or demands of a large family.

A further look at the distribution of cowpea producers by their age group, as presented in Figure1 indicates that the majority of cowpeas producers (42%) fell between the ages 31 and 49 years.

Figure 1 Distribution by Age Group

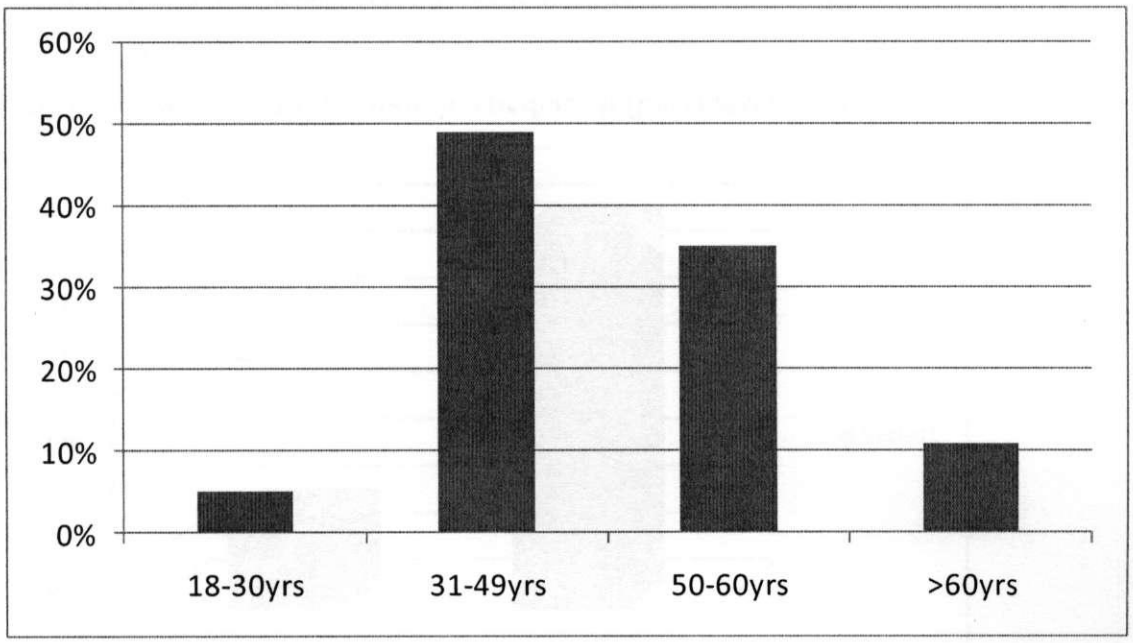


Source: survey data, 2008.

4.3 Supply Chain Participation by Age Group

Similarly, the participation levels with regard to the age group, as presented in Figure 2, showed that the majority of cowpea sellers (50%) also ranged between the ages 31 and 49 years followed by those between 50 and 60 years, with the proportion of participation of about 35%. This may have an implication with regard to targeting of efforts or interventions aimed at improving cowpeas supply chain participation. This means that cowpea sellers in these age groups should mostly be considered if any strategies to improve cowpea marketing were formulated, as they account for the majority of the suppliers.

Figure 2 Participation by Age group



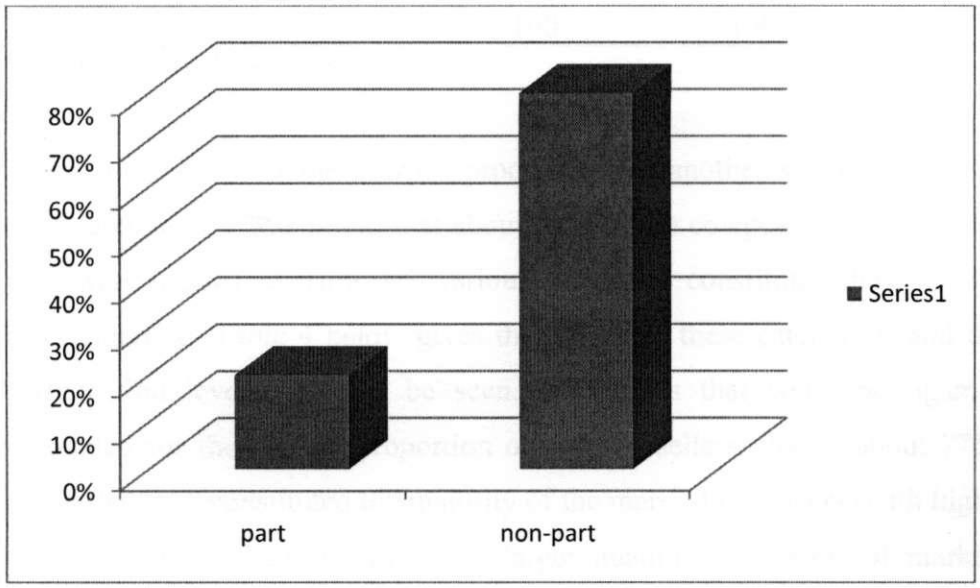
Source: survey data, 2008.

4.4 Supply Chain Participation Levels

With regard to the supply chain participation levels alone, as shown in Figure 3, it was found that of all the cowpea producers considered in this study, only 20% participated in the cowpeas supply chain, or sold their produce. Whilst 80% of the producers did not sell the cowpeas they produced. This clearly indicates the low levels of supply chain participation that exists among cowpea producers. Similar studies carried out in West Africa found that some of the reasons for this low participation included; lack of markets for cowpeas, little or no value addition with regard to pulse based foods, therefore incomes generated from cowpea sales was too low, and lastly consumer preference factors such as taste and cooking alternatives rendered cowpeas unpopular (Mahamane,2008 and Payne,2006). Some of these reasons may be extended to the Zambian scenario as well, for information from key informants indicated that there are no formal records of existing viable markets that trade in cowpeas (AMIC, 2010) and there

is only one company that has attempted to add value to the pulses (by canning the product), of which cowpeas has not really been considered (Fresh Pikt, 2010).

Figure 3 Cowpeas Supply chain participation (part) level



Source: survey data, 2008.

4.5 Supply Chain Participation by Gender and Marital Status

With respect to social factors such as gender, cowpeas supply chain participation is male dominated, as shown in Table 3. This finding was expected as much of the crop is mainly grown by male headed households. About 88% of the cowpea traders are males whilst only 11.6% are females. Most commonly, product marketing is carried out by males (Lubbock, 2009). Not much variation was observed however, between the male participants and non-participants, with proportions of participation of about 88% and 80% respectively.

Table 3 Participation by Gender

	Supply Chain Participation		
	No	**Yes**	**Total**
Male	79	88.4	169
Female	21	11.6	40
Total	100	100	209

Source: survey data, 2008

The marital status of the cowpea producers was another social characteristic that was considered, and it was found that about 81% of the cowpea producers were married and 19% were unmarried. However various categories constituted those who were married and unmarried, Table 4 below gives the details of these categories, and their respective participation levels. As can be seen, individuals that were monogamously married accounted for the highest proportion of cowpea sellers, that is about 77%. It was also found that they constituted the majority of the married producers (with higher volumes of cowpea output), therefore they had larger quantities in terms of marketable surplus. Similarly, the monogamously married again were the majority (about 58%) in the category of non participants.

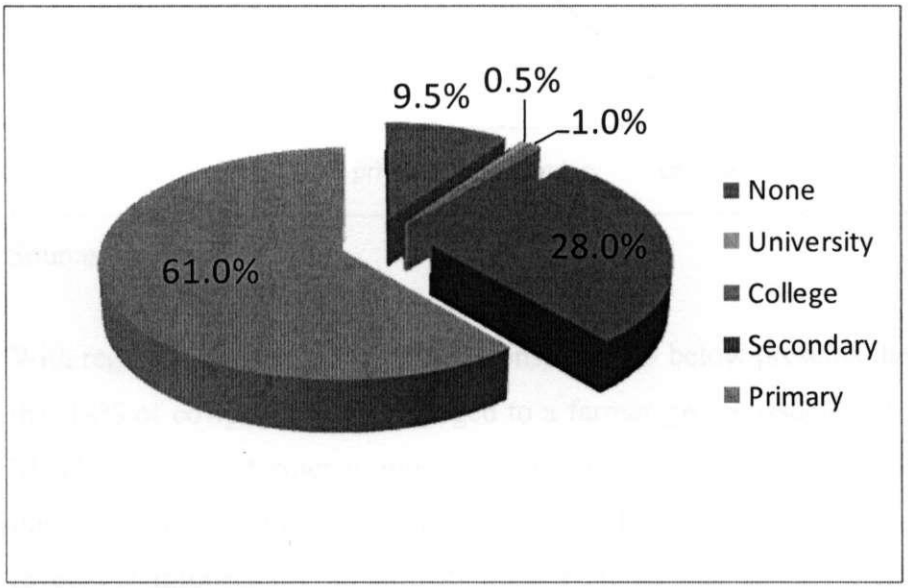
Table 4 Participation by Marital Status

	Supply chain participation		
Marital status	**yes (%)**	**No(%)**	**Number**
Never married	0	0.6	1
Monogamously married	76.7	57.8	129
Polygamously married	11.6	21.1	40
Divorced	0	3.6	6
Widowed	11.6	14.5	29
Seperated	0	1.8	3
Cohabit	0	0.6	1
Total	100	100	209

Source: survey data, 2008.

Economic factors such as education, which is the basis for determining literacy levels were also considered. As presented in Figure 4, most of the cowpea producers (61%) have only acquired primary education. The proportion of producers growing cowpeas declines with an increase in educational status. For higher levels of education attainments, only about 1% of Producers acquired a university level education.

Figure 4 Distribution of Cowpea producers by Educational level

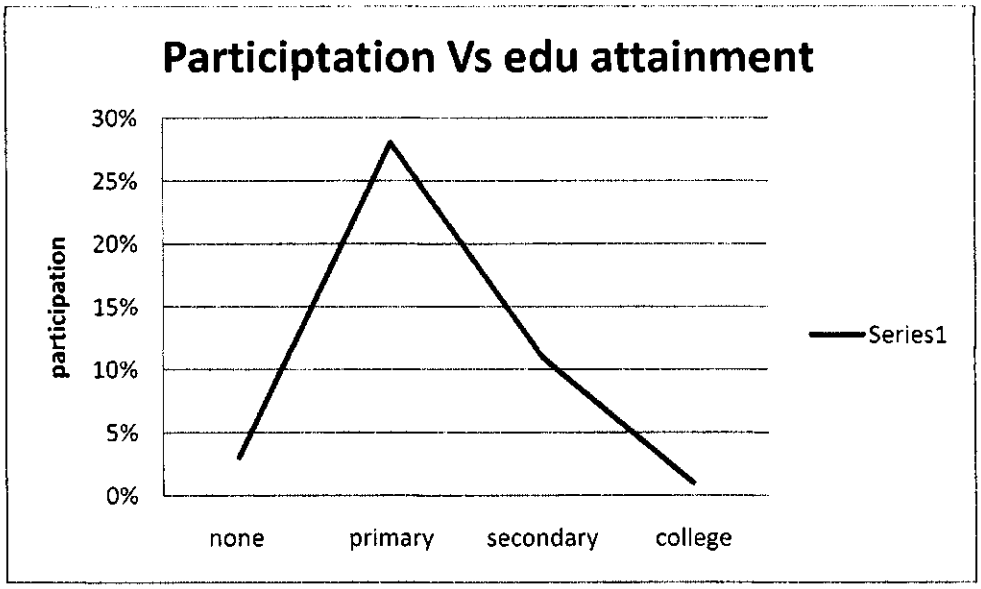


Source: survey data, 2008.

4.6 Supply Chain participation by Educational level and Horizontal alliances

A further look at the education factor in relation to participation levels showed similar results. As shown in Figure 5 the proportion of producers participating in the supply chain declined with an increase in educational attainment. The producers with basic educational attainments constituted the majority of the participants (about 25%), whilst producers with higher educational attainments recorded a lower proportion of participation (less than1%).

Figure 5 Participation by Education attainment



Source: survey data, 2008

With regard to farmer group associations, Table 5 below presents the results that showed that 14% of cowpea traders belonged to a farmer group association, whilst 86% did not. Membership into farmer groups was not widespread among the cowpea producers and this may inhibit them from taking advantage of incentives such as easy and quick access to market information, as well as other benefits that usually stem from group action marketing.

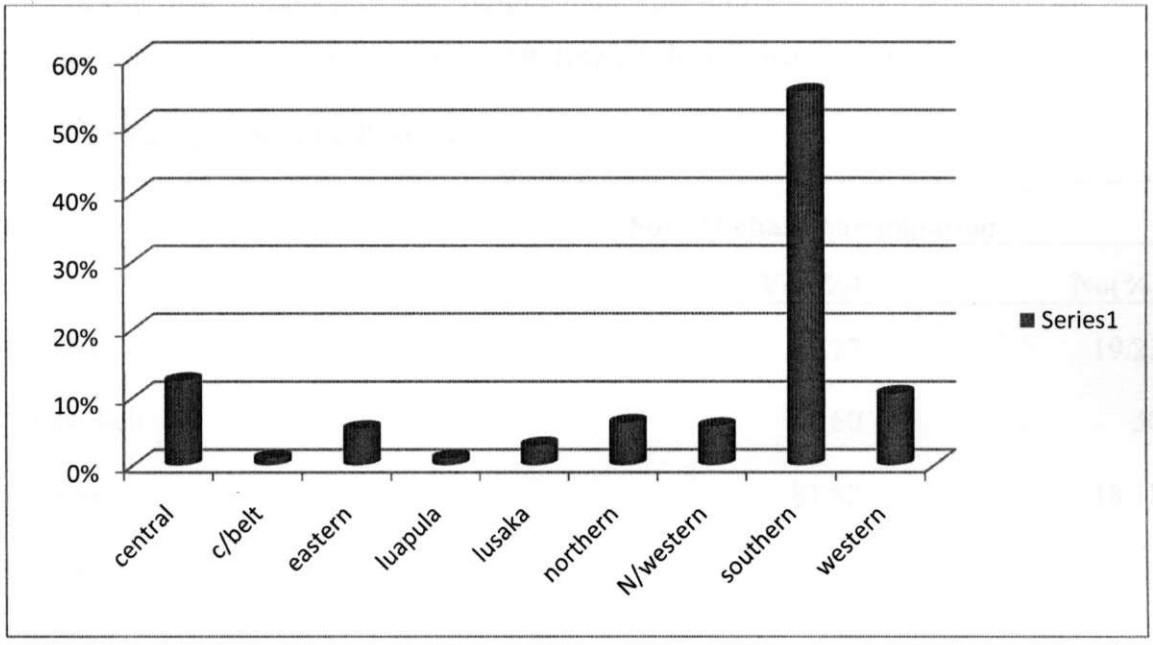
Table 5 Distribution of Farmers by Farmer Group Affiliation

Framer group association	**Supply chain participation**		
	Yes(%)	**No(%)**	**Frequency**
Yes	14	8.4	20
No	86	91.6	189
Total	100	100	209

Source: survey data, 2008

The geographical distribution of producers in Figure 6 below showed that Southern Province accounted for the largest proportion of cowpea producers (55%), while Luapula and the Copperbelt Province has the lowest proportion (1%). Past literature on cowpea production also confirms this finding, giving a record of 58% for Southern Province (PVCI work plan, 2010).

Figure 6 Distribution by Province



Source: survey data, 2008.

4.7 Supply Chain Participation by Province

Apart from having the highest proportion of producers, many of these Southern Province producers (87%) participate in the cowpea supply chain, accounting for the highest proportion relative to the other provinces (as shown in Table 6 below). Eastern, Western and Central provinces also have most of the cowpea producers selling their crop, with proportions of about 80%. As for the rest of the provinces, the proportion of participation falls below 70%. Lusaka province, despite indicating 100% participation levels, accounts for a negligible proportion of overall quantities produced, that is about 1%.

Table 6: Participation by Province

Province	Supply chain participation	
	Yes(%)	No(%)
Central	80.77	19.23
Copperbelt	50	50
Eastern	81.82	18.18
Luapula	0	100
Lusaka	100	0
Northern	69.23	30.77
Northwestern	16.67	83.33
Southern	86.96	13.04
Western	81.82	18.18

Source: survey data, 2008.

4.8 Probit Regression Estimates

The results of the estimated equation are discussed in terms of the significance and signs on the parameters. Evidence from the model as contained in Table 7, shows that the variables of significance in determining cowpea supply chain participation include price, total income, hactares under cowpea production, mechanization and ownership of vehicular transport. Whilst gender, household size, education level, age, marital status, horizontal alliance/ farmer group affiliation are not statistically significant in explaining the probability of participating in the cowpeas supply chain at 95% confidence level.

Table 7: Probit Model results

Variables	Marginal Effect (df/dx)	Robust standard Errors	Z	P>[Z]
Price	0.003	8.27E-03	1,86	0.06 *
Hactares	0.17	0.367	1.85	0.064*
Total Hhsize	-0.00541	0.0244	-0.89	0.376
Total Income	-0.0054	8.34E-05	-2.48	0.013**
Age	-0.00108	0.0074	0.58	0.559
Gender1	0.1017	0.54	0.86	0.389
Trans1	-0.1408	0.255	-2.49	0.013**
Mech1	0.2417	0.24	3.8	0.000**
FGA1	0.1297	0.344	1.29	0.198
Edu level1	0.0023	0.41	0.02	0.982
Edu level2	-0.0388	0.47	-0.34	0.734
M_Status	0.02131	0.548	0.16	0.873

Dependent variable: Supply chain participation dummy. Level of significance: * = 10%, ** = 5%

Obsevations	209
Prob > chi2	0.0015
Wald Chi2(19)	31.82
Pseudo R2	0.1662

The price per kg of cowpeas output was found to be statistically significant in determining the producers' participation in the cowpea supply chain at 90% confidence level (p-value<0.1). It affects participation positively, giving a marginal effect of 0.3%. This implies that a unit increase in the price of cowpeas will increase the probability of producer supply chain participation by 0.3%. Higher prices entail a higher expected pay-off for the farmer, resulting in a positive effect on participation. Ziote (2007) in his study carried out in South Africa similarly found that the price of cowpeas per kg was significantly important in explaining the factors that determined the cowpea producers' decision to sell his produce. However his study indicated a much higher marginal effect of the price (5%), compared to the 0.3% found in this study.

The producer's value of earnings was another variable found to be statistically significant in determining the producers' participation in the cowpea supply chain at 95% confidence level (p-value<0.05). It has a negative effect on participation, giving a marginal effect of 0.5%. This implies that a unit increase in the producer's total earnings decreases the probability of producer supply chain participation by 0.5%. This result was not according to expectation, but reasons for this negative effect could be that cowpea producers tend to engage more of their time and resources in selling other crops that they grow, such as maize and beans (that have a ready market) as their income increase. That is, increased income enables them to meet marketing costs more effectively, and cowpea producers substitute selling cowpeas for selling other crops with an already established market.

The amount of hactares of cowpeas produced was found to be statistically significant in explaining the factors that determine the producers' participation in the cowpea supply chain at 90% confidence level (p-value<0.1). It affects participation positively, giving a marginal effect of 17%. This implies that a unit increase in the amount of hactares of cowpeas produced will increase the probability of producer supply chain participation by 17%. Larger areas of land devoted to cowpeas production enables producers to realize a higher output. An increased output of cowpeas provides an incentive for the farmer to sell his/her crop, for the enlarged output implies the farmer can meet both consumption and commercial demands effectively. A study carried out by Padi and Ehlers (2007),

considered farmers that grew cowpeas on a large to medium scale, indicated that production of large hactares of cowpeas increased quantities produced, of which most producers did not find profitable to store (increased storage costs), therefore they offloaded the excess produce onto the market, even at prices that were not so favourable.

Ownership of productive assets or farming equipment such as ox drawn ploughs was found to be statistically significant in determining the producers' participation in the cowpea supply chain at 95% confidence level (p-value<0.05). It affects participation positively, giving a marginal effect of 24%. This implies that ownership and use of farming equipment increases the probability of producer supply chain participation by 24%. Mechanisation increases productivity and ultimately the yield produced. With increased yield, the farmer is able to produce quantities that exceed household consumption requirements, providing enough for sale. Also, since it was discovered that cowpeas is grown as a side crop (not as a producer's main enterprise), mechanization allows for timeliness of farming activities, leaving some time for the farmers to grow and sale crops such as cowpeas as well (Padi and Ehlers, 2007).

Ownership of vehicular transport was another variable found to be statistically significant in determining the producers' participation in the cowpea supply chain at 95% confidence level (p-value<0.05). It has a negative effect on participation, giving a marginal effect of 14%. This implies that ownership of vehicular transport decreases the probability of producer supply chain participation by 14%. This result was also not expected, but reasons for this negative effect are similar to that for the income variable, in that cowpea producers tend to engage more of their resources (for instance delivery trucks, coach carts) in selling other crops that they grow, such as maize and beans (that have a ready market). With ownership of such assets cowpea producers substitute selling cowpeas for other commercialized crops.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the recommendations which were based on the findings and interpretations of this study. It also presents a discussion on the conclusions of this research.

5.2 Recommendations

There is need to increase efforts targeted at cooperative development and improvement of existing horizontal alliances. The study revealed that there are few farmers that are members of a farmer group, therefore there is need to sensitize the farmers on the benefits that can be derived from farmer group action. The farmer group associations do not necessarily need to be organized by government alone, but the farmers can be encouraged to come up with such alliances themselves if they are to operate private and viable agribusinesses.

Value addition is another aspect that requires serious consideration. Most studies in West Africa have discovered various ways in which value can be added in cowpeas (for instance forming cowpea meal that can be used in the confectionary industry) (Afoakwa et.al,2004; Phillips et.al, 2003; Plahar et.al, 2006). This will not only increase the returns per given cowpeas output, but will also provide various markets which farmers can sell to. In addition, value addition will ensure that farmers who tend to move away from cowpea production (as their incomes increase) do not do so, for cowpeas production will equally be profitable.

Extension services in the MACO should endeavor to focus on teaching improved cowpea production practices, in order to increase cowpeas productivity and eventually yields. Higher yields provide a positive incentive for supply chain participation. In as much as new cowpeas varieties have been developed by ZARI that enhance productivity and yields, not much of this seed has been distributed to the rural farmers, who are the bulk of the producers. Therefore, private input traders and the extension organization in the

MACO can make coordinated distribution efforts to ensure the improved seed varieties reach the farmers.

Further research on cowpeas should be carried out to reinforce the existing knowledge and increase awareness on the benefits of cowpeas production, not just to the rural farmer but more so in the learning institutions. The study findings indicate that cowpea production and supply chain participation occurs the least among the highly learned.

Institutions such as CSO and AMIC should endeavor to carry out surveys in order to gather more information on the pulse industry in particular. It was observed that these institutions did not have current data or information on pulse prices and quantities, especially for cowpeas.

Lastly, attempts by both the public and private sector should be made to develop appropriate, simple and affordable farming technology. Accessibility and use of these simple technologies affect supply chain participation positively.

5.3 Conclusions

This paper was designed to study the factors that determine smallholder farmer's participation in the cowpeas supply chain using data from the CSO and FSRP third supplemental survey to the 1999/2000 post-harvest survey. Poverty and malnutrition is among the challenges that many households are facing, with more than half the population estimated as living below the poverty line. Hence, there is a need for smallholder farmers to take up cowpeas production in order to reduce nutrition deficiencies.

From this study the factors that were included in the model to determine participation in the supply chain were: sex of the farmer, level of education of respondent, age of the respondent, total income, land under cultivation, farmer group affiliation, gender, marital status, ownership of productive assets and vehicular transport. Of all these, the factors of statistical significance in determining participation are land under cultivation, total

income, price of output, ownership of productive assets and vehicular transport, while the remaining variables were statistically insignificant in determining supply chain participation. In view of these statistically significant variables, we conclude that these are of importance when considering farmers' cowpeas supply chain participation.

Contrary to expectations, horizontal alliance affiliation was not significant in determining supply chain participation. It can also be further concluded that cowpea production and participation in its supply chain is male dominated, that is the proportion of male cowpea producers and sellers was at about 80%.

Southern province accounts for the highest proportion of Cowpea production and supply chain participation. On overall however, producer participation in the cowpeas supply chain(s) is low, with 20% of cowpea producers being participants and 80% being non participants.

REFERENCES

Afoakwa, E. O., O. Sefa-Dedeh, E. Sakyi-Dawson . 2004. Effect of Cowpea Fortification, Dehydration Method and Storage Time on Some Quality Characteristics of Maize Based Traditional Weaning Foods. *African Journal of Food Agriculture, Nutrition and Development. 4 (1)*

Arega, D., A. Alene, H. Omanya, M. Mignouna, G. Bokanga, G. Odhiambo, 2008. Smallholder Market Participation Under Transactions Costs: Maize Supply And Fertilizer Demand In Kenya. *Food Policy. 33: Pp 318-328.*

Barrett .B, 2008. Smallholder Market Participation: Concepts And Evidence From Eastern And Southern Africa. *Food Policy. 33: Pp 299-317.*

Beaver, J.S., J. Rosas, J. Myers, 2003. Contributions Of The Bean/Cowpea CRSP to Cultivar and Germplasm Development in Common Bean. *Field Crops Research. 82: Pp 87–102.*

Bjornlund H., 2003. Farmer Participation in Markets for Temporary and Permanent Water in Southeastern Australia. *Agriculture Water Management.63: Pp 57-76.*

_____.1997-2002, Zambia Demographic Health Survey.

_____.2004, Crop Production Survey.

Colin C. and P. Trivedi, 2005. Microeconometric Methods and Applications. *Cambridge University Press, UK.*

Fang, J., P. Chao, C. Roberts and H. Ehlers, 2007. Genetic Diversity of Cowpea (Vigna Unguiculata) in Four West African and USA Breeding Programs as Determined by AFLP Analysis. Genet. Resour. Crop Evol. 54:1197-1209.

Food and Agricultural Organisation of The United Nations (FAO) 2009.*Protein Energy Sources- Malnutrition Mitigation Work Plan.*

Faye, M., K. Jooste, K. Lowenberg-Deboer and J. Fulton, 2006. Impact of Sucrose Contents and Cooking Time on Cowpea Prices in Senegal. *South African Journal of Economic and Management Sciences. 9 (2): 207–212.*

Government Republic of Zambia. Fifth *National Development Plan*, 2006.

.....2004. *National Agricultural Policy. Lusaka*, Zambia.

Hall. B, 2003. Future Directions of The Bean/Cowpea Collaborative Research Support Program. *Field Crops Research. 82: Pp 233-239.*

Kelly, J.D., P. Gepts, N. Miklas, D. Coyne, 2003. Tagging and Mapping Of Genes and QTL and Molecular Marker-Assisted Selection for Traits Of Economic Importance in Bean and Cowpea. *Field Crops Research. 82: Pp 135–154.*

Langyintuo A,S, J. Lowenberg-Deboer, M. Faye, G. Lambert G, 2003. Cowpea Supply And Demand In West And Central Africa. *Journal Of Agriculture And Resource Economics. 82: Pp 215-231.*

Langyintuo A.S., L. Ntoukam, J. Murdock, J. Lowenberg-Deboer, 2004. Consumer Preferences for Cowpea in Cameroon and Ghana. *Journal of Agriculture and Resource Economics. 30: Pp 203-213.*

Lapar M.L, G. Holloway, S. Ehui. 2003. "Policy Options Promoting Market Participation Among Smallholder Livestock Producers: A Case Study From The Philippines. *Food Policy 28: Pp 187-211.*

Larry L., D. Murdock , S. Dogo S, 2003. Preservation of Cowpea Grain In Sub-Saharan, Africa—Bean/Cowpea CRSP Contributions. *Field Crops Research. 82: Pp 169-178.*

Lubbock. A., 2009. *Practical Tips for Gender Sensitive Value Chain Mapping.* IFAD, Rome.

Ministry of Agriculture And Cooperatives (MACO), 2004. *Agricultural Marketing of Fresh and Dry Beans*, Lusaka, Zambia.

Mahamane S, 2008. Evaluation of Cowpea Genotypes for Adaptation to Low Soil Ph Conditions and Rock Phosphate Application. *Phd Dissertation, Texas A&M University.*

Munyinda. K, 2000. *Mixed Bean Germplasm Development.* University of Zambia.

Munyinda. K, 2003-2008. *Genetic Cultivar Improvement Project of Cowpeas and Beans.* University of Zambia.

Padi F. and J.D. Ehlers, 2007. Effectiveness of Early Generation Selection In Cowpea for Grain Yield and Agronomic Characteristics in Semi-Arid West Africa. *Crop Science 48:533-540.*

Payne W.A, 2006. Dryland Cropping Systems of West And East Africa. *American Society of Agronomy.*

Phillips W, Z. Mensa, A. Nnanna A, 2003. Utilization of Cowpeas for Human Food. *Field Crops Research. 82:193 213*

Plahar M. and K. Chinnan, 2006. Effect of Saponins on the Physical Characteristics, Composition and Quality of Akara (Fried Cowpea Paste) Made from Non Decorticated Cream Cowpeas. *Lebensmittel-Food Sci. & Tech. 39:275-284.*

Shaikh A., T. Rehman and C.Yates, 2002. Logit Models for Identifying the Factors that Influence the Uptake of New 'No-Tillage' Technologies by Farmers in Rice-Wheat and The Cotton-Wheat Farming Systems of Pakistan Punjab. *American Journal of Agricultural Economics Vol. 23 (2): 294-304*

Tembo. G, 2010. *The Pulse Value Chain Initiative-Zambia; Dry Grain Pulses CRSP Work Plan.* University Of Zambia.

Van Der Laan, H.L.,1999. Agricultural Marketing in Tropical Africa: Obstacles to Systematic Study. *Africa Studies Centre, Leiden. Ashgate Journal Press, Pp. 1–18.*

Wagner, J., P. Miles And P. Miklas, 2006. Evaluating Heirloom Dry Bean Varieties as a Niche Market Crop in The Maritime Northwest. *Bean Improvement Cooperative. 49:129-130.*

William H. G, 2002. *Econometric Analysis*. Fifth Edition, Cambridge University Press, UK.

Ziote, J.M.E, 2007. An Investigation into the Demand Chain of Beans And Cowpeas in Mozambique. *M. Agric Thesis, University of The Free State, Bloemfontein, South Africa.*