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Comparative Farm Enterprise Profitability Of Cabbage Farmers. A Case Study Of The Ashanti Region Of Ghana

Boakye-Agyeman Maxwell

Adu-Berko Felicia

Abstract: ***The main purpose of farm enterprise is to make profit. The study examined farmers' performance measure from both profitability and efficiency perspective. Farm enterprises profitability and drivers of efficiency among cabbage farmers, chosen from the Ashanti region of Ghana were investigated. For farm enterprise profitability gross margin analysis was used while a stochastic frontier approach was used to analyze technical efficiency. The profitability analysis revealed that farmers in the rural areas obtained the highest gross margin of GH₵ 3,896.67 per hectare whereas farmers in the urban areas obtained the least gross margin of GH₵ 2,896.47 per hectare. The estimated mean technical efficiency levels obtained by the farmers were 72%, 68%, and 54% for rural, peri-urban and urban farmers respectively. Based on the findings of the study it is recommended that, improving the managerial skill and technical innovation of rural and urban cabbage farmers would help increase their technical efficiency level. For peri-urban farmers agricultural extension programs aimed at improving resource allocation in cabbage production methods need to be expanded.***

I. INTRODUCTION

Cabbage is a vegetable of expanding commercial importance in Ghana, produced by farmers in urban, peri-urban and rural areas (Amankwa, 2012). Commercial cabbage production is a significant industry in Ghana, serving local and regional markets and because of increase in demand by consumers, cabbage is now cultivated all year round (Timbilla and Nyarko, 2004). Therefore cabbage growers make an important contribution to the national food supply, hence getting a productive output is necessary in an expanding economy. This calls for urgent need to intensifying the production of cabbage.

The cabbage industry in Ghana can be regarded as having three distinct components: i) commercial gardening areas sited in and around principal urban centres, ii) a form of truck farming in which vegetables are produced in rural areas from where they are purchased by contractors or middlemen and transported by road to the cities and urban centres, and iii) small domestic or backyard gardening. Cabbage cultivation is considered one of the major sources of food security and income generation among the rural community (Codjoe, 2007). Urban farmers are able to cultivate all year round, which provides them with an earning capacity that is at least twice higher than that of their rural staple crop counterparts (Obuobie *et al*., 2006). A research conducted in Kumasi by International Water Management Institute (Ghana) in 2005 showed that, urban farmers with access to irrigation are able to cultivate all year round and can reach annual income levels of about US$ 400-800 and this is twice the income they would earn in the rural settings (Obuobie *et al*., 2006). Cornish and Lawrence (2001) also reported that for peri-urban farmers' dry season cabbage irrigation adds 40-50% of cash to their normal income.

Cabbage production in urban, peri-urban and rural areas provides employment and income for a chain of beneficiaries such as farmers, middlemen, market sellers, and input suppliers among others; and therefore contributes significantly to the national economy (Obosu-Mensah, 1999).

A. OBJECTIVES OF THE STUDY

The general objective of this study was to examine the farm level efficiency and profitability of cabbage production of urban, peri-urban and rural cabbage farmers.

The specific objectives of the study were to:

- ✓ Estimate relative profit levels at the farm gate for cabbage production in the selected urban, peri-urban and rural areas.
- ✓ Determine the technical efficiency levels in cabbage production among urban, peri-urban and rural areas.

B. JUSTIFICATION

Farmers operate rationally by maximizing profit whilst minimizing cost. Outcomes of measures of profitability and efficiency are indicators of farm performance and farmers living standards. Profitability is an important yardstick for measuring efficiency; however, the extent of profitability cannot be taken as a final proof of efficiency. Therefore, technical efficiency together with the profitability of the cabbage farmers will show how the sampled farmers in the Urban, Peri-Urban and Rural areas can make profit by using all the available resources at their disposal.

Though cabbage production in Ghana is quite significant, yield potentials vary across areas. There is no guarantee of generalization in terms of effective and equal yield for all the areas in the country. In addition, there is no direct correlation in the production condition across regions and areas (Braun *et.al.*, 1999), which implies that specific production information need to be generated at specific locations.

Information on cabbage farmers' locations and geographical distribution to facilitate studies into their production characteristics including the profitability and efficiency of production is unavailable at the national level. This limitation serves as major challenge. This study, therefore addresses some of the challenges by comparing the profitability and technical efficiency of cabbage production in rural, peri-urban and urban areas of Ashanti Region in order to explain the differences in the performance measures among the cabbage farmers.

II. METHODOLOGY

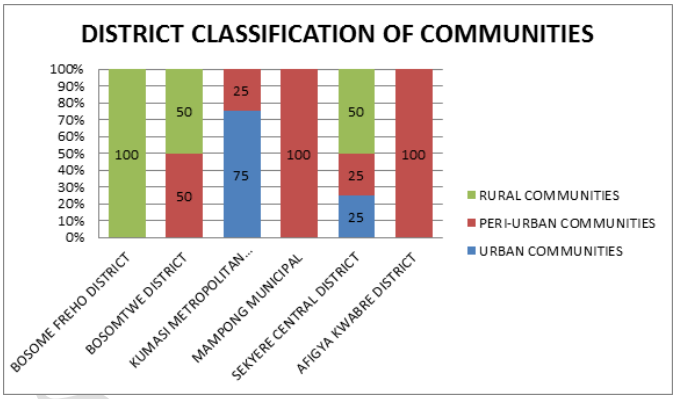
A. STUDY AREA

The study was carried out in Ashanti Region of Ghana, where the production of cabbage, a major vegetable crop in Ghana is done on large scales and also widespread. The Ashanti Region is centrally located in the middle belt of Ghana. It lies between longitudes 0.15^0 W and 2.25^0W, and latitudes 5.50^0 N and 7.46^0 N. (Ashanti Region, 2011). The region produces a large volume of vegetables scattered in the various districts in the region. In most parts of the region, vegetable farming is done all-year-round, whereas in peri-urban and rural areas, vegetables are mostly produced in the dry season when prices are high. The youth in the region who embark on vegetable production usually cultivate cabbage (MoFA, 2011). Cabbage cultivation is now considered to be profitable making more farmers in the region now engaged in its production).

B. DATA SOURCE AND SAMPLING PROCEDURE

The study was initiated with a reconnaissance survey to the cabbage growing areas. This helped in the selection of the project sites. The survey helped by aiding the collection of some basic information on the various locations (rural, peri-urban and urban) and the farmers.

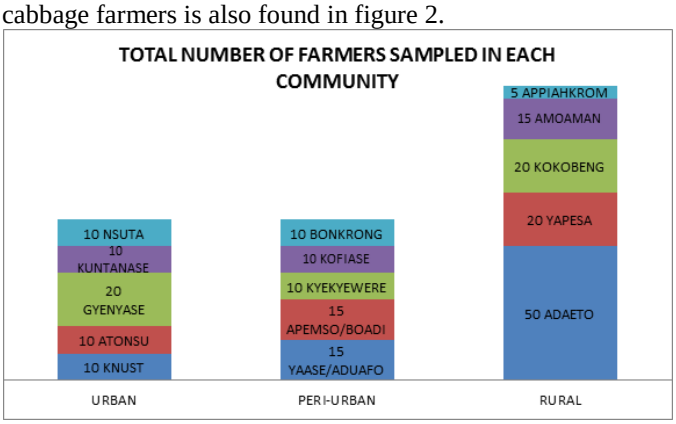
A purposive sampling technique was employed to select 6 districts. The districts that were selected were as shown in figure 1 below are; Bosome-Freho District, Sekyere Central, Afigya Kwabre, Mampong Municipal, Bosomtwe District and Kumasi Metropolitan Assembly. It also shows the percentage of selected communities from the three categorized areas in the selected districts.



Source: Field Survey 2015

Figure 1: District classification of the three selected areas

Simple random sampling method was used to select 230 cabbage farmers in the three identified study areas; 60 farmers were sampled in the urban areas, 60 from the peri-urban areas and 110 sampled from the rural areas as shown in figure 2. The selected sample sizes for the various areas were based on the size of cabbage farmer population in these areas. The selected communities with their respective number of selected cabbage farmers is also found in figure 2.



Source: Field Survey 2015

Figure 2: Sampled farmers in cabbage producing communities

C. EMPIRICAL APPROACH AND DATA ANALYSIS

The data collected was analyzed using various analytical techniques. Regression analysis was used to obtain the structural equation for cabbage output at each area as well as fitting a cabbage production response function using the Maximum Likelihood estimation technique**.** Gross margin analysis was also used to determine the farmer's profit. The

statistical computer program used for the data analysis was Statistical Package for Social Science for Windows Version 16.0 and STATA11 was used for the Maximum Likelihood estimate and efficiency determination.

D. GROSS MARGIN EMPIRICAL MODEL

The Total Variable Costs (TVC) incurred by the farmers, and the Total Revenues (TR) realized in the production were used to estimate the farmers gross margin

The *TR* was estimated as the prevailing market price of a given output (*Py*) multiplied by quantity of output sold (*Qys*)

(*Py* * *Qys*)……..1

The total variable cost was estimated as the prevailing market price of a given input (*Pxi*) multiplied by quantity of the input used (*Qxi*)

(Pxi * Qxi)……..…2

Thus, Gross margin for each enterprise is calculated as:

$GM = (Py * Qys) - Pxi * Qxi$ ……3

E. THE EFFICIENCY EMPIRICAL MODEL

Stochastic frontier model was specified and estimated. The Stochastic frontier production model was used to determine the relationship between the dependent variable (cabbage output) and the independent variables as well as to determine the technical efficiency in farmers operation in the study areas.

a. THE STOCHASTIC FRONTIER MODEL

The study applied a stochastic frontier model to estimate technical efficiency using the input approach, following Amaza and Maurice (2005).

The model was generally defined as

$Y = f(X_i\beta)\, e^{Vi - Ui}$……..…1

Where Y is dependent variable, f(x) is the functional form, β is estimated parameter,

V_i-U_i is a composed error term where V_i is the random error term and U_i represents the technical inefficiency, and e is the exponential operator.

The linear form of the Cobb-Douglas production frontier function adopted for this study was specified as

$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + V_i - U_i$…….. 2

Where:

ln Denotes natural logarithms

Y = Total output of cabbage was measured in kg per hectare

X_1= Farm size where cabbage is being cultivated was expressed in hectares

X_2= Fertilizer being applied on cabbage farms, measured in 50kg bags per hectare

X_3 = Spraying being undertaken on farm, measured in litres of pesticides

X_4 = Irrigation, cabbage water needs, measured by the number of times the farmer waters the cabbage farm per production period.

X_5= seed for cultivation, expressed in grams per hectare

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = Estimated parameters.

b. TECHNICAL EFFICIENCY ESTIMATION

The technical efficiency level was estimated using the equation

$$TE = \frac{Y_i}{f(X_i,\beta)\exp V_i} \quad \text{.....4}$$

$$TE = \frac{f(X_i\beta)\exp(\varepsilon_i)}{f(X_i\beta)\exp V_i} \quad \text{.....3}$$

The inefficiency function was specified as;

$$\cup = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 \quad \text{.....6}$$

$$TE = \exp(-\cup_i) \quad \text{.....5}$$

Z_1= household size, household used in farming activities measured by the number of people in the farmer's house who contribute to production.

Z_2 = Occupational education measured the knowledge level of the farmer in cabbage production and this was expressed by the number of years in cabbage production

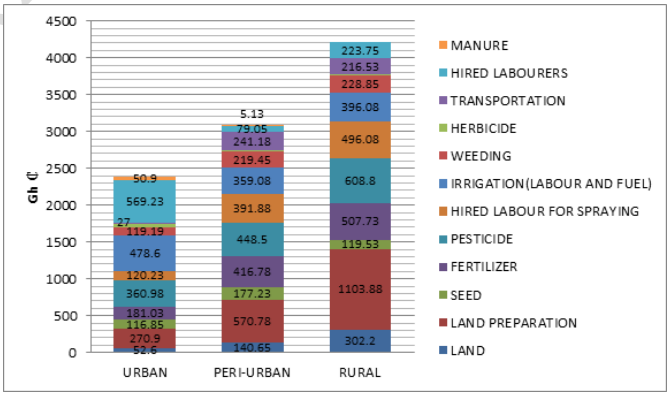
Z_3 = Gender, Dummy variable showing value of 1 if the farmer is a male, otherwise zero

Z_4= Age, Dummy variable showing value of 1 if the farmer is 40 years and above, otherwise zero

Z_5= Extension, 1 if extension service is available and 0 otherwise

Z_1, Z_2, Z_3, Z_4, Z_5= Estimated parameters.

III. ENTERPRISE COST AND REVENUE ANALYSIS RESULTS



Source: Field Survey, 2015

Figure 3: Cost of production of a hectare of cabbage in Gh₵ in the three selected areas

There are several factors that influence the production cost of farmers. It is very crucial for the income situation of farmers because to know their profit, their cost situation would have to be assessed.

The results in Figure 3 above showed that rural cabbage farmers incurred the highest total variable cost of GH₵4,204.85 per hectare which exceeded the total variable cost of peri-urban farmers by GH₵ 1,132.59 and urban farmers by GH₵ 2,247.17 per hectare. The results also indicated that cost of land preparation was the highest total variable cost factor in both rural and peri-urban areas as against the cost of hiring labourers in the urban areas. The least total variable cost factor in the urban areas was the cost

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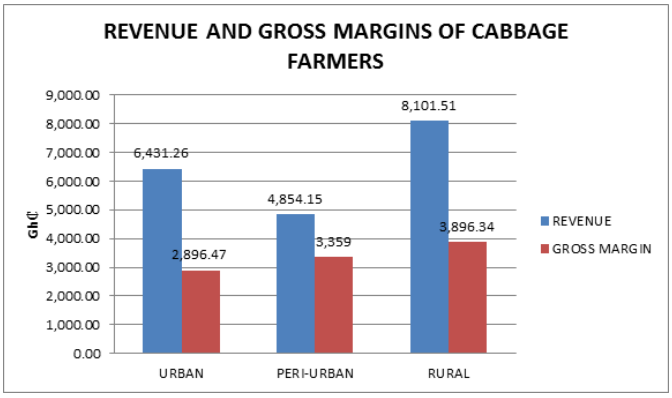
of transportation as against cost of manure in the peri-urban and cost of herbicide in the rural areas.



Source: Field Survey, 2015

Figure 4: Total revenue as a result of output per hectare by the unit price of cabbage

Farmers in the rural areas had an output of 10,948 kg per hectare and sold at a unit price of Gh ₵ 0.74 where as Peri-Urban and Urban cabbage farmers had an output of 10,373 kg and 7,035kg respectively. Urban and Peri-Urban farmers sold their produce at a unit price of Gh ₵ 0.69 and Gh ₵ 0.62. Finally the results from the Figure 4 revealed the respective gross margins for farmers in the study areas. Farmers in the rural areas obtained the highest gross margin of GH₵ 3896.67 per hectare which exceeded the gross margin of peri-urban farmers by GH₵ 537.67 and urban farmers by GH₵ 1,000.20. This is an indication that cabbage farming in rural areas is more profitable. This result is consistent with the findings of Karim *et al.*, (2009), who empirically revealed that vegetable farming in rural areas which serves as a main source of income to the farmers is profitable. Farmers in the rural areas received higher prices for their cabbage than farmers in both peri-urban and urban areas, largely due to the direct sale of their produce to traders whereas Peri-urban and Urban farmers mostly sold their produce directly to retailers. This agrees with the findings of IFAD on a research conducted in Zambia on Agricultural marketing of vegetables in 2004. In furtherance to this, rural farmers obtained higher price based on the quantity of cabbage that they sold. This affirms Say's law which explains that the positive relationship between price and quantity sold was as a result of rural farmers production level that created sufficient market for their produce (Arnold, 2005).

IV. EMPIRICAL RESULTS

A. VARIANCE PARAMETERS

The results derived from the Maximum Likelihood Estimates of Stochastic Frontier are presented in Tables 1, 2, and 3. Rural cabbage farmers had the highest mean efficiency of 0.72, that is 72% followed by Peri-Urban farmers (68%, that is 0.68), and Urban farmers (54% that is 0.54). In theory, technical efficiency levels ranges between zero and one. The higher the technical efficiency value, the higher the level of technical efficiency of the farm (Coelli, 1994). The 72% mean technical efficiency in the rural areas implies that, 28% more output would have been produced with the same level of inputs if cabbage farmers in the rural areas were to produce on the most efficient frontier following best practices. Farmers in the peri-urban areas could have also produced 32% more output given the same set of inputs if they were to produce on the most efficient frontier. Farmers in the urban areas have the potential of producing 46 percent more output given the same set of inputs.

The technical efficiency levels of the farmers in the region can be compared with the findings of Abaidoo *et al.*, (2009) where he reported the mean technical efficiency of lettuce farmers to be 66.67% in a research conducted in Kumasi (Ghana). In a similar studies conducted by Udo and Etim (2008) among city water-leaf farmers in Akwa Ibom State in Nigeria, they found that the water-leaf output can still be increased by 18% using available input and technology.

The likelihood function is expressed in terms of the variance parameters sigma (σ) and gamma (γ) (Battese and Coelli, 1995). The estimated sigma square (σ^2) for cabbage farmers in the areas (rural, peri-urban and urban) are 0.45, 0.61, and 1.45 and are significant at 5%, 1% and 1% respectively. The sigma square indicates the goodness of fit of the model. The significant sigma square values for the cabbage farmers indicates that technical inefficiency exists in cabbage production with urban farmers having the highest estimated sigma square value (1.45).

The estimated gamma (γ) parameter value for the rural areas is 0.81 which means that 81 per cent of the total variation in cabbage output among the farmers was due to differences in their technical efficiency levels. In the peri-urban area the value of gamma is 0.79, implying that 79 percent of the variation in peri-urban farm output is due to disparity in their technical efficiency levels. The discrepancies in the level of efficiencies which necessitated the total variation in the cabbage output of urban farmers were as result of an estimated gamma parameter value of 0.15.

Presence of inefficiency in the production input-output data for the cabbage farmers was detected. The test was carried out by estimating the stochastic frontier production function and conducting a Likelihood-ratio test. The test statistics are computed automatically when the frontier model is estimated using STATA version 11. The test statistics is defined by chi-square ($\chi 2$). As indicated in Tables 1, 2 and 3. The inefficiency component of the disturbance term (u) is significantly different from zero. This indicates that there is statistically significant inefficiency in the data.

B. CABBAGE PRODUCTION FUNCTION ANALYSES

Table1, 2 and 3 provide the results obtained from the Stochastic frontier production functions analyses and results of the inefficiency model.

Dependent variable Ln cabbage output(kg)				
Variable	Coefficient	Std.Error	t-statistic	Prob.
Constant	2.8388	0.6052	4.69	0.000***
Ln fertilizer	0.1005	0.0983	1.02	0.307
Ln spraying	0.2859	0.0712	4.01	0.000***
Ln farm size	-.0.2085	0.0912	-2.28	0.022**
Ln irrigation	0.1798	0.1628	1.10	0.270
Ln seed	0.3579	0.1410	2.54	0.011***

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Inefficiency model				
Constant	0.2643	0.0306	8.62	0.000***
Household size	-.0.0014	0.0031	-0.45	0.653
Occupational education	-0.0026	0.0014	-1.75	0.083*
Gender	-.0064	0.0171	-0.38	0.708
Age	0.0013	0.0006	1.80	0.074*
Extension	-0.0141	0.0168	-.0.84	0.405
Variance parameters				
Log likelihood function	-94.070			
Sigma-squared	0.452			
Gamma	0.81			
Wald chi2(5)	46.8			
Prob>chi2	0.000***			
Mean efficiency	0.72			

****1% Significant level ** 5% Significant level *10% Significant level*

Tables 1: Regression results for rural cabbage farmers

Dependent variable Ln cabbage output(kg)				
Variable	Coefficient	Std.Error	t-statistic	Prob.
Constant	2.3708	0.9138	2.59	0.009**
Ln fertilizer	0.5072	0.2007	2.53	0.012**
Ln spraying	0.1004	0.1328	0.76	0.450
Ln farm size	0.0042	0.1483	0.03	0.977
Ln irrigation	0.1777	0.2010	0.88	0.377
Ln seed	0.4617	0.1971	2.34	0.019**
Inefficiency model				
Constant	0.2379	0.1613	1.48	0.146*
Household size	-0.04771	0.0199	-2.39	0.020**
Occupational education	-0.0081	0.0183	-0.44	0.658
Gender	0.0343	0.0400	0.86	0.396
Age	0.0370	0.0442	0.84	0.406
Extension	-0.0453	0.0262	-1.76	0.089*
Variance parameters				
Log likelihood function	-60.42			
Sigma-squared	0.61			
Wald chi2(5)	23.6			
Prob>chi2	0.002***			
Gamma	0.79			
Mean efficiency	0.68			

****1% Significant level ** 5% Significant level *10% Significant level*

Table 2: Regression results of cabbage production in the peri-urban areas

Dependent variable Ln cabbage output(kg)				
Variable	Coefficient	Std.Error	t-statistic	Prob.
Constant	2.8824	0.3974	7.25	0.000***
Ln fertilizer	0.4960	0.0423	11.71	0.000***
Ln spraying	0.0785	0.3066	2.56	0.010**
Ln farm size	0.2708	0.1739	1.56	0.120*
Ln irrigation	0.3877	0.1221	3.17	0.002***
Ln seed	0.5141	0.2345	2.19	0.028**
Inefficiency model				
Constant	0.7088	0.1762	4.02	0.000***
Household size	-0.0280	0.0255	-1.10	0.277
Occupational education	-0.0214	0.0129	-1.73	0.089**
Gender	-0.1805	0.1225	-1.47	0.147*
Age	0.0010	0.0030	0.33	0.743
Extension	0.1193	0.0641	1.86	0.068*
Variance parameters				
Log likelihood function	-54.79			
Sigma-squared	1.45			
Gamma	0.15			
Wald chi2(5)	8.6			
Prob>chi2	0.000***			
Mean efficiency	0.54			

****1% Significant level ** 5% Significant level *10% Significant level*

Table 3: Production function and inefficiency model results of urban farmers

Fertilizer had an insignificant relationship with output in the rural areas as shown in table 1. This was as result of untimely and inappropriate application of fertilizer. This is in accordance with a study conducted by Kemble *et. al.,* (1999) which states that timely and appropriate application of fertilizer can make a significant difference in the quality and quantity of cabbage output**.** Fertilizer in both peri-urban and urban areas as shown by Tables 2 and 3 was statistically significant. The implication of this finding is that an increase in the application of fertilizer in both peri-urban and urban areas brought about an increase in the output per acre of cabbage. A kilogram increase in fertilizer usage in the peri-urban areas resulted in 0.50 kg increase in output. This was so because fertilizer as a yield enhancing input provided the needed nutrient required by cabbage. The effectiveness of fertilizer application as a good farming practice in the study area was seen in the positive significant relationship which indicated that, the required amount of fertilizer being applied on cabbage in the study area resulted in large cabbage heads which in turn had positive influence on the output by 50%.

Results of cabbage production in the three selected areas as presented in Tables 1, 2 and 3 showed a positive significant correlation between spraying and output in both rural and urban areas with the exception of an insignificant relationship in the peri-urban areas**.** Output increased by 0.285 kg as a result of a litre increase in spraying in the rural areas. In the same vein it went up by 0.0785 kg in the urban. The essence of pesticide application is to prevent, control or reduce pest infestation; therefore the positive significant relationship implied a successful and effective pesticide application which resulted in reduced plant loss thereby enhancing higher yields and better quality of cabbage. The insignificant relationship between spraying and output in the peri-urban areas was as a result of ineffective pesticide application**.** Spraying was significant at 1% and, 5% levels of probability in the rural and urban areas respectively. This explains that output of cabbage

could be increased if pest controlled measures are taken effectively.

The positive relationship between spraying and cabbage output conforms to the findings of Hodgson, (2003) which linked the rapid increase in the quantity of pesticides used in the agriculture sector to the positive impact of spraying on yield.

Farm size had positive significant relationship with output only in the urban areas as depicted by Table 3 implying that, cabbage production is positively influenced by the size of the farm. A unit increase in the size of the farm in the urban areas resulted in 0.27 kg increase in output. This implies that effective expansion of the areas under cultivation in addition to the acquisition of new farm lands resulted in cabbage yields by 27%.However, except for farm size in rural areas (Table 1) which impacted negatively on output, farm size in the peri-urban areas (Table 2) was also found to be statistically insignificant. The unexpected inverse but significant relationship between farm size and output in the rural areas indicates that increasing the sizes of the farm increased output by a smaller margin due to inefficient input combination (Cornia,1985). Finally the insignificant relationship between farm size and output in the peri-urban areas is as result of ineffective expansion of the areas under cultivation.

In all the three selected areas, irrigation is positively signed and significant with output only in the urban areas (Table 3). This gives credence to the fact that cabbage farming that is irrigated during dry season would have a positive yield since cabbages need regular and effective irrigation to ensure rapid growth and evenness of maturity. In addition to the statistical significance effect of irrigation on output per hectare in the urban areas, its coefficient magnitude was 38% and significant at 5% error level. This agrees with the findings of Daugovish *et al*., (2008) which revealed that vegetables are usually grown under irrigated conditions hence; require more irrigation than do cereal crops. The insignificant relationship between irrigation and output in both rural and peri-urban areas is as a result of non frequent water application due to the type of soils in those areas which do not require much irrigation as in the case of the urban areas. According to Daugovish *et al*., (2008), water requirement of cabbage depends on the irrigation method, weather conditions and the type of soil. The insignificant relationship between output and irrigation in both the peri-urban and the rural areas was also as a result of untimely water application. This was so because their farms were big and they could water from early morning through to the afternoon which put much stress on the cabbage. Irrigating farms in the afternoon is not effective as the water will evaporate and in effect the gross water requirement of the cabbage would not be met. This is in accordance with the findings of Dalvi *et. al.,* (1999) which states that timely application of appropriate gross water depths to crop demand increases yield.

From the results the coefficient of seed was positive and significant in all the three selected areas as depicted by Tables 1, 2 and 3. These results corresponded to the findings of Spence,(2006). He explained that a required quantity of seed per hectare is effective for sustained growth in vegetable production.

C. TECHNICAL EFFICIENCY ANALYSIS

In the inefficiency model, variables are included as inefficiency variables; thus a negative coefficient means an increase in efficiency and a positive effect on productivity.

The estimated coefficient of the household size on technical inefficiency was negative in all the three areas from the tables. This shows the importance of household size with positive labour in increasing farmers' technical efficiency. The result is in line with the findings of Alemu *et al*., (2002) which revealed that an increase in the number of adults in the family could increase technical efficiency if it results in increased labour devoted to crop production.

In all the three selected areas as depicted by the tables, occupational education measured by the number of years of farming experience was negatively related with technical inefficiency. This explains the fact that, higher efficiency level also depends on the farmers experience in cabbage farming. It was also found out that occupational education among urban farmers had statistically significant relationship with technical inefficiency**.** This result is consistent with findings of Abdulai and Eberlin (2001) who stated that experience in cabbage farming is very valuable for positive yield. Most farmers therefore relied on their years of experience to attain technical efficiency.

Results from Tables 1 and 3 depicts that gender increases efficiency in both rural and the urban areas. This shows that male cabbage farmers are more efficient in cabbage farming than their female counterparts or male-constrained cabbage farmers. This is because the availability of male cabbage farmers is often associated with timeliness of farm operations. As expected the sign for gender is negative indicating that the more the number of male cabbage farmers, the less the inefficiency level. This result is in line with the findings of Ekunwe and Emokaro, (2009) that empirically showed that male labour are more efficient than male constrained farmers.

Results on age which was measured as a dummy variable showing a value of one (1) if the farmer is forty (40) years and above and otherwise zero showed that age reduces efficiency as indicated by Tables 1, 2 and 3. They had positive relationship with inefficiency indicating that, the farmers were less adaptive to modern technologies. Similar result on the effect of age and efficiency has been empirically explained in a study by Kibaara (2005). The results of his study showed that younger farmers who were less than 50 years were more efficient than the older ones.

From the results it is found that it is only extension coefficient in peri-urban areas as shown by Table 2 that significantly reduces inefficiency. This implies that farmers who received more extension visits tend to be less inefficient. This conforms to the earlier findings that extension service improved efficiency as better management and information utilization leads to greater benefits to farmers (Seyoum *et al*., 1998).

V. CONCLUSIONS AND RECOMMENDATIONS

Results from the profitability analysis showed that farmers in the rural areas incurred the highest total variable

cost of GH₵ 4,204.85 per hectare which exceeded the total variable cost of peri-urban farmers by GH₵ 1,132.59 per hectare and urban farmers by GH₵ 2,247.17 per hectare. Rural farmers obtained the highest gross margin of GH₵ 3,896.34 per hectare whereas farmers in the urban areas obtained the least gross margin of GH₵ 2,896.47 per hectare. Even under circumstances of high total variable cost, rural farmers obtained the highest gross margin

The Maximum likelihood estimates also indicated that the coefficient of seed use was positive and significant in all the three selected areas. In addition, occupational education was found to reduce inefficiency levels significantly in the rural and urban areas whereas household size and extension significantly reduce inefficiency levels in the peri-urban areas and finally gender was found to significantly reduce the level of inefficiency in the urban areas. By implication the results of the maximum likelihood estimates showed that not all the performance enhancing inputs variables were positive and significant in all the three selected areas.

From the stochastic frontier analysis, the mean technical efficiency was found to be 72%, 68%, and 54% for rural, peri-urban and urban farmers respectively. By implication, rural farmers would require 28% more output to be on the frontier. Farmers in the peri-urban areas could have also been on the most efficient frontier with 32% more output and 44% more output would have enabled urban farmers to be on the frontier.

Occupational education reduces inefficiency in both rural and urban areas. Therefore, improving the managerial skill and technical innovation of rural and urban farmers can lead to increase in cabbage production. In the peri-urban areas, agricultural extension programs with the purpose of improving resource allocation in cabbage production methods need to be expanded.

Cabbage production is labour intensive and needs intensive care with frequent spraying of pesticides to control insect pests from the study. There is the need to encourage female farmers to undertake cabbage production in the urban areas through sensitization programs.

Earnings are essential requirement in farm enterprise and healthy farm enterprise is that which has good profitability. This notwithstanding, efficiency shows how farmers make profit by using all the resources available and existing technology. Profitability is therefore a measure of evaluating the overall efficiency of farm enterprise. The highest gross margin obtained by the rural cabbage farmers corresponded with a high level of efficiency followed by Peri-Urban and Urban respectively. This is a good performance measure indicator where higher gross margin reflects high level of efficiency.

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