Medicon Agriculture & Environmental Sciences
Volume 2 Issue 4 April 2022
Review Article

The Effects of Planting for Food and Jobs Program on the Technical Efficiency of Maize Farmers in the Techiman North Municipality of Ghana

Hussein Kumah Lansah* and Anastasia Konadu Lansah

Institute of Abjel communications and Igrieve, Cantoments, Accra-Ghana

***Corresponding Author:** Hussein Kumah Lansah, Institute of Abjel communications and Igrieve, Cantoments, Accra-Ghana.

Received: March 17, 2022; **Published:** March 29, 2022

Abstract

The study analyzed the effects of "Planting for Food and Jobs (PFJ) Program" on the technical efficiency of maize farmers in the Techiman North Municipality of Ghana. The study randomly selected 400 maize farmers to construct a three-year recall panel for 2017, 2018 and 2019 farming seasons. Both closed and open-ended questionnaires were used to elicit information from the respondents. The results from the inverse probability weighted regression adjustment (IPWRA) model signify that the PFJ program had a statistically significant positive effect on technical efficiency of maize farmers in the Techiman North Municipality. The study therefore, recommends that the PFJ program should be intensified as it improves technical efficiency of maize farmers in the Techiman North Municipality of Ghana. Again, restructuring of the national buffer stock company and the school feeding program will be a far better alternative in providing ready market to the farmers which helps reduces post-harvest losses.

Background and problem statement

Agriculture as a major driver of the African economy helps in creating employment avenues, provision of enough food to feed the masses and generate revenue for the government through export (World Bank, 2007). With rapid rises in population and sluggish growth in agricultural productivity, accelerated production of staple foods, such as maize, remains a panacea to putting an end to hunger and poverty. To this end, the transformation of the agricultural sector into a modern vibrant sector is an important investment for many African countries such as Ghana (SRID, 2018; Tanko, Ismaila & Sadiq, 2019).

Maize is a major staple that is cultivated by 80% of smallholder farmers in Ghana (Ministry of Food and Agriculture [MoFA], 2016). Maize accounts for over 50% of total cereal cultivation in the crop sub-sector and contribute about 41% to gross farm income (Mather, Boughton & Jayne, 2013). However, the productivity of maize in Ghana is generally low. For instance, the average yield of maize in Ghana increased from 1.92 metric tons per hectare (mt/ha) in 2015 to 2.51 mt/ha in 2019 which is far below the achievable yield of 6mt/ha (MoFA, 2019). This suggests a yield gap of over 50%which needs to be closed.

To improve food security, reduce poverty and ensure broad-based economic development of farmers whose major livelihood activities revolve around maize production and ancillary industries, state interventions such as the Medium-term Agricultural Development Policy (1991), Food and Agricultural Sector Development Policy (2002), Medium-term Agriculture Sector Investment Plan(2009), and the most recent government initiative for the advancement of the crops subsector known as the Planting for Food and Jobs (PFJ) Program was introduced in 2017. The aim of the PFJ program is to promote growth in food production by facilitating access to both inputs and output markets thereby creating jobs in Ghana (MoFA, 2017). The first module of the program promotes food-security crops such as maize, rice, sorghum, soybeans and vegetables such as onion, tomato and pepper. The program has been expanded in recent times to include groundnut, cabbage, carrots, cucumber, lettuce, cassava, cowpea, plantain, orange and sweet potato (MoFA, 2019). Other modules include the planting for export and rural development, rearing for food and jobs, greenhouse villages and agricultural mechanization service centers. The planting for food and jobs program campaign is designed with five key pillars which include provision of seeds, supply of fertilizer, dedicated extension services, marketing option and electronic agriculture. Improved seeds and fertilizers are expected to be supplied at a subsidized price of 50% (MoFA, 2017).

Since the implementation of the PFJ program in 2017, no evaluation has been done on its outcomes relative to maize production. The closest study (Mabe, Danso-Abbeam & Ehiakpor, 2018) based on my knowledge on the evaluation of the PFJ program addressed the lessons learned and how to improve the implementation but it did not address the impact of the program on the productivity of maize farmers. More so, many of the studies (Manda, Alene, Gardebroek & Berresaw, 2015; Allotey and Zakaria, 2019 and Tambo, Uzayisenga, Mugambi & Bundi, 2020) that were done in the past on treatment effects focused on the use of traditional methods such as propensity score matching (PSM) and endogenous switching regression to analyzed the available data. Whilst these approaches may generate robust evidence, the current study uses the inverse probability weighted regression adjustment (IPWRA) estimator in determining the impact of the PFJ program. The IPWRA is a doubly robust estimator which offers several choices for functional forms of the outcome and treatment model against the traditional methods which have only treatment model with a single functional form (Wooldridge, 2010; Okyere and Usman, 2020).

Therefore, understanding the factors that enables participation into the PFJ program and its impact on technical efficiency will go a long way to shape and trigger appropriate policy reactions that improve productivity, enhance food security, reduce poverty and raise farm incomes.

Literature review

Maize is considered as one of the most important crops accounting for more than 50% of the total cereal cultivation in Ghana. Ghana is the 35th leading producer of maize in the world (FAO, 2019). Maize is a versatile crop grown across the various ecological zones in Ghana.

Kuwornu, Amoah and Seini (2013) used the translog model to analyze technical efficiency of maize farmers in the Eastern region. The results from the study showed that farmer-based organization (FBO) membership, frequency of meeting by FBO members, formal training in maize farming, extension visits, cash and in-kind credits were the major determinants of the levels of farmers' technical efficiency. The result also indicated that the average level of technical efficiency of the maize farmers was 59%. This indicates the possibility of increasing output given the existing technology.

Abdulai, Nkegbe & Donkoh (2017) used the stochastic frontier estimation technique to examine the technical, allocative and economic efficiency of maize production in Northern Ghana. Inputs such as farm size, seed, fertilizer, labor and weedicide tended to have a positive and a statistically significant effect on output. The mean estimates were 85.1% for technical efficiency, 87.8% for allocative efficiency and 74.7% for economic efficiency.

Shamsudeen, Nkegbe & Donkoh (2017) used the input-oriented data envelopment analysis to assess the technical efficiency of maize production in Northern Ghana. The result of the analysis showed that whereas agricultural extension positively influenced technical efficiency, agricultural mechanization and formal education had statistically-negative effects on technical efficiency.

Tanko et al. (2019) examined the PFJ program as a panacea for productivity and welfare of rice farmers in Northern Ghana. The data was analyzed using the inverse propensity weighting estimation and the local average treatment effect. They showed a positive impact of agricultural technologies implemented under the program for rice growers.

Kibirigi, Mufutau & Musuku (2018) suggested that many farmers in sub-Saharan Africa allocated resources inefficiently. This suggestion was made based on his assessment that farmers were not appropriately combine existing and new technologies as well as resources due to poor managerial skills and information asymmetry.

Nguyen and Nguyen-Anh (2020) assessed the impact of government intervention to maize efficiency at farmer's level across time in Vietnam. The analysis showed that farmers who benefited from the government's intervention achieved higher output than the non-trained farmers. Environmental factors (such as temperature) had a significant effect on efficiency.

Minviel and Latruffe (2017) used the meta-frontier technique to analyze public subsidies on farm technical efficiency based on data gathered from systematic literature review. Subsidies had a significantly-negative relationship with technical efficiency.

Nguyen and Tuan (2020) evaluated the impact of a government intervention program on the level of maize farmer's efficiency across time in Northern Vietnam using the "difference-in-difference" method. Land size, played a significant role in improving efficiency; extension visits did not have a clear outcome on efficiency. Though trained farmers initially had higher level of technical efficiency scores but they were overtaken by non-trainers after five years of training.

Methodology

Econometric framework for empirical analysis

Several methods such as propensity score matching (PSM), endogenous switching regression (ESR) method, inverse propensity score weighting (IPSW) etc. have been used in evaluating treatment effects but the most reliable, unbiased and doubly robust estimator in recent times is the IPWRA. It basically deals with weight assigned to an outcome relative to the inverse of the probability of the outcome occurring given a set of covariates assigned to the treatment. The IPWRA was proposed by Wooldridge (2010). In most observational data, it is observed that there is no randomization of treatment assignment due to selection bias. The estimator then estimate selection, predict treatment for all observations, assign inverse of probability for the treated and controlled group and finally re-estimate the model using the new weights. It is doubly robust because even if one of the models is not correctly specified, the estimates are still consistent and unbiased. The model is empirically specified as:

$$ATT_{IPWRA} = {n_A}^{-1} \sum_{i=1}^{n} T_i [r_A^*(\mathrm{X}, \mathrm{Y}_A^*) - r_N^*(X, \mathrm{Y}_N^*)] \ldots\ldots\ldots\ldots(1)$$

Where the weighted regression procedure is expressed as:

$$\mathrm{Y}_A^*(\alpha_A^*, \beta_A^*) = \min \sum_{i=1}^{n} T_i [(Y_i - \alpha_A^* - \mathrm{X}\beta_A^*)^2 / \hat{P}(X, \hat{Y})] \ldots\ldots\ldots\ldots (2)$$

$$\mathrm{X}_N^*(\alpha_N^*, \beta_N^*) = \min \sum_{i=1}^{n} T_i [(Y_i - \alpha_N^* - \mathrm{X}\beta_N^*)^2 / \hat{P}(X, \hat{X})] \ldots\ldots\ldots\ldots(3)$$

Specification of variables in the treatment and outcome models

The covariate estimation for the probabilities of adoption (PFJ program) is based on both theory and previous studies that follows the path of treatment effects (Kassie, Shiferaw & Geoffrey, 2011). The variables can be summarized as follows: (1) household and farm variables: age, gender, education, experience, extension visits, household size, farm size and total output. (2) Treatment variable (PFJ): improved seed subsidy, fertilizer subsidy, e-agriculture, marketing option and free extension service.

Derivation of the optimal sample size used for the study

The optimal sample size was established based on statistical theory using the concepts of binomial and normal probability distributions. The assumptions were that each house contained at least one maize farmer; 40% of the maize farmers were in the program and 60% were not in the program. The assumption that 40% of maize farmers in the area were in the PFJ program was based on information from the MoFA. The optimal sample size was 368. An over sampling of the magnitude of 32 was done to make the total sample size 400.An oversampling of 32 was done to account for farmers who were absent or were not interested in the survey.

Allowing for 2.5% maximum standard error (MSE) to be achieved with 95% confidence level (1.96 standard errors from normal distribution), the optimal sample size (n) was derived as follows based on the works of De Vaus (2014) and Anaman (2014).

$$MSE=S*1.96=0.025 \qquad S= [(p*q)/n]^{0.5}$$
$$S=0.050/1.96=0.02551= [(0.4*0.6)/n]^{0.5}$$
$$0.000651= (0.24/n)$$
$$|n=1536.64*0.24 \qquad n=368.$$

Sampling procedure

The sampling was based on households in 16 communities in Techiman North Municipality of Ghana. Out of the 18 communities, two were not considered for the study due to low intensity of maize cultivation based on pilot study in February 2020. Therefore, the researcher considered only 16 out of the 18 communities in the Techiman North Municipality for this study.

Using the proportion of households to the total household per the 2010 PHC and adjusted for with information from the Municipal Assembly, the number of households to be interviewed was determined. The houses in each community were numbered from 1 to the nth household. A simple random procedure was then used to select the houses that formed the sample. The random numbers were generated using the scientific calculator.

Method of data collection

Data was collected using questionnaires which are both open and closed ended. Focused group discussion was also used to elicit responses from farmers particularly those who belong to farmer-based groups. The data was collected between February and March 2020 with the help of the Nation Builders' Corp (NABCO) personnel and extension officers from MoFA in the Techiman North Municipality.

Study area and sources of data

The Techiman North Municipality is a locality in the Bono East Region. The municipality was established by a legislative instrument (LI 209) and duly inaugurated on Thursday 28th June, 2012 with Tuobodom as its capital (MoFA, 2017). The municipality covers an area of 389.4 kilometer (km) square and lies between longitudes 1°49' East and 2°30' West and latitude 8°00' North and 7°35' South. According to the 2010 Population and Housing Census (PHC), the municipality had a population of 59,068 with 28,766 males and 30,302 females (GSS, 2010). In terms of economic activities, 49.1 % are engaged in agriculture, 20% engaged in services and sales, 12.7% engaged in craft and related trade and 5.1% engaged in elementary occupation (GSS, 2010).

Data used for this study was sourced from maize farmers in the Techiman North Municipality of Ghana. The three-year cross-sectional data was used to build a recall panel for 2017, 2018 and 2019.

Results and discussion

Descriptive statistics of the variables

The descriptive statistics indicates about 513 representing 42.75% of the respondents were females; the remaining 687 were males. This result suggested that maize cultivation in the Techiman North Municipality was dominated by males. The result contributes to a long-standing debate that males are risk lovers as compared to their female counterparts (Abdoulganiour, 2017). However, Bempomaa (2014) found evidence from agricultural productivity which suggests that both males and females have similar abilities in farm management when given equal opportunities.

Table 4.1 represents the age distribution, marital status and household size of the respondents. The biggest age group of farmers was the 40-49 years; this group accounted for 34% of the total number of respondents. The next biggest groups in order of importance were 30-39 years and 50-59 years. These two groups accounted for 25% and 22% of the total number of respondents, respectively. All the other age groups accounted for 19% of the total number of respondents. Contrary to the general perception that farming in Ghana is dominated by the older people (for example, refer to the work of Amoatey et al., 2017), this particular finding about the composition of the respondents by age revealed by this study provided a countervailing result indicating that the vast majority of farmers (81%) were actually within the middle-age group from 30 to 59 years. Also, out of the 1200 respondents interviewed in the Techiman North Municipality, 51 of the maize farmers representing 4.25% were single, 138 representing 11.50% were either divorced or separated and 150 representing 12.50% were widowed. The majority of the farmers, 861 representing 71.75% were married at the time of the survey. Studies by Asante, Osei, Dankyi & Berchie (2013) and Tambo and Gbemu (2010) showed that married status has the highest frequency.

Again, Table 4.1 showed that most (70.5%) of the maize farmers in the Techiman North Municipality have a household size ranging from 6 to10. Large household size has a direct bearing on farm size and economies of scale (Abdul-Hanan and Abdul-Rahaman, 2017). The availability of household members to carry out farm activities is critical to increasing productivity and profitability of small holder farmers. Thus, hired labor is only used whenever the available family labor is not enough (Akramov and Malek, 2012) However, with the gradual shift towards the use of technology (agriculture mechanization) coupled with economic demands, large household size is becoming a thing of the past (Mottaleb, 2018).

Age	***Frequency***	***Percentage***
0-19 20-29	10 93	1 8
30-39	299	25
40-49	407	34
50-59	263	22
60-69	111	9
70 and above	17	1
Total	***1200***	***100***
Marital status		
Single	51	4.25
Married	861	71.75
Divorce/separate	138	11.50
Widowed	150	12.50
Total	***1200***	***100***
Household size		
1-5	267	22.25
6-10	847	70.5
11-15	83	7
16 and above	3	0.25
Total	***400***	***100***

Source: Field survey (2020).

Table 4.1: Age distribution, marital status and household size of the respondents.

Figure 4.1 illustrates that about 145 respondents representing 12.08% had a technical efficiency score below 50%, whereas four respondents representing 0.33% had technical efficiency score between 51% and 60%. A large chunk of the respondents, with a frequency of 470, representing 39.17% had a technical efficiency score between 81% and 90%. Two hundred and ninety of the respondents representing 24.17% had a technical efficiency score above 90%. About 87.92% of the farmers in the Techiman North Municipality had a technical efficiency score of at least 50%. Only few farmers representing 12.08% operates with a technical efficiency score below 50%. The mean technical efficiency score predicted by the stochastic frontier model was 79.67%. This implied that on average, maize farmers in the Techiman North Municipality produced 79.67% of the potential frontier output given the existing level of technology.

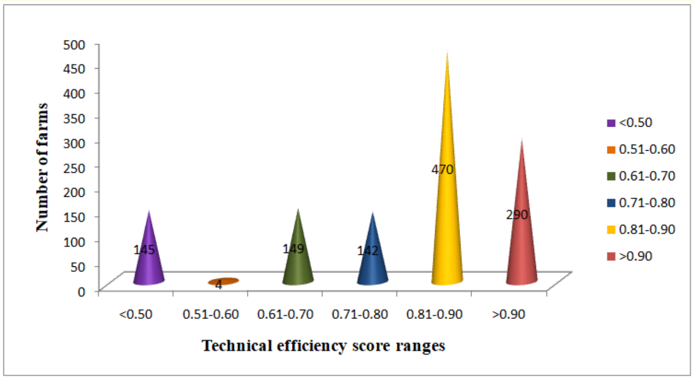

Figure 4.1: Distribution of technical efficiency scores.

Robustness check of the IPWRA estimator

The over identification test indicates that the covariates are balanced since the null hypothesis cannot be rejected based on the probability values of 0.181 and 0.194 in both model. Further, the "tebalance summarize" result showed a perfectly balanced covariate since the standardized mean differences are closer to zero and the variance ratio close to one. The overlap plot also indicates that there is a chance of seeing observations in both control and the treatment groups at each combination of covariates. Thus, the overlap assumption is met.

The Effects of the PFJ Program on Technical Efficiency

The effects of the PFJ program on the technical efficiency of maize production are summarized in Table 4.2 based on results from two competing models, the pooled model and the random effect model. The random effect model is the preferred model chosen for interpretative analysis and policy implications. This is due to the fact that this model takes into account the panel structure of the data allowing yields from different years that are linked to different types of weather to be captured in the analysis. The results indicate that the PFJ program has a positive and statistically significant effect on the technical efficiency of maize production at the 5% level. The program increased technically efficiency by 23.1%, when assessed as a comparison between the participants and non-participants of the program. This increase could be due to the access and use of improved seeds and fertilizers and are similar to those observed by Mabe et al., (2018); Anang and Kudadze (2019).

Indicator	***Pooled (ATE)***	***RE (ATE)***
Technical efficiency	0.173** (0.012)	
Over identification test	0.181	0.194
Treated observations Control observations	587.9 612.1	587.9 612.1
No. of observation	1200	1200

Note: *** denotes significance level at 1%. Figures in bracket represent standard errors. ATE denotes average treatment effect and RE denotes random effect.

Table 4.2: Impact of PFJ program on technical efficiency.

Table 4.3 shows the impact of the individual pillars of the PFJ program on the technical efficiency of the maize farmers. The result above indicates that all the three components are statistically significant and influence technical efficiency positively. However, subsidized fertilizer is the most dominant component. Out of the 23.1% impact index of the three components on technical efficiency, subsidized fertilizer accounted for 52.6%, subsidized seed accounted for 33.2% and free extension visit accounted for 14.2%. This signifies that farmers are more interested in interventions that will quickly transform their lives but not a system that has to rely on long term result as the implementing authority is prone to change in the next election.

The fear of abandoning the policy by successive governments pushes farmers to go for only components that produce quick result (Mabe et al., 2018; Lencucha, Appau, Thow & Drope, 2020). However, Tanko et al., (2019) argue that the other two components of the program, particularly e-agriculture require modern technology which is capital intensive. Hence, detailed feasibility study must be done on it before resources are committed. In terms of access to market, a well-structured mechanism and capacity must be put in place to ensure smooth transition from the farm to the various marketing channels.

Indicator	***Pooled (ATE)***	***RE (ATE)***
Subsidized seed	0.311	0.332**
Subsidized fertilizer	0.624	0.526***
Free extension services	0.195	0.142*

Note: *, ** and *** denotes significance level at 10%, 5% and 1%.

Table 4.3: Differential impacts of some PFJ Program pillars on technical efficiency.

Conclusion and recommendation

Conclusions

The study found that majority of the maize farmers in the Techiman North municipality does not have access to ready market. Also, maize farmers in the Techiman North municipality are highly technically efficient. Finally, the PFJ program had a significant effect on the technical efficiency of the farmers with subsidized fertilizer having the most dominant impact factor.

Recommendations

The highly significant nature of access to ready market suggests a more pressing need of dealing with post-harvest losses and lack of processing centers to absorb the outputs. The study recommends the restructuring the National Buffer Stock Company to purchase outputs from the farmers on a permanent basis.

Further, the School Feeding Program could also be used as a major source of government purchase of outputs from farmers in order to assure ready markets. The issue of late arrival of inputs such as seeds and fertilizers must also be addressed. Local authorities could be used to announce the arrival and distribution of input.

Finally, farmers must also be trained on basic skills such as reading and writing. This can help them to keep records and track the progress of output and inputs used. It also can help them to read and follow basic instructions of equipment, input usage and agronomic practices.

References

1. Abdul-Hanan A and Abdul-Rahaman A. "Technical efficiency of maize farmers in Ghana: Astochastic frontier approach". International Journal of Innovation and Scientific Research 29.2 (2017): 110-118.
2. Abdoulganiour AT. "The determinants of participation in global value chains: the case of ECOWAS". Cogent Economics and Finance 5.1 (2017): 1-14.

3. Anaman KA. "Research Methods in Economics and Other Social Sciences". Saarbrucken, Germany: Lambert Academic Publishing 2.1 (2014): 12-47.
4. Anang BT and Kudadze S. "Ghana's Fertilizer subsidy programme: Assessing farmer participation and perceptions of its effectiveness". International Journal of Agricultural Sciences 3.1 (2019): 142-149.
5. Akromov K and Malek M. "Analyzing profitability of Maize, rice and soyabean production in Ghana: Results of PAM and DEA analysis". Ghana Strategy Support Program (GSSP) Working Paper 028, International Food Policy Research (IFPRI) (2012).
6. Asante BO, Osei MK, Dankyi AA and Berchie JN. "Producer characteristics and determinants of technical efficiency of tomato based production system in Ghana". Journal of Development and Agricultural Economics 5.3 (2013): 92-103.
7. Bempomaa B and Acquah HD. "Technical efficiency analysis of maize production: Evidence from Ghana". Journal of Applied Studies in Agribusiness and Commerce 8.2-3 (2014): 73-79.
8. De Vaus D. Social Research Today. Surveys in Social Research, Sixth Edition. London: Routledge/Taylor & Francis Group (2014).
9. FAO. Declaration of the World Summit on Food Security, Rome: FAO (2009).
10. FAOSTATS. Global Maize Production (2019).
11. FAO, IFAD, UNICEF, WFP and WHO. The state of ood security and nutrition in the world 2018. Building climate resilience for food security and nutrition. Rome, FAO (2018).
12. Kassie M, shiferaw B and Geoffrey M. "Agricultural technology, crop income and poverty alleviation in Uganda". Journal of World Development 39.10 (2011): 1784-1795.
13. Kibirige D, Mufutau R and Musuku M. "Efficiency analysis of the Sub-Saharan African small-scale Agriculture: A review of literature on technical efficiency of maize production". Journal of Agriculture and Veterinary Sciences 7.12 (2018): 124-131.
14. Kuwornu JKM, Amoah E and Seini W. "Technical efficiency analysis of maize farmers in the Eastern region of Ghana". Journal of Social and Development Sciences 4.2 (2013): 84-99.
15. Lencucha R, Pal N, Appau A, Thow A-M and Drope J. "Government policy and agricultural production: a scoping review to inform research and policy on healthy agricultural commodities". Journal of Globalization and Health 3.4 (2020): 1-19.
16. Mabe NF, Danso-Abbeam G and Ehiakpor D. Assessment of the implementation of the planting for food and jobs programme: Lessons and ways forward (Feed the future Ghana agriculture policy support project). United States Aid (2018).
17. Manda J., et al. "Adoption and impacts of sustainable agricultural practices on maize yields and incomes: Evidence from rural Zambia". Journal of Agricultural Economics 67.1 (2015): 130-153.
18. Mather LD, Boughton D and Jayne TS. "Explaining smallholder maize marketing in Southern and Eastern Africa: The roles of market access, technology and household resource endowments". Journal of Food Policy 43.1 (2013): 248-266.
19. Minviel JJ and Latruffe L. "Effect of public subsidies on farm technical efficiency: A meta-analysis of empirical results". Journal of Applied Economics 49.2 (2017): 213-226.
20. Mottaleb AK. "Perception and adoption of new agricultural technology: Evidence from a developing country". Journal of Technology in Society 55.1 (2018): 126-135.
21. MOFA (2020). Ministry of food and agriculture in Ghana annual report. Ministry of food and agriculture information directorate.
22. MOFA. "Planting for Food and Jobs: Strategic Plan for Implementation (2017-2020)". (2017): 6032.
23. Nguyen T and Nguyen-Anh T. "Impact of government intervention to maize efficiency at farmer's level across time: robust evidence in Northern Vietnam". Journal of Environment, Development and Sustainability 2.3 (2020): 1-24.
24. Okyere CY and Usman MA. "The impact of irrigated agriculture on child nutrition outcomes in Southern Ghana". Journal of Water Resources and Economics (2020).
25. Shamsudeen A, Nkegbe P and Donkoh S. "Assessing the economic efficiency of maize production in Northern Ghana". Journal of Development Studies 2.1 (2017): 47-79.
26. SRID (2016). Agriculture in Ghana. Facts and figures (2016) ministry of food and agriculture-statistics, research and information directorate (srid) 2017.
27. Tanko M, Ismaila S and Sadiq SA. "Planting for food and jobs (PFJ): A panacea for productivity and welfare of rice farmers in North-

ern Ghana". Journal of Congent Economics and Finance 7.1 (2019).

28. Tambo AJ, Uzayisenga B, Mugambi I and Bundi M. "Do plant clinics improve household food security? Evidence from Rwanda". Journal of Agricultural Economics (2020).
29. Tambo AJ and Gbemu T. Resource use efficiency in tomato production in the Dangme West District, Ghana. Conference on International Research on Food Security, Natural Research Management and Rural Development, Zurich, Switzerland (2010)
30. Wooldridge J. Econometrics analysis of cross section and panel data, second edition. Cambridge, Massachutsetts: MIT press (2010)
31. World Bank, World Development Report 2007: Agriculture for Development. Washington, DC: World Bank (2007).

Volume 2 Issue 4 April 2022