

Research Article

An Assessment of the Factors Influencing Farmers' Access to Fertilizer Markets in Some Selected Local Government Areas in Kaduna State, Nigeria

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Abstract

The study assessed the factors influencing farmers access to fertilizer markets in selected local government areas in Kaduna State. A multinomial regression analysis was used to assess whether the factors have significant effect on the odds of observing certain market categories. The model was assessed based on an alpha value of 0.05 and the result of the multinomial regression model were significant, $\chi^2(20) = 278.21$, $p < .001$ suggesting that education, cooperative association, credit, distance, ease of use, availability, comparative cost, accessibility, affordability and quality had a significant effect on the odds of observing at least one of the response categories of the market relative the retailer outlet. The significant variables' influence on the odds of choosing specific market outlets is indicative of the multifaceted nature of farmers' decision-making processes. Education, cooperative membership, distance, and product availability emerged as key determinants of selecting retailers. Meanwhile, credit, quality, and availability of the product were found to influence the choice of wholesaler outlets. Understanding the interplay of these factors can guide policymakers, extension services, and market stakeholders in designing targeted interventions. Enhancing access to credit, improving product quality, and addressing distance-related challenges can facilitate better market access, promote value chain efficiency, and potentially lead to increased market participation and improved livelihoods for farmers

Keywords

Fertilizer, Power Analysis, Information Flow, Product Flow, Relationship Strength

1. Introduction

Access to fertilizers and fertilizer markets is a significant challenge in Kaduna State because it affects availability, distribution, linkages between actors and ultimately usage by farmers. According to the FAO, only 50% of the world's population has access to sufficient quantities of fertilizers, with most of the fertilizer use concentrated in developed

countries [3]. In Sub-Saharan Africa, less than 10% of cropland is fertilized, contributing to low crop yields and food insecurity [7]. The high cost of fertilizers is a significant barrier to access, particularly for smallholder farmers who make up the majority of farmers in developing countries. A study by [4] found that fertilizer prices in Sub-Saharan Africa were up

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Received: 18 January 2024; **Accepted:** 14 February 2024; **Published:** 7 March 2024



to 80% higher than international prices, making it difficult for smallholder farmers to afford them. The lack of access to fertilizers has led to low yields, food insecurity, and poverty among smallholder farmers.

The inefficient production and distribution of fertilizers contribute to high prices and limit access to fertilizers. Fertilizer production requires significant capital investments, which are often lacking in developing countries [1]. Furthermore, the transportation and distribution of fertilizers are often inefficient, resulting in high transport costs and further increasing fertilizer prices. The lack of efficient logistics and distribution systems hinders the availability and affordability of fertilizers, particularly in remote and rural areas.

Inadequate infrastructure is another challenge facing the fertilizer value chain. The lack of proper storage facilities and transportation networks contribute to fertilizer losses and increased costs [2]. The absence of adequate storage facilities results in fertilizer losses through moisture, pests, and theft. Additionally, the lack of proper transportation networks hinders the efficient distribution of fertilizers, particularly in remote areas. The absence of efficient transportation networks limits access to fertilizers and increases transportation costs, further contributing to high fertilizer prices.

Access to financing is a significant challenge in the fertilizer value chain, particularly for smallholder farmers. Smallholder farmers often lack collateral and formal financial histories, making it difficult for them to access financing from formal financial institutions [3]. As a result, they often rely on informal sources of financing, which often come with high-interest rates and strict repayment terms. Furthermore, fertilizer manufacturers and distributors also face challenges in accessing financing, hindering their ability to expand and improve their operations.

The objective of the study is to identify the factors influencing farmers' access to fertilizer markets created by chain activities;

2. Sampling Technique

The study area is Kaduna State, Nigeria and focused on some selected Local Government Areas which are Igabi, Giwa, Lere, Makarfi and Soba respectively based on the intensity of farming activities in these areas. Power analysis was used to select 220 retailers and 484 farmers based on an actual power of 0.95 and 0.99 for retailers and farmers respectively. 41 agro-dealers that registered with the blending plants were selected and 10 blending plants in Kaduna State were also selected.

3. Analytical Tool: Multinomial Logistic Regression Analysis

This study modelled the logs of the odds of improved market access as a linear function of a set of independent

variables implicitly [8]

$$\ln \left(M = \frac{p}{1-p} \right) = f(Z_i V_i) = \frac{1}{1 - \theta Z_i V_i} = \frac{\theta Z_i V_i}{\theta Z_i V_i - 2} \quad (1)$$

Where:

p is the probability of the dependent variable occurring given the independent variables Z_i and V_i .

Z_{ij} , is vector of specific chain activity performance with farm firm j in producer category i

V_{ij} , a vector socio-economic characteristic associated with farm firm j in producer category i

In order to determine the values of Z_i and V_i , the likelihood of observing the sample needs to be formed by introducing a dichotomy response variable M_i such that

$$m_i = \int \begin{matrix} 1 & \text{if } i\text{th farmer has improved market access status} \\ 0 & \text{if } i\text{th farmer has no improved market access status} \end{matrix} \quad (2)$$

Thus, the explicit equation assumes the form:

$$M_{ij} = \beta_0 + \beta_1 Z_i + \beta_2 V_i + U_i \quad (3)$$

Where;

M_{ij} is a dummy variable (coded Yes = 1 for farmer with improved market access, and No = 0 for farmer without improved market access, Z_i and V_i as explained above, β_i a measure of coefficient of slope and U_i , the error term.

The variable "improved market access" (M_i^*) was used as a dummy dependent variable to test the relationship presented in equation above. The farm firm level independent variables to be used to test these relationships at the farm firm level include all the chain activities performance scales (Z_i) (that is product flow, information flow and relationship strength). Each of this chain activity performance level was measured in this study as the share of farm firms with producer category that was satisfied with each chain activity performance and the farm firm socio-economic characteristics (V_i) was tested.

V_1 = Age (years),

V_2 = Level of education (years),

V_3 = Household size (number of people),

V_4 = Farm size (hectare),

V_5 = Extension contacts (number of times),

V_6 = Membership of a cooperative (years),

V_7 = Amount of credit received (N),

Z_1 = Product flow (5=strongly agree, 4=agree, 3=undecided, 2=disagree, 1=strongly disagree),

Z_2 = Information flow (5=strongly agree, 4=agree, 3=undecided, 2=disagree, 1=strongly disagree),

Z_3 = Relationship strength (5=strongly agree, 4=agree, 3=undecided, 2=disagree, 1=strongly disagree)

4. Result and Discussions

This addressed the objective of the study; determine the factors influencing farmers' access to markets created by

chain activities and a multinomial logistic regression analysis was conducted to assess whether education, cooperative association, credit, distance, ease of use, availability, comparative cost, accessibility, affordability, and quality had a significant effect on the odds of observing each response category of marketing outlets nominal relative to retailer. The assumption of absence of multicollinearity was examined using variance inflation factors. Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity between predictors. High VIFs indicate increased effects of multicollinearity in the model. VIFs greater than 5 are cause for concern, whereas VIFs of 10 should be considered the maximum upper limit [6]. All predictors in the regression model have VIFs less than 10. Table 1 presents the VIF for each predictor in the model.

The model was evaluated based on an alpha of 0.05. The results of the multinomial logistic regression model were significant, $\chi^2(20) = 278.21, p < .001$, suggesting that education, association, credit, distance, ease of use, availability, comparative cost, accessibility, affordability, and quality had a significant effect on the odds of observing at least one response category of marketing outlets nominal relative to re-

tailer. McFadden's R-squared was calculated to examine the model fit, where values greater than 0.2 are indicative of models with excellent fit [5]. The McFadden R-squared value calculated for this model was 0.30.

The coefficients from multinomial logit can be difficult to interpret because they are interpreted relative to the base outcome. To better evaluate the effect of a unit change in covariates on the dependent variable, the marginal effects (odd ratio {OR}) are also examined and reported. The sign of the coefficient shows the direction of influence of the variable on the logit.

It follows that a positive value indicates an increase in the likelihood that a household will change to the alternative option from the baseline group (blenders). The result showed that some of the variables were significant at both market outlets while some others were significant in one marketing outlet but not in the other outlet. Compared to the base category (retailers) education, cooperative membership, distance and availability of the product determined the selection of retailers as market options while the variables credit, distance, quality and availability of the product affected the choice of wholesaler outlet.

Table 1. Factors Influencing Farmers' Access to Fertilizer Markets Created by Chain Activities.

Variable	Blender				Wholesaler				VIF
	β	SE	P-value	OR	β	SE	P-value	OR	
Intercept	-4.95***	1.41	0.001	0.007	1.02**	0.49	0.037	2.77	
Education	-0.41**	0.19	0.032	0.67	0.15	0.11	0.145	1.17	1.06
Association	-4.43***	0.77	0.001	83.62	0.22	0.28	0.446	1.24	1.15
Credit	-7E-07	1E-06	0.446	1.0	-4E-06**	2E-06	0.035	1	1.07
Distance	-0.11**	0.05	0.018	0.9	-0.11***	0.02	0.001	0.89	1.08
Ease of Use	0.52	0.46	0.253	1.68	-0.03	0.25	0.891	0.97	1.2
Availability	1.08*	0.65	0.096	2.93	1.58***	0.32	0.001	4.83	1.77
Comparative Cost	-0.88	1.07	0.408	0.41	0.18	0.82	0.83	1.19	1.19
Accessibility	0.32	0.92	0.729	1.37	-0.61	0.59	0.302	0.54	5.16
Affordability	0.79	1.04	0.448	2.2	0.89	0.7	0.203	2.44	6.21
Quality	1.1	1.08	0.308	3.02	1.49***	0.33	0.001	0.22	1.3

Note. $\chi^2(20) = 278.21, p < .001, \text{McFadden } R^2 = 0.30$.

The results of the estimated OR are discussed in terms of the significance and signs on the parameters. The positive estimated coefficients of a variable indicates that the probability of the farmers either purchasing from wholesaler market outlet or retailer market outlet relative to purchasing from blenders market outlet increases as these explanatory variables increase. The implication is that the probability of the

respondents to be on these outcomes is greater than the probability of being retailer outlet (the base category). The negative and significant parameter indicates the probability of using wholesale outlet is higher than the probability of being in the two alternatives. Estimates not significantly different from zero indicate that the explanatory variable concerned does not affect the probability of the respondents' decision to

use manufacturers' outlet category than in the other two categories.

The regression coefficient for education was negatively and significant related with retail outlet choice at 5% significance level, $B = -0.41$, $\chi^2 = 4.59$, $p = .032$, and not significant for wholesaler marketing outlet, suggesting that a one-unit increase in education of the respondents would decrease the odds of observing the retailer marketing category of marketing outlets Nominal relative to the retailer category by 67%. The result also confirmed that, if respondent is educated the probability of choice of retail outlet decreased by 67% relative to wholesaler outlet. Education is believed to give individuals with the necessary knowledge that can be used to collect information, interpret the information received, and make productive and marketing decision. Education is related with the wholesale market outlet because as the education level increases farmers' accessibility to product quality and quantity and strengthen the linkage with wholesalers.

Membership in any cooperative determines respondent's market outlet choice decision. As hypothesized the coefficients (B) = 4.43, $\chi^2 = 33.00$, $p < .001$ for this variable is negative and significantly related with retailer outlets at 1% significance level and not significant for wholesaler, suggesting that a one-unit increase in association would decrease the odds of observing the retailers' category of marketing outlets relative to the blenders/manufacture category by 8,261.56%. This result indicated that respondents who are members of cooperatives are less likely to choose retailer's outlet by 8,261.56% compared to buying from the blenders. This is mostly related to the reality that those multipurpose cooperatives purchase bulk fertilizer from the blenders to retailers and wholesaler. It also serves as avenue of passing down production and market information they accessed directly or indirectly to their members.

Access to credit was negative and significantly $B = -0.000004$, $\chi^2 = 4.43$, $p = .035$, related to the probability of choosing wholesale marketing outlet at 5% level and not significant for retailer's outlet, suggesting that a one-unit increase in credit would decrease the odds of observing the wholesaler category of marketing outlets relative to the blenders by 100%. Access to credit increases respondents' access to resources needed for production and to cover marketing costs. A change from no access to credit access increased the choice probability by 100 percent, *ceteris paribus*. Respondents with credit access preferred purchasing their fertilizer product directly from the blenders relative to wholesaler marketing outlet because credit access enabled them to meet production and marketing costs. According to [9] agricultural credit could prove to be the panacea and allow producers to transform their agriculture and boost their economy. To transform, these types of farming need to invest and, often, for lack of sufficient own resources, seek access to appropriate financial services. This assertion is further buttressed by [10] that credit is an essential facilitator for the sustainable development of agriculture. Access to improved

inputs mostly depends on access to credit. Access to credit influences technology adoption; thus, it is decidedly linked with agricultural productivity.

The regression coefficient for distance in response category retailers of marketing outlets nominal was significant, $B = 0.11$, $\chi^2 = 5.62$, $p = .018$, suggesting that a one-unit increase in distance would decrease the odds of observing the blender and wholesalers marketing outlets nominal relative to the retailers by 90 and 89% respectively. As expected *a priori*, the distance to marketing outlet was positive and significantly associated with the probability of a respondent choosing blender outlet at 10% and wholesaler marketing outlet at 5% level. Accordingly, a unit increase in distance to retailers will increase the probability of the respondents purchasing from blender or wholesaler outlet market due to proximity, *ceteris paribus*. Distance is associated with increased in purchasing cost of the product and consequently reduces the marketable surplus.

The regression coefficient for availability of the product was positive and significant at 10 and 1% ($B = 1.58$, $\chi^2 = 24.30$, $p < .001$) for blender and wholesaler market outlet respectively, suggesting that a one-unit increase in availability of the product would increase the odds of observing the retailer and wholesaler outlet market category of marketing outlets relative to the retailer outlet category by 293 and 483% respectively. While quality of the product was negative and significant $B = -1.49$, $\chi^2 = 20.30$, $p < .001$, for wholesaler and not significant for blender marketing outlet, suggesting that a one-unit increase in quality of the product would decrease the odds of observing the wholesaler category of marketing outlets nominal relative to the retailer category by 22%.

5. Conclusion

In conclusion, the study provided a thorough understanding of the complex dynamics within the fertilizer value chain in Kaduna State. It confirmed the existence of a structured value chain with key actors involved in both the vertical (Blender-farmers) and horizontal aspects. The study also confirmed the choices and preferences of the market outlets based on the parameters measured, education, cooperative membership, distance and availability of the product determined the selection of retailers as market options while the variables credit, distance, quality and availability of the product affected the choice of wholesaler outlet. The study also concluded that enhancing access to credit, improving product quality, and addressing distance-related challenges can facilitate better market access, promote value chain efficiency, and potentially lead to increased market participation and improved livelihoods for farmers.

Abbreviations

FAO: Food and Agriculture Organization
VIFs: Variance Inflation Factors

OR: Odd ratio
SE: Standard Error

Conflicts of Interest

The author declare no conflict of interest.

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