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The influence of socio-economic factors on efficiency of wheat farmers in Nigeria

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Abstract

The study examined the socio-economic factors influencing efficiency of wheat farmers in some wheat producing states of Nigeria. The study did not cover Borno and Yobe states wheat producing areas due to security challenges. Primary data was obtained from 866 farmers using proportionate selection of wheat farmers from the states list of farmers. A structured questionnaire and interview schedule were administered to the farmers to collect data for the study. Stochastic frontier model was used to capture wheat farmers production efficiency. Years of experience in wheat farming, extension visit, sex, level of literacy and household size were found to inversely influence technical inefficiency of respondents. There should be training and retraining of more wheat farmers to reduce technical inefficiency among wheat farmers across the wheat producing states in Nigeria.

Key words: Wheat farmers, Socioeconomic factors, Efficiency, Influence

Introduction

Wheat is a global staple food usually process into wheat-based foods (flour noodles, semolina pasta, biscuit wheat meal), beer, beverages and animal feed. Many developing countries including Nigeria are facing challenges of low output, productivity and constrained input supply patterns (Alternburg, 2007). Wheat is one of the most important agricultural commodities in Nigeria that need accelerated local production as a result of population growth. Nigeria produces approximately 60000MT of wheat in 2016 worth $12.66mn (only 0.004% of the global production). Therefore, a huge demand gap of 4.57mn tons making Nigeria less self-sufficient in wheat production. This could be as a result of technical inefficiency of wheat farmers that need to be measured, since it provides information as to whether or not wheat farmers are producing a given quantity of output using minimum quantity of inputs

Although, many studies have been conducted on technical efficiency of wheat farmers in other countries like Anatolia in Turkey, Bihar in Indian, South Willo in North-central of Ethiopia by Oren (2006), Prafulla (2012) and Hassen (2016) respectively, in Nigeria, studies carried out on technical efficiency focused on crops other than wheat. For example, Mukhtar et al

(2018) employed Data Envelopment Analysis (DEA) to determine technical efficiency of small holder pearl millet farmers in Kano state. However, no study has estimated technical efficiency of wheat production domicile in wheat producing states of the country. Hence the main focus of this study is to determine the efficiency status of Nigerian wheat farmers.

The main objective of the study is to analyze the socio-economic factors influencing wheat farmers efficiency in Nigeria and the specific objectives of the study are to examine the socio-economic characteristics of wheat farmers in wheat producing states of Nigeria and estimate farmers specific factors on efficiency of wheat farmers in the study area.

Material and Method

Study Area

The study was conducted in wheat growing zone of Nigeria that comprise northern states of the country which lies between latitude $10^0$26/N to $10^0$55/ of the equator and longitudes $12^0$26/E to $13^0$45/. The climate of the area is tropical with distinct wet and dry seasons. The area experience 4-6 months of rainfall with a mean annual rainfall of about 1000mm-1500mm. The mean annual temperature is 26.3^0C (REF). Majority of the people are full time farmers with a good number engaged in wheat farming. The major crops cultivated along with wheat are: sorghum, maize, groundnut and millet. Animal such as cattle, sheep, goat and poultry are also kept at both subsistence and commercial levels.

Sampling technique

Samples were drawn from five out of seven wheat producing states of Nigeria which include: Kano, Bauchi, Jigawa, Kebbi and Sokoto. Borno and Yobe states were excluded because of the security challenges. The study considered 866 sample farmers from sample frame obtained from the states Association of Wheat Farmers. These samples were proportionally selected from that list.

Primary data and secondary information were used for the study. Primary data were obtained from respondents with the use of structured questionnaire and interview schedule. Data relating to socio-economic characteristics were obtained from wheat farmers. Secondary information was obtained from journals, publications of the Ministries of Agriculture, Agricultural Development Programs (ADPs) and internet. Enumerators were trained to administer the questionnaire and interview schedule to the respondents.

Analytical Tool

The study employed the use of stochastic frontier model (SFM) to estimate technical efficiency of wheat farmers in Nigeria.

Model specification:

$\text{In}Y_i = \beta^1 x_i + v_i - u_i$

Y_i = wheat yield

β^1= estimated input parameters

v_i = random noise term ($v_i \sim N(0,\sigma^2_{vi})$

u_i = technical inefficiency

Cobb Douglas production form

The Tobit regression model was used to analyze the determinants of inefficiency in wheat production among respondents

$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + u$

Y= technical inefficiency

X_1= years of experience in wheat farming

X_2= extension visit

X_3= sex

X_4= level of literacy

X5= household size

U= error term

Result and Discussion

The socio-economic results in Table 1 showed that most wheat farmers in Nigeria are males (96.54%) with less than 5% females practicing wheat farming, which is an indication of how tedious the agricultural practice looks like and showing the level of responsibilities involved. This finding is consistent with Baba and Horst (2018) who clarified that men are predominantly farmers as the case in most rural northern Nigeria. Majority (30.14%) of the respondents age ranges within 40 to 49years. The average age of respondent was 43 years which implies that majority of the respondents were in their active age across the study area. Moreover, most of the respondents could be said to be matured, risk-taker and have responsibilities owing to the fact that 92.96% of them were married with average household-size estimated as 10. Furthermore, respondents (86.95%) indicated crop farming as their major occupation while less than 13% showed other works like civil service, handcraft, livestock rearing and so on alongside with wheat farming. Moreover, 69.05% of the respondents claimed to have formal education with 19.75%, 28.06%, 4.62% and 1.85% of the respondents having primary, secondary, degree and post graduate certificates respectively as their highest educational attainment. The average years of education spent by respondents in schools was 12 years which implies that most of the respondent are secondary school leavers. This suggests that majority of the respondents are literate. The average farming years of experience of respondent is 23years with lower years of experience of 10 years in wheat farming across the study area. This implies that majority of the respondents have more years of farming experience in other crops than wheat crop farming. It should also be noted that most of the respondents (76.79%) claimed not to have had access to credit use which could have helped them expand and boost their wheat production. The minority (23.21%) of the respondents that had access to credit usually got it from sources such as commercial bank, Bank of Agric., cooperative, money lender, friends and families. It could be observed that friends and families (9.24%) remained the major source of credit for wheat production across the study area while commercial banks remained the least source of credit for wheat farmers with high interest rate and collateral bottlenecks.

The result from Table 2 revealed that land size (Ln of land per hectare), quantity of seed planted (Lnseedq4planted), quantity of NPK fertilizer applied (Lnfertilizerq3a), quantity of Urea fertilizer applied (Lnfertilizerq3b) and labour used in man-day (Lnmanday2) influenced wheat yield (Ln yield) across the study area. The parameter estimates showed positive sign all through which indicated that, there was direct relationship between wheat yield and its determinants.

More importantly, the statistically significant at 1% (Prob<=z = 0.000) from truncated normal result in Table 2 testing the null hypothesis (H_0=there is no inefficiency component) implies that we reject the null hypothesis (H_0) and conclude that inefficiency component exist.

Table1: Socio Economic Characteristics of the Respondents

Social economic variables		Frequency	Percentage
Sex	Male	836	96.54
	Female	30	3.46
	Total	866	100.00
Age	10-29	92	10.62
	30-39	230	26.56
Average age = 43	40-49	261	30.14
	50-59	190	21.94
	≥60	93	10.74
	Total	866	100.00
Marital status	Single	55	6.35
	Married	805	92.96
	Divorce	4	0.46
	Widow	2	0.23
	Total	866	100.00
Household size	≤10	440	50.81
	11-20	335	38.68
Average Household size =10	21-30	80	9.24
	31-40	11	1.27
	Total	866	100.00
Major Occupation	Crop Farming	753	86.95
	Livestock rearing	23	2.66
	Laborer	1	0.12
	Trade	25	2.89
	Handcraft	8	0.92
	Civil servant	52	6.00
	Transporter	2	0.23
	Others	2	0.23
Formal education	No	268	30.95
	Yes	598	69.05
	Total	866	100.00
Highest education attainment	No formal education	268	30.95
	Primary	171	19.75
	Secondary	243	28.06
	NCE	68	7.85
	OND	30	3.46
	HND	30	3.46
	Degree	40	4.62
	Post graduate	16	1.85
	Total	866	100.00
Farming years of experience	<10	92	10.63
	10-29	461	53.23
	30-39	198	22.86
	≥40	115	13.28
Wheat Farming years of experience	<10	536	61.89
	10-29	270	31.18
	≥30	60	06.93
Credit use	Yes	201	23.21
	No	665	76.79
Credit source	Don't Source Credit	665	76.79
	Commercial bank	10	1.15
	Bank of Agric.	23	2.66
	Cooperative	21	2.42
	Money lender	19	2.19
	Friends and Families	80	9.24
	Others	48	5.54

Source: Field Survey, 2023

Table 2: Predicted Inefficiency table

Variable	Observation	Mean	Std. Dev.	Min	Max
Predicted inefficiency(U)	830	0.4969	0.4106	0.0974	3.3114

Source: Field Survey, 2023

Table 2 : Regression assumption test table

Regression assumptions:	**Test:**	**We seek values**
heteroskedasticity problem	**Breusch-Pagan Hettes** Chi2(1): 4.732 p-value: 0.030	> 0.05
no multicollinearity problem	**Variance inflation factor**	< 5.00
	Lnfertilizerq3a : 2.44 Lnfertilizerq3b : 2.44 Lnseedqplanted : 1.62 Lnlperhect : 1.44 Lnmanday2 : 1.13	Mean VIF | 1.81
residuals are not normally distributed	**Shapiro-Wilk W normality test**	> 0.01
	z: 8.001 p-value: 0.000	
no specification problem	Linktest	< 5.00
	t: 0.320 p-value: 0.749	
appropriate functional form	**Test for appropriate functional form**	> 0.05
	F(3,821):2.142 p-value: 0.093	
no influential observations	**Cook's distance**	< 1.00
	no distance is above the cutoff	

Source: Field Survey, 2023

The average predicted inefficiency (U) estimated from table 3 was 0.4969 or 49.69% with minimum and maximum technical inefficiency of 0.0907 and 3.3114 respectively. This implies that nearly half of the entire respondents were technically inefficient in wheat production in the study area. Hence, Tobit regression was used to determine factors that influences technical inefficiency among wheat farmers in the study area after validating regression assumptions.

The post estimation result test table 2 shows that there is no problem of multicollinearity, no specification problem, no influencial observations, but there is appropriate functional form and the residual are not normally distributed. The heterokedasticity problem from the table was corrected with robust standard error. It should be noted that the test pass majority of the model assumption thereby confirming the reality of the result.

The Tobit regression result in Table 3 is in-line with a prior expectation. The years of experience in wheat farming, extension visit, sex(sex), level of literacy (li and household size were used to predict for technical inefficiency among wheat farmers in the study area. The negative sign of the

coefficient estimated shows that years of experience in wheat farming, extension visit, sex, level of literacy and household size have inverse relationship with technical inefficiency among wheat farmers in the country. These implies that an increase in years of experience of wheat farmer, number of extensions visit and literacy level is likely to reduce wheat farming technical inefficiency across wheat producing area in the country which were statistically significant at 1%, 10% and 5% respectively. Jothan (2012) argued that the higher the literacy level the higher will be the efficiency and the lower will be the likelihood for inefficiency. Linking a region's literacy level to its academic achievement, the central region with the highest literacy rate of 92%, has the highest technical efficiency of primary school (97.5%). On the other hand, the Northern Region with the lowest literacy rate of 86% has the lowest level of technical efficiency (76.5%). This suggests that literacy level could be said to be positively correlated with efficiency but negatively related to inefficiency. In case of sex, the result shows that male farmers are less likely to be technical inefficient in wheat production compared to their female counterparts and statistically significant at 5%. This is consistent with the work of Rahman and Hasan (2008) that male farmers are more efficient than female farmers, which might be due to men's control to key productive resources in many rural communities. Moreover, an increase in household size is likely to decrease wheat production technical inefficiency but it is statistically insignificant. This result is in line with the finding of Balogun and Akinyemi (2017) that large household size indicates an increase in land fragmentation among household members which could be a source of technical inefficiency. But since the household coefficient result is statistically insignificant, this suggested that land fragmentation problem contributing to technical inefficiency might not be the real issue in the wheat producing areas.

It is important to note that marginal effects after Tobit gives the same result as that of Tobit regression in Table 3. In other words, the result in table 5 reveals that 1 unit increase in years of experience of wheat farmer, extension visit and level of literacy will lead to decrease in technical inefficiency among wheat farmers in Nigeria by 0.60%, 6.16% and 2.87% respectively. The result is consistent with Shaheen (2003) that the more frequent extension visits by an extension agent and other formal organization significantly reduces inefficiency. Furthermore, there would be 0.1696 decrease in technical inefficiency among wheat farmers in the study area as male wheat farmers increase by 1 unit which is statistically significant. This may be so owing to the fact that wheat farming needs much strength and vigor to break even considering many activities (land preparation, bonding, planting, irrigation, fertilizer application, harvesting, processing and so on) that are involved. In other words, as male wheat farmer increases by 1 unit it will lead to 16.96% decrease in the technical inefficiency among wheat farmers in the study area.

The major constraints to wheat production identified by respondent in the study area according to their level of severity in Table 6 includes: poor access to credit (40.07%), lack of dependable market (39.49%), poor access to improved and quality seed (36.95%) which are categorized as the most severe. High cost of fertilizer (39.61%), lack of proper germplasm wheat material (32.25%), Poor utilization of local wheat /preference of imported wheat to local wheat (30.25%). these are more severe

constraints in wheat production. High energy cost for wheat irrigation (34.53%), pest and diseases infestation (32.22%), lack of functional wheat-based farmers association (25.17%) and non-availability of fertilizer at required time (25.98%) were severe constraints facing by wheat farmers in the study area. Furthermore, lack of capacity building for the extension staff and farmers (26.44%) stands moderately severe in the study area. While non-availability of farm labour as at when due (34.76%) is least severe.

Table 3: Tobit regression table

Number of obs = 830

LR chi2(5) = 31.81
Prob > chi2 = 0.0000
Log likelihood = -452.45871 Pseudo R2 = 0.0340

U	Coef.	Std. Err.	t	p>ltl	[95% conf. Interval]	
Wyearexp	-0.0060	0.0018	-3.40	0.001***	-0.0095	-0.0025
Extvisit	-0.0615	0.0328	-1.88	0.061*	-0.1259	0.0029
Sex	-0.1696	0.0783	-2.17	0.031**	-0.3232	-0.0160
Literacylevel	-0.0213	0.0107	-2.00	0.046**	-0.0423	-0.0004
Hdsize	-0.0029	0.0023	-1.24	0.214	-0.0074	0.0017
_cons	0.8478	0.0940	9.02	0.000	0.6633	1.0324
/sigma	0.4164	0.0102			0.3964	0.4365

Source: Field Survey, 2023. ** significant at 1%, ** significant at 5%,*significant at 10%,***

Conclusion and Recommendation

The study concluded that there were about 50% technical inefficiencies existing among wheat farmers across the study area. These inefficiency variables could be said to be negatively correlated with wheat technical inefficiency. The years of experience in wheat farming, extension visit, sex and level of literacy have inverse relationship with technical inefficiency among wheat farmers in the study area and are statistically significant. Hence the study recommends the following:

- There should be training and retraining of more wheat farmers to reduce technical inefficiency among wheat farmers across the study area.
- Literate unemployed youth should be empowered to take up wheat farming as their main occupation so as to reduce technical inefficiency among wheat farmers.
- Adequate funding should be made available for smooth extension service delivery across wheat producing area in the country which will in turn reduce technical inefficiency among wheat farmers.
- Formulations and adhere to policies that will encourage and increase local wheat uptake for industrial use and readymade market should be provided by the government to wheat farmers as a means to tackle some of the problems militating against wheat production in Nigeria.

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