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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Determinants of farmers' access to fertilizer under fertilizer task force distribution system in Kogi State, Nigeria

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Abstract: This study investigated the determinants of farmers' access to fertilizer under Fertilizer Task Force Distribution System in Kogi State, Nigeria. A multi-stage random technique was used to select 160 farmers for the study. Probit model analysis on the factors that influence farmers' access to fertilizer showed that age of the farmers, farm size (negative), distance to procurement centers, and social participation (positive) significantly influenced the probability of farmers' access to fertilizer. Effective strategies of task force in the procurement and distribution of fertilizer perceived by the respondents among others are: distribution of fertilizer through local government agricultural offices, subsidy at source including transportation subsidy to delivery points, and promotion of subsidies for the poor farmers, development of private agro-dealers network. It is envisaged that these factors could serve as a guide to policy-makers regarding procurement and distribution of fertilizer to enhance farmers' access and crop productivity in Nigeria.

Subjects: Area Studies; Development Studies; Economics, Finance, Business & Industry; Social Sciences

Keywords: farmers' access; fertilizer; probit analysis; task force distribution system; Nigeria

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Moradeyo Adebanjo Otitoju

PUBLIC INTEREST STATEMENT

Nigeria has the challenge of soil depletion and needs greater political action and mass mobilization of its population to avert the clear and present danger of massive food crisis. Fertilizers are needed to redeem her impoverished farmlands and forestall a looming food crisis in the country. Nigerian government imports more than 95 percent of the fertilizer needs of the farmers. Apart from the high cost of importing fertilizer, the challenge of its effective distribution to farmers across the country is enormous. Most of the time the fertilizer gets to the farmers at a cost they cannot afford or at a time they no longer need it. As one of the distribution strategies, Task Force Distribution System was used in Kogi State, Nigeria to distribute fertilizers to farmers. This study was conducted to assess factors that influence access to fertilizer under this strategy, to help sharpen effective fertilizer distribution strategy.

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1. Introduction

Nigeria needs fertilizers to redeem her impoverished farmlands and forestall a looming food crisis in the country. Nigeria, along with Guinea, Congo, Angola, Rwanda, Burundi, and Uganda, was identified as one country that has the highest rate of soil depletion and needs greater political action and mass mobilization of its population to avert the clear and present danger of massive food crisis. Fertilizer is therefore one product that Nigerian farmers and, indeed the agricultural sector generally, need to feed the nation's exploding population. For now, the Nigerian government imports more than 95 percent of the fertilizer needs of the farmers (Fertilizer Suppliers Association of Nigeria [FEPSAN], 2011). Apart from the high cost of importing fertilizer, the challenge of its effective distribution to farmers across the country is enormous. Most of the time the fertilizer gets to the farmers at a cost they cannot afford or at a time they no longer need it—late deliveries (FEPSAN, 2011). A historical review of Nigeria fertilizer policies indicates an inconsistency of government fertilizer policy over the year. Policies kept changing almost year by year, in attempt to respond to problem of availability, accessibility, leakage, and arbitrage. None of the policy attempts succeeded as designed. The main constraints to fertilizer use are seen as high price, low fertilizer quality, accessibility, and non availability of fertilizer at the time required.

In an effort to ameliorate the problems of late delivery and high cost of fertilizers, successive Nigeria Governments came up with the various models in the fertilizer sector distribution. Federal Government provided the guidelines for implementing the stabilization program, these models were applied at the state levels, they include: (a) distribution solely by Ministry of Agriculture, through the Local Governments; (b) distribution by a Task Force or Special Committee appointed by the Ministry of Agriculture; (c) distribution through the Agricultural Input Supply Company (AISC) of the State; (d) distribution through the Agricultural Development Projects (ADPs) of the State and (e) distribution through hybrid arrangements of two or more of the above systems (Kwa, 2011).

Tackling the problems of quality, quantity, timeliness, price, and credit may, in the long run, be a better option. This is because, if the distribution system does not address the issue of availability and accessibility of fertilizer as at when due, the essence of the provision of subsidy on the produce will be defeated as the farmers will not be able to use the fertilizer for crop production when they are finally supplied. To ensure having fertilizers at the right time, place, form, quality, quantity, and affordable price by the farmers especially the small-scale farmers, Kogi State Government in an attempt to proffer solution to fertilizer distribution challenges adopted task force system or model to reduce the burden of the farmers, which are mostly resource-poor in order to boost their crop output.

Previous studies like Edun, Agrega, and Ikpi (2009), on the determinants of fertilizer usage in Northern Nigeria, and Liverpool-Tasie, Olaniyan, Salau, and Sackey (2010) on the review of fertilizer policy issues in Nigeria and Ezeh, Onwuka, and Nwachukwu (2008) on the correlates of inorganic fertilizer consumption among smallholder farmers in Abia State, Nigeria and Banful, Nkonya, and Oboh (2010) on the constraints of fertilizer use in Nigeria. Ricker-Gilbert, Jayne, and Chirwa (2011) investigated how fertilizer subsidies affect demand for commercial fertilizer in Malawi using double-hurdle model with panel data. Yanggen, Kelly, Reardon, and Nassem (1998) worked on the incentives for fertilizer use in sub-Saharan Africa with particular emphasis on fertilizer response and profitability. Jha and Hojjati (1993) examined fertilizer use on smallholder farms in the transition from subsistence farming to a more commercialized agriculture in Eastern Province, Zambia. Ahmed (1987) determined the structure and dynamics of fertilizer subsidy in Bangladesh. But none of these available studies addressed the issues of factors influencing farmers' access to fertilizer, especially under fertilizer task force distribution system or model in Nigeria. On this background, this study examined the factors influencing farmers' access to fertilizer under Fertilizer Task Force Distribution System in Kogi State, Nigeria.

The following specific objectives guided the study to: (i) assess farmers' awareness of Fertilizer Task Force in the study area, (ii) determine factors that influence farmers' access to fertilizer under

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task force distribution system in the study area, and (iii) assess the perception of farmers on the effectiveness of fertilizer procurement and distribution strategies used under task force distribution system in the study area.

2. Methodology

2.1. Study area
The study area is Kogi State. It is located in the North central zone of Nigeria, approximately between latitude 6°33′ and 8 44′ N and longitude 5 22′ and 7 49′ E. The state was created along with eight others during the state creation exercise of 22 August 1991. It is bounded to the south by Anambra and Edo State; to the north by Niger, Nassarawa and Federal Capital Territory; to the east by Benue and Enugu State. On the western flank, it shares common border with Ondo, Ekiti, and Kwara States (Kogi State Agricultural Development Programme [KSADP], 1995). The state has a current population of about 3,278,487 people (National Population Commission [NPC], 2006).

It has an average of 172,000 farm families. About 70 percent of the population live in the rural areas and engaged in agricultural production (KSADP, 1995). The population is made up of various ethnic groups, of which the major groups are Igala, Ebira, Okun, Bassa, and Nupe. The state comprises 21 Local Government Area (LGA), which is divided by KASDP for extension administration purposes into four agricultural zones namely: Zone A comprises Ijumu, Kobba/bunu, Yagba-East and Yagba-West, Lokoja, Kogi, and Mopa-Moro Local Government Areas, having Aiyetoro-gbede as the zonal headquarters; Zone B comprises Dekina, Bassan, Ankpa, Olamaborok, and Omala Local Government Areas, with Anyigba as it headquarters; Zone C comprises Adavi, Ajaokuta, Konotofarfe, Kogi, Okene, Okehi, and Ogori Mongogo Local Government Areas with Koton-Karfe as its headquarters; and Zone D comprises Idah, Ofu, Ibaji, Igala-mela/Odolu, and Olamaboro Local Government Areas having Aloma as its headquarters.

2.2. Data collection
The study was conducted in Kogi State, Nigeria. It is made up of four agricultural zones. Data for this study were obtained mainly from primary source during 2009/2010 cropping season. Multi-stage random sampling method was used for selecting respondents. Firstly, one LGA was randomly selected from each agricultural zone giving four local government areas in all. Secondly, two communities were randomly selected from each local government, amounting to eight communities in all. Thirdly, two villages were random selected from each community to make up 16 villages in all. Lastly, 10 farmers were randomly selected from each village amounting to a total of 160 respondents.

2.3. Estimation technique

2.3.1. The probit model
The probit model specified in this study to analyze farmers' access to fertilizer under Fertilizer task force distribution system or model can be expressed as follows:

The specification of the probit model with several explanatory variables is as stated below:

$$\pi_i = \Phi(\eta_i) = \Phi(\beta_0 + \beta_{t1}X_{t1} + \beta_2 X_{t2} + \cdots + \beta_{ik}X_{ik} + \varepsilon) \tag{1}$$

$$= \Phi\left(X_i^t \beta \varepsilon_i\right) \tag{2}$$

where $\varphi(\cdot)$ = distribution function for the Standard Normal Random Variable; β_0 and β_i = are parameters to be estimated; π_i = conditional probability; β_i = coefficient of the explanatory variables; X_i = the explanatory variables, and ε_i = error term. The normal distribution of errors stated in Equation (3) makes probit model different from the logit model which assumes logistic distribution of errors.

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$$\Phi^{-1}(Y_i) = \sum_{k=0}^{k=n} \beta_k X_{ik} \varepsilon_i \tag{3}$$

Then, the probit model in this study can be written implicitly as:

$$Y_i^* = X_i \beta + \varepsilon_i \tag{4}$$

It can be explicitly stated as,

$$Y_i^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \varepsilon_i \tag{5}$$

where Y_i^* = {1 if farmer had access to fertilizer in the cropping season, 0 if farmer did not have access to fertilizer}. X_1 is age of the farmer in years; X_2 is measured in dummy, 1 if male and 0 otherwise; X_3 represents education of the household head measured in the years of schooling; X_4 represents household size measured in number of persons staying under the same roof and eating from the same pot with the farmer; X_5 represents distance from the farmers residence to the source of fertilizer sales/procurement designated by the task force in kilometers; X_6 represents social participation measured in the number of associations the farmers belong; X_7 represents the awareness of the task force oversight distribution function in the area by the farmer, measured in dummy, 1 if yes and 0 otherwise; X_8 represents number of years' awareness; X_9 represents farm size of the farmers in hectares, X_{10} represents number of visits of the extension workers in the cropping season; and X_{11} represents tenure security (based on land ownership) measured in dummy, 1 if owned land and 0 otherwise. The probit model was used to examine the influence of selected factors on access to fertilizer by farmers in Kogi State, Nigeria. β_0 = intercept. β_1–β_{11} = parameters of the explanatory or independent variables.

The probit function is estimated by the maximum likelihood method. Stata 11 statistical software was used to obtain the maximum likelihood estimates of the probit analysis for the model developed in the study. Probit analysis is based on the cumulative normal probability distribution.

The objective on the perception of the farmers' effectiveness of fertilizer task force in the procurement and distribution strategies was realized using Likert scale rating technique where the weighted mean (≥2.50) was used to determine the effective strategies.

3. Results and discussion

3.1. Farmers' awareness of fertilizer task force
Awareness of fertilizer task force may play a role in helping the farmers (fertilizer users) to procure and use more fertilizer. Frequency distribution of farmers according to their awareness of fertilizer task force is shown in Table 1. Majority of the sampled farmers (84.4%) were aware of the fertilizer task force, while 15.5% of them were not aware. More so, 48.2% of those that were aware had been

Table 1. Frequency distribution of farmers' awareness of fertilizer task force

Awareness (N = 160)	Frequency	Percentage
Yes	135	84.4
No	25	15.6
Years of awareness (N = 135)		
1–5	18	13.3
6–10	65	48.2
11–15	46	34.1
>15	6	4.4
Total	**135**	**100.0**

Source: Computed from field data, 2011.

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aware for about 6–10 years, 34.1% of them fell within 11–15 years of awareness, 13.3% of them had been aware for not more than 5 years, and 4.4% of them were aware for 15 years and above. This implies that a good number of the farmers in the study area were aware of fertilizer task force which have been changed by past successive government in the state. But awareness does not necessarily translate to having access to fertilizer.

3.2. Factors that influence farmers' access to fertilizer under task force distribution system in Kogi State, Nigeria

The result of the probit model indicates that different factors (age, distance to the procurement source, social participation, and farm size) influence farmers' access to fertilizer in the study area. The likelihood ratio statistics as indicated by χ^2 statistics are highly significant ($p < 0.05$), suggesting the model has a strong explanatory power. Table 2 presents the parameter estimates, standard error, and the z-ratios from the probit model. In Table 2, after looking at the econometric criteria in the three models, Model 1 was selected as the lead model and further discussion on the objective it is set to address was based on that.

Table 2. Parameter estimates of factors that influence farmers' access to fertilizer under task force distribution system in Kogi State, Nigeria

Variables	Model 1			Model 2			Model 3		
	Coefficient	z-ratio	p-value	Coefficient	z-ratio	p-value	Coefficient	z-ratio	p-value
Age (years)	−0.0179 (0.0098)	−1.83*	0.067	−0.077 (0.0099)	−0.78	0.435	−0.0075 (0.0099)	−0.76	0.448
Sex (male = 1, 0 = female)	0.123 (0.302)	0.41	0.684	0.3002 (0.295)	1.02	0.309	0.313 (0.292)	1.07	0.284
Farmer's education (years of schooling)	−0.0081 (0.0203)	−0.40	0.690	−0.0108 (0.0203)	−0.53	0.593	−0.0087 (0.0201)	−0.43	0.664
Household size (number)	−0.0370 (0.0356)	−1.04	0.298	−0.0622 (0.0354)	−1.75*	0.079	−0.0615 (0.0349)	−1.76**	0.079
Distance to the point of procurement (km)	0.116 (0.0697)	1.66*	0.096	–	–	–	–	–	–
Social participation (number)	0.261 (0.120)	2.18**	0.029	0.293 (0.121)	2.42**	0.016	0.298 (0.121)	2.47**	0.014
Awareness of task force (1 if aware, 0 otherwise)	0.0698 (0.428)	0.16	0.871	0.274 (0.299)	0.92	0.360	–	–	–
Years of awareness of task force	0.0323 (0.0349)	0.93	0.353	–	–	–	0.0379 (0.0235)	1.61	0.107
Farm size (hectare)	−0.0586 (0.0353)	−1.66*	0.097	–	–	–	–	–	–
Extension (number of visits)	0.00867 (0.0144)	0.60	0.548	0.0192 (0.0199)	0.97	0.334	–	–	–
Tenure security (1 if land secured, 0 otherwise)	0.199 (0.228)	0.87	0.382	0.115 (0.225)	0.51	0.608	0.1604 (0.226)	0.71	0.478
Constant	0.306 (0.656)	0.656	0.641	0.186 (0.645)	0.29	0.773	0.1502 (0.635)	0.24	0.813
Number of observation	160			160			160		
Log likelihood ratio χ^2	(11) = 21.66			(8) = 15.59			(7) = 16.13		
Prob > χ^2	0.0272			0.0486			0.0239		
Pseudo R^2	0.0993			0.0740			0.0766		

Source: Computed from field data, 2011.

*Means significant at 10% level.

**Means significant at 5% level.

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3.2.1. Age of the farmers

Age of the farmer affects access to fertilizer under task force distribution model in Kogi State. The probability of having access to fertilizer is significantly and negatively related to the age of the farmers. This is in agreement with a priori expectation. This means that young farmers have more access to fertilizer than the older farmers and have the ability to source for fertilizer in the study area than their older counterparts. Also, young farmers adopt new technology than older farmers because they have a longer planning horizon than older farmers. This result agrees with the findings of Alexander and Mellor (2005) which found that GM corn adoption increased with age for younger farmers as they gain experience and increase their stock of human capital but declines with age for those farmers closer to retirement.

3.2.2. Distance to the fertilizer distribution sources

Distance from farms to the point of sales of fertilizer has a positive and significant relationship with probability of having access to fertilizer in the study area. The positive value of the coefficient might be due to the fact that farmers' associations and cooperatives societies do more of procuring and distributing fertilizers for their members, so the issue of distance might not really count in determining access to fertilizer under the task force distribution model in Kogi State, Nigeria.

3.2.3. Social participation

Social participation is agrarian associations, cooperative societies, and farmers' associations such as production, supra-community and social groups. Table 2 shows that social participation was positively and significantly related to the probability of having access to fertilizer at 5% level of probability. This implies that the more the number of association a farmer belongs to, the more the access he or she has to fertilizer under the task force distribution mode in the study area. Production associations such as farmers' groups are directly involved in procuring inorganic fertilizer and distributing it to the members, which promotes access to fertilizers in the study area.

3.2.4. Farm size

Farm size is negatively and significantly related to the probability of having access to fertilizer in the study area at 10% level of significance. This shows that farmers with less farm size had access to fertilizer than their counterpart with bigger farms. Even with small farm size, farmers can still improve their productivity optimally by intensifying the use of agricultural inputs, in this case fertilizer and with this knowledge, smallholder farmers can then strategize to acquire and use fertilizer than farmers with large farms which may not think in this direction on how to acquire and use it. It has been shown in some adoption studies that farm size had an inverse relationship with some agricultural technologies, e.g. Hassan and Nhemachena (2008) found out that the probability of choosing and using multiple crops under irrigation and multiple crop-livestock under irrigation was negatively influenced by farm size. Also, Deressa, Ringler, and Hassan (2010) found a negative relationship between probability to choose sold livestock and borrowed from relatives as a coping strategy for climate extremes and farm size.

3.3. Farmers' perception of the effectiveness of the procurement and distribution strategies of the task force distribution system

Effectiveness of the procurement and distribution strategies of the fertilizer task force as perceived by the farmers (fertilizer users) is presented in Table 3. Results in Table 3 indicate the respondents' perception of the effectiveness of strategies used by task force in fertilizer procurement and distribution. Based on the weighted mean, the strategies perceived as being more effective include distribution of fertilizer through local government agricultural offices (3.18), subsidy at source including transportation subsidy to delivery points (2.77), promotion of subsidies for the poor farmers (2.62), development of private agro-dealers network (2.59), market economy approach with a government-supported voucher scheme to help resource-poor farmers (2.58), and joint procurement and distribution by the state government and Federal Ministry of Agriculture (2.52).

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Table 3. Farmers' perception of the effectiveness of the fertilizer task force procurement and distribution strategies in Kogi State, Nigeria		
Variables	**Mean**	**S.D.**
Harmonization of policies and regulations to ensure duty and tax free movement across the states	1.38	0.63
Elimination of taxes and tariffs on fertilizer importation	1.00	0.00
Elimination of taxes and tariffs on fertilizer raw materials	1.22	0.42
Increase in farmers timely access to fertilizer	1.79	0.66
Reduction in cost of fertilizer procurement across the state	2.00	0.69
Development and increase in the number of dealers' across the state	1.28	0.64
Development of community-based networks across rural areas	1.35	0.66
Strengthening farmers' organizations and associations for easy distribution	1.55	0.85
Establishment of fertilizer procurement & distribution facilities such as transport and fiscal incentives	1.69	0.89
Distribution of fertilizer through ADP village extension agents (VEAs)	1.80	1.14
Improvement of farmers' timely availability to quality of fertilizers	1.45	0.88
Promotion of market transparency through market information systems	1.59	0.97
Financing of private fertilizer dealers'	1.41	0.64
Sale of fertilizer at government approved prices	2.18	0.90
Promotion of local and private manufacturing of fertilizers	1.68	0.73
Provision of subsidies for the resource-poor farmers	2.62*	0.71
Packaging of fertilizers in acceptable quantity	1.00	0.00
Inability to sell fertilizer above government approved quantity	1.98	0.77
Development of private agro-dealers network	2.59*	0.72
Distribution of fertilizer through political wards	2.27	0.60
Distribution of fertilizer through local government agricultural offices	3.18*	0.81
Subsidy at source including transportation subsidy to delivery points	2.77*	0.77
Joint procurement and distribution by the local government, state government and Federal Ministry of Agriculture	2.52*	0.51
Market economy approach with a government-supported voucher scheme to help resource-poor farmers	2.58*	0.75
Government monopoly procurement and subsidy on the final product	1.64	0.76
Government partial procurement and subsidy on the government product	2.36	0.99

Note: Cut-off point = 2.5.

Source: Computed from field data, 2011.

*Strategies adopted by task force assessed to be effective.

Meanwhile, fertilizer procurement and distribution strategies perceived as less effective by the respondents include Government partial procurement and subsidy on the government product (2.36), distribution of fertilizer through political wards (2.27), sale of fertilizer at government-approved prices (2.18), reduction in cost of fertilizer procurement across the state (2.00), inability to sell fertilizer above government approved quantity (1.98), distribution of fertilizer through village extension agents (1.80), increase in farmers timely access to fertilizer (1.79), establishment of fertilizer procurement and distribution facilities such as transport and fiscal incentives (1.69), promotion of local and private manufacturing of fertilizers (1.68), and promotion of market transparency through market information systems (1.59).

Other perceived less effective fertilizer procurement and distribution strategies by the respondents include improvement of farmers' timely access to quality of fertilizer (1.45), financing of fertilizer dealers' (1.41), harmonization of policies and regulations to ensure duty and tax free movement

across the states (1.38), development and increase in the number of dealers' across the state (1.28), elimination of taxes and tariffs on fertilizer raw materials (1.22) and elimination of taxes and tariffs on fertilizer (1.0).

4. Conclusion and policy recommendation

Farmers' access to fertilizer is an important aspect of measuring the effectiveness of a public strategy on fertilizer distribution. The findings revealed that majority of the sampled farmers (84.4%) were aware of the fertilizer task force, while 15.5% of them were not aware. Factors that influence farmers' access to fertilizer are age, farm size, social participation, and distance to procurement center. Age of the farmers and farm size have negative and significant relationship with the probability of farmers' access to fertilizer, while distance to procurement center and social participation positively and significantly related with the probability of farmers having access to fertilizer. It is also revealed that the strategies put in place by the task force in the procurement and distribution of fertilizer in Kogi State perceived as being more effective by the sampled farmers among others are: distribution of fertilizer through local government agricultural offices, subsidy at source including transportation subsidy to delivery points, and promotion of subsidies for the poor farmers, development of private agro-dealers network. To achieve better farmers' access to fertilizer, the efforts of government through the task force have to be complemented by monitoring and/or supervising the private sector participation in the procurement and distribution of fertilizer, so that the long envisaged increased crop output and productivity can be achieved in Kogi State, Nigeria. Again, any Government policy on fertilizer distribution should take social capital into consideration in order to achieve much envisaged success. More so, young farmers should be considered as a major stakeholder in fertilizer distribution strategy, especially for Nigerian Government that wants to diversify its economy base to non-oil sectors like agriculture. It is envisaged that these factors could serve as a guide to policy-makers regarding distribution of fertilizer to enhance farmers' access.

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