



**EXPLORING GENDER DIFFERENCES IN THE DETERMINANTS OF CROP PRODUCTION TECHNOLOGY USE IN AKKO LOCAL GOVERNMENT AREA OF GOMBE STATE, NIGERIA**

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**ABSTRACT**

This study investigated the gender differences in the determinants of crop production technology use among farmers in Akko Local Government Area, Gombe State, Nigeria. The specific objectives were to describe the socioeconomic characteristics of the respondents, ascertain the factors influencing their use of crop production technologies, and identify the constraints associated with adoption of crop production technologies. A multistage sampling procedure was used to select 248 respondents, and data were analyzed using descriptive statistics and multiple regression analysis. The results showed that male farmers had larger mean household sizes (7 persons) than females (5 persons), and higher levels of formal education, with 70.84% of males attaining at least primary education compared to 54.90% of females. Multiple regression analysis revealed that age ( $P < 0.01$ ), education status ( $P < 0.05$ ), and farming experience ( $P < 0.10$ ) of male farmers significantly influenced their crop production technology usage, with the model explaining 85.82% of the variation. For female farmers, farming experience was the only significant determinant ( $P < 0.01$ ), accounting for 64.17% of the variation in technology usage. Major constraints affecting both male and female farmers included lack of awareness (male = 2.46; female = 2.47), high cost of technology (male = 2.56; female = 2.72), low literacy levels (male = 2.57; female = 2.60), and inadequate extension contacts (male = 2.49; female = 2.81). Difficult application procedures were a severe constraint for female farmers only (mean = 2.72). The study concluded that age, education status and farming experience were the determinants of crop production technology usage among male farmers in the study area while farming experience remains the only determinant among female farmers. It is recommended that information on available crop production technologies should be disseminated through multiple channels such as community meetings, radio programs, farmer groups, and mobile platforms to ensure both male and female farmers are adequately informed.

**Keywords;** Adoption, Gender, Disparity, Technology, Determinants, Crop.

**INTRODUCTION**

Agricultural technology adoption remains a critical determinant of productivity and sustainability in rural economies, especially in developing countries. Despite numerous efforts to promote technological advancements in farming, gender disparities continue to shape access to, and utilization of, these innovations (Doss *et al.*, 2018). In many agricultural settings, men and women engage differently with production technologies due to socioeconomic, cultural, and institutional barriers (FAO, 2016). While agriculture serves as a major source of livelihood in Nigeria, disparities in technology adoption between male and female farmers are increasingly evident, particularly in rural communities (World Bank, 2014).

Women account for a significant portion of Nigeria's agricultural labour force, contributing approximately 70% of farm labour (IFPRI, 2012). However, their use of technologies such as improved seeds, fertilizers, and mechanized tools remains significantly lower than that of their male counterparts (Ayoade *et al.*, 2014). This underutilization is attributed to limited access to education, extension services, credit facilities, and ownership of productive resources—factors that are closely tied to gender norms and roles (Olagunju *et al.*, 2015; Kabeer, 2005). Studies have shown that access to formal education increases the likelihood of technology adoption, and that farmers with more years of



experience are more inclined to integrate new technologies into their practices (Oladele & Adeoti, 2015).

Understanding the dynamics of gender in technology adoption is crucial for designing inclusive agricultural policies that cater to the unique needs of both men and women (Quisumbing *et al.*, 2014). This is particularly relevant in Akko Local Government Area of Gombe State, where agricultural livelihoods dominate, yet disparities in access and usage of technologies persist. The area features a diversity of farmers with varying educational levels, household structures, and farming experiences, which shape their interactions with technology. Evidence suggests that male and female farmers in the region experience different constraints and opportunities, resulting in varied adoption rates and productivity outcomes (Njuki *et al.*, 2013).

Against this backdrop, this study aims to examine the determinants of agricultural technology adoption through a gender-disaggregated lens. Specifically, it seeks to identify how variables such as age, education, extension services, and farming experience influence the uptake of agricultural technologies among male and female farmers in Akko LGA. Such insights are vital for guiding interventions that bridge the gender gap in agricultural productivity and ensure equitable rural development. The specific objectives of the study are to;

- i. describe the socioeconomic characteristics of the female and male farmers in the study area;
- ii. ascertain the factors that influence the usage of crop production technologies in the study area; and,
- iii. identify and describe the major constraints hindering the use of crop production technologies amongst female and male farmers in the study area.

## METHODOLOGY

### Study Area

This study was conducted in Akko Local Government Area (LGA) of Gombe State, situated in the northeastern part of Nigeria. The administrative headquarters of the LGA is Kumo, a multi-ethnic town inhabited by over 30 ethnic groups, including major ones like the Fulani and Hausa, as well as minority groups such as the Jukun and Tula. Geographically, Akko LGA lies in the western part of the state, positioned between latitudes 10°17'N to 10°28'N and longitudes 10°28'E to 10°96'E. As per the 2006 population census, Akko LGA had a population of 337,853, which was projected to rise to approximately 521,645 by the year 2023, assuming an annual growth rate of 3.2%. The area experiences a tropical climate marked by a distinct wet season (April to October) and a dry season (October to March), largely influenced by the movement of the Inter Tropical Convergence Zone (ITCZ). Average annual rainfall varies between 850 mm and 1000 mm, with peak precipitation observed during July and August, often accompanied by high-intensity storms. Temperatures reach an average maximum of 37°C between March and October, while the lowest temperatures—around 21°C—are recorded from December to February. Relative humidity typically peaks at 94% in August and falls below 10% during the harmattan season in December and January. The dominant soil types are ferruginous, generally dark in color, with pH values ranging between 4 and 6 depending on specific location characteristics.

### Sample Size and Sampling Technique

A multistage sampling procedure was adopted to select respondents for this study. In the initial stage, two districts—Kumo and Pindiga—were chosen randomly out of the three that make up Akko Local Government Area. In the second stage, approximately 70% of the wards within these selected districts were randomly chosen. This was followed by a further random selection of about 50% of the villages within the identified wards. Subsequently, a stratified sampling technique was employed to categorize the respondents based on gender—male and female. Within each stratum, respondents were selected through simple random sampling.

To determine the appropriate sample size, the Taro Yamane formula was applied. The formula is expressed as:

$$n = \frac{N}{1 + N(e)^2} \quad \dots (1)$$

Where:

- $n$  = the calculated sample size



- $N$  = the total population of interest
- $e$  = the acceptable margin of error (set at 0.05 for this study)

Based on this method, a total of 248 farmers were initially sampled, comprising 172 male and 76 female respondents. However, after data cleaning, 219 valid responses were retained and used for analysis.

#### **Data Collection**

The research relied solely on primary data, which were gathered through the use of a structured questionnaire. The questionnaire captured relevant information regarding respondents' demographic profiles, usage of agricultural technologies, and the challenges encountered in adopting such technologies. Data were collected digitally through the Kobo Toolbox platform, an electronic data gathering tool commonly used in development and humanitarian work. The questionnaire was designed and administered using mobile devices over a period of three months, from December 2022 to March 2023. A total of five trained field assistants were engaged for the data collection process, operating under the close supervision of the researcher. Sampling involved randomly selecting five wards within two districts—Kumo and Pindiga—which were themselves randomly chosen.

From an initial sampling frame comprising 399 registered farmers, a target sample size of 248 was determined. After the data cleaning process to remove incomplete or inconsistent responses, 219 fully completed and valid questionnaires remained and were used for subsequent data analysis.

#### **Analytical Techniques**

Both descriptive and inferential analytical methods were employed in this study to address the stated research objectives effectively.

#### **Descriptive statistic**

To address objectives (i) and (iii) of the study, basic descriptive statistical tools were applied. These included measures such as frequency distributions, and percentage.

#### **Multiple regression model**

Multiple regression model was used to achieve objective ii. The explicit form of the multiple regression model used is expressed as;

$$Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + e \quad \dots (3)$$

Where;

$Y$  = Use of crop production technologies (% of technologies used by a respondent)

$X_1$  = Age of the farmer (years)

$X_2$  = Educational status of the farmers (Educated 1, otherwise 0)

$X_3$  = Number of times visited by extension agent in the last cropping season (numbers)

$X_4$  = Participation in on farm test or demonstration (participated 1, otherwise 0)

$X_5$  = Household size (numbers)

$X_6$  = Experience in farming (years)

$X_1 - X_7$  = independent variables

$\beta_0$  = Intercept (or constant)

$e$  = Error terms

$\beta_1 - \beta_7$  = Estimated regression coefficients for each independent variable

## **RESULT AND DISCUSSION**

### **Socioeconomic Characteristics**

#### **Family size**

The result in Table 1 provides information on the family size of respondents in the study area. The differences in mean family sizes for females (5 persons) and males (7 persons) underscore distinctive household compositions and dynamics. Such variations in family size could affect resource allocation, labour availability, and the receptiveness to technology adoption within different household structures. The higher standard deviation in male family sizes (3.52) compared to that of females (2.21) suggests a broader range of family sizes among males. This variability might reflect diverse family structures, potentially leading to differences in labour division, resource distribution, and the adoption of technology practices. This is in line with the finding of Igbokwe *et al.*, (2020) who reported that larger family sizes were positively associated with the adoption of improved maize varieties in Nigeria.



**Table 1:** Distribution of Respondents Based on Family Size

Variables	Frequency	Mean	Std dev.	Min	Max
Family size (Female)	51	4.92	2.21	3	14
Family size (Male)	168	7.16	3.52	2	20

**Source:** Field survey 2023

### Educational Attainment

The highest educational level attained by the respondents is presented in Table 2. The results of educational attainment revealed distinct patterns among the observed respondent. The prevalence of primary education among females (31.37%) and the notably higher occurrence of secondary education among males (50.60%) suggest varying levels of technical literacy and cognitive aptitude. Addressing this divergence becomes crucial in designing technology transfer strategies that account for differing levels of familiarity with technological interfaces and concepts.

The presence of females (1.96%) and males (20.24%) with tertiary education attests to a segment with potentially enhanced receptivity to innovative crop technologies. These individuals might possess greater analytical and adaptive capacities, thus facilitating the adoption of complex technological systems. The substantial proportion of individuals with no formal education among females (45.10%) and males (20.24%) underscores the need for strategies that prioritize user-friendly interfaces and simplified technological interventions. This is line with the findings of Oladeebo and Fakayode (2020) in their study on education and technology adoption among farmers in Nigeriareported that most farmers had at least some formal education, with the majority having completed secondary education.

**Table 2:** Distribution of Respondents Based on Educational Attainment

Education level	Freq. (Female)	Percentage (Female)	Freq. (Male)	Percentage (Male)
Primary	16	31.37	15	8.93
Secondary	11	21.57	85	50.60
Tertiary	1	1.96	34	20.24
No formal education	23	45.10	34	20.24
Total	51	100.00	168	100.00

**Source:** Field Survey, 2023

### Occupation of the Respondents

The result in Table 3 shows the distribution of major occupation of respondents in the study area. The result for female respondents showed that 21.57% of females were engaged in farming only, while a substantial 50.98% were involved in a combination of business and farming. Additionally, 27.45% pursued other occupations. Conversely, the male population demonstrates distinct occupational tendencies. A notable proportion for males, representing 15.48% is engaged in civil service and farming. Furthermore, 36.90% are exclusively involved in farming, and 30.95% undertake a dual role in business and farming. The remaining 16.67% of males pursue alternative occupations. The observed patterns, where females are prominently engaged in business and farming (50.98%) and males exhibit a combination of civil service and farming roles (15.48%), highlight potential disparities in exposure to technology and technical proficiency. These disparities are pertinent as they can affect the ease of technology uptake and the potential for utilizing advanced crop tools effectively. Ibe and Anyanwu (2020) in their study on diversification of livelihoodsand technology adoption among farmers in Nigeria reported that the diversification of livelihoods among farmers can have positive effects on adoption of technologies practices.



**Table 3:** Distribution of Respondents Based on Occupation

Occupation	Freq. (Female)	Percentage (Female)	Freq.(Male)	Percentage (Male)
Civil Service and farming	0	0.00	26	25.48
Farming only	11	21.57	62	36.90
Business and farming	26	50.98	52	30.95
Others	14	27.45	28	16.67
Total	51	100.00	168	100.00

**Source:** Field survey, 2023

### Factors Influencing Male Respondents Usage of Crop Production Technologies

The result of multiple regression (Semi-log functional form) analysis of usage to crop production technologies is presented in Table 4 which showed that the coefficient of age for male respondents is -9.81, indicating that a 1% increase in age for male respondents is associated with a 0.09% decrease in the use of crop production technologies and statistically significant at 1%. This implies that older farmers may face challenges using crop production technologies due to factors such as technological skills and resistant to change as younger farmers may be more familiar with and open to utilizing these technologies. The finding that younger male farmers have better use to crop production technologies is supported by Okuneye and Adeyemo (2018) in their study on impact of age on farmers' use to crop production facilities in Oyo State, Nigeria who reported that younger farmers tend to have technological skills and knowledge about farming practices, which makes them better equipped to use and use crop production technologies. Furthermore, the coefficient for education status is 4.92, indicating that educated male farmer's use of crop production technologies is 0.04% higher than those with no formal education and statistically significant at 5%. This suggests that education may play a role in improving use to crop production technologies for both male and female farmers. The finding that educated male and female farmers have higher use to crop production technologies is supported by Olagunju *et al.* (2015) in a study on role of education on the adoption of improved maize varieties among farmers in Nigeria who reported that education plays a crucial role in improving the adoption of modern crop practices, which in turn enhances productivity and food security.

However, the coefficient for farming experience for male respondents is 1.77, indicating that 1% increase in farming experience is associated with a 0.0177% increase in the use to crop production technologies and statistically significant at 10%. This implies that both male and female farmers with more farming experience may have better use to crop production technologies than those with less experience. Oladele and Adeoti (2015) in a study on factors influencing adoption of modern crop technologies by smallholder farmers in developing countries reported that farming experience significantly influences farmers' use to crop technologies in Nigeria. This supports the finding of this study.

For male respondents, the overall model was found to be highly statistically significant at 1%, with F-value of 77.76 ( $p < 0.01$ ). This suggest that independent variables as a group are useful in predicting the dependent variable. The R-square value of 0.8582 indicated that the independent variables included in the model accounted for 85.82% of the variation in the use to crop production technologies, which is a measure of how well the model fit the data.

**Table 4:** Factors Influencing Male Respondents Usage of Crop Production Technologies

Variables	coefficient	Std Err.	t-calculated	p-value
(Constant)	38.26902	4.103106	9.33	0.000
Age	-9.810255	0.3449129	28.44	0.000***
Education status	4.925853	2.327272	-2.12	0.036**
Extension visit	-0.510086 <sup>NS</sup>	0.4937885	-0.10	0.918
Farm demonstration				
Participation	1.815026 <sup>NS</sup>	1.632721	1.11	0.268
Household size	-1.067627 <sup>NS</sup>	1.254478	-0.85	0.396
Farming experience	1.775175*	0.9392059	-1.89	0.061*
R <sup>2</sup> = 0.8582				
F-Statistic = 77.76				0.000***

Source: Field survey, 2023

\* p<0.1; \*\* p<0.05; \*\*\*p<0.01 level of significance

### Factors Influencing Female Respondents' Usage of Crop Production Technologies

The result for female respondents shows that only farming experience is significant, while the other variables that are not significant, hence do not deserve further discussion. The coefficient for farming experience for Female respondents is 24.29, indicating that 1% increase in farming experience is associated with a 0.24% increase in the use to crop production technologies and statistically significant at 1%. This implies that both male and female farmers with more farming experience may have better use to crop production technologies than those with less experience. Oladele and Adeoti (2015) in a study on factors influencing adoption of modern crop technologies by smallholder farmers in developing countries reported that farming experience significantly influences farmers' use to crop technologies in Nigeria. This supports the finding of this study.

For female respondents, the overall model was found to be highly statistically significant at 1%, with F-value of 12.24 (p<0.01). This suggest that independent variables as a group are useful in predicting the dependent variable. The R-square value of 0.6417 indicated that the independent variables included in the model accounted for 64.17% of the variation in the use to crop production technologies, which is a measure of how well the model fit the data.

**Table 5:** Factors Influencing Female Respondents Usage of Crop Production Technologies

Variables	Coefficient	Std err.	t-calculated	p-value
(Constant)	-2.022495	17.34866	-0.20	0.841
Age	-1.775175 <sup>NS</sup>	1.085715	-0.64	0.104
Education status	-8.781226 <sup>NS</sup>	13.20283	-0.77	0.448
Extension visit	-0.175531 <sup>NS</sup>	0.9047388	-0.22	0.824
Farm demonstration				
Participation	1.452684 <sup>NS</sup>	7.279313	0.22	0.824
Household size	-0.0510086 <sup>NS</sup>	0.47425	-0.11	0.914
Farming experience	24.2931***	2.85111	6.67	0.000
R <sup>2</sup> = 0.6417				
F-Statistic = 12.24				0.000***

Source: Field survey, 2023

\* p<0.1; \*\* p<0.05; \*\*\*p<0.01

### Constraints Associated with Using Crop Production Technologies

The results in Table 6 shows the mean scores and severity levels of constraints that impede use of crop production technologies in the study area. The study identified five major constraints that significantly hinder the use of crop production technologies among farmers in Akko LGA, Gombe State—namely, lack of awareness, high cost of technology, low literacy levels, inadequate extension contacts, and difficult application procedures (for females only), based on mean scores above the cut-off point of 2.00. Both male and female respondents considered lack of awareness to be a severe constraint (mean = 2.46 and 2.47, respectively), suggesting limited access to information, particularly among women due to cultural and communication barriers. This aligns with Maiyaki *et al.* (2021), who



reported that farmers in Gombe State lacked adequate information on available crop technologies, which significantly reduced their adoption rates. High cost of technology was also rated as severe (male = 2.56; female = 2.72), especially among women, indicating financial constraints that limit access to modern technologies. Similarly, Abdullahi *et al.* (2021) found that smallholder farmers in Gombe State—both male and female—struggled to afford new technologies, thereby hindering their adoption. Low literacy level emerged as another critical barrier (male = 2.57; female = 2.60), affecting the ability of farmers to understand instructions, training, and extension materials. This finding is consistent with Oyekale and Adekanye (2021), who observed that low educational attainment significantly restricted the adoption of agricultural technologies among small-scale farmers in Niger State. Inadequate extension contacts were rated as severe by both genders (male = 2.49; female = 2.81), highlighting limited access to expert advice and support. Ajayi *et al.* (2019) similarly found that both male and female farmers in Oyo State faced major difficulties due to insufficient contact with extension agents, resulting from staff shortages, poor funding, and weak communication systems. Lastly, while men did not find difficult application procedures to be severe (1.79), women rated it much higher (2.72), indicating gender-based disparities in technical support. This aligns with Yusuf and Abdulraheem (2018), who reported that complex procedures and lack of training disproportionately affected female smallholder farmers in Kwara State, thus reducing their ability to adopt modern technologies.

**Table 6:** Constraints Associated with Using Crop Production Technologies

Constraints	Mean score (Male)	Decision	Mean score (Female)	Decision
Lack of awareness	2.46	Severe	2.47	Severe
High cost of technology	2.56	Severe	2.72	Severe
Low literacy level	2.57	Severe	2.60	Severe
Inadequate extension contacts	2.49	Severe	2.81	Severe
Difficult application procedure	1.79	Not severe	2.72	Severe
<b>Overall mean score (cut-off mean) = 2.00</b>				

Field survey, 2023

## CONCLUSION AND RECOMMENDATION

This study reveals clear gender-based differences in the usage of crop production technologies among farmers in Akko Local Government Area of Gombe State. Male farmers' technology usage is significantly influenced by age, education, and farming experience, while farming experience is the only significant determinant for female farmers, highlighting women's reliance on experiential knowledge amid limited access to resources. Both male and female farmers face major constraints, including lack of awareness, high cost of technologies, low literacy levels, and inadequate extension services, with difficult application procedures posing an additional challenge for women. The study recommends:

- i. Government and development agencies should support the dissemination of low-cost, labor-saving, and easy-to-use technologies that consider women's physical capacity, time constraints, and limited access to capital.
- ii. Since farming experience significantly influences technology usage, farmer-to-farmer extension approaches, demonstrations, and mentoring systems should be encouraged to facilitate learning through experience, especially among less-experienced farmers.
- iii. Information on available crop production technologies should be disseminated through multiple channels such as community meetings, radio programs, farmer groups, and mobile platforms to ensure both male and female farmers are adequately informed.

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