# Principal Component Analysis of Production Constraints of Smallholder Arable Crop Farmers in Kwara State, Nigeria

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**Abstract**
The study attempted to analyse the production constraints of smallholder arable crop farmers in Kwara State, Nigeria.Multi-stage sampling procedure was used to sample a total of 261 arable crop farmers in the state. Primary data were elicited from the farmers with the aid of structured questionnaire that was complemented with interview schedule. Data analysis was done with descriptive statistics and principal component model. The result showed that an average crop farmer was 51 years old, had household size of 8 persons and 10years of formal education. 91.57% of the farmers were male and 86.21% were married. The principal component analysis revealed that the major constraints of the farmers were economic and socio-cultural, institutional, environmental and infrastructural factors which explained 53.06% of the variance in the 13 constraining variable components. It was concluded that the arable crop farmers in Kwara State are faced with several production constraints which poses great threat to their productivity and this calls for urgent intervention and remedy.

## Introduction

Food crop production has remained a major component of all production activities in Nigeria agricultural sub-sector parading a large array of arable crops that include cassava, yam, maize, rice, sorghum, millet, cowpea, soybean, groundnut, sugarcane, potatoes, cocoyam, cotton, pineapple, banana, plantain among others. Igwe*et al.* (2011, p.77) stated that food crop farmers who engage majorly on arable crops constitute about 95% of the total food crop farming units in the country producing about 90% of the food output. Smallholder farmers are the drivers of many economies in the world as they play an important role in livelihoods creation amongst the rural poor. These farmers are characterised with limited level of resources and are faced with the challenge of competing choices for allocating farm resources to obtain maximum yield. They were said to be resource poor and practiced small scale farming (0.1 – 2ha). Small scale farming is often characterised by small farm size, subsistence and low use of resources. Arene (2008, p.103) defined resource poor farmers in terms of land availability, estimated income per farmer, access to credit and capital. Generally, a lot of factors inhibit the smallholder farmers in a bid to produce food and fibres for domestic and industrial use in Nigeria and Kwara State in particular. Some of these factors could be socio-cultural, economic/financial, institutional, environmental or infrastructural among others. This study therefore attempted to analyse the production constraints of the smallholder arable crop farmers in Kwara State, Nigeria. It specifically described the socioeconomic characteristics of the farmers, identified the various cropping enterprises undertaken and described the constraints to arable crop production among the smallholder farmers in Kwara State. The output of this study is expected to reveal areas of policy interventions that might help alleviate the smallholder farmers' production constraints. Therefore, agricultural project administrators, policy makers, extension agents and researchers both in the public and private sectors will find the outcome of this study beneficial to their work.

## Methodology

The study was conducted in Kwara State, Nigeria. Kwara State is located in North Central Nigeria between Latitudes 7°45'N to 9°30'N and Longitudes 2°30'E to 6°25'E.The mean annual rainfall ranges between 1000mm and 1500mm. The State has a total population of 2,371,089 persons (Kwara State Planning Commission (KWSPC), 2007) and a projected population of 3,212,714 as at 2017. The State has a total land area of 32,500 square kilometres, 75.3% of which is cultivable (Kwara State Ministry of Agriculture and Natural Resources (KWSMANR), 2010). The average temperature ranges between 30°C and 35°C. The topography of the State which is mainly plain to slightly gentle rolling lands and the climatic condition favours the cultivation of various arable crops. The major tribes in the State are Yoruba, Nupe and Baruba. Other tribes present include Fulani, Igbo and Hausa.

A multi-stage sampling procedure was employed for this study. All smallholder arable crop farmers in the State constituted the population of study. A total of 261 farmers were sampled for the study.

Primary data were used for this study. The data were collected from the farmers with the aid of a structured questionnaire that was complemented with interview schedules. Resident extension agents and enumerators were trained to assist during the data collection process.

Data analysis involved the use of descriptive statistics and principal component model. Factor analysis of the smallholder farmers' constraints was done with the principal factor model. The constraints were grouped using principal factor method with varimax orthogonal rotation method of Kaiser (1958, Pp.187-200). Model acceptance was based on two criteria: each variable, in order to be included in the variable cluster of a factor, must load to it more than 0.4 and variables that load in more than one factor were discarded following Sallawu*et al.* (2019, p.81). The model is presented as:

$Y_1 = a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + *** + a_{1n}X_n$

$Y_2 = a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + *** + a_{2n}X_n$

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$Y_n = a_{n1}X_1 + a_{n2}X_2 + a_{n3}X_3 + *** + a_{nm}X_n$

Where:

$Y_1,\ Y_2, \ldots\ldots, Y_n$ = Observed variables/constraints to arable crop production;

$a_1 - a_n$ = Constraint loading or correlation coefficients;

$X_1,\ X_2, \ldots\ldots, X_n$ = Unobserved underlying factors constraining farmers in arable crop production.

To determine the sampling adequacy and the factorability of the model as a whole, Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) test were used. Bartlett's test of sphericity relates to the significance of the study and therefore shows the validity and suitability of the responses collected. A dataset with KMO test value of 0.70 and above was assumed adequate and acceptable for factor analysis.

**Results and Discussion**

**Socio-economic Characteristics of the Smallholder Arable Crop Farmers in Kwara State**

The results presented in Figure 1 shows that majority of the farmers representing 91.57% are males and females represented only 8.43%. This is an indication that the males are the dominant arable crop farmers in the study area. This may not be unconnected with the fact that most arable crops production requires a lot of energy of which most women do not have, and cannot cope with the rigorous activities involved. The result on farmers marital status presented in Figure 2 revealed that majority of them were married which accounted for 86.21%, while 5.36%, 5.36% and 3.07% of the farmers respectively were single, widowed and divorced respectively. Since the larger percentage of the respondents is married, the family sizes will probably increase and thereby enhancing the provision of cheap labour, that is, family labour.

Age is a key determinant of the quality and quantity of labour in agriculture. The result in Table 1 revealed that an average crop farmer in the area was 51 years old. This implies that majority of the sampled farmers were no longer in their economically active age. This result is in contrast with the findings of Jirgi (2013) who reported that farmers in Kebbi States respectively were in their economically active age. The result further revealed an average of eight persons per household in the study area. The household size is important as it could determine the level of family labour available for farming activities which could enhance optimum production in the area. Also, result shows that the average years of formal education of the farmers was 10 years. Formal education is a vital variable that can enhance the chance of farmers to accept modern ways of agricultural production especially the optimum farm plans.

**Principal Component Analysis of Farmers' Production Constraints in Kwara State**

Principal component analysis using the varimax rotated factors with Kaiser Normalization was used to analyze the perception of the arable crop farmers in the study area on their production constraints. The factorability of the constraint variables was examined. The result presented in Table 2 shows that the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.729 which is adequate and acceptable based on the KMO classification. The Bartlett's test of sphericity ($\mathcal{X}^2$ = 542.799) also was significant at p<0.01 probability level which shows that the matrix is significantly different from zero (0), that is, the matrix is significantly different from identity matrix. This implied that there were sufficient inter-correlations to conduct the factor analysis. More so, variables with factor loadings of less than 0.40 were not used.

The result presented in Table 3 shows the outcome of factor loadings from principal component analysis after varimax rotation of farmers' responses to questions on production constraints associated with arable crop production in the study area. These constraints were listed according to the proportion of variance associated with them and were classified under four major factors. These are economic and socio-cultural, institutional, environmental and infrastructural factors and are discussed as follows:

**Factor 1 (economic and socio-cultural factors):** The constraintsthat load high in factor one comprised of high cost of farm inputs (0.649), low and unattractive prices for farm produce (0.707), pilfering/theft (0.608)

and conflict with Fulani herdsmen (0.600). High cost of farm inputs is a major constraint which poses a barrier to farmers' timely access to adequate resources required for improved crop productivity. Low and unattractive market prices could limit the profit maximization objective the farmers and could discourage them from intensifying production. Pilfering/theft and conflict with Fulani herdsmen have the potential to reduce farmers' crop yield and farm income.

**Factor 2 (institutional factors):** This was dominated by problem of high cost of acquiring credit facilities (0.538), inadequate market information (0.795), inadequate extension and farm advisory services (0.759) and no co-operative or farmers' association (0.691). Credit facilities serves a great purpose of enabling farmers gain access to required inputs towards improved productivity and standard of living. However, when farmers are not able to access adequate credit, they tend to get discouraged and reduce cultivable acreage to a sizeable level. This inhibits their productivity as well as their livelihood. Also, the problem of inadequate market information and extension services could be that extension agents were not enough in terms of number and perhaps are not also well equipped with adequate knowledge and facilities that will foster appropriate service delivery to the farmers. The farmers also had the problem of no cooperative society or farmers' association. This lends credence to the argument of Eze and Akpa (2010, p.113) that, inadequate transfer of information to farmers by extension agents due to bottlenecks such as inexistence of or poor cooperation of the farmers which could lead to poor service delivery.

**Factor 3 (environmental factors):** The environmental factors here had high loading on high incidence of pest and disease (0.695), impoverished farmland (0.535) and flooding (0.715). It is possible that the farmers are using seeds that are not pest and disease resistant. These problems altogether poses great threat to crop yield and farmers' productivity in the study area.

**Factor 4 (infrastructural factors):** This was dominated by problem of poor road access and transport facilities (0.581) and inadequate storage facilities (0.617)). The implication of these is that, farmers are not able to smoothly transport their farm produce from the field and also not able to preserve it for a long time. This could cause the farmers to suffer post-harvest losses which will reduce their farm income.

After the factor analysis, the combination of variables in the first factor explained 19.77% of the variance, the second factor component explained 15.59% of the variance, the third factor explained 9.75% of the variance and the fourth factor explained 7.95% of the variance in the 13 variables scale. The true factors that were retained explained 53.06% of the variance in the 13 constraining factor or variable components.

## Conclusion

Onthe basis of the results of this study, it can be concluded that arable crop farmers in Kwara State are faced with several production constraints which poses great threat to their productivity and this calls for urgent intervention and remedy. It was therefore recommended that; government in collaboration with security agencies and community leaders should make efforts to curb conflicts with Fulani herdsmen, government through the relevant agricultural agencies and financial institutions in the study area should facilitate the provision of subsidized inputs provide adequate and effective farm advisory/extension services to the farmers and the farmers should form cooperative societies to help enhance their access credit facilities.

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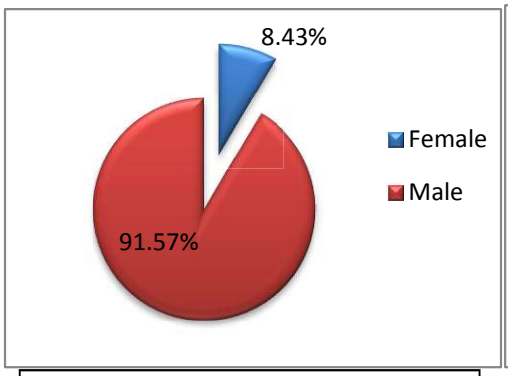


**Figure 1: Distribution of Respondents According to their Sex**

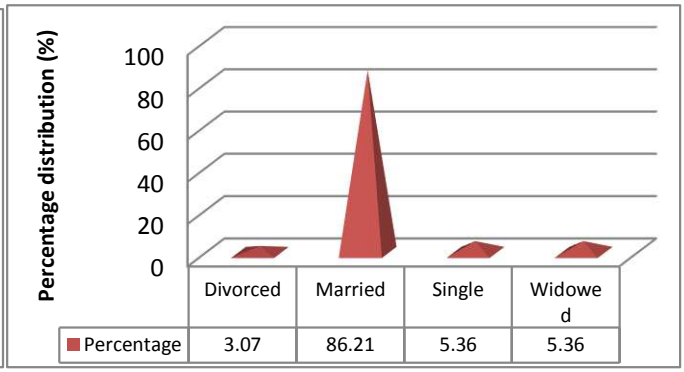


**Figure 2: Distribution of Respondents According to their Marital Status**

**Table 1: Distribution of Respondents According to Socio-economic Characteristics**

| Variable | Average value |
|---|---|
| Age (years) | 51.00 |
| Household size (number of people) | 8.00 |
| Years of formal education | 10.00 |

Source: computed from field survey, 2019.

**Table 2: KMO and Bartlett's Test**

| Test category | Value |
|---|---|
| Kaiser-Meyer-Olkin measure of sampling adequacy | 0.729 |
| Bartlett's test of sphericity (Chi-Square) | 542.7985*** |

Source: computed from field survey, 2019.

**Table 3: Principal component analysis of farmers' production constraints in the study area**

| Constraints | Component | | | |
|---|---|---|---|---|
| | **Factor 1** | **Factor 2** | **Factor 3** | **Factor 4** |
| High cost of farm inputs | 0.649 | | | |
| Low and unattractive prices for farm produce | 0.707 | | | |
| Pilfering/theft | 0.608 | | | |
| Conflict with Fulani herdsmen | 0.600 | | | |
| High cost of acquiring credit facilities | | 0.538 | | |

| | | | | |
|---|---|---|---|---|
| Inadequate market information | | 0.795 | | |
| Inadequate extension and farm advisory services | | 0.759 | | |
| No co-operative or farmers' association | | 0.691 | | |
| High incidence of pests and diseases | | | 0.695 | |
| Impoverished farm land | | | 0.535 | |
| Flood problem | | | 0.715 | |
| Poor road access and transport facilities | | | | 0.581 |
| Inadequate storage facilities | | | | 0.617 |
| **Percentage of total variance** | **19.77** | **15.59** | **9.75** | **7.95** |

Source: computed from field survey, 2019.
**Note:**Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Factor loading of **0.40** was used at 10% overlapping variance.
Variables with factor loadings of less than **0.40** were not used.



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