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Full Length Research Paper

Analysis of Technical Efficiency of Pig Production in Southern Kebbi State, Nigeria

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This study analyzes the technical efficiency of pig production in southern Kebbi State. A purposive and snowball sampling techniques were used in the selection of 252 pig farmers. The data obtained from the farmers were analyzed using descriptive statistics and stochastic frontier production function, using a linearized Cobb–Douglas production function in determining the technical efficiency and inefficiency level of the farms in the study area. The results indicated that gender of the farmers, farming experience; household size and management system were negative and significant at 10%, implying that any increase in these variables will lead to increase in their technical efficiency level. The estimated gamma parameter of the model was 8.77, which indicates that about 91.23% of the total variation in pig output among the producers could be attributed to differences in their technical efficiencies. The mean technical efficiency of the pig farmers is 0.70, and the minimum technical efficiency is 0.27, while the maximum technical efficiency is 0.94. The result suggests that technical efficiency in pig production in the study area could be increased by 6% through better use of available resources given current state of technology. This also means that if the average farmer in the sample is to achieve the technical efficiency level of his or her most efficient counterpart, the average farmer would be 24% [i.e. 0.94-(.70)] more productive. Similarly, the most technically inefficient farmer would be 67% [i.e. 0.94-(.27)] more productive in order to achieve more productive level of the most technically efficient. Government should establish more research institutes for various disease control, breeding centers, effective extension services, market linkages for pig products to encourage more involvement in pig production. The result of the research recommends that farmers, whose technical efficiency level is very low, are expected to seek advice from the prospective ones on how to improve and attain greater level of efficiency in their production.

Keywords: Pig, Technical Efficiency, Determinants, Stochastic frontier Production function, Southern Kebbi.

INTRODUCTION

The livestock sub-sector of Agricultural sector is vital to the national economy since it is the main supplier of the essential animal protein. The importance of livestock sub-sector is in line with recommendation of the F.A.O (2003) that on an average basis, a man's daily protein intake should be between 65-72 grams and 53% (about 35 grams) of this should be animal based. Animal protein is

essential in human nutrition because of its biological significance. In realization of this, the various governments in Nigeria have been pursuing programmes at national, state and local levels to boost the mass production of food and livestock. Some of the programmes include the Farm Settlement Scheme, Agricultural Development Project (ADP), Better Life Programme, Agricultural Transformation Agenda (ATA), and Microcredit Scheme for Livestock, to mention few. Pig production is an example of such community level livestock programmes.

The name pig is broadly applied to all mammals of the family *Suidae* and order *Artiodactayla*but specifically to the domestic animal known scientifically as *Susscofa* from which domestic pig was developed. One of the major advantages of pigs is the ability to convert different kinds of feed including kitchen waste to meat (Rahman et al., 2008). Considering general feed conversion, pig is by far the most efficient among farm animals in the conversion of feed energy to body energy. The high rate of productivity is another major advantage of pigs, ranging from 9.3-9.96, live piglets per sow CTA (1995), and Okoli (2006).Though, before weaning, an average of 1.51 may die, leaving the average number of piglet weaned per sow to be 8.45. The sow have ability of farrowing twice a year with an average of 16.9 piglets per year, this is a remarkable advantage over other ruminants like cattle whose maximum are two young one within such period. Other researchers such as Tewe and Adesehinwa, (1995) revealed that the pig is more efficient carcass yielder than cattle, sheep or goat, dressing out at about 70% compared to 52.5% for cattle and about 50% for sheep and goat. In addition, pig carcass has a smaller proportion for bones and higher proportion of edible meat. It is relatively easy to establish intensive pig production in a developing country like Nigeria; if capital is available and adequate feed supplies are assured (Ogunniyi and Omoteso, 2011). Profitable pig production will however not be achieved unless the right products are produced in the right place at the right price. It is therefore important for the intending pig producer to understand the economic, physical, social, ethnic and religious forces which operate to determine the effective way of producing swine. All over the world, meat production remains overwhelmingly the main purpose of keeping pigs. The pork can be utilized by the producer and his family or sold as a source of income. Processed meats such as bacon, sausage are also being produced and are increasingly gaining recognition. By-products such as pigskin and bristle are used in manufacturing of light leather and brushes especially in Asian countries (Young 2005). Pig manure is a valuable fertilizer and can be aerobically digested to produce cooking gas; it also stimulates the growth of microorganisms and plants for feeding fresh water fish and ducks (Okoli, 2006).

Despite the afore-mentioned attributes and contributions, production of pigs in Southern kebbi State, has remained low. Opposition to pig production is very significant and may not favour profitable pig production. Though, despite these problems, there is still existence of pig farms in the study area. One can conclude that there are reasons of their existence.

Based on these, The main objective of this study is to analyze the efficiency of pig production in Southern Kebbi State; by describe the socio-economic characteristics of pig farmers; measuring their existing production efficiency levels; and identifying the determinants of technical inefficiency levels of pig farms.

METHODOLOGY

Study Area

This research was carried out in Southern Kebbi State (Zuru Emirate), Nigeria. Zuru Emirate is one of the four Emirates in Kebbi state. The Emirate comprises of four Local Government Areas (LGAs) namely; Danko-Wasagu, Fakai, Sakaba and Zuru. The Emirate is located within latitudes 11^{o} and 12^{o} N and longitudes 4^{o} and 5^{o} E of the equator (KBSG. 2003). The state was carved out from the former Sokoto State in 1991; it covers an area of approximately 9,000 square kilometers. It is located on a hilly terrain and is bounded to the north by Gummi Local Government Area of Zamfara State, North-west by Koko Local Government Area, South-west by Yauri Local Government Area, North-east by Bukuyum Local Government Area of Zamfara State and south by Rijau Local Government Area of Niger state (Girma, 2008).

The estimated population of the Emirate is 582, 106 people (NPC, 2006). The various indigenous cultural and ethnic groups of the Emirate are the Dakkarkari, Fakkawa, Dukkawa, Kelawa, Kambarawa, Katsinawanlaka and Achifawa. Other non indigenous ethnic groups in the area, Hausa, Fulani, Yoruba, Igbo and other tribes found in Nigeria. Animal husbandry was practiced side by side with crop production, even though on limited scale. The people of the Emirate depend largely on the pastoral Fulani for meat, milk and butter. Pig production in Zuru emirate is relatively low compared to other animals. The sales and marketing of pig and piggery products in the study area seems to be very low, this could be due to discriminatory attitude towards the production and consumption of pigs and their products.

Models Specification

The Stochastic Frontier Production Function (SFPF) Model:

The SFPF model used by Onu*et al* (2000), Parikh and Shah (1995),which was derived from the composed error model of Aigner et al. (1977), Meeusen and Broeck (1977), and Forsund et al. (1980) were applied in the analysis of data. The Cobb Douglas production function was linearized in the form:

$InY_i = \beta_0 + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + \beta_4 InX_4 + \beta_5 InX_5 + V_i - U_i$..... (1)

Where: InY_i = Natural Logarithm of Y

Y_i = Pig output (kg)

X_1 = Initial cost of piglets (₦)

X_2 = Quantity of feed (kg)

X_3 = Water (liters)

X_4 = Labor (man/days)

X_5 = Cost of medication (₦)

X_6 = Housing cost (₦)

Vi = represent random disturbances cost due to factors outside the scope of the farmers which is assumed to be identically and normally distributed with a mean of zero and constant variance of V~N (o, σ2v) and independent of U U_i = non-negative random variable associated with technical efficiency in production, and is assumed to be independently identically and normally distributed. U~N (o, σ2u) where the conditional mean μ is assumed to be related to farm and farmers related socioeconomic characteristics.

The inefficiency model was specified as:

$U_i = \delta_0 + \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4 + \delta_5 D_5 + \delta_6 D_6 + \delta_7 D_7 + \delta_8 D_8$ .....(2)

Where: U_i = Inefficiency

D_1 = Age (years)

D_2 = Sex Dummy Variable (1 male, 0 female)

D_3 = Educational Level (years)

D_4 = Household Size (Number of people)

D_5 = Pig Rearing Experience (years)

D_6 = Management Systems Dummy Variable (1 if intensive, 0 if otherwise)

D_7 = Breed of Pig (1 if exotic, 0 if local)

D_8 = Extension Agents Contact

δ = Parameters to be Estimated.

RESULTS AND DISCUSSION

The socio-economic characteristics of the respondents are presented in Table 1. The study revealed that majority of the pig farmers' age are between 36-45 years with 37.3%, while the age of 18-35 constitutes 34.1% of the pig farmers in the study area, and the age of above 45 years constitute 25.8% of the pig farmers, and the age below 18 constitute 2.8%. This shows that teenagers are less involved in pig production but the adults who are agile are more engaged in pig production in the study area. This could be attributed to the fact that pig management is labour intensive and requires patience from the farmers.

On gender of the respondents the result indicated men to be the highest in production of pigs in the study area with 58.7%, while the female carries 41.3% of the pig farmers. This indicates that men were more involved in pig production than females. The finding is in consonance with those of Umeh*et al.* (2015) who stated that men who are relatively stronger are mostly involved in pig production and also suggested that sex may increase technical efficiency as male producers who often are the head of the family, who are energetic to procure and administer production inputs are the majority of pig farmers in the study area. Though the male are more involved in pig production, females also contributed to labour on light farm operations such as serving of feed and water, and cleaning of the piggery as corroborated by Osondu*et al.* (2014).

The educational level of pig farmers indicated that majority of pig farmers (46.4%) in the study area are primary school leavers. Twenty four percent (24.2%) of the pig farmers have been found to have attained secondary school while eighteen percent (18.3%) of the pig farmers have tertiary level of education and eleven percent (11.1%) of the pig farmers has non-formal education.

Table 1, also shows the majority (69.0%) of pig farmers to be farmers who took farming as their primary source of living. This could be because; they have ample time to stay around their pigs to take care of them. Civil servants appeared to be the next majority (12.3%) in pig farming. This could be attributed to them for having acquired skills on animal husbandry and could manage their pigs efficiently. Also students (9.5%) were found to be involved in pig farming. The low involvement of students in pig farming could be based on not having ample time to stay at home and take good care of their pigs. Also traders who are known to be always busy with their trading business are found to be less involved (9.1%) in pig farming. The result indicates that farmers are more actively involved in keeping of pigs than the rest. This is because pig has less prestige when compared to other domestic animals in the study area. Furthermore, people have wrong perception that pigs are dirty animals and should not be reared by people of higher social status. Midau*et al* (2011), in their survey found that, majority of the respondents (about 75%) had little or no education. The implication of this is that it will be difficult for them to accept and adopt improved production techniques that will enhance their product-ivity.

Majority (78.2%) of the pig farmers in the study

area are married. While single constitutes 10.7% of the pig farmers in the study area. Widows who engaged in the pig farming constitutes 9.1% of the pig farmers. But divorced women constitutes only 2.0% which appeared to be the least in pig farming probably because of their small size in number. The low involvement of widows and divorced could be, that they could not afford a reasonable amount to start up the pig farming business looking at the cost involvement in pig production, especially on the feeds, medication and labour.

Table 1, also indicates family size distribution of the pig farmers in the study area. The least family size (1-5) appeared to be the largest with (46.0%) in pig production in the study area; this could be because the youths are very agile and could easily carry out the labour needed in pig farming. While the family size 6-10 have the second (40.1%) and the third farmers of pig in the study area fall at 11-15 family sized populace, with 12.7%. But the family size of 16-20 appeared to be the least in pig farming. This reveals that as the family size kept on increasing the lesser they engage in pig farming, this is because larger families could exert their family problems on the pig farms and as the result the production could deteriorate.

The farming experience of the pig farmers indicated that those having 2-6 years farming experience have the highest population (47.2%) in pig farming in the study area, this could be that, they are starting with a good zeal to pig farming. Those with 7-11 years farming experience have population of about 29.0% while those ranging from 12-16 years of farming experience constitute 15.5% of the pig farmers and those ranging from 17-21 takes 6.7% of the total population. Those above 21 years are the least in pig farming in the study area, probably because they became tired and old.

Table 1: Socio-Economic Characteristics of Pig Farmers

Age	Frequency	Percentage (%)
<18	7	2.8
18-35	86	34.1
36-45	94	37.3
>45	65	25.8
Total	**252**	**100.0**
Gender		
Male	148	58.7
Female	104	41.3
Total	**252**	**100.0**
Education		
Primary	117	46.4
Secondary	61	24.2
Tertiary	46	18.3
Non formal educ.	28	11.1
Total	**252**	**100.0**
Occupation		
Civil servant	31	12.3
Trader	23	9.1
Farming	174	69.0
Student	24	9.5
Total	**252**	**100.0**
Marital status		
Married	197	78.2
Single	27	10.7
Divorce	5	2.0
Widow	23	9.1
Total	**252**	**100.0**
Family Size		
1-5	116	46.0
6-10	101	40.1
11-15	32	12.7
16-20	3	1.2
Total	**252**	**100.0**
Farming Experience		
2-6	119	47.2
7-11	73	29.0
12-16	39	15.5
17-21	17	6.7
>21	4	1.6
Total	**252**	**100.0**

Source: Field Survey, 2018.

Maximum Likelihood Estimate

The Maximum likelihood estimation of the Stochastic Frontier Production Function. The coefficients in the model for production (feeds, water, labour and housing) are positive and statistically significant at 1%, except for labour, which is significant at 5% level. While initial cost of stocking pigs and medication are negative and does not show any significance. This indicates that pig farmers in the study area purchase adult pigs in place of piglets for stocking which cost them high. Also the negative effect of technical efficiency of drug use is not a surprise in the study area, most of the farmers do not use neither drugs nor vaccines for their pigs.

Table 2: Maximum likelihood estimates for the parameters of the stochastic frontier production function for pig production

Variables	Parameter	Coefficient	Standard-Error	T-Ratio
Constant	B_0	-0.630	0.647	-0.973
Cost of piglets	B_1	-0.006	0.004	-0.913
Quantity of feeds	B_2	0.375	0.019	4.457***
Water quantity	B_3	0.347	0.061	5.260***
Labor used	B_4	0.251	0.121	2.072**
Medication	B_5	-0.005	0.009	-0.243
Housing	B_6	0.078	0.003	2.730***
Sigma-squared	δ^2	0.525	0.265	1.979
Gamma	Γ	0.838	0.956	8.769
Log likelihood function	β_0	= -157.176		

NB: (***) = Significant at 1%; (**) = Significant at 5 percent level

Source: Field Survey, 2018

Determinants of Technical inefficiency

Farmer's socio-economic factors can influence the ability to make use of the available technology and as such not operate on the efficiency frontier. Based on this, some socio-economic variables were included in the model to determine their influence on the farmer's technical efficiency. The signs of the estimated coefficients in the model have important implications on the technical efficiency.

The inefficiency parameters captured in this study, relates to the farmers' socio-economic factors including age of the farmer, gender of the farmer, educational level of the farmer, household size, farming experience, management systems used, breeds of the pigs, and frequency of the extension service received.

Level of age is positively related to technical inefficiency. This implies that there is increased level of technical inefficiency as level of age increases, the older farmers are less likely to adopt new ideas or to use new technology which will lead to decreasing their technical efficiency. Because of this behavior of old people, they are likely to be less technically efficient than younger farmers.

The gender coefficient is estimated to be negative and not significant, which implies that male farmers are relatively more efficient in pig production. Considering that the management operations are labour-intensive, this result is not surprising. Female farmers also have relatively less access to productive resources. The result could also be explained by the imbalance in resource's access by gender. In literature, allocation of resources to poor women has a bigger impact on production and productivity; hence the result could imply the relatively low efficiency of women-headed pig farmers could be due to lack of access to productive resources.

Level of education is also positively related to technical inefficiency. This implies that there is increased level of technical inefficiency as level of education increases. This is in contrast with the findings of Ferenji and Heidhues (2007) and Raphael (2008) that education of the household has positive and significant influence on the technical efficiency of farmers. The reason for this is probably because of the religion, ethnic and cultural perception on pig production in the study area, which affects the efficiency level of its production. The more educated pig farmers are in the area, the more they realize how

different groups in the community perceive on their involvement in pig production and as such their commitment towards pig production will reduce and hence efficiency level will decrease. In other words the more educated ones among the participants may develop inferiority complex which might be responsible for their inefficiency in pig production in the area. Education shows no significant relationship with technical efficiency. This agrees with Onyeweaku and Effiong (2005), but disagrees with Onu, *et al* (2000).

The coefficient of household size is estimated to be negative and statistically significant at 10%. This implies that small farming households size are efficient, possibly because, as noted, larger household sizes exert pressure on the limited resources available to the smallholder farmer and seem to exacerbate poverty. Poverty-stricken farmers are more likely to be inefficient, as they cannot afford to buy productivity-enhancing inputs such as feeds and medications. In addition, the bigger the household size, the higher the dependency ratio in most cases, which could well, contribute to this study. This result, however, contradicts Wang, *et al* (1996), who found that household sizes are positively related to technical efficiency in Chinese agriculture, but agrees with Rahman and Umar (2009)

The coefficient for the frequency of extension services is estimated to be positive and statistically not significant. This indicates that farmers do not receive advices from the extension agents probably because there is scanty population of extension workers and as such, they could not reach all the farmers. More frequent extension services tend to increase technical efficiency, as extension agents provide advice on issues such as new technologies and production-related information. This finding is in line with those of Seyoum*et al.* (1998), Parikh *et al*. (1995) and Owens *et al.* (2001).

The result of pig rearing experience is found to decrease technical inefficiency as it was negative and significant at 10 %. This suggests that specialization is developed over time leading to improved production methods and higher efficiency. This finding is in agreement with those of Nsikak-Abasi *et al*. (2014), that pig farmers with more years of farming experience will have more technical skills in management and thus higher efficiency than younger pig farmers. Etim and Edet (2014) opined in their study that increased experience in agricultural production may also enhance critical evaluation of the relevance of better production decisions including efficient utilization of productive resources

The variables like gender, household size, farming experience, and management system had negative effect on technical inefficiency while farming experience and management system was significant at (10%) level. The negative effect of these variables implies increase in technical efficiency if such variables are increased in the production. These conform to a priori expectation and were similar to the findings of Ajibefun and Daramola (1999). The result indicated that the more the age and the higher the education status, the more likely farmers are to be inefficient on their production.

Table 3: Determinants of Technical inefficiency in Pig Production

Variables	Parameter	Coefficient	Standard-Error	T-Ratio
Constant	δ_0	-1.363	1.201	-1.135
Age (years)	δ_1	2.837	1.660	1.708*
Gender	δ_2	-0.343	0.815	-0.697
Educational level	δ_3	0.309	0.443	0.697
Household size	δ_4	-0.921	0.774	-1.189
Farming experience	δ_5	-1.590	0.915	-1.736*
Management system	δ_6	-1.352	0.961	-1.707*
Breed of pigs	δ_7	0.000	1.000	0.000
Extension contacts	δ_8	0.965	1.520	0.634
Gamma	Γ	0.838	0.956	8.769
Log likelihood function		= -157.176		

NB: (*) = Significant at 10%

Source: Field Survey, 2018.

Resource-Use Efficiency

One important feature of the stochastic production frontier is its ability to estimate individual, farm specific technical, allocation and economic efficiencies and revealed variation in efficiency indices across the sampled pig farms. The average resource-use efficiency is 0.70 leaving an inefficiency gap of 0.30, meaning that about 30% increase in pig production could be accomplished using the same input combination. According to a recent study by Etim and Edet (2014), this is an indication of product wastage due to inefficiency of resource use by the pig producers. From the table, the least and most efficient producer had efficiency indices of 0.27and 0.94 respectively. Result revealed that none of the pig farmers reached the frontier threshold, implying that producers must have encountered some production and environmental constraints they were unable to completely surmount. According to Ali (1996), in small scale farming, resources are mostly allocated to various uses on the basis of their shadow values, which is the amount by which the contribution could be raised if an additional unit of the input was utilized, thereby preventing the producers from maximizing production efficiency

From the result majority of the respondents (61.9%) operated at a technical efficiency of 0.70 – 0.89 while 19.4% of the respondents operated within the technical efficiency of 0.50 – 0.69, and those operated below < 0.50 constitute 15.5% of the respondents. The respondents with the highest technical efficiency operated within 0.90 – 0.99, constituting 3.1% of the respondents. The mean technical efficiency of pig farms in the study area is 0.70, and the minimum technical efficiency is 0.27, while the maximum technical efficiency is 0.94. The result shows a level of technical inefficiency among pig farms in the study area. It suggests that technical efficiency in pig production in the study area could be increased by 30% through better use of available resources given the current state of technology. This also means that if the average farmer in the sample is to achieve the technical efficiency level of his or her most efficient counterpart, the average farmer would be 24% [i.e. 0.94-(.70)] more productive. Similarly, the most technically inefficient farmer would be 67% [i.e. 0.94-(.27)] more productive in order to achieve the productive level of the most technically efficient. This finding conforms to the findings of Joseph *et-al* (2015).

Table 4: Efficiency Distribution of Pig Farms in Southern Kebbi State

Efficiency level	Frequency	Percentage
< 0.50	39	15.5
0.50 - 0.69	49	19.4
0.70 – 0.89	156	61.9
0.90 - 0.99	8	3.1
Mean Efficiency	0.70	
Minimum	0.27	
Maximum	0.94	

Source: Field Survey, 2018.

SUMMARY

This study has shown the distribution of technical efficiency of pig farms in southern Kebbi state. More so, the distribution of efficiency estimates among the pig farms has shown a level of technical inefficiency. On an average, technical efficiency of the pig farms could be increased by 30%, using the current production technology.

Relative technical efficiency in input orientation depends on many variables. Inputs and outputs are analyzed by using a frontier production function. The results show a relative technical efficiency score for each farm from an input perspective. None of the farms operate on full scale efficiency, but they can improve farm inefficiency by providing proper production structure.

The variables like gender, household size, farming experience, and management system had negative effect on technical inefficiency but farming experience and management system was significant at (10%) level. The negative effect of these variables implies increase in technical efficiency. These conformed to a priori expectation and were similar to the findings of Ajibefun and Daramola (1999). The result indicated that the more the age and the higher the education status, the more likely farmers are to be inefficient on their production. This result conformed to

that of Kebede (2001), who reported a positive coefficient for age.

CONCLUSION

This study was conducted to measure the technical efficiency of pig production in Southern Kebbi State, Nigeria. The study revealed that majority of the sampled respondents were male, married and within the economically active age group. Based on the efficiency indicator, it can be concluded that pig production in the study area is not fully technically efficient in the resource use. The result shows relatively substantial technical inefficiency on pig farms in southern Kebbi State. From the result majority of the respondents (61.9%) operated at a technical efficiency of 0.70-0.89 while 19.4% of the respondents operated within the technical efficiency of 0.50 – 0.69, and those operated below < 0.50 constitute 15.5% of the respondents. The respondents with the highest technical efficiency operated within 0.90 – 0.99, constituting 3.1%. The mean technical efficiency of pig farms in the study area was 0.70, and the minimum technical efficiency was 0.27, while the maximum technical efficiency was 0.94. The result suggests that, there is an opportunity to improve pig production in the region by adopting appropriate management practices. The heterogeneity in management and production practices employed by farmers with varying socio-economic situation may explain the distribution of technical efficiency in the study area.

RECOMMENDATIONS

Based on the findings of the study, some recommendations have been made.

1. Efficiency in pig production in southern Kebbi State could be increased through better use of available resources, given the current state of technology and through policies that would encourage pig farming.
2. Policies that would encourage indepth research by research institutions to proffer solutions to prevalent diseases in pig production are advocated. This would reduce the risk in pig production and also increase efficiency.
3. An effective extension service should be established to bridge the gap between pig farmers and the research institutions, and also to create awareness about improved technologies in pig production
4. To the farmers whose technical efficiency level is very low, are expected to seek advice from the prospective ones on how to improve and attain greater level of efficiency in their production.

REFERENCE

Aigner D., Lovell C. A. K., Schmidt P.J, (1977). Formulation and estimation of stochastic frontier production models. Journal of Econometrics, 6, 21–37.

Ajibefun, I.A., Daramola, A.G. (1999). Measurement and sources of technical inefficiency in poultry egg production In Ondo State. Journal of Rural Economics and Development,Environmental Sci.2(2): 182-188.

Augie, A. R. and S. U. Lawal (1990). Studies in the History of the People of Zuru Emirate. Enugu: Fourth Dimension Publishing Co. Ltd., 112Pp.

C.T.A. Agricultural Extension in Africa, Technical Centre for Agriculture and Rural Cooperation. Yaunde Cameron, 1995.

Etim N. A., Udoh E. J. (2014): Identifying sources of efficiency among resource poor indigenous vegetable farmers in Uyo, Nigeria. International Journal of Food and Agricultural Economics 2: 33 – 39.

Ferenji, B.T. and heidhues, F. (2007), "Fall in technical efficiency of small farm households in the post reform period" *Quarterly Journal of international Agriculture*46(3):241 – 261 retrieved from http://www.agrar.hu-berlin.de/struktur/institute/wisola/publ/qjia/contents/2007/3-07/ferenji.htm on the 6th November, 2008

Food and Agriculture Organization. (2003). Agriculture in Nigeria. F.A.O of United Nation, Rome.

Forsund, F.R., Lovell, C.A.K., Schmidt, P. (1980). A survey of frontier production functions and of their relationship to efficiency measurement. Journal of Econometrics, 13, 525.

Girma, S.A. (2008). Agro-climatology of Millet Production in Desert Fringe Zone of Nigeria, A Case Study of Kebbi State. Unpublished M.Scdessertation. Federal University of Technology Minna, Niger state. 97Pp.

Joseph *et al*, (2015). Technical Efficiency Analysis of Pig production: A sustainable Animal Protein Augmentation for Nigerians. Journal of Advanced Agricultural Technology, Vol.2, No1

Kebbi State Government (KBSG) (2003). Kebbi State Government Official Diary. Directorate of Information, Kebbi. 10Pp.

Kebede, T.A., (2001). Farm Household Technical Efficiency: A Stochastic Frontier Analysis. A Study of Rice Producers in Mardi Watershed in the Western Development Region of Nepal. A Master Thesis Submitted to Department of Economics and Social Sciences, Agricultural University of Norway.

Meesusen, W., Broeck, V.D. (1977). Efficiency Estimation for Cobb-Douglas Production Function with Composed Error. International Economic Review, 18, 435-444.

Midau et-al (2011) Global Journal of Science Frontier Research V0l.11 Issue 7 Version 1.0

National Population Commission (NPC), (2006). 2006 National Population Census Figures, Abuja, Nigeria.

NsikakAbasi A. E., NseAbasi N. E., Edem E. A. O.(2014): Estimation of efficiency in small scale pig production. European International Journal of Science and Technology 3: 111–118.

Ogunniyi L. T. and Omoteso O. A. (2011). Economic Analysis of Swine Production in Nigeria: A Case Study of Ibadan Zone of Oyo State. J. Hum. Ecol., 35(2): 137-142

Okoli, C.I. (2006). Topical Tips On Intensive Pig Production; Animal Management and Health Issues. Technical Notes. Tapas Institute of Scientific Research and Development.

Onu ,J.K, P.SAmaza and F.YOkunmadewa (2000). "Determinants of Cotton Production and Economic Efficiency" African Journal of Business and Economic Research,vol. 1 No.1 pp. 234-240

Onyenweaku, C.E. (2005), "Technical Efficiency in Pig Production in Akwa Ibom State, Nigeria" I***nternational Journal of Agriculture and Rural Development*** 6:51- 57 retrieved from http://www.ajol.info/viewarticle.php?id=24342 on the 6th November, 2008

Osondu C. K., Ijioma, J.C., Anyiro, C. O., Obike K. (2014): Economic analysis of pig production in Abia State, Nigeria. International Journal of Applied Research and Technology 3: 3–10.

Owens, T., Hoddinott, J., & Kinsey, B. (2001). *The impact ofagricultural extension on farm production in resettlementareas of Zimbabwe* (Working Paper CSAE WPS/2001–6).Oxford: Centre for the Study of African Economies (CSAE),University of Oxford.

Parikh, A., Ali, F. & Shah, M. K. (1995). Measurement of economic efficiency in agriculture. American Journal of Agricultural Economics, 77:675-85.

Rahman, S., Barthakur, S.G. Kalita. (2008). Pig production and management system in Aizawl District of Mizoram, India. Livestock Research for Rural Development, 20(9).

Ramírez, O., Ojeda, A., Tomàs, A., Gallardo, D., Huang, L. S., Folch, J. M., Clop, A.,Sánchez, A., Badaoui, B.,Hanotte, O., Galman-Omitogun, O., Makuza, S. M., Soto, H., Cadillo, J., Kelly, L., Cho, I. C., Yeghoyan,S., Pérez-Enciso, M., &Amills, M. (2009). Integrating Y-chromosome, mitochondrial, and autosomal datato analyze the origin of pig breeds. Molecular Biology and Evolution, 26, 2061–2072.

Raphael, I.O. "Technical Efficiency of Cassava farmers in South Eastern Nigeria: Stochastic Frontier Approach" ***MedwellOn Line Agricultural Journal*** 3(2):152 -156. retrieved from http://www.medwelljournals.com/fulltext/aj/2008/152-156.pdf on the 6th November, 2008.

Seyoum, E.T., Battese, G.E., Flemming, E.M., 1998. Technical efficiency and productivity of maize producers in Eastern Ethiopia: a study of farmers within and outside the Sasakawa-Global 2000 Project. Agricultural Economics 19, 341–348

Tewe, O., Adesehinwa, A.O.K. (1995). Resource requirement for profitable pig farming. In: Pig Production Workshop Training Manual, pp.16-26. NAERLS, A.B.U., Zaria.

Umeh J. C., Ogbanje C., Adejo M. A. (2015): Technical efficiency analysis of pig production: A sustainable animal protein augmentation for Nigerians. Journal of Advanced Agricultural Technologies 2: 19–24.

Wang, J., Cramer, G. L., & Wailes, E. J. (1996). Production efficiency of Chinese agriculture: Evidence from rural household survey data. Agricultural Economics, 15, 17–28. http://dx.doi.org/10.1016/S0169-5150 (96)01192-9