AN ASSSESSMENT OF FACTORS INFLUENCING

THE PROFITABILITY OF BEAN PRODUCTION IN ZAMBIA

BY

PAUL CHIMUKA SAMBOKO

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AN ASSSESSMENT OF FACTORS INFLUENCING THE PROFITABILITY OF BEAN PRODUCTION IN ZAMBIA

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By

Paul Chimuka Samboko

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KEY TO ABREVIATIONS

CSO	Central Statistical Office
FSRP	Food Security Research Project
GRZ	Government of the Republic of Zambia
GM	Gross Margin
TVC	Total Variable Costs
SSA	Sub-Saharan Africa
TR	Total Revenue
ZARI	Zambia Agricultural Research Institute
ZMK	Zambian Kwacha
FNDP	Fifth National Development Plan
FSRP	Food Security Research Project

ABSTRACT

AN ASSSESSMENT OF FACTORS INFLUENCING THE PROFITABILITY OF BEAN PRODUCTION IN ZAMBIA

Paul Chimuka Samboko **Supervisors: Ms M. Mwiinga**
The University of Zambia, 2011 **Dr. G. Tembo**

This study focused on determining the value accruing to producers of beans in Zambia and its influencing factors specifically taking a snapshot view of the 2006/2007 production year. The specific objectives were; to determine the market value of bean production; and to determine the socio-economic and demographic factors influencing the value accruing to bean producers. The sample consisted of 868 bean-producing households that were captured in the 2008 supplemental survey (CSO/FSRP 2008). A two-stage analysis strategy was used in this study. First, partial budgeting was used to determine the gross margin (GM) of the bean enterprise for each farmer. Second, the computed GM was then used as an explanatory variable in a regression model explaining value as a function of a number of hypothesized explanatory variables.

The results of the gross margin analysis suggest that bean production in Zambia is unprofitable on average. However, the observed gross margins varied across provinces and according to the marketing channel used. On average, households that did not sell their produce and those that sold to their neighbors recorded losses whilst those that sold to private traders within the district, within the village and those that sold to consumers outside the district recorded profits. The econometric results revealed that yield ($p= 0.000$), price ($p=0.05$), land ownership ($p=0.093$), household size ($p=0.028$), tillage method used ($p=0.076$), power source ($p=0.008$) are important determinants of profitability of bean production in Zambia.

Based on the findings, if bean production is to emerge as one of the major income sources amongst farmers in Zambia, it is important that farmers are encouraged to follow recommended production practices to improve yields. In addition, conservation farming practices should be encouraged as they positively impact on profits. Farmers should also be encouraged to acquire title deeds for land as it encourages them to invest in land improvement and conservation practices.The results showed that private traders were the most profitable channel for bean marketing by the farmers, it is important that a study that looks at the impact of transaction costs on the traders' marketing decisions be conducted. Results suggest that bean production for the 2007/2008 produced mixed results as far as profitability is concerned, with some farmers recording profits whilst others recorded losses. Therefore, it is important that a study on the extent of resource use efficiency be conducted to determine by how much the farmers that made losses need to improve productivity if they are to profit from bean production. The study can also be extended to include non- market valuation on other consumed parts of the bean plant. Time series analysis should also be conducted to assess how the profitability of bean production has changed over time.

CHAPTER ONE
INTRODUCTION

1.0 Background

Historically, beans (*Phaseolus vulgaris*) have been an important constituent of the diet of Zambians and many other people in the world. The crop is a source of vegetable protein, which can be an easy substitute for animal protein for the majority of the rural and urban Zambians, B vitamins (which include thiamine, niacin and folic acid). When coupled with the nutrients present in mealie meal (a major constituent of the average Zambian's diet), necessary nutrients for growth and development are provided. By virtue of them being drought tolerant, beans also help to minimize the effects of weather-related uncertainties.

The Agricultural sector is an important part of the Zambian economy contributing about 18-20 percent of the gross domestic product (CSO, 2006), and employing about two-thirds of the labor force (FNDP 2006). According to ZARI (2010), beans rank second to groundnuts as a leguminous crop of economic importance as represented by the area under cultivation and the number of households producing it. Currently, the Sub-Saharan Africa's (SSA) demand for beans is at 20,000 metric tons per year and this is projected to increase. South Africa's consumption as of the year 2000 was at greater than 80 percent of the SSA demand, Zambia demands greater than 5000 metric tons per year (Muimui, 2010).Opportunities in the bean industry have increased with the establishment of processing firms such as FRESHPIKT, Zambia is poised to emerge as one of the major exporters of beans if production can be increased. With increased prices due to the high demand ceteris paribus, one can expect the value realized by bean producers to increase.

However, despite the immense potential bean production has in Zambia, information on its value chain economics is missing and thus calls for attention from researchers and scholars. In addition to risk and utility maximization, profitability has been identified as one of the major factors in an individual's decision to produce if they are to remain competitive and ensure that agriculture remains a vital force in poverty reduction and

economic growth. Of the few profitability analyses that have been conducted in Zambia, beans have been left out and most of the focus has been on other agronomic aspects such as improving productivity through varietal development among others. This research addresses this knowledge gap through the determination of the value accruing to producers of beans and the factors correlated with.

1.1 Problem Statement

Despite the potential of bean production in enhancing food security, there is still a dearth of empirical evidence regarding the bean value chain, let alone the value accruing to bean producers in Zambia. Over time, bean-related research has focused on the agronomic aspects of beans (ZARI, 2010), much to the exclusion of other important aspects of bean production such as resource use efficiency and enterprise profitability. The profitability of bean production is influenced by several factors with the implication being that to ensure an effective policy framework targeting agricultural development, there is need to identify factors influencing the profitability of bean production in Zambia. This is important because despite many factors having been identified as influencing profitability of bean production elsewhere (Tschering, 2002; Ishikawa, 1999; Reardan., et al 1997); it is unclear as to whether the same factors apply to Zambia as it presents a unique case.

Whereas some studies have looked at the profitability of bean production, some aspects of profitability have not been tackled. Moreover, some studies such as one conducted by Ibro in 2008 looked at the profitability at a level higher than production in the cowpea supply chain; considering that producers represent the most important level in the supply chain, there is need to look at profitability of production at the farm level.

In a study conducted by Tschering (2002), factors affecting yields and variability in bean profitability were not identified indicating a dearth in knowledge. Moreover, the study identified that very few farmers followed the recommended production practices indicating a call for further research. Furthermore, Tschering (2002) points out that the one factor that might contribute to the knowledge gap in developing countries could be

poor record keeping. Thus, it is clear that beans and other pulses have been left out in profitability analyses and thus it is imperative that a study be conducted to address the dearth in knowledge.

1.2 Study Objectives

The overall objective of this study was to determine the value accruing to bean producers and factors correlated with it.

The specific objectives of the study were to:

i) Determine the market value of bean production in Zambia.
ii) Identify factors influencing the value accruing to bean producers.

1.4 Rationale

In the National Agricultural Policy (NAP), the government has reiterated its commitment to ensuring the development of a competitive, sustainable and efficient agricultural sector that assures food security and poverty reduction. For any firm, the profit motive leads to decisions that ensure that maximum utility is gained from a venture. Similarly, the value of a crop is one important factor that influences the farmer's decision on whether to grow it or not. Value in this case refers to the market value of bean production measured as the total revenue at market prices less variable costs. It is assumed that farmers are rational and thus are likely to make production decisions based on crops that will yield the most utility or profit to them. Identifying the value accruing to bean producers is likely to provide information essential to understanding the economics of bean production. It is expected that an understanding of the value producers attach to production and the factors correlated with it would provide important information for policy formulation and alteration for increased bean production, poverty alleviation and reduction of income inequality. Given the importance of beans and the opportunities arising in the bean industry, it is expected that beans are likely to take center stage as an important cash and food crop; it is thus vital that policy makers have an understanding of the economics of bean production.

1.5 Theoretical Framework

The decision of whether or not to produce beans is influenced by a myriad of factors. Economists and other scholars have identified three theories underlying farmers' production decisions. The literature suggests that farmers may be motivated to produce on the basis of their attitude towards risk; the utility derived from production; and for profit reasons. To date, there is still confusion regarding the theory of profits, this problem is exacerbated by the fact that there is a lack of consensus amongst economists regarding the true function of the entrepreneur (Ahuja 2000). Some scholars such as Knight have associated profits with uncertainty; he contends that uncertainty in the economy is a factor that gives rise to profits (Knight 1921).

Other scholars such as Clark (1987) conceive that profits are a dynamic surplus and can therefore only exist in a dynamic environment. Clark argued that with no changes in the conditions of demand and supply, the prices paid on the factors of production on the basis of their marginal productivity would exhaust the total value of production and no cost of production. However, in competitive long run equilibrium, price equals average cost of production and thus no pure profits are made. Given this state of affairs, Clark (1987) contends that the only forces that would lead to profits are the changes in the quality and quantity of human wants, changes in the techniques and modes of production, changes in the amount of capital, and changes in the forms of business organization.

Schumpeter (1960), in his theory of profits stressed that successful innovations are an important source of profits. He divides innovations into two categories; the first category includes those innovations that reduce the cost of production and the second category includes innovations that raise the demand for a product. In his theory, Schumpeter concludes that innovations if successful yield profits and the profit is also a motive for innovation. In some instances, profits have been associated with the degree of competition in a particular industry. The monopoly power of a firm has been associated with profits in that the firm has the ability to raise prices of a product. Such firms can

only enjoy super-normal profits in instances where strong entry barriers exist in the industry (Ahuja 2000).

1.6 Organization of the Report

The report is organized into five chapters; Chapter one provides an overview of the bean industry in Zambia and the world at large. It also gives the problem statement, study objectives, the hypotheses and rationale. Chapter two presents a review of the relevant literature to the study. Chapter three outlines the research methods and procedures, specifically looking at the data collection and analysis procedures used. It also presents a theoretical and empirical model for determining the value accruing to producers of beans and the factors correlated with it. In chapter four the study findings are presented, interpreted and discussed. Finally, chapter five presents the summary and conclusions drawn from the empirical data, implications for future research and recommendations.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of relevant literature to the study. Profitability studies that have been conducted so far, their objectives and the methods employed, it points out the observed weaknesses in some of the studies and possible knowledge gaps that can be bridged. The review of literature recognized that market valuations were relatively close to the agricultural industry and they existed in form of gross margin analyses for various crops. The chapter ends with a conclusion based on the reviewed literature.

2.1 Empirical Studies on Profitability Analyses

One of the key observations in the review of literature was that most of the studies that have been conducted on the profitability of bean production or other enterprises were done as part of other studies. Tschering (2002), conducted a profitability analysis of bean production in Honduras ,the focus of the study was on record keeping data collected from Honduran bean farmers in the main bean-growing regions during the period 1998-2000 .In the study, Tschering identified ways to improve record keeping to reduce the cost of future data collection. An assessment of the cost pattern of input and labor and consequently a profitability analysis of bean production for farmers growing traditional and improved bean varieties was conducted. It was observed that farmers growing modern varieties had higher average yields and earned higher profits or suffered less loss than the farmers growing traditional varieties. The results on the effect of new varieties on yield are in line with those of Ishikawa, (1999) who found that yield was very influential in explaining profitability. The enterprise gross margin sensitivity analysis showed that for traditional farmers, gross margins were more sensitive to yield and price changes than for modern farmers. The study found that none of the farmers in the sample completely followed the recommended practices for bean production and that the major share of the total production cost consisted of labor cost. However, this study focused

more on cost and input pattern amongst bean farmers. Nonetheless, there is a still need to study the farmer characteristics that influence the yields and variability in profitability of beans. Ishikawa, (1999) followed a similar approach and assessed costs and patterns of input and labor use and the profitability of bean production in Nicaragua. The producers of beans in most cases differed depending on whether one is a commercial or small-scale farmer, Tschering (2002) and Ishikawa (1999) both showed that modern farmers apply fertilizer and use hybrid seed varieties in their production practices; a phenomenon which is not common amongst the traditional small-scale farmers. Ishikawa (1999) also showed that modern farmers earned higher profits than the traditional farmers due to their higher yields probably due to the fact that dummy for seed variety was the key significant variable affecting bean yield.

In a study that was conducted by Ibro, (2008) on the value chain of cowpeas in Nigeria, it was found that businesses operating at a greater scale, earned more per input. Neither experience nor education was found to be a strong predictor of profitability. However, in this study, Ibro focused on the vendors and not the producers of cowpeas. Even though vendors represent an important part of the cowpea supply chain, there is need to determine the value accruing to producers of cowpeas.

2.2 Factors Influencing Profitability in Agriculture

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

Erbaugh et al., (2008) found that farm size, production costs, farm location, interaction between production costs and farm gate price as well as the interaction between the varieties used and fertilizer applied were significant in explaining the observed sorghum gross margins. However, contrary to literature farm size was found to negatively influence the gross margins. Their view on the relationship between farm size and gross margins contrast with findings elsewhere such as those by Sulumbe et al., (2010) and Ibro, (2008) who found positive relationships between gross margins and farm size. The interaction between Production cost and farm gate price was found to be positive and significant while the farm gate price alone was insignificant. The findings also showed that the variety used, tillage method, and the application of fertilizer were not significant but the interaction between variety used and fertilizer application was significant and positive. In another study, Sulumbe, et al., (2010) looked at the profitability of cotton production under sole-cropping in Nigeria; they reported that, family size, income and extension were positively related to cotton output. Farming experience, was, however negatively related to the cotton output.

In another study on productivity determinants in Africa, other incomes were found to be important and direct determinants of productivity through their effects on farm input acquisition and investments. Farm size and land tenure were also seen to affect productivity, commercial farmers were seen to have higher yields than smallholders. Well-functioning input and output markets were seen to also be an indirect determinant of productivity as they affect profitability of farming outlets and input access. Other factors included seed type and fertilizer usage, the two were seen to positively affect productivity (Rearden, et al., 1997). The observations made by Rearden, et al., on the effect of hybrid seed on productivity were echoed by Ibro and Erbaugh elsewhere.

In a study conducted on the benefits of the magoye ripper in Zambia, Kabwe et al., 2006 found that conservation farming practices in form of the magoye ripper as opposed to conventional tillage resulted in increased profits by ZmK575, 800[1] and ZmK93, 800 in the Eastern and southern provinces of Zambia, respectively. They also found that 20

[1] One U.S Dollar is equivalent to 4730 Zambian Kwacha

percent of the benefits resulted from early land preparation whilst 18 percent was as a result of early planting.

2.3 Methodology Common to Market Valuation

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

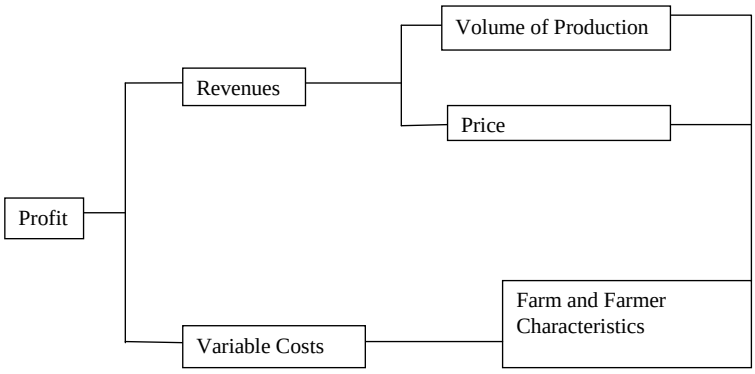
2.4 Conclusion

From the reviewed literature, it is clear that whereas bean profitability analyses have been conducted elsewhere, no study is recorded as having been conducted in Zambia. Moreover, it is clear that factors that influence profitability elsewhere may not have the same effect in Zambia. Moreover, the literature suggests that in as much as profitability analyses have been conducted elsewhere, some aspects have not been tackled and therefore warrant further research With respect to the methodology, it is clear that gross margin analyses can be successfully applied to ascertain the profitability of a crop enterprise. In identifying profitability explanatory variables, two approaches stand out, the first is to regress the gross margin on the hypothesized variables and the other is to regress yield on the hypothesized explanatory variables. In both approaches the dependent variables act as proxies for profitability.

2.5 Conceptual Framework

At the core of this study is the assumption of producers' optimization behavior in which they attempt to maximize some objective function subject to a set of constraints. The literature suggests that farmers may be motivated to produce on the basis of their attitude towards risk; the utility derived from production; and for profit reasons (Knight 1923; Bioca 1997). It is assumed that farmers differ in their farm and physical characteristics. These characteristics are expected to impact on the profits through their impact on the volume of production, price received per unit of a commodity and the cost structure as depicted in figure 1 below.

Figure 1: Profitability Conceptual Analysis



Source: Adapted From Engel E. (2000)

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

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

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

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

With respect to yield, it is expected that other things being equal, households with more kilograms of beans harvested per unit area would record more profits. In the same respect, through the impact on yield, it is expected that households that use hybrid seed varieties would record more volume of production and consequently higher profits.

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

CHAPTER THREE
RESEARCH METHODS AND PROCEDURES

3.1 Introduction

This chapter presents a description of the methods and procedures used in achieving the stated objectives, and the data used in the analysis as well as the actual empirical models used. The study employed a two-step analysis. In the first step, a gross margin analysis was conducted to determine market value of bean production. In the second step, a multiple regression model was employed to identify factors influencing the value accruing to bean producers.

3.2 Data and Variables

The bean production data used in this study are taken from the third supplemental survey to the 1999/2000 Post Harvest Survey (PHS) collected by the Food Security Research Project (FSRP), in collaboration with the Central Statistical Office (CSO) and MACO. The sample comprised all households that completed the first and/or second supplemental surveys conducted in 2001 and 2004.From the 2001 sample of 6922 households, 5419 households completed the survey in 2004.However, of those 5419 did not match the households from the previous sample.5344 appeared to match the previous survey. A total of 8094 households were interviewed 269 were panel households no longer in the standard enumeration areas(SEA),4301 were panel households in the in the selected SEA and 3524 were new households. The study used 2008 cross-sectional household data in which a total of 868 out of the total 8094 households were used in the analysis.

The variables were selected from economic theory and literature as presented in the literature review and conceptual framework.

3.3 Gross Margin Analysis

To determine the market value of beans, a gross margin analysis was conducted. Cross-sectional data on variable costs per hectare associated with production of beans and the revenue generated from the sale of these was used. Gross margin was used as a proxy for profitability of an enterprise. According to Hazell, (1971) gross margin is gross output (price multiplied by yield) less variable or direct costs. Kay et al., (2004) defined gross margin as the difference between income and variable costs. To compute the gross income (total revenue), output in kilograms per hectare for each household was multiplied by the highest price at which a household sold the beans. All variable costs per hectare associated with bean production were identified (the cost of labor, implements, and inputs).The gross margin was then computed as the difference between the total revenue and the total variable costs.

Algebraically gross margin can be expressed as:

$$GM = TR - TVC \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where GM is the gross margin, TR is total revenue (Price times output) and TVC is total variable costs incurred in production.

3.4 Factors Influencing Profitability

To identify the factors influencing the value accruing to bean producers, a multiple regression was run in STATA based on the hypothesized variables i.e. regressing the observed gross margin for each producer on the hypothesized variables.

The dependent variable was the computed gross margin for each household. A number of explanatory variables were identified and included in the model. Off-farm income was measured in Zambian Kwacha for each household and included both cash and in-kind items; another variable included was the yield measured in kilograms per hectare. Other variables included, the tillage method that was mostly used by the household in question; whether or not the household received extension in any form (extension methods

included radio, television, cooperative membership, and visits by extension personnel); the variety of seed used which included local and hybrid varieties; the price received per kilogram of beans sold; the major source of power for tillage; and farmer characteristics that included the age of household-head, gender and the education level.

3.4.1 Multiple Regression

The multiple linear regression model otherwise known as the multiple regression model is still the most widely used vehicle for empirical analysis and the social sciences (Wooldridge 2004).Multiple regression analysis is more amenable to ceteris paribus analysis because it allows us to explicitly control for many other factors which simultaneously affect the dependent variable. Wooldridge 2004 also contends that multiple regression models can accommodate many regressors which may be correlated thus helping us infer causality where simple regression analysis would be misleading.Multiple regression analysis can also incorporate fairly general functional form relationships.Generally, multiple regression with k independent variables can be stated as:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_k x_k + u \qquad (2)$$

Where the x's are the explanatory variables and the betas are the partial effects.

3.4.2 Empirical Model Specification

The empirical model specification is as shown in equation 2 below.

$$GM = f(Fsize, price, yield, Offinc, P\cos t, P\cos t * price, S\text{var}, Age, Tillage, Tenure, Edu, Ext, Gender, HHsize) \qquad (2)$$

Where: GM is the computed gross margin for household i.

Fsize = is the size of the land devoted to bean production in hectares.

Price = Price per kilogram in Zambian Kwacha.

Yield=the yield (in Kilograms per hectare) realized by the household in question.

Offinc= is the value of Off Farm Income received in Zambian Kwacha

PCost = Farm total variable production costs in Zambian Kwacha.

Pcost*price= is the interaction between production costs and the price.

SVar. = Seed variety dummy (equal to 1 if the farmer used hybrid seed and 0 otherwise).

Age= Age of household head in years.

Tillage= Dummy variables for tillage method used.

Ten=Land tenure dummies

Edu= Dummies for the education level of the farmer.

Ext=Extension dummy (equal to 1 if the farmer received any extension services and equal to zero otherwise).

Gender=gender dummy for the household head (equal to 1 if male and zero otherwise).

HHsize=Size of the household.

3.5 Regression Diagnostics

To ensure that the regression model was correctly specified and in line with the assumptions of Ordinary Least Squares (OLS), a number of regression diagnostics were conducted. The data was checked for heteroskedasticity which is a violation of one of the assumptions of OLS, in which the error variance is non-constant; consequences of which the estimated coefficients are unbiased but inefficient leading to erroneous conclusions. Heteroskedasticity is usually a problem in cross-sectional data, the data used is no exception. Initial estimates of the Breusch-Pagan/Cook-Weisberg test suggested the presence of heteroskedasticity; the data was thus corrected using White's heteroskedasticity corrected standard errors for OLS estimators to avoid drawing erroneous conclusions (Gujarati 2003). The model was also checked for adequacy to ensure it assumed the correct functional form and that it wasn't in need of more variables.

A multicollinearity test was also done to ensure that the assumption of no correlation between variables was not violated. The results showed that multicollinearity wasn't a problem. Normality tests were also conducted and results suggested non-normality in the distribution of the error term. However, given the large sample size, this violation of the OLS assumptions was overlooked.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

This Chapter presents a discussion on the study findings. A description of sample characteristics is first presented followed by the results of the gross margin analysis .The chapter ends with a discussion on the factors influencing profitability of bean production.

4.2 Sample Characteristics

Table 1 below presents some of the descriptive statistics of the respondents. It specifically focuses on the value of off-farm income received, yield of beans, age of respondents, and price per kilogram of beans, house-hold size, and the area under bean production. The mean household size of the respondents was about 7 and it ranged between 1 and 28 members per household. The average price received per kilogram of beans sold was 2324.943 Zambian Kwacha (ZMK) with a minimum of ZMK193.91 Kwacha and a maximum of ZMK6, 000.

Table1: Table of Descriptive Statistics on Continuous Variables

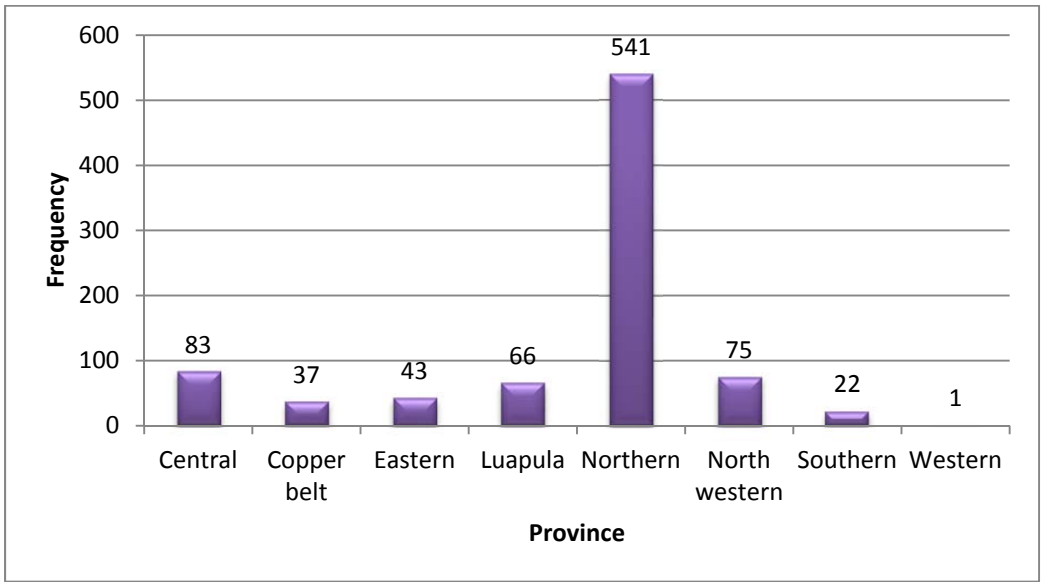
Variable	Obs	Mean	Std. Dev.	Min	Max
Off-farm Income	868	443228.2	1868002	500	3.31E+07
Yield	868	557.1957	509.055	11.28395	6480
Total Variable Costs	868	1318323	215133.3	923717.4	1694978
Age	868	48.26037	14.57388	20	94
Price	868	2324.943	842.3959	193.9058	6000
House-hold size	868	6.762673	3.220306	1	28
Farm size	868	0.4548471	0.5517271	0.016	5

Source: 2008 CSO/FSRP Supplemental Survey Data

The age of the household head ranged between 20 and 94 years with a mean of 48.26 years. The data also showed that the majority of bean producers in Zambia are aged below 50 years indicating the ability to comprehend new technologies. The average value

of off-farm income received by the households amounted to ZMK 443,228.2. Mean total variable costs of production amounted to ZMK1, 318, 323 per hectare with a minimum and maximum of ZMK923, 717.4 and ZMK1, 792,471 respectively. The average yield was 557.196 kilograms per hectare (Kgs per ha) with a minimum of 11.28 (Kgs per ha) and a maximum of 6480 (Kgs per ha).

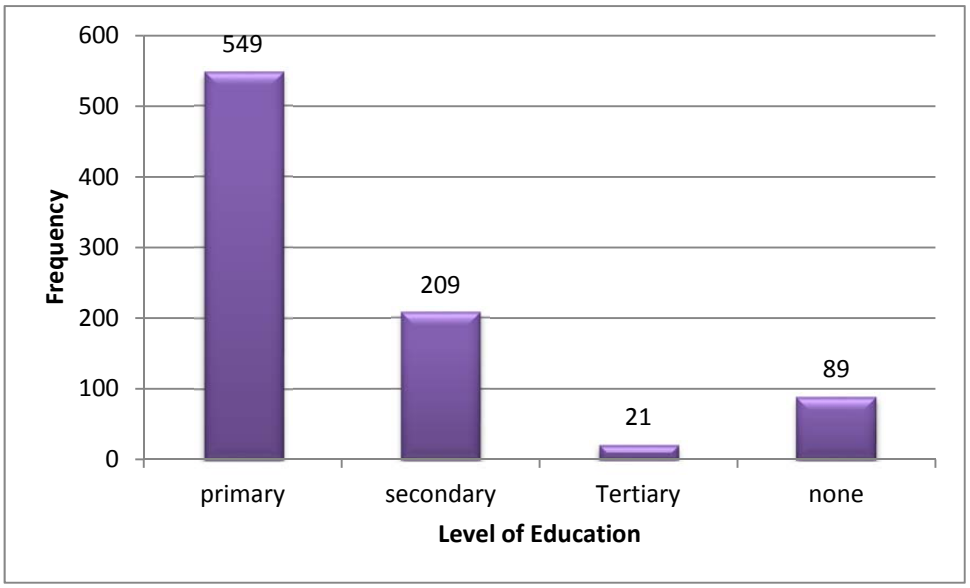
Figure 2: Distribution of Bean Producers by Province



Source: 2008 FSRP/CSO Supplemental Survey

Figure 2 above shows the distribution of the respondents by province. The majority of the producers are from the Northern Province (62.33 percent) followed by Central province (9.56 percent).North western ,Luapula, Eastern, Copper belt ,Southern, and Western provinces accounted for 8.64,7.60,4.96,4.26,2.53, and 0.11 percent respectively. The data also showed that of the 868 respondents, females represented the minority accounting for 20.74 percent whilst the males accounted for 79.38 percent.

Figure 3: Education Attainment of Household Head



Source: 2008 FSRP/CSO Supplemental Survey

Figure 3 above shows the distribution of the respondents with respect to educational attainment, the majority of the respondents attained primary education (63.25 percent), of the total 868 respondents, 24.08 reported as having attained secondary level of education, about 10.25 percent had no formal education whatsoever. Finally, 2.42 percent of the respondents attained tertiary education level.

4.3 Gross Margin Analysis

Table 3 below shows a summary of the mean gross margins for each province in the sample. The results of the gross margin analysis suggest varying levels of value accruing to producers of beans (see figure A.1). The mean bean gross margin was (ZMK67, 040.2). The mean gross margins varied according to the province in question. The Southern province recorded a positive mean gross margin (ZMK291, 567 per hectare) whilst the rest of the provinces recorded negative mean gross margins. Of the provinces that recorded negative mean gross margins, the results show that Central province recorded the most losses followed by the Eastern, Western, North-western, Luapula, and Copper belt provinces respectively.

Table 2: Summary of Mean Gross Margin by Province

Province	Mean	Std. Dev.	Freq.
Central	-275520	1100779.5	83
Copper belt	-40612	1670349.3	37
Eastern	-163876	979289.8	43
Luapula	-71577	1074196.6	66
Northern	-36586.1	1027460.1	541
North western	-98223.5	1837333.5	75
Southern	291567.4	2193625.8	22
Western	-1303956	0	1
Total	-67040.2	1198317.4	868

Source: 2008 CSO/FSRP Supplemental Survey

4.4 Factors Influencing Profitability

Table 3 shows the multiple regression results on factors influencing value accruing to producers of beans. The regression results in table 3 show that about 89.4 percent of the variation in the gross margin is explained by the regressors. Overall, the model was statistically significant in explaining the relationship between the regressors and the observed gross margins.

Estimates of the regression output indicate that the price, ridging dummy, bunding dummy, household size, titled land dummy, production costs, household labor dummy and the yield are statistically significant in explaining the value accruing to producers of beans. Of the variables in the model, the regression results show that yield is the most important variable in explaining the observed gross margins (elasticity=4.94) followed by the price per kilogram (elasticity=3.12).

The price per kilogram as expected is positively related to the gross margin, the marginal effect indicates that the ceteris paribus effect of a one Kwacha increase in the price is an increase in the gross margin by ZMK 367.827. The elasticity suggests that on average, a one percent increase in the price would result in a 4.94 percent reduction in the gross margin. The observed relationship is due to the fact that through its impact on the total revenue, a higher price will increase the revenue and with other things being equal, the gross margin increases.

Table 3: Regression Output on Factors Influencing Profitability

VARIABLES	LABELS	(1) Gross margin coef	Elasticity ey/ex	(2) se
FgPrice	Price	367.8269*	3.12041	(187.752)
offincperthousand	Off-farm income Received per thousand	-1.5644		(4.031)
ha	Farm Size Devoted To Bean Production	64.1957	-9.51e-6	(22,451.908)
hhsize	Household size	-10,739.4733*	-0.272315	(4,869.548)
DPloughing	Ploughing	-112836.7975	-0.010768	(125,284.578)
Dridging	Ridging	44,968.2218*	0.16411	(27,218.536)
Dbunding	Bunding	64,118.0102*	0.01158	(36,152.385)
Dmounding	Mounding	6,762.5396	-0.00233	(42,152.821)
DownAnimals	Own Animals	-36,188.4258	-0.003979	(142,283.936)
Dhire_borr_animals	Hired/Borrowed Animals	-50,578.0515	-0.00047	(104,323.223)
DHHlabor	Household Labor Dummy	-331680.2019***	-0.350352	(125,011.264)
DOwn_withdeed	Own Land With Deed	125,626.7296*	0.4830476	(74,726.655)
DOwn_woutdeed	Own Land Without Deed	64,387.4254	-0.004287	(82,123.204)
dedulev1	Primary Education Level	-38,503.0001	-0.032321	(43,266.015)
dedulev2	Secondary Education Level	-50,077.6913	0.023317	(62,130.171)
dedulev3	Tertiary Education Level	59,863.3824	0.034932	(107,335.295)
dgender1	Male Headed Household	48,541.1635	0.16892	(36,263.361)
ddext2	Household Received Extension	6,338.3661	0.00957	(24,139.420)
dvar2	Hybrid Seed Usage	-742844.1440	0.016892	(559,328.067)
Gross_cost	Gross Production Cost	-0.3727	-1.617735	(0.465)
yield	Kgharvested Per Hectare	2,143.4439***	4.93732	(105.201)
costprice	Cost*Price/10000000	589.9436	0.5651	(1,413.929)
Age	Age Of Household Head	475.0006	0.087522	(953.716)
Constant	Constant	-1.6613e+06**		(566,374.061)
Observations		868		
R-squared		0.8971		
Adj.R-squared		0.8943		

Robust standard errors in parentheses ***, **, * denote p<0.01, p<0.05, p<0.1 respectively.
Source: Own Analysis

The ridging dummy presented an interesting result as far as conservational farming is concerned; compared to farmers who used conventional hand-hoe tillage, farmers who used ridging showed a proportionate higher the gross margins. The observed impact of ridging as a tillage practice is consistent with those of Kabwe et al., 2006 and Erbaugh et al., 2008. The bunding dummy also showed that farmers who used bunding as a tillage practice recorded higher profits than those who used conventional hand-hoe tillage.

The variable yield is highly significant in influencing the value accruing to producers of beans. As expected, a positive relationship exists between yields and gross margin in that at higher yield levels other things being equal, the total revenue increases and in turn positively impacts on the gross margin. Ishikawa, 1999 and Tschering, 2002 report similar findings in other countries.

The variable household size was significant in explaining the observed gross margin at 0.05 alpha level. Household size serves as an indication of the availability of labor on a farm household, it is thus expected that large households will have greater bargaining power and ability to carry out production activities in time. However, the results of the regression show a negative relationship between household size and the value accruing to producers of beans, the observed relationship may be due to the fact that in some instances, despite the relatively larger household size, most members spend their time on other activities such as alcohol consumption and thus may not present a readily available labor force. This result is inconsistent with findings elsewhere such as those by Sulumbe et al., 2010.

Land titling dummy was significant in explaining the observed gross margins at alpha level equal to 0.1. Farmers who had title to their land were observed to have received more income per hectare than those who rented or borrowed and those who had no land title. The observed relationship can be explained from the fact that farmers with land titles invest more in land improvement and conservation practices for the long term profitability of the farm business whilst those who rent have no incentive in investing in land improvements and conservation.

The household labor dummy was significant in explaining the observed gross margins. The results indicate that compared to households that hired labor, households that used family labor showed proportionately lesser gross margins (marginal effect= 331,680.2); this variable was significant in explaining the observed gross margins. In the same category, households that used machines as power sources in tillage though insignificant were seen to have proportionately higher yields than those that used hired labor. It is expected that mechanization would result in timeliness of operations whilst enabling

farmers to cultivate large fields that would in turn spread variable costs across a large volume of production and lead to gains from economies of scale.

The dummy for gender of the household head had the expected positive sign although insignificant. *A priori*, it had been hypothesized that due to differential access to productive resources and access to information, male headed households would report higher gross margins than female headed households.

The age of the household head was not a factor in influencing the observed gross margin. However, the sign on its coefficient signals a positive relationship which is in line with findings elsewhere such as those by Olayiwolaa, 2008 but in contrast with the hypothesized negative relationship. It was expected that the younger more energetic farmers would report higher gross margins than the older ones due to their ability to comprehend new technologies. However, the negative relationship observed might have been due to the fact that adoption rates of new technologies such as improved seed varieties is low in Zambia and thus farming experience may be a major determining factor.

The results suggest a negative relationship between gross margin and area devoted to bean production, one would expect a positive relationship due to economies of scale; however, the observed relationship might have been due to inefficiencies in production and possibly poor land management and improvement systems. Neither education nor gender was seen to be a predictor of the value accruing to bean producers. The variety used was not seen to affect the value accruing to producers of beans probably due to the fact that very few people in the sample used hybrid seed most farmers are resource poor and prefer the traditional varieties with low investment and returns (ZARI, 2009).

Extension service was insignificant in determining the value accruing to producers of beans contrary to expectations that the more people are aware of the recommended production practices and the markets available to them, the more they are likely to make decisions that yield the most benefits.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

*5.*1Summary and Conclusions

The study focused on the value accruing to producers of beans and the factors influencing it. The specific objectives were; to determine the value of bean production; and to identify the factors influencing the value accruing to bean producers. The sample consisted of 868 households from the 2008 CSO/FSRP supplemental survey data. The results of the gross margin analysis suggest that on average, bean production in Zambia is unprofitable. However, the observed gross margins varied across provinces and according to the market channels used. On average, households that did not sell their produce and those that sold to their neighbors recorded losses whilst those that sold to private traders within the district, within the village and those that sold to consumers outside the district recorded profits.

The econometric assessment of factors influencing profitability revealed that yield, price, land titling, source of power in form of household labor, size of the household, tillage methods in form of the bunding and the ridging are important determinants of value accruing to producers of beans.

5.2 Recommendations

Based on the findings, if bean production is to emerge as one of the major income sources amongst farmers in Zambia, it is important that farmers are encouraged to follow recommended practices to improve the yields. In addition, conservation farming practices should be encouraged. Farmers should also be encouraged to invest in land improvement and conservation practices.

5. 3Implications for Future Research

Having identified private traders as the most profitable channel for bean marketing by the smallholder farmers, it is important that a study that looks at the impact of transaction costs on the traders' marketing decisions be conducted. Results suggest that bean production for the 2007/2008 produced mixed results as far as profitability is concerned, with some farmers recording profits whilst others recorded losses. Therefore, it is important that a study on the extent of resource use efficiency be conducted to determine by how much the farmers that made losses need to improve productivity if they are to profit from bean production. This relationship might have been due to poor land management and improvement systems, thus farmers should be encouraged to improve their land. The study can also be extended to include non-market valuation. It would also be interesting to use panel data to assess how the profitability of bean production has changed over time.

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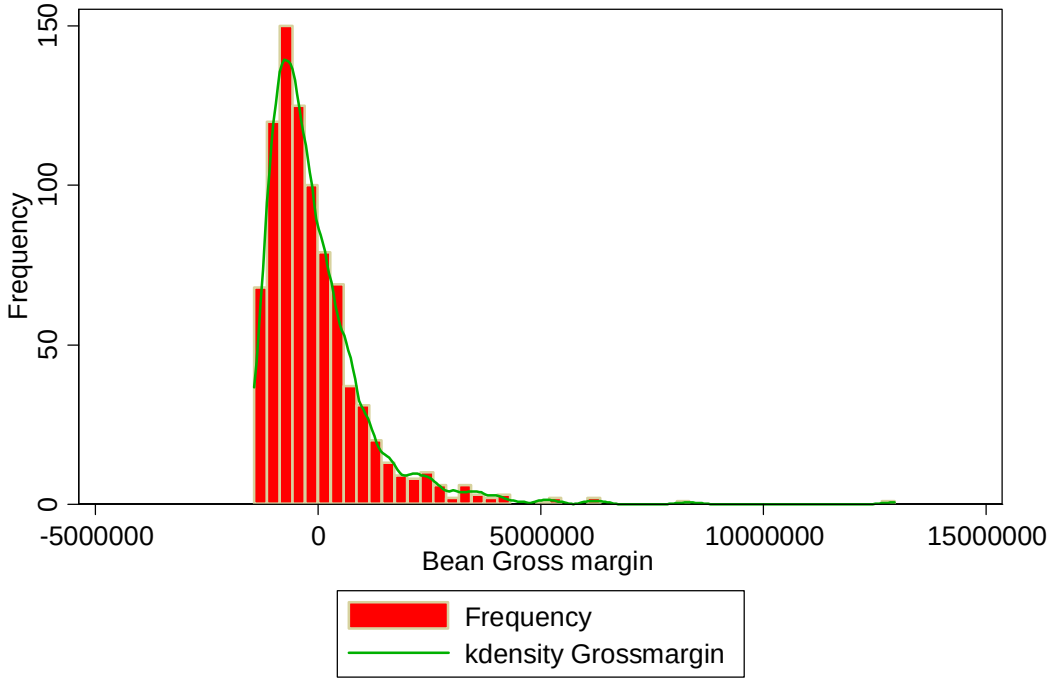
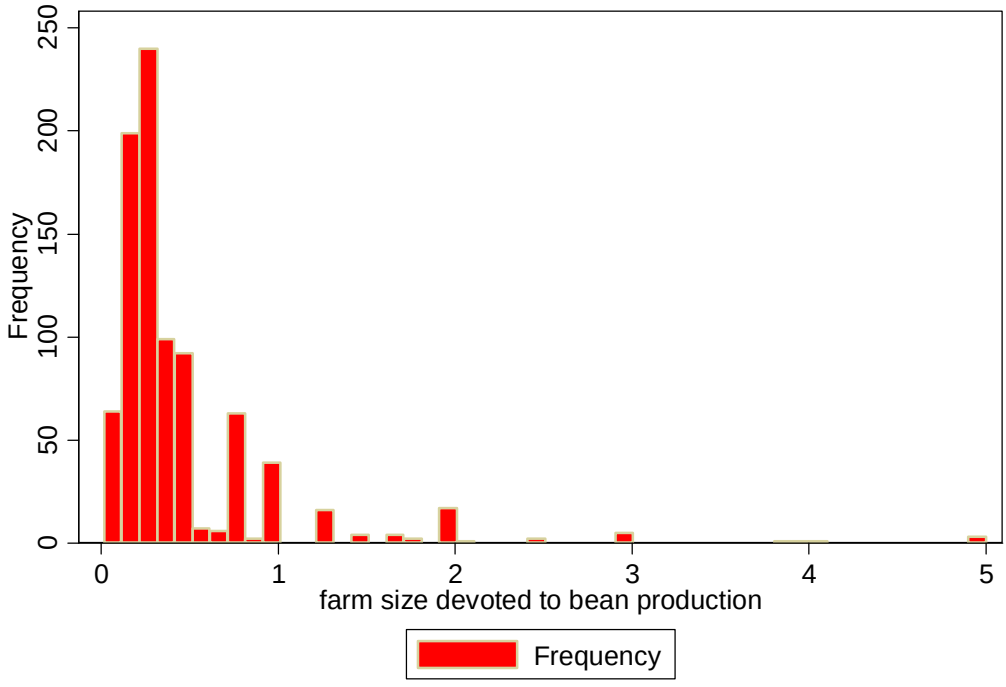
APPENDICES

Appendix 1: Histogram of Bean Gross Margin per Hectare



Source:Own Analysis

Appendix 2: Histogram of Farm Size Devoted to Bean Production



Source:Own Analysis