Economic Analysis of Groundnut Production in Kasungu District, Malawi: A production Economics Approach

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27 September 2012

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ABSTRACT

This study was rolled out to assess resource use efficiency in small scale groundnut production in Kasungu district. A household survey was administered to 42 groundnut farmers in Northern part of Kasungu district. The study has established that a farmers return MK2 for every Kwacha invested. The farmer incurs MK95 for every Kg of groundnut produced. The foregoing analysis of production function indicated that farm size, seed and labour are the important factors of production that affect groundnut output in the study area. The regression coefficients of these inputs were positive and statistically significant. Farm size had the highest MVPs as compared to other inputs. Seed was the second production factor with higher MVP indicating that farmers can increase their groundnut output by using optimal seedrate. The main constraints to marketing included low output prices and poor (unstandardized) measurement scales.

JEL classification code: D24

Keywords: Groundnut, MVP, Smallholder farmer, Kasungu

I. INTRODUCTION

Groundnut (Arachis hypogea L.) is a very important crop for Malawi. It is widely grown and used both as food and to generate cash income. The seed contains approximately 25% protein and 50% edible oils. It is a rain-fed crop in most areas of Malawi and is cultivated either as a sole crop, or in association with cereals such as maize, sorghum or with other legumes such as pigeon peas. The crop is mostly grown in plateau areas especially the Lilongwe-Kasungu plain in the central region where 70% of the crop is produced. Other areas are the Mzimba plain, Lakeshore plains, Shire valley, Nkhata bay rural and Karonga rural (Chiyembekeza et al, 2003). The crop grows well on deep, well-drained, sandy loam soils that are well supplied with calcium and contain a moderate amount of organic matter. The soil pH should be at 5.0-6.2 and optimum soil temperature for good germination is 30^{o}C.

Groundnut in Malawi is grown for export, oil extraction and local use such as roasting and as an additive to vegetable dishes. They are important for smallholder agriculture and for the national diet in Malawi; they contribute significantly to dietary requirements in most parts of the country and provide more than 25% of all smallholder income. National policy objectives are to increase national production through increased yield as this will reduce import requirements for edible soils, increase the exports of confectionery nuts, improve quality of smallholder diets and improve smallholder cash income (Nyirenda et al 1992). Groundnut is either sold as pods (in shell) or as kernels (shelled) and hence prices vary between the two forms. Usually the price per unit of unshelled groundnut is half that of shelled kernels. During the 2009/2010 marketing season, the prices ranged from MK80.00-MK120.00 of shelled kernels (Chamango, 2010).

As pointed out in ASWAP (2011) groundnut production need to be promoted, as it is the main source of is can provide an alternative source of cash crop. Thus, it can contribute considerably as income source and as one-way of job creation for self-employment. Spencer (2002) revealed that resources – poor farmers must be assisted to rise beyond subsistence to increase their incomes through more efficient use of resources. They must be guided on what level of inputs combination that would ensure optimum production. Little is known about economic viability of ground production in the study area. It is against this background that this study attempt to explore, answers to questions like: do rural farmers who are engaged in ground production in the study area make profit? Are they optimizing their input use? However, other studies have been commission by Edriss and Simtowe (2002) in which they analyzed technical efficiency of groundnut production. Kankwamba et al (2012) focused on seed demand systems while generalizing on legume other than isolating groundnut crop alone. Thus, this study differs from earlier studies in both space and content.

Unpacking economic viability of groundnut production would help to identify opportunities and constraints that can be used as input information to devise improvement strategies that intensify groundnut production. Therefore, the results of the present study can be extended for inference in other parts of the country. Hence, these results can be used by policy planners, government and Non-government organizations to streamline intervention for groundnut production in the country in general and for the study area in particular. The objective of this study is two-fold; to evaluate productivity differences of major factors of production (input) employed in groundnut production and to determine profitability of groundnut production in the area.

II. METHODOLOGY

a. The Data

The study was conducted in Kasungu district in Kaluluma Extension Planning Area. The area was purposively chosen because it is in one of groundnut rich producing areas. The study used both primary and secondary data. Secondary data was accessed at Kasungu ADD offices, Kaluluma EPA offices and Kasungu RDP offices. Primary data was obtained from Focus Group Discussions and a structured questionnaire administered to 42 groundnut farmers. Focus group discussions were conducted to validate household data and seek consensus with regard to qualitative data. Input use data, input price data, output data and prices were collected using structured questionnaire. Data for this study was subjected to different types of analyses with the aid of statistical package for social scientists (SPSS), STATA 11 and Microsoft excel packages.

b. Econometric Model

The implicit form of regression for this study was specified as:

$$Y = f(X_1, X_2, X_3) \quad [1]$$

and explicit form of the regression model for this analysis is given by:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + U_i \quad [2]$$

Where: Y=total output of groundnut (kilogram)
X_1=labour (man-days)
X_2= farm size (hectare)
X_3 = seed (kilogram)
b_o to b_3 = Regression coefficients to be estimated.
u = error term (error or disturbance term is included to capture the effects of exogenous and endogenous variables not included in the model)

Introducing logarithms on both sides of the equation results in a Cobb-Douglas Production Function. The new function would become

$$Y = \beta_0 X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} U_i \quad [3]$$

Or alternatively expressed as

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + U_i \quad [4]$$

The Average Physical Product (APP) was derived by dividing total output by total inputs, and is given by

$$APP = \frac{TPP}{total\ inputs} \quad [5]$$

The marginal physical product (MPP) was derived by differentiating the production function (TPP) with respect to input.

$$MPP = \frac{\partial TPP}{\partial x_i} \quad [6]$$

Marginal Value Product (MVP) is derived by multiplying marginal physical product by the output price.

$$MVP = MPP \times P_x \quad [7]$$

The allocative efficiency (AE) of resource was determined by checking whether or not the ratio of the marginal value product to input price was equal to 1.

$$AE = \frac{MVP}{P_x} = 1 \qquad [8]$$

Elasticticy of production was derived by taking the ration of marginal physical product (MPP) to average physical product (APP)

$$\in = \frac{MPP}{APP} \qquad [9]$$

III. EMPIRICAL FINDINGS

a. Socio-demographic characteristics

The average age of household heads ranged from 20 to 69 years. Most farmers (37%) were found to be within the age group of 50 to 59. This was followed by 12% of farmers within age group of 30 to 39 years old. This in a sense, had shown than the age of household head was not normally distributed. Very few (7%) household heads were found between the age group of 20 to 29 years of age. This could imply that most groundnut people within this age group were doing farming under their parents if at all they were engaged in groundnut farming. Those between 40 to 49 years and 60 to 69 years age groups to were 12% and 10%, respectively.

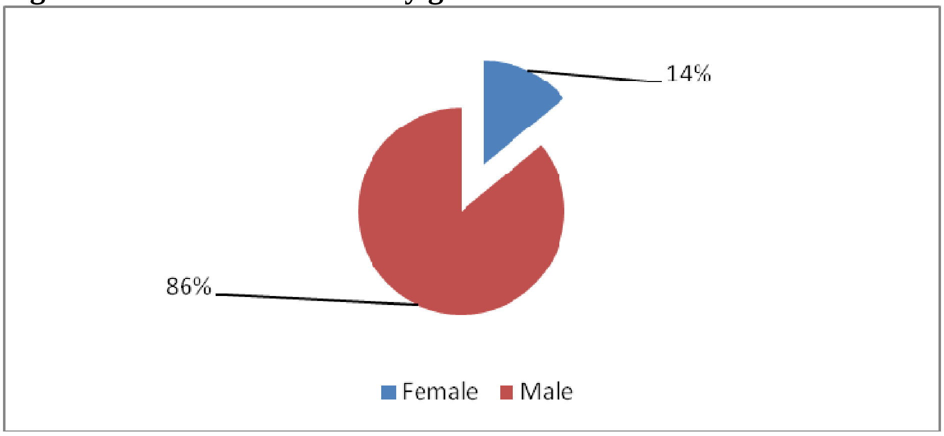
Table 1: Age groups of groundnut farmers in Kasungu

Age Range	Frequency	Percent
20-29	3	7.3
30-39	14	34.1
40-49	5	12.2
50-59	15	36.6
60-69	4	9.8
Total	**41**	**100.0**

Source: 2012 Chatoloma survey

Gender of the household head is one aspect that might affect the profitability of a household interprize. Gender of a farmer may affect one's access to credit for input purchase which, in turn, may affect the production, productivity and profit levels. In the study area, the random sample was dominated by female farmers. About 14% of sampled farmers were male and 85% were male farmers. However, NSO (2005) reported that in Malawi, 77% of households are male headed while 23% are female headed.

Figure 1: Head of household by gender

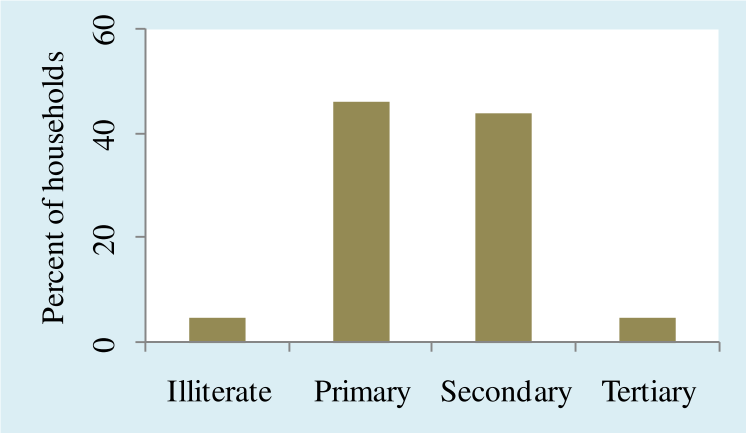


The marital status of the farmers varies from household to household. This aspect may be influenced by the socio-cultural factors in different regions of the country. The farm dynamics between married and widowed farmers could be different. Widow farmers under chitengwa would lose their landownership as the spouses relatives would take off the land. Thus, such farmer would concentrate on staple food crop before getting another enough land for other cash crops. The sample household has indicated that 90% of farmers were married and 10% were widowed.

Figure 2: Marital status of household head

Education level of a farmer is very crucial for comprehending technologies which when adopted could cause a great productivity shift. In addition, education level of a farmer would help the farmer to calculate and determine profitability of the farm enterprise before he is kicked out of the industry by market forced forces. The sample data has revealed that a good percent of farmers had attained some level of education (Figure below).

Figure 3: Education status of household head

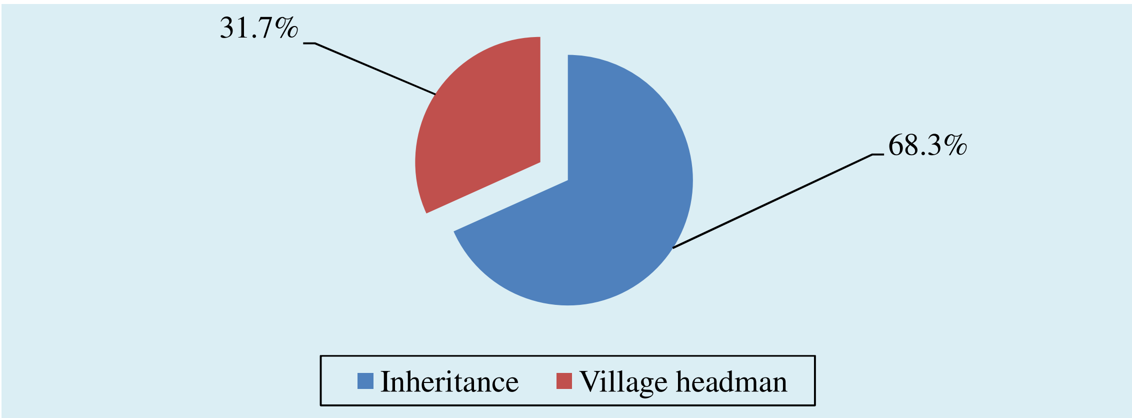


Source: own computation (2012)

Among the farmers of the sampled households, about 46% have attended primary school. This percent is larger than the rest probably because of the free primary education in the country. This was followed by 44% of household who attended secondary school. Mostly, those who have attended tertiary education migrated from rural community to seek for greener pastures to town. This is verified by a small percentage of farmers who attended tertiary education (about 5%). Those who were illiterate were 5%.

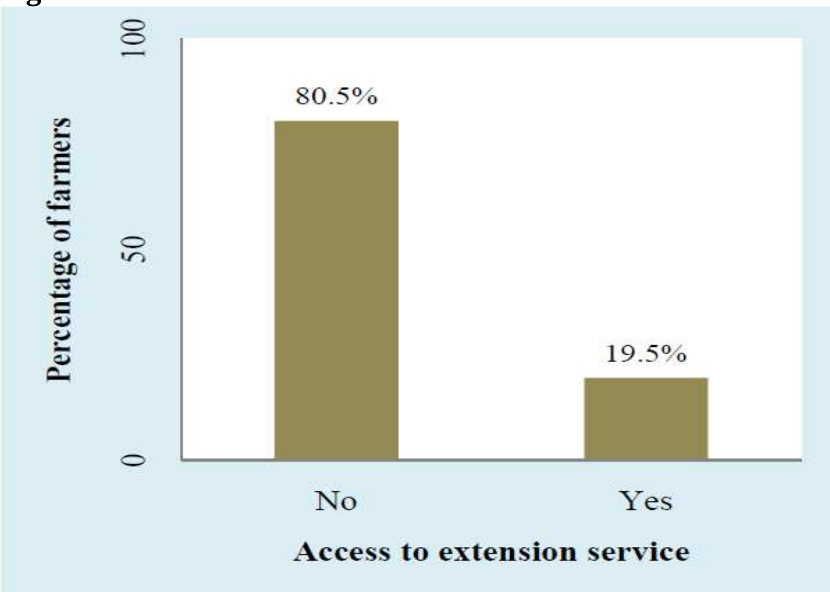
Land ownership can be attained by different ways. Among other ways, the study explored two ways of acquiring ownership of land. Firstly, land could be owned through inheritance or allocations by a village head. Those who acquired their land through inheritance were 68% while those who acquired it through allocation by village head were 32% (see table below).

Figure 4: Household land acquisition



Extension services play an important role in improving the livelihood of farmers. Some of its contributions include provision of non-formal education on a wide range of areas, bringing awareness and promotion of new technologies. The Government through the Ministry of Agriculture and Food Security is the major extension service provider in the country.

Figure 5: Access to extension service



From the study result, it was found that 80.5% had access to no access to extension services while 19.5% had access to extension services (Figure above). Despite the low percentage of access to extension service most farmers report to learn agricultural related advice from fellow farmers.

b. Gross Margin Analysis

Table 2 presents a gross margin analysis for groundnut production in year 2010/2011. Gross margin is presented by the total amount of income earned by selling the farm products less variable costs. Variable costs are those costs in production, which are specific to the enterprise and vary in proportion to the size of the enterprise. A gross margin usually indicates the income farmers have left for fixed costs and profits. As presented here the gross margin indicates the yearly amount left for paying the fixed rent and any profits.

Any farm production system is characterized by variable costs. Major variable costs of groundnut production in the study area included cost of seed, cost of labour, cost of packaging and cost of transport. The study sample has indicated that an average farmer spends MK 6,699 on groundnut seed on a per hectare basis. The second variable cost considered in this study was labour cost. The value of hired labour is taken as given while the shadow/imputed value is used for family labour. It was found that not many farmers employ hired labour due to their budget constraint. The average cost of labour in all sampled households registered an amount of

MK16,749 yet this amount increases to an average of MK18,247.92/ha when we exclude households that did not use hired labour. This in some way implies that farmers prefer to hire labour when it is cheaper than imputed value of family labour.

Table 2: Gross margin for groundnut production

Gross Revenue	**Amount (per ha)**	**Std Error**
Average Yield of Groundnut (Kg/ha)	310	12
Average Price of Groundnut (MK)	200	32
Total Revenue	**62,000**	**9,754**
Variable costs		
Cost of seed	6, 699	590
Cost of labour	16,749	5,991
Cost of transport (harvesting and marketing)	4,000	230
Cost of packaging	1,988	121
Total Variable Costs (TVC)	**29,436**	**1,722**
Gross Margin	**32,635**	**5,212**

Source: own computation 2012

Most groundnut plots were located a way distance from the farmers' residence. As a result, transportation of groundnut yield from the fields of production to the farmer's point of storage becomes one other source of cost. The other side of transportation cost is transporting produce from point of storage to point of sell (market). Modes of transportation include the use of oxcarts, bicycles and head-load. Transportation cost averaged an amount of MK 4,000/ha. Cost of packaging included the cost of purchasing storage sacks or granary materials. The cost, for an average producer was found to be MK1988/ha.

Gross Margin Analysis results as summarized by Table 2, show positive orientation. This does not negate the fact that the some households had negative gross margins. From the original data set, it was computed that 4% of the households interviewed had negative gross margins. About twenty four percent (24%) had gross margins less MK11, 436 but greater than MK1. Forty four percent (44%) had their gross margins between MK11, 436 to less than MK52, 308. Seventeen percent (17%) had their gross margins ranging from MK52, 308 and above.

The average gross margin per Malawi Kwacha invested was MK1 (GM/TVC). This means that the farmer benefits MK1 for every Kwacha invested. The Break Even Point (BEP) of production shows, at this level of cost of production, that farmers' minimum production is 147Kg per hactare. For the farmer to break even given the current average production per hectare, he/she has to incur MK95 for every Kg of groundnut produced. This implies that the minimum price of groundnut, for the farmer just to recover the costs of production is MK95 per Kg of groundnut.

c. Econometric Estimation of Groundnut production function

To estimate the production function, a tradition linearized Cobb-Douglass model was used and the results are presented in Table 3. The adjusted R–squared value indicated that the model was explaining 86% of the variation in the groundnut production by farmers. This had shown a sensible as well as a high degree of goodness of fit in adequately explaining the determinants of groundnut output. The model had an F-value of 86.97 significant at 1% level (*p-value*=0.0061) implying that the independent variables significantly explained the variation in the dependent variable all at 1% level. All the independent variables in the model were also tested for multicollinearity and proved no serious level of multicollinearity as supported by mean Variance Inflation Factor (VIF) of less than 10 (Table 3) (Edriss, 2003). The mean VIF was 1.68. Breusch-Pagan Chi-square statistic was not significant implying that there was no heteroskedasticity in the model.

For some production functions, the returns to scale is the same over the total domain. In this case we say that the specific returns to scale applies globally. The Cobb–Douglas production function is one such production function which has either constant, increasing or decreasing returns to scale globally. This means that if the sum of the parameters is less than 1, then the Cobb–Douglas production function has decreasing returns to scale, if the sum is greater than 1, then it has increasing returns to scale; and if the sum is equal to 1, it has constant returns to scale. From an empirical point of view, it seems reasonable to state that groundnut production in Kasungu is characterised by increasing returns to scale. This is discovered by adding input coefficients (0.990+0.401+0.479>1). This means that given groundnut farmers' fixed factors of production, there is ample room for increasing production by increasing variable inputs only in the short run.

Table 3: Production function estimates

Variable	Coefficient	p-value
Log of seed	0.990 (0.000)***	0.000
Log of land	0.401 (0.00)***	0.000
Log of labour	0.479 (0.001)***	0.000
Constant	56.88 (4.460)***	0.000
F-Value	86.97***	0.0061
R^2	87%	
Adjusted R^2	86%	
Breusch-Pagan Chi-square	1.09***	0.2961
Varince Inflation Factor (VIF)	1.68	

* ** means significance at 1%, in brackets are standard errors.
Source: Author's computation

The efficiency of inputs used for groundnut production was assessed for the farmers. The efficiency of the groundnut farms in the study area assumes the existence of perfect competition of inputs and products and profit maximization. The efficiency of inputs was examined through marginal value products. The estimates of the MVPs are given in value terms. Each value of the marginal product indicates the expected increase in groundnut income generated from the use of an additional unit of input, the value of other inputs remaining unchanged. The MVPs of any resource depends on the quantity of it already being used and on the level of the other resources with which it is combined in the production process (Heady and Dillon, 1961). Therefore, the value of marginal productivity of input factors are derived at the mean of each input factor level and groundnut output. The marginal value productivity is computed as derivative of output with respect to mean level of inputs which is found to be significant in the production function multiplied by input price.

Table 4: Production Analysis

Variable	EP (mp/ap)	AP (y/x)	MPP	MVP	AE (MVP/P_x)
Seed	1.04	7.54	7.9	1,580	7.9
Farm size	0.29	880	260	52,000	5.9
Labour	0.462	1.320	0.61	122	0.81

Estimated elasticities of production function (EP), Average production (AP), Marginal production (MPP), Marginal value product (MVP) and Allocative efficiency (AE) of groundnut production

Source: Author's computation 2012

Production is said to be efficiently organized under perfectly competitive condition in output and input relationship when MVPs are equal to their respective factor costs. To evaluate the efficiency of inputs and to perform comparison between MVPs and respective costs, the cost of the inputs have to estimated on the bases of the nature of inputs and the price offered in the groundnut production process in the study area. For the purpose of testing the input efficiency, the ratio of MVPs to input factor cost is computed and the results are presented in Table 4.

Table 4 revealed that marginal value product of seed, farm size and labour were MK7.9, MK52,000 and MK0.61, respectively, while allocative efficiency for seed, farm size and labour, were 7.9 (underutilized), 5.9 (underutilized), 0.81 (over utilized), there existed production in-efficiency, there is potential for groundnut farmers to improve their production technique. Under utilization of seed could be as a result of high cost of seed. As this input is expensive, most farmers do not think about its optimal use. Labour was over utilized probably because it is cheap labour as much of it comes from family labour. Family labour is difficult to control unlike hired labour. As a result, efficiency in its use is probably undermined. On the other hand, hired labour is easier to monitor and instruct and can be fired if it is learned that its contribution to farm production system is not optimal. The labour in the sample data was dominated by family labour other than hired labour.

From the table it is evident that, seed has higher MVPs to factor cost ratio for groundnut production. For every additional one MK incurred on seed, there is more than one MK return in case of groundnut farms in the study area. In similar manner, ratio of MVP for labour to its factor cost is greater than 1. Investing one more unit of farm size in groundnut production contributes positively to net income. Therefore, these inputs need to be increased in groundnut production until the ratio of MVPs to input cost reach 1. While, for the case of labour the ratio is almost unity.

d. Constraints to groundnut Marketing

Traders take advantage of the small voice an individual farmer has. The private traders adjust their measuring scale to set it in a way that it measures a kilogram that is more than the actual kilogram. This is purely theft the traders do. This can be translated that a farmer sales more than a kilogram value of groundnut at a price that is agreed as worthy a kilogram. As a result, a farmer loses a lot of produce for sub-optimal returns due to the traders' malpractice. As though that is not enough, the prices/Kg that the transactions go at is unsatisfactory to the producers. The combined effects of unethical actions of private traders in the market are one cause of the sub-optimized gross margins.

Low groundnut prices offered by vendors has triggered unhealthy farmer incomes realized from groundnut produce. Though the study learnt positive gross margins of groundnut marketing by smallholder farmers, literature has shown relatively greater groundnut gross margins that can be realized in the marketing of groundnut. The wider discrepancy between the literature and the empirical findings may be attributed to the poor groundnut prices offered on the market in favour of vendor (private traders) than producers. Low incomes which the farmers realize have a cumulative effect on the subsequent production cycle as they may not manage to purchase farm inputs. They are caught up in a vicious cycle.

IV. CONCLUSIONS AND IMPLICATIONS

This study was commission to assess profitability of groundnut production and differences in input productivity in Kasungu district, Malawi. The study has found that gross margin per Malawi Kwacha invested was 2. This means that the farmer returns MK2 for every kwacha invested. The Break Even Point (BEP) of production shows, at this level of cost of production, that farmers' minimum production is 147Kg per hactare for the farmer to break even. The farmer incurs MK95 for every Kg of groundnut produced. This means that the minimum price of groundnut, for the farmer just to recover the costs of production is MK95 per kg of groundnut.

The foregoing analysis of production function indicates that farm size, seed and labour are the important factors of production that affect groundnut output in the study area. The regression coefficients of these inputs were positive and statistically significant. Farm size had the highest MVPs as compared to other inputs, however, this input is a fixed factor in the short run. Seed was the second production factor with higher MVP indicating that farmers can increase their groundnut output by using more seed.

Based on the findings, the following general implications are drawn:

1. Introduction of cooperatives in areas where there are none and strengthening cooperatives in areas where there are present coupled with encouragement of farmers to sell groundnut

through these cooperatives. This would help to enhance their price bargaining power, a factor that is necessary to increasing farmers' revenue.

2. The utilization of inputs should be adjusted to the optimal level until the MVPs equate the factor price of the respective inputs. However, there is need for another study to build on this finding and compute the optimal input levels for groundnut production.

REFERENCES

Chirwa,E.W., and Zakeyo, C. (2003). Impact of Economic and Trade Policy Reforms on Food Security in Malawi. Report submitted to the food and Agriculture Organisation(FAO) and the African Economic Research Consortium (AERC).

Getnet Geremew, 1994. Efficiency of Resource Use in Coffee Growing Area: The case of Smallholder Farmers in Ghibi Woreda Unpublished M.sc. Thesis Presented to the School of Graduate Studies of Alemaya University.

Gujarati, N.D., 1999. Essential of Econometrics. 2nd edition, U.S Military Academy, West point, New York, NY, U.S.A. pp 256-270.

Edriss, A.K. and F. Simtowe. (2002). Technical Efficiency in Groundnut Production in Malawi: An Application of a Frontier Production Function. *UNISWA Journal*, 45-60.

Heady, E.O., and J. L. Dillon, 1961. Agricultural Production Functions, USA, Iowa State University press, Ames, pp.73, 75-76, 97-98, 197.

Kankwamba, H., Mangisoni, J.H., Simtowe, F., Mausch, K. and Siambi, M. (2012). Improved Legume Seed Demand Systems in Central Malawi: What Do Farmers' Seed Expenditures Say About Their Preferences? 2012 Conference, August 18-24, 2012, Foz do Iguaçu, Brazil

Kherallah, M., Minot N., Kachule, R., Soule B.G. and Berry, P. (2001). Impact of agricultural market reforms on small holder farmers in Benin and Malawi. IFRI collaborative Research Project.

Guide to Agricultural Production in Malawi(2004/5). Government publications.

Makato, C.J.A.(1997). A Description of Crop Varieties Grown in Malawi.

Nyirenda, N.E., Cusack, T.J. and Saka, V.W. (1992). Groundnut Agronomy research in Malawi: Past achievements and future Priorities.Proceedings of the fifth regional groundnut workshop for southern Africa.

Chiyembekeza, A.J., Subrahmanyam, P. Kisyombe,C.T. and Nyirenda, N.E. (2003). Groundnut : a package of recommendations for production in Malawi.

Chamango, A.(2010). Groundnut Varieties of Malawi: Botanical types, characteristics, uses and production areas.

Heady, E.O., 1952. Economics of Agriculture Production and Resource Use, U.S.A. Prentice-Hall, Inc. Englewood Cliffs, pp. 21-22, 29-30.