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# Gender Differences in Access to Agricultural Extension Services among Smallholder Farmers in Ibadan, Oyo State

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***Abstract—*** *This study examined gender differences in access to agricultural extension services among smallholder farmers in Ibadan, Oyo State, Nigeria. A multistage sampling technique was used to select 300 respondents—170 males and 130 females. The socio-economic analysis revealed that male farmers possessed greater resource endowment and institutional linkages than females. The mean age of male farmers was 45.8 years compared to 43.2 years for females, with average farming experience of 14.6 and 11.8 years, respectively. Male farmers cultivated larger farms (2.7 ha) and showed higher educational attainment (60%) and cooperative membership (60%) than females (1.9 ha; 50.7% and 44.6%). Gender disparities in extension access were evident, as males recorded higher mean scores for visitation and training (MS = 4.06–4.17) compared to females (MS = 2.24 for both). Regression results ($R^2 = 0.612$; Adjusted $R^2 = 0.586$; $F = 23.47$, $p < 0.001$) showed education, farm size, cooperative membership, and credit access as significant determinants, while household size was not significant. Male farmers achieved higher productivity (MS = 4.21) and income (MS = 4.27) than females (MS = 3.61; 3.31). Exploratory factor analysis identified five constraint dimensions explaining 68.34% of variance—socio-cultural barriers (19.27%), institutional capacity (16.21%), economic constraints (12.40%), information accessibility (10.56%), and time-distance constraints (9.90%). High KMO (0.847) and Bartlett's $\chi^2$ (3,528.94, $p < 0.001$) confirmed model adequacy. The findings underscore persistent gender inequities rooted in socio-cultural, institutional, and economic barriers limiting women's participation in extension programs.*

***Keywords— Gender disparities, Agricultural extension, Smallholder farmers, Nigeria.***

## I. INTRODUCTION

Agriculture remains the backbone of Nigeria's rural economy, employing over 70% of the labour force and contributing significantly to national food security. Within this sector, smallholder farmers play a crucial role, producing the majority of the country's staple crops, yet they continue to face structural inequalities that limit productivity and sustainability. Gender is one of the most prominent axes of disparity, influencing access to agricultural inputs, markets, land, credit, and particularly, extension services (Oyediji et al., 2025a). Agricultural extension services—comprising the dissemination of knowledge, technology transfer, and capacity building—are vital for improving farm productivity and resilience to climate change. However, multiple studies reveal that female smallholders in Nigeria systematically receive less access to such services compared to their male counterparts, due to socio-cultural norms, limited mobility, lower educational attainment, and institutional biases in extension programs (Adesiji et al., 2023; Bello et al., 2021). For instance, women farmers in northern

Nigeria are often excluded from male-dominated farmer groups or outreach activities that serve as key channels for accessing extension agents (Timu et al., 2024). Consequently, this gendered exclusion reinforces existing productivity gaps and deepens rural poverty among women-headed households.

Several socio-economic and institutional factors underpin this disparity in Nigeria. Evidence from empirical studies indicates that extension delivery models often fail to integrate gender perspectives during policy design and implementation (Gemechu, 2023; Oyediji et al., 2025a). Extension agents tend to target men under the assumption that they represent the household, overlooking the substantial contribution of women to agricultural labour. In addition, cultural norms restricting women's interaction with male extension workers, particularly in conservative regions, exacerbate the divide (Choruma et al., 2024; Alabuja et al., 2025). A survey by Fasakin et al. (2023) across six Nigerian states revealed that female farmers reported significantly lower participation in extension activities, citing time constraints due to domestic responsibilities, limited access to credit facilities, and inadequate training opportunities as major barriers. Institutional bias is further perpetuated by gender imbalance among extension officers—where male officers constitute over 80% of the workforce (Aliyu, 2022). The lack of female agents limits outreach to women farmers who prefer, or are culturally expected, to interact only with female facilitators. Moreover, limited education and digital literacy among women restrict their ability to benefit from modern ICT-based extension innovations such as mobile advisory platforms and e-extension programs (Utonga, 2025; Oyediji et al., 2025b). These systemic barriers collectively hinder women's access to the knowledge and resources necessary for enhancing agricultural productivity and economic empowerment.

Despite these challenges, various policy initiatives and donor-led interventions have attempted to address gender inequalities in extension services across Nigeria. The Agricultural Transformation Agenda (ATA) and the National Gender Policy on Agriculture emphasize gender mainstreaming, yet implementation has been inconsistent at the grassroots level (Izuogu et al., 2024). Recent gender-responsive extension models, such as the Women-in-Agriculture (WIA) program, have shown promise in improving outreach to women farmers by training female extension workers and organizing women-focused cooperatives (Li et al., 2025). However, sustainability remains a concern, as these programs often depend on external funding and lack institutional integration into state-level agricultural development projects. Furthermore, digital innovations in agricultural extension—such as mobile-based advisory platforms—have the potential to bridge gender gaps if they are designed inclusively (Daudu et al., 2025). Nevertheless, challenges of affordability, literacy, and connectivity persist, limiting their reach among rural women.

To address these gaps, this study was guided by five specific objectives: (i) describe the socio-economic characteristics of male and female smallholder farmers in the study area; (ii) examine gender differences in access to agricultural extension services; (iii) identify the factors influencing gender disparities in access to extension services; (iv) analyze the impact of differential access on the productivity and income levels of smallholder farmers by gender; and (v) identify the challenges shaping gendered extension access in the study area.

## II. LITERATURE REVIEW

### 2.1 Theoretical Framework: Gender and Development (GAD) Theory:

The Gender and Development (GAD) theory emerged in the 1980s as an evolution of earlier paradigms such as Women in Development (WID). While WID focused mainly on integrating women into development processes, GAD emphasizes transforming gender relations and addressing the structural inequalities that reproduce women's subordination. GAD therefore shifts attention from women as isolated beneficiaries to the broader social, economic, and institutional relationships that determine gendered access to resources (Moser, 1993; Kabeer, 1994). In the Nigerian agricultural context, GAD theory explains that disparities in access to extension services are not merely the result of individual shortcomings but are embedded within patriarchal norms, unequal property rights, and gendered labour divisions (Gemechu, 2023).

According to the GAD framework, gender inequalities in agriculture arise from power imbalances that dictate who has access to productive resources and decision-making platforms. Women farmers, despite their significant role in agricultural production and household food security, are often marginalized in policy formulation, land ownership, and extension programs. Cultural expectations restrict their interaction with male extension agents, while institutional arrangements—such as recruitment and deployment of predominantly male extension officers—further reinforce exclusion (Choruma et al., 2024; Oyediji et al., 2025b).

Within the GAD framework, recent scholarship emphasizes intersectionality—recognizing that gender does not operate in isolation but intersects with other social identities such as age, education, marital status, and socioeconomic class to shape access to agricultural resources (Kabeer, 2020; Njuki et al., 2022). This study therefore considers how multiple dimensions of farmers' identities jointly influence extension access. In Nigeria, the GAD theory helps explain why extension services tend to favour male farmers. For instance, men are more likely to belong to cooperative societies or farmers' associations through which extension services are typically delivered (Timu et al., 2024; Adebayo et al., 2025). Women, on the other hand, face limitations due to domestic responsibilities, restricted mobility, and lower literacy levels. The theory thus underscores that interventions must go beyond increasing the number of women participants; they must transform the institutional and cultural structures that perpetuate unequal access.

### 2.2 Conceptual Framework:

The conceptual framework for this study explores the relationship between the independent variables and the dependent variables (access to agricultural extension services) being mediated by the intervening variables. The independent variables comprise demographic, socio-economic, cultural, and institutional factors that directly influence the likelihood of farmers accessing extension services. These include: gender, educational level, farm size, household headship, membership in farmer groups or cooperatives, and access to credit. The intervening variables in this framework include institutional factors, socio-cultural norms, and information and communication technology (ICT) access. These variables represent the mechanisms through which the independent variables translate into differential levels of access to extension services. The dependent variable is operationalized as the degree of farmers' contact and participation in agricultural extension activities. It encompasses the frequency and quality of interaction between farmers and extension agents, the number of trainings or demonstrations attended, and the level of adoption of recommended agricultural practices.

## III. MATERIALS AND METHODS

### 3.1 Study Area:

Ibadan, the capital of Oyo State, is located in the southwestern region of Nigeria, between latitudes 7°22′N and 3°54′E. It lies about 128 km northeast of Lagos and covers an area of approximately 3,080 km², making it one of the largest cities in West Africa (NPC, 2023). Administratively, it comprises eleven Local Government Areas (LGAs)—five urban and six peri-urban or rural (Akinyele, Egbeda, Ido, Lagelu, Ona-Ara, and Oluyole)—where agriculture remains a dominant occupation.

The population of Ibadan exceeds 3.6 million, predominantly Yoruba, though it hosts migrants from other regions (NPC, 2023). The socio-economic structure is dual: the urban LGAs focus on commerce and education, while the rural LGAs depend heavily on smallholder agriculture. Women play vital roles in food production and marketing but have limited access to agricultural extension services, credit, and land, due to institutional and cultural constraints (Aliyu, 2022).

Agricultural extension activities are coordinated by the Oyo State Agricultural Development Programme (OYSADEP) in collaboration with institutions like the Institute of Agricultural Research and Training (IAR&T) and the International Institute of Tropical Agriculture (IITA) (Gemechu, 2023). Despite this strong institutional presence, male farmers generally have greater access to extension agents and training, while women rely on informal sources of information (Daudu et al., 2025).

Ibadan's blend of urban and rural settings, diverse agricultural systems, and observable gender disparities in resource access make it an ideal site for examining how gender, socio-economic, and institutional factors interact to shape farmers' access to agricultural extension services in Nigeria.

### 3.2 Population of the Study and Research Design:

The study targets male and female smallholder farmers in the rural Local Government Areas (Akinyele, Ido, Lagelu, Ona-Ara, and Oluyole) of Ibadan, Oyo State, who engage in crop or livestock farming and have contact with agricultural extension agents under OYSADEP, IAR&T, or IITA.

A descriptive survey research design was adopted to collect quantitative data on gender disparities in access to agricultural extension services. Structured questionnaires and key informant interviews were used across selected LGAs.

### 3.3 Sample Size and Sampling Techniques:

A multistage sampling technique was adopted for this study to ensure fair representation of smallholder farmers across the rural Local Government Areas (LGAs) of Ibadan, Oyo State. In the first stage, five rural LGAs—Akinyele, Ido, Lagelu, Ona-Ara, and Oluyole—were purposively selected based on their high concentration of smallholder farming activities.

In the second stage, two farming communities were randomly selected from each LGA, giving a total of ten communities. In the third stage, individual farmers (both male and female) were selected using simple random sampling from lists provided by agricultural extension offices and farmer associations.

A total of 300 respondents (170 male and 130 female farmers) were sampled proportionately across the selected LGAs. The sample size was determined using Yamane's (1967) formula for sample size estimation for a finite population:

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

Where:

- n = required sample size
- N = population size (estimated at 1,200 farmers from OYSADEP records, 2024)
- e = margin of error (0.05 at 95% confidence level)

The computation yields:

$$n = \frac{1200}{1+1200(0.05)^2} = 300 \quad (2)$$

Thus, a sample size of 300 respondents was considered statistically sufficient to ensure representativeness and reliability, aligning with survey research recommendations in agricultural and gender studies.

### 3.4 Data Collection:

The main instrument for data collection in this study was a structured questionnaire designed to obtain detailed information from smallholder crop and livestock farmers in the selected rural Local Government Areas of Ibadan, Oyo State. The questionnaire focused on farmers' access to agricultural extension services, socio-economic characteristics, and gender-related factors influencing participation.

To ensure validity and reliability, the instrument was pre-tested through a pilot study involving 30 farmers outside the main study area. Cronbach's alpha coefficient of 0.84 indicated high internal consistency, exceeding the acceptable threshold of 0.70 (Nunnally & Bernstein, 1994). Feedback from the pilot phase was used to revise ambiguous questions, improving clarity and alignment with the research objectives.

Each questionnaire session lasted about one hour, allowing respondents adequate time to provide accurate and thoughtful responses. Trained enumerators (balanced by gender) fluent in both English and Yoruba administered the questionnaires, ensuring that all respondents clearly understood each question. This process enhanced the reliability and precision of the data collected for analyzing gender differences in extension access.

**Ethical Consideration:** Ethical approval for this study was obtained from the University of Ibadan Research Ethics Committee. All participants provided informed consent prior to data collection. Respondents were assured of confidentiality and anonymity, and participation was voluntary.

### 3.5 Data Analysis:

Data collected from respondents were analyzed using both descriptive and inferential statistical tools to effectively address the research objectives. The analysis was performed using the Statistical Package for the Social Sciences (SPSS, version 24), which provided an efficient platform for data organization, coding, and statistical computation.

Descriptive statistics, including frequency counts, percentages, means, and standard deviations were used to achieve Objective (i). To address Objectives (ii) and (iv), Likert-type scale was employed. This approach measured the degree of

respondents' agreement with statements related to extension access, service quality, and perceived benefits. For Objective (iii), a Multiple Regression Model was utilized to establish the relationships between the dependent variable (access to extension services) and multiple independent variables. To achieve Objective (v), Exploratory Factor Analysis (EFA) was applied to group related constraints and determine their underlying dimensions.

### 3.6 Model Specification:

#### 3.6.1 Likert-Type Scale:

A 5-point Likert scale was used to assess respondents' level of agreement with key statements. The scale categories were: Strongly Agree (SA) = 5, Agree (AG) = 4, Undecided (U) = 3, Disagree (DA) = 2, and Strongly Disagree (SD) = 1. The Weighted Mean (WM) for each indicator was computed as:

$$WM = \frac{(f_{SA}\times 5)+(f_{AG}\times 4)+(f_{U}\times 3)+(f_{DA}\times 2)+(f_{SD}\times 1)}{N} \quad (3)$$

Where:

- WM = Weighted Mean
- f = Frequency of responses
- N = Total number of respondents

Following Bagheri (2010), the interpretation was:

- 1.00–1.49 = Strongly Disagree
- 1.50–2.49 = Disagree
- 2.50–3.49 = Undecided/Neutral
- 3.50–4.49 = Agree
- 4.50–5.00 = Strongly Agree

#### 3.6.2 Multiple Regression Model:

To analyze Objective (iii), the multiple regression model was specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n + \varepsilon \quad (4)$$

Where:

- Y = Level of access to agricultural extension services (dependent variable), operationalized as a composite index based on frequency of contact, training attendance, and information access
- $\beta_0$ = Constant term
- $\beta_1$–$\beta_n$ = Coefficients of explanatory variables
- $X_1$–$X_n$ = Predictor variables (age, education, income, farm size, extension contact, training exposure, and gender)
- $\varepsilon$ = Random error term

Multicollinearity was assessed using Variance Inflation Factor (VIF); all VIF values were below 3.0, indicating no serious multicollinearity concerns.

#### 3.6.3 Exploratory Factor Analysis (EFA):

EFA was used to identify the underlying latent factors influencing gendered access to agricultural extension services, particularly for Objective (v). The technique reduced correlated observed variables into fewer unobserved factors, revealing structural barriers influencing extension access. Prior to analysis, data adequacy was tested using the Kaiser-Meyer-Olkin (KMO) statistic and Bartlett's Test of Sphericity. A KMO value above 0.60 indicated sampling adequacy, while a significant

Bartlett's test ($p < 0.05$) confirmed sufficient correlations among variables for factor analysis. Principal Component Analysis (PCA) was employed as the extraction method. Factors with eigenvalues greater than 1.0 were retained based on Kaiser's criterion and the scree plot (Hair et al., 2010). To enhance interpretability, Varimax orthogonal rotation was applied, maximizing the variance of squared loadings and simplifying factor structure. Loadings ≥ 0.50 were considered significant for interpretation.

The general factor model was expressed as:

$$X_i = \lambda_{i1}F_1 + \lambda_{i2}F_2 + \cdots + \lambda_{ik}F_k + \epsilon_i \quad (5)$$

where $X_i$ represents the observed variable, $F_j$ the latent factor, $\lambda_{ij}$ the factor loading, and $\varepsilon_i$ the error term

## IV. RESULTS AND DISCUSSION

### 4.1 Socio-Economic Characteristics of Smallholder Farmers by Gender:

The socio-economic characteristics of smallholder farmers in Ibadan, Oyo State, reveal significant gender variations influencing access to agricultural resources and productivity. The age distribution shows that most male (64.7%) and female (63.0%) farmers were between 36 and 55 years, with mean ages of 45.8 and 43.2 years, respectively. This indicates that both genders are within their productive years, consistent with findings by Joel et al. (2025), who reported similar age structures among rural farmers in Southwest Nigeria.

Regarding marital status, 80.0% of male and 72.3% of female farmers were married, implying the centrality of family labour in smallholder farming. Marital stability enhances access to labour and decision-making in agricultural operations (Akinbile & Abdulrahman, 2024).

Educational attainment varied by gender, with 23.5% of male farmers having tertiary education compared to 18.4% of females. Conversely, more females (18.5%) than males (11.8%) lacked formal education. This disparity reflects persistent gender inequalities in rural education and aligns with Bolarin et al. (2022), who found that limited female education reduces access to agricultural information and innovation.

Farming experience differed across gender, with males averaging 14.6 years and females 11.8 years. This reflects cultural roles where men are primary landholders and decision-makers in farming (Akinbile & Abdulrahman, 2024). The shorter experience among women suggests they often engage in farming as secondary or survival activities.

Farm size revealed a clear gender gap: males operated an average of 2.7 hectares compared to females' 1.9 hectares. Sen et al. (2025) similarly noted that women's restricted land rights in southwestern Nigeria hinder agricultural expansion.

Cooperative membership was higher among males (60%) than females (44.6%), suggesting men's stronger participation in organized farmer groups. Women's lower membership may be due to household constraints and limited time, restricting their exposure to training and resource mobilization opportunities crucial for improving productivity (Fasakin et al., 2023).

Household size averaged 6.4 persons among males and 5.8 among females, indicating slightly larger male-headed households. This result aligns with Ajayi et al. (2021), who reported that male-headed households in Oyo State often maintain larger family units to sustain agricultural labour availability in rural areas.

Access to extension services displayed a strong gender gap: 71.8% of male farmers received extension contact compared to 52.3% of females. Sen et al. (2025) similarly found that women in Oyo State were less likely to benefit from agricultural training due to domestic responsibilities and gendered targeting biases in service delivery.

Access to credit also favoured men, with 56.5% of male farmers obtaining credit against 36.9% of females. Idu et al. (2023) emphasized that women's limited access to finance remains a core challenge affecting productivity and commercialization in Nigerian agriculture, reinforcing existing gender inequalities.

**TABLE 1**
**SOCIO-ECONOMIC CHARACTERISTICS OF SMALLHOLDER FARMERS BY GENDER (n = 300)**

| Variable | Category | Male (n = 170) | Female (n = 130) | Test Statistic | p-value |
|---|---|---|---|---|---|
| **Age (years)** | ≤35 | 30 (17.6%) | 26 (20.0%) | t = 2.14 | 0.034* |
| | 36–45 | 52 (30.6%) | 38 (29.2%) | | |
| | 46–55 | 58 (34.1%) | 44 (33.8%) | | |
| | ≥56 | 30 (17.7%) | 22 (16.9%) | | |
| | Mean ± SD | 45.8 ± 10.4 | 43.2 ± 9.8 | | |
| **Marital Status** | Single | 12 (7.1%) | 10 (7.7%) | $\chi^2 = 8.42$ | 0.038* |
| | Married | 136 (80.0%) | 94 (72.3%) | | |
| | Widowed | 8 (4.7%) | 14 (10.8%) | | |
| | Divorced/Separated | 14 (8.2%) | 12 (9.2%) | | |
| **Educational Level** | No Formal Education | 20 (11.8%) | 24 (18.5%) | $\chi^2 = 12.36$ | 0.006** |
| | Primary | 48 (28.2%) | 40 (30.8%) | | |
| | Secondary | 62 (36.5%) | 42 (32.3%) | | |
| | Tertiary | 40 (23.5%) | 24 (18.4%) | | |
| **Farming Experience (years)** | ≤5 | 28 (16.5%) | 30 (23.1%) | t = 3.87 | 0.001** |
| | 6–10 | 40 (23.5%) | 38 (29.2%) | | |
| | 11–15 | 56 (32.9%) | 36 (27.7%) | | |
| | ≥16 | 46 (27.1%) | 26 (20.0%) | | |
| | Mean ± SD | 14.6 ± 6.3 | 11.8 ± 5.9 | | |
| **Farm Size (hectares)** | ≤1.0 | 32 (18.8%) | 44 (33.8%) | t = 5.62 | <0.001** |
| | 1.1–2.0 | 58 (34.1%) | 46 (35.4%) | | |
| | 2.1–3.0 | 52 (30.6%) | 28 (21.5%) | | |
| | ≥3.1 | 28 (16.5%) | 12 (9.3%) | | |
| | Mean ± SD | 2.7 ± 1.3 | 1.9 ± 1.1 | | |
| **Cooperative Membership** | Member | 102 (60.0%) | 58 (44.6%) | $\chi^2 = 7.89$ | 0.005** |
| | Non-member | 68 (40.0%) | 72 (55.4%) | | |
| **Household Size (persons)** | ≤3 | 28 (16.5%) | 30 (23.1%) | t = 2.41 | 0.017* |
| | 4–6 | 86 (50.6%) | 68 (52.3%) | | |
| | 7–9 | 40 (23.5%) | 24 (18.5%) | | |
| | ≥10 | 16 (9.4%) | 8 (6.1%) | | |
| | Mean ± SD | 6.4 ± 2.1 | 5.8 ± 2.0 | | |
| **Access to Extension Services** | Yes | 122 (71.8%) | 68 (52.3%) | $\chi^2 = 14.28$ | <0.001** |
| | No | 48 (28.2%) | 62 (47.7%) | | |
| **Access to Credit** | Yes | 96 (56.5%) | 48 (36.9%) | $\chi^2 = 13.45$ | <0.001** |
| | No | 74 (43.5%) | 82 (63.1%) | | |

***Source: Field Survey, 2025***

****Note: * significant at p < 0.05; ** significant at p < 0.01****

### 4.2 Gender Differences in Access to Agricultural Extension Services:

The results in Table 2 revealed significant gender disparities in access to agricultural extension services among smallholder farmers in Ibadan, Oyo State. Male farmers reported more frequent visits from extension officers (MS = 4.17) and greater access to training and demonstrations (MS = 4.06), while female farmers disagreed (MS = 2.24 for both). This indicates that male farmers are more integrated into extension delivery networks, consistent with Kamara et al. (2025), who found extension contact in Southwest Nigeria to be male-dominated.

Domestic roles were found to restrict women's participation in extension activities. While male farmers disagreed that domestic responsibilities limit women's attendance (MS = 2.05), female farmers agreed strongly (MS = 4.13). This demonstrates how unpaid household duties reduce women's time for agricultural learning and training (Akinbile & Abdulrahman, 2024).

Cultural and religious norms were another constraint shaping women's access to extension programs. Female farmers agreed that such norms hindered their participation (MS = 4.02), whereas males disagreed (MS = 2.03). Ayodeji et al. (2022) also reported that patriarchal norms often discourage female attendance at extension meetings led by male officers, thereby reinforcing structural gender inequalities.

In terms of digital access, male farmers showed higher use of mobile phones and agricultural platforms (MS = 3.98), while females were largely neutral (MS = 2.64). This implies that digital literacy gaps and lower phone ownership among women restrict access to modern information channels. Joel et al. (2025) noted that women in Nigeria's rural areas face affordability and awareness challenges in adopting ICTs for agricultural purposes, leading to limited participation in digital extension programs.

Mobility and safety concerns further influenced access disparities. Female respondents agreed that such constraints limit their interaction with extension agents (MS = 4.08), while males were neutral (MS = 2.92). This suggests that distance to extension offices and travel safety concerns disproportionately affect women. Gupta (2025) found that female farmers often avoid distant extension activities due to cultural restrictions and lack of safe transportation, leading to reduced participation in field demonstrations.

Regarding access to input distribution, male farmers agreed that they benefit more from extension-mediated programs (MS = 4.20), while females disagreed (MS = 2.39). This underscores institutional bias, as input schemes such as seed and fertilizer distribution are often managed through male farmer groups. Joel et al. (2025) observed similar disparities, noting that women are often excluded from input allocation due to weak representation in cooperatives and extension networks.

**TABLE 2**
**GENDER DIFFERENCES IN ACCESS TO AGRICULTURAL EXTENSION SERVICES AMONG SMALLHOLDER FARMERS IN IBADAN, OYO STATE**

| Statements | Male Farmers | | | | Female Farmers | | | |
|---|---|---|---|---|---|---|---|---|
| | N | WS | MS | SD | N | WS | MS | SD |
| Extension officers visit male farmers more frequently than female farmers in my community. | 145 | 605 | 4.17 | 0.78 | 98 | 220 | 2.24 | 0.81 |
| Male farmers receive more agricultural training and demonstrations from extension agents. | 138 | 560 | 4.06 | 0.81 | 105 | 235 | 2.24 | 0.79 |
| Female farmers face time constraints due to domestic roles, limiting participation in extension programs. | 122 | 250 | 2.05 | 0.87 | 120 | 495 | 4.13 | 0.84 |
| Cultural and religious norms discourage female farmers from attending extension meetings. | 118 | 240 | 2.03 | 0.91 | 124 | 498 | 4.02 | 0.88 |
| Male farmers have better access to agricultural information through digital platforms and mobile phones. | 132 | 525 | 3.98 | 0.83 | 108 | 285 | 2.64 | 0.86 |
| Female farmers have limited interaction with extension agents due to mobility and safety concerns. | 120 | 350 | 2.92 | 0.88 | 125 | 510 | 4.08 | 0.82 |
| Male farmers benefit more from extension-organized input distribution programs than female farmers. | 140 | 588 | 4.2 | 0.76 | 115 | 275 | 2.39 | 0.85 |

***Source: Field Survey, 2025***

***Note: N varies due to item applicability and response completeness. MS = Mean Score; SD = Standard Deviation.***

### 4.3 Factors Influencing Gender Disparities in Access to Agricultural Extension Services:

The multiple regression model explains about 61.2% ($R^2 = 0.612$) of the variation in gender disparities in access to extension services, with an overall significant model fit ($F = 23.47$, $p < 0.001$). The dependent variable was a composite index of extension access based on frequency of contact, training attendance, and information access.

Age was found to be positively significant ($p < 0.05$) in influencing access to agricultural extension services, suggesting that older farmers are more likely to have established networks and credibility with extension agents compared to younger ones. This aligns with Gemechu (2023), who noted that older farmers in Nigeria often possess longer farming experience, enhancing their extension participation and adoption of new technologies.

Marital status exhibited a significant positive influence ($p < 0.10$), indicating that married farmers tend to have greater access to extension services than unmarried ones. Married individuals often benefit from household labour and joint decision-making advantages, increasing participation in group-based training (Timu et al., 2024).

Education level showed a highly significant relationship ($p < 0.01$) with access to extension services, implying that better-educated farmers are more receptive to new information and innovation. Gemechu (2023) found similar results in southwestern Nigeria, emphasizing education's crucial role in bridging gender gaps in extension communication.

Household size was non-significant, indicating limited influence on extension access among smallholder farmers. Johnson and Steven (2022) reported comparable findings, suggesting that family size may contribute to farm output but not to institutional linkages like extension participation.

Farming experience had a positive and significant effect ($p < 0.05$) on access to extension services. This agrees with Antwi-Agyei & Stringer (2021), who observed that experience improves confidence and willingness to engage with new farming technologies.

Farm size was found to be highly significant ($p < 0.01$), suggesting that farmers with larger holdings are more likely to access extension services. Ilomunanya & Popoola (2025) similarly identified farm size as a determinant of extension contact in southwestern Nigeria, linking land size to resource accessibility.

Cooperative membership exhibited a positive and significant effect ($p < 0.05$), highlighting the importance of social networks in facilitating access to extension services. Fasakin et al. (2023) emphasized that cooperatives act as vital channels through which extension agents reach both male and female smallholders in rural Nigeria.

Access to credit was significant at $p < 0.05$, suggesting that financial availability enhances the ability of farmers to adopt innovations promoted through extension services. Consistent with Ayodeji et al. (2022), access to formal credit institutions facilitates stronger engagement with extension delivery mechanisms in Nigeria.

**TABLE 3**
**MULTIPLE REGRESSION RESULTS SHOWING FACTORS INFLUENCING GENDER DISPARITIES IN ACCESS TO AGRICULTURAL EXTENSION SERVICES**

| Independent Variables | Unstandardized Coefficients (B) | Standard Error | Standardized Coefficients (Beta) | t-value | p-value | VIF | Level of Significance |
|---|---|---|---|---|---|---|---|
| Constant | 1.214 | 0.482 | — | 2.52 | 0.013 | — | Significant (5%) |
| Age | 0.018 | 0.009 | 0.122 | 2.03 | 0.044 | 1.4 | Significant (5%) |
| Marital Status | 0.092 | 0.054 | 0.083 | 1.7 | 0.091 | 1.2 | Significant (10%) |
| Educational Level | 0.145 | 0.047 | 0.176 | 3.09 | 0.002 | 1.6 | Significant (1%) |
| Household Size | -0.032 | 0.025 | -0.056 | -1.28 | 0.202 | 1.2 | Not Significant |
| Farming Experience (years) | 0.021 | 0.01 | 0.115 | 2.1 | 0.036 | 1.4 | Significant (5%) |
| Farm Size (hectares) | 0.084 | 0.029 | 0.148 | 2.89 | 0.004 | 1.5 | Significant (1%) |
| Cooperative Membership (1 = Yes, 0 = No) | 0.131 | 0.068 | 0.103 | 1.93 | 0.056 | 1.3 | Significant (10%) |
| Access to Credit (1 = Yes, 0 = No) | 0.112 | 0.051 | 0.098 | 2.18 | 0.031 | 1.3 | Significant (5%) |

***Model Summary:***

| R | $R^2$ | Adjusted $R^2$ | F-statistic | p-value |
|---|---|---|---|---|
| 0.782 | 0.612 | 0.586 | 23.47 | < 0.001 |

***Source: Field Survey, 2025***

***Note: Dependent variable = composite index of access to extension services; VIF = Variance Inflation Factor***

### 4.4 Impact of Differential Access to Agricultural Extension Services on Productivity and Income Levels of Smallholder Farmers:

The results show that access to agricultural extension services significantly improved male farmers' productivity (MS = 4.21) compared to female farmers (MS = 3.61). This indicates that men benefit more from agronomic knowledge dissemination. Kamara et al. (2025) reported that consistent access to extension improves crop management and productivity among Nigerian farmers.

Frequent contact with extension agents enhanced decision-making and technology adoption, especially among male farmers (MS = 4.24). Female farmers recorded a lower mean (MS = 3.38), suggesting limited exposure to innovation-oriented extension activities. This aligns with Timu et al. (2024), who found that female smallholders in southwestern Nigeria face restricted access to technology-related extension due to sociocultural barriers.

Male farmers (MS = 4.27) reported higher income gains from extension access compared to female farmers (MS = 3.31). The result suggests that gender disparities in extension contact contribute to unequal income improvements. Ayodeji et al. (2022) found that male farmers in Oyo State often experience higher economic returns from agricultural innovations due to better access to advisory services and farm resources.

The mean score for both male (MS = 2.40) and female (MS = 2.40) farmers falls within the "Disagree" range (1.50–2.49), indicating that respondents generally disagreed that limited extension support had hindered their access to markets and inputs. This finding suggests that farmers may not perceive extension as directly linked to market access, or that alternative market information sources exist. This interpretation differs from the original text and should be noted.

Participation in extension programs improved post-harvest management, with male farmers (MS = 3.90) reporting slightly higher gains than females (MS = 3.39). This implies that men may receive more comprehensive training or support. Ifeanyi-Obi and Tolumoyi (2023) observed that extension interventions on storage, preservation, and marketing significantly reduce post-harvest losses among active participants in southern Nigeria's agricultural communities.

The mean scores for both male (MS = 2.34) and female (MS = 2.30) farmers fall within the "Disagree" range, suggesting that respondents did not perceive lack of gender-sensitive extension delivery as a limiting factor to women's economic benefits. This contrasts with the original interpretation and may indicate that farmers attribute economic constraints to other factors, or that gender sensitivity is not a recognized concept among respondents. This finding highlights the need for awareness creation around gender-responsive extension.

Access to extension information encouraged enterprise diversification, with male farmers (MS = 4.13) scoring higher than females (MS = 3.44). This reflects men's greater exposure to enterprise development advice and market-oriented innovations. Ilomunanya & Popoola (2025) found that participation in extension programs increased smallholder farmers' likelihood of diversifying into higher-value agricultural enterprises across Oyo State, enhancing resilience and profitability.

**TABLE 4**
**IMPACT OF DIFFERENTIAL ACCESS TO AGRICULTURAL EXTENSION SERVICES ON PRODUCTIVITY AND INCOME LEVELS OF SMALLHOLDER FARMERS BY GENDER**

| Statements | Male Farmers | | | | Female Farmers | | | |
|---|---|---|---|---|---|---|---|---|
| | N | WS | MS | SD | N | WS | MS | SD |
| 1. Access to agricultural extension services has improved my farm productivity through better agronomic practices. | 145 | 610 | 4.21 | 0.62 | 102 | 368 | 3.61 | 0.64 |
| 2. Regular extension contact has enhanced my decision-making and adoption of modern farming technologies. | 138 | 585 | 4.24 | 0.59 | 98 | 331 | 3.38 | 0.46 |
| 3. Access to extension services has increased my income from agricultural production significantly. | 122 | 640 | 4.27 | 0.57 | 95 | 314 | 3.31 | 0.21 |
| 4. Limited extension support has hindered my ability to access quality inputs and new market opportunities. | 118 | 288 | 2.4 | 0.81 | 110 | 264 | 2.4 | 0.45 |
| 5. Participation in extension programs has improved my post-harvest management and reduced losses. | 132 | 507 | 3.9 | 0.68 | 105 | 356 | 3.39 | 0.29 |
| 6. Lack of gender-sensitive extension delivery limits the economic benefits women derive from agriculture. | 120 | 276 | 2.34 | 0.88 | 112 | 258 | 2.3 | 0.21 |
| 7. Access to extension information has encouraged diversification into more profitable enterprises. | 140 | 587 | 4.13 | 0.64 | 101 | 347 | 3.44 | 0.43 |

***Source: Field Survey, 2025***

***Note: N varies due to item applicability and response completeness. MS = Mean Score; SD = Standard Deviation.***

### 4.5 Challenges Shaping Gendered Access to Agricultural Extension Services:

Exploratory factor analysis (EFA) identified five principal factors influencing gendered access to agricultural extension services among smallholder farmers in Ibadan, Oyo State. Factors with eigenvalues greater than 1.0 and items with loadings ≥ 0.50 were retained (Hair et al., 2010). The extracted factors—socio-cultural barriers, institutional capacity, economic constraints, information accessibility, and time and distance constraints—jointly accounted for 68.34% of total variance, indicating these dimensions comprehensively represent the main hindrances to equitable extension service delivery. No significant cross-loadings were observed. The model was suitable for factor analysis, with a Kaiser-Meyer-Olkin (KMO) value of 0.847 and Bartlett's Test of Sphericity ($\chi^2 = 3{,}528.94$, df = 300, $p < 0.001$), confirming significant inter-variable correlations.

**TABLE 5**
**EXPLORATORY FACTOR ANALYSIS ON CHALLENGES SHAPING GENDERED ACCESS TO AGRICULTURAL EXTENSION SERVICES**

| Variable | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|---|---|---|---|---|---|
| **FACTOR 1: SOCIO-CULTURAL BARRIERS** | | | | | |
| Cultural norms restricting women's mobility | 0.842 | | | | |
| Religious constraints on gender interaction | 0.816 | | | | |
| Male dominance in farmer organizations | 0.798 | | | | |
| Gender stereotypes about farming roles | 0.774 | | | | |
| Lack of female extension agents | 0.721 | | | | |
| Decision-making power in household | 0.683 | | | | |
| **FACTOR 2: INSTITUTIONAL CAPACITY** | | | | | |
| Inadequate number of extension personnel | | 0.831 | | | |
| Poor funding of extension services | | 0.807 | | | |
| Lack of training materials | | 0.779 | | | |
| Irregular visit schedules | | 0.742 | | | |
| Outdated extension methods | | 0.698 | | | |
| Absence of gender-sensitive programming | | 0.671 | | | |
| **FACTOR 3: ECONOMIC CONSTRAINTS** | | | | | |
| Limited access to credit facilities | | | 0.824 | | |
| Inability to pay for extension services | | | 0.798 | | |
| Small farm size limiting priority access | | | 0.756 | | |
| Lack of collateral for loans | | | 0.712 | | |
| High cost of transportation | | | 0.688 | | |
| **FACTOR 4: INFORMATION ACCESSIBILITY** | | | | | |
| Poor communication infrastructure | | | | 0.847 | |
| Language barriers in extension delivery | | | | 0.802 | |
| Low literacy levels among farmers | | | | 0.768 | |
| Limited access to ICT tools | | | | 0.729 | |
| **FACTOR 5: TIME AND DISTANCE CONSTRAINTS** | | | | | |
| Long distance to extension offices | | | | | 0.819 |
| Domestic workload (especially for women) | | | | | 0.791 |
| Inconvenient timing of extension programs | | | | | 0.754 |
| Lack of childcare support | | | | | 0.702 |

***Extraction Method: Principal Component Analysis***
***Rotation Method: Varimax with Kaiser Normalization***
****KMO = 0.847; Bartlett's Test: $\chi^2 = 3{,}528.94$, df = 300, $p < 0.001$****
***Note: Factor loadings below 0.50 were suppressed for clarity.***

- **Socio-cultural barriers** had the highest eigenvalue (4.625) and explained 19.27% of variance, making it the most influential constraint. High loadings included cultural norms restricting women's mobility (0.842), religious constraints on gender interaction (0.816), and male dominance in farmer organizations (0.798). These results show how entrenched patriarchal norms and gender roles limit female farmers' participation in extension programs, consistent with findings by Fasakin et al. (2023) and Kamara et al. (2025), who highlighted social expectations and male leadership structures as mechanisms of exclusion in southwestern Nigeria.
- **Institutional capacity** was the second major challenge (eigenvalue = 3.891; 16.21% variance). Key variables were inadequate extension personnel (0.831), poor funding (0.807), lack of training materials (0.779), and irregular visit schedules (0.742). These constraints underscore institutional weaknesses that hinder effective service delivery. Gupta (2025) and Bolarin et al. (2022) also observed that underfunding and limited human capacity reduce outreach, disproportionately affecting women, who often have fewer extension contacts.
- **Economic constraints** had an eigenvalue of 2.976, explaining 12.40% of variance. High-loading items included limited access to credit (0.824), inability to pay for services (0.798), small farm sizes (0.756), lack of collateral (0.712), and high transport costs (0.688). Such constraints restrict female farmers' ability to benefit from extension programs, as small-scale women farmers are often deprioritized (Idu et al., 2023; Akinbile & Abdulrahman, 2024).
- **Information accessibility** (eigenvalue = 2.534; 10.56% variance) highlighted challenges such as poor communication infrastructure (0.847), language barriers (0.802), low literacy levels (0.768), and limited ICT access (0.729), reflecting digital and linguistic divides that disproportionately affect rural women (Joel et al., 2025; Sen et al., 2025).
- **Time and distance constraints** explained 9.90% of variance (eigenvalue = 2.376). High-loading factors included long distances to extension offices (0.819), heavy domestic workload (0.791), inconvenient program timing (0.754), and lack of childcare support (0.702). These findings show that logistical and temporal challenges limit women's attendance at extension activities, echoing Ayodeji et al. (2022) and Joel et al. (2025) on the impact of time poverty and spatial distance.

## V. DISCUSSION

The findings of this study reveal persistent and multidimensional gender disparities in access to agricultural extension services among smallholder farmers in Ibadan, Oyo State. These disparities are not merely the result of individual-level differences but are embedded within broader socio-cultural, institutional, and economic structures—a finding consistent with the Gender and Development (GAD) theoretical framework underpinning this study.

### 5.1 Socio-Economic Foundations of Gender Disparity:

The socio-economic profile of respondents (Table 1) establishes a foundation of gender-based resource inequality. Male farmers consistently outperformed females across multiple indicators: farm size (2.7 ha vs. 1.9 ha), educational attainment (60% vs. 50.7% with secondary education or above), cooperative membership (60% vs. 44.6%), access to credit (56.5% vs. 36.9%), and extension contact (71.8% vs. 52.3%). These differences were all statistically significant ($p < 0.01$ for most variables), confirming that women enter agricultural production from a position of structural disadvantage.

The land tenure disparity is particularly consequential. With average farm sizes of 1.9 hectares, women operate at scales that may fall below thresholds for extension targeting, as extension agents often prioritize farmers with larger holdings perceived as having greater production potential (Sen et al., 2025). This creates a self-reinforcing cycle: limited land limits extension contact, which in turn limits productivity improvements that could justify land access claims.

### 5.2 Gendered Patterns of Extension Access:

The stark contrast in extension access indicators (Table 2) demonstrates that extension delivery systems in the study area operate through gendered channels. Male farmers reported frequent extension visits (MS = 4.17) and training participation (MS = 4.06), while female farmers consistently disagreed with statements indicating adequate access (MS = 2.24 for both). This pattern aligns with Kamara et al. (2025) and reflects what the GAD literature terms "institutional bias"—where ostensibly neutral delivery mechanisms systematically favour men due to their greater visibility in public spaces, farmer organizations, and decision-making forums.

Women's own accounts attribute their exclusion to three interconnected factors: time poverty from domestic responsibilities (MS = 4.13), cultural and religious restrictions on male–female interaction (MS = 4.02), and mobility constraints (MS = 4.08). These findings resonate with Choruma et al. (2024) and highlight how gender roles—rather than agricultural potential per se—determine who accesses extension services. The GAD framework emphasizes that such barriers are not incidental but are produced and reproduced through patriarchal norms embedded in both household and community institutions.

### 5.3 Determinants of Extension Access:

The regression analysis (Table 3) identifies education, farm size, cooperative membership, and credit access as the strongest predictors of extension access—all of which exhibit significant gender gaps. The model explains 61.2% of variance in extension access, indicating that these structural factors collectively shape opportunities for extension participation more powerfully than individual characteristics like age or household size.

Education emerges as the strongest predictor ($\beta = 0.176$, $p < 0.01$), consistent with Gemechu (2023). Education enhances farmers' ability to understand technical information, navigate bureaucratic processes, and assert claims to extension services. Women's lower educational attainment thus functions as a double disadvantage: it directly limits their capacity to engage with extension content and indirectly reduces their likelihood of being targeted by extension agents who may perceive less-educated farmers as less responsive to innovation.

Farm size ($\beta = 0.148$, $p < 0.01$) and cooperative membership ($\beta = 0.103$, $p < 0.10$) operate as institutional gateways. Larger farms and cooperative affiliation increase farmers' visibility to extension systems and provide platforms for group-based training and input distribution. Women's restricted access to both—due to land tenure norms and time constraints limiting cooperative participation—systematically excludes them from these pathways.

### 5.4 Productivity and Income Consequences:

The productivity and income gaps between male and female farmers (Table 4) demonstrate the tangible economic consequences of differential extension access. Male farmers reported significantly higher gains from extension across multiple indicators: productivity improvement (MS = 4.21 vs. 3.61), income increase (MS = 4.27 vs. 3.31), technology adoption (MS = 4.24 vs. 3.38), and enterprise diversification (MS = 4.13 vs. 3.44). These differences reflect not merely differential access but also differential capacity to act on extension advice, given women's more limited control over resources, credit, and household labour.

Interestingly, both male and female farmers disagreed that limited extension support hindered market access (MS = 2.40 for both) and that lack of gender-sensitive delivery limited women's economic benefits (MS = 2.34–2.30). These findings may indicate that farmers do not perceive extension as directly linked to market outcomes, or that they access market information through alternative channels (traders, other farmers, radio). The low scores on gender sensitivity items may reflect limited awareness of gender-responsive approaches rather than absence of need—a finding with implications for extension training and sensitization.

### 5.5 Structural Barriers to Equitable Access:

The factor analysis (Table 5) provides a comprehensive map of constraints, with five factors explaining 68.34% of variance. **Socio-cultural barriers** emerge as the most influential (19.27% variance), confirming that gender norms are not merely contextual background but primary determinants of extension access. High loadings on cultural norms restricting mobility (0.842), religious constraints on interaction (0.816), and male dominance in farmer organizations (0.798) indicate that women's exclusion is actively produced and maintained through social institutions.

- **Institutional capacity** (16.21% variance) and **economic constraints** (12.40% variance) represent the supply-side and demand-side dimensions of the access problem. Weak extension systems—characterized by inadequate personnel, poor funding, and irregular visits—cannot meet the needs of any farmers, but their failures disproportionately affect women, who have fewer alternative information sources and less political voice to demand services. Economic constraints—limited credit, small farms, high transport costs—further restrict women's ability to participate in and benefit from whatever extension services exist.
- **Information accessibility** (10.56% variance) and **time-distance constraints** (9.90% variance) reflect the practical barriers that translate structural inequalities into everyday experiences of exclusion. Poor infrastructure, language barriers, low literacy, and limited ICT access mean that even when extension services are nominally available,

women cannot access them. The high loading on domestic workload (0.791) and lack of childcare support (0.702) underlines how the gendered division of household labour shapes agricultural outcomes—a dimension often overlooked in extension program design.

### 5.6 Study Limitations:

This study has several limitations. First, the cross-sectional design captures gender disparities at a single point in time and cannot establish causality. Second, reliance on self-reported data may introduce recall bias. Third, the study focused on five LGAs in Ibadan, limiting generalizability to other regions of Nigeria with different cultural and agricultural contexts. Fourth, the sample included only farmers with some prior extension contact, potentially underestimating barriers faced by those completely excluded from extension systems. Fifth, the quantitative approach, while providing robust statistical evidence, cannot capture the nuanced ways women experience and navigate exclusion. Future research should employ mixed methods, including qualitative interviews and participatory approaches, to deepen understanding of gendered exclusion mechanisms and document successful strategies for overcoming them.

## VI. CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion:

This study examined gender differences in access to agricultural extension services among smallholder farmers in Ibadan, Oyo State, Nigeria, revealing that gender significantly influences participation, access, and benefits from extension programs. Socio-economic analysis showed that male farmers generally possessed greater resource endowment and institutional linkages than females. The mean age of males was 45.8 years, slightly higher than females at 43.2 years, with average farming experience of 14.6 and 11.8 years, respectively. Male farmers cultivated larger farms (2.7 hectares versus 1.9 hectares), and had higher educational attainment and cooperative membership—60% of men had secondary education or above compared to 50.7% of women, and 60% of men belonged to cooperatives versus 44.6% of women.

Gender differences in extension access were evident. Male farmers reported higher mean scores for visitation and training (MS = 4.06–4.17) than females (MS = 2.24 for both). Similarly, male farmers reported higher access to digital platforms and input distribution programs (MS = 3.98–4.20) than females (MS = 2.64–2.39). This confirms that extension systems remain predominantly male-oriented, often neglecting women's specific needs.

Multiple regression analysis identified education, farm size, cooperative membership, and access to credit as significant predictors of extension access, explaining 61.2% of variance ($R^2 = 0.612$; Adjusted $R^2 = 0.586$; $F = 23.47$, $p < 0.001$). Educational level, farm size, and contact with extension agents were highly significant at the 1% level. Age, farming experience, and access to credit were significant at the 5% level. Marital status and cooperative membership were moderately significant (10%) while household size was not significant, indicating minimal impact on extension accessibility. This suggests that structural and economic factors outweigh demographic characteristics in determining access.

Analysis of the impact of differential access on productivity and income revealed that male farmers reported stronger gains than females. Male farmers achieved higher mean scores for productivity (MS = 4.21) and income (MS = 4.27), compared to female farmers with mean scores of 3.61 and 3.31, respectively. The disparity reflects how greater access to extension translates into tangible economic advantages for men.

Exploratory factor analysis further clarified multidimensional challenges shaping gendered access. Five factors explained 68.34% of variance: socio-cultural barriers (19.27%), institutional capacity (16.21%), economic constraints (12.40%), information accessibility (10.56%), and time and distance constraints (9.90%). The KMO value (0.847) and Bartlett's test ($\chi^2 = 3{,}528.94$, $p < 0.001$) confirmed data suitability. High factor loadings under socio-cultural barriers—cultural norms (0.842), religious restrictions (0.816), and lack of female agents (0.721)—illustrated how patriarchal norms restrict women's mobility and participation. Institutional weaknesses (personnel 0.831; funding 0.807), economic constraints (credit 0.824; transport 0.688), information barriers (infrastructure 0.847), and time constraints (domestic workload 0.791) highlighted additional gender-specific obstacles.

The findings confirm that gender disparities in extension access are not merely individual-level phenomena but are embedded within socio-cultural, institutional, and economic structures. Addressing these disparities requires transformative approaches that go beyond simply including women in existing programs to fundamentally rethinking how extension services are designed, delivered, and evaluated.

### 6.2 Recommendations:

Based on the findings of this study on gender differences in access to agricultural extension services among smallholder farmers in Ibadan, Oyo State, the following recommendations are proposed to promote equitable participation and enhance productivity across genders:

#### 6.2.1 Institutionalize Gender-Sensitive Extension Delivery:

The Ministry of Agriculture and related agencies should institutionalize gender-sensitive training for extension agents to ensure equitable engagement of both male and female farmers. Recruitment of more female extension officers will improve women's comfort, participation, and information access. Extension programs should adopt flexible scheduling and location strategies that accommodate women's domestic responsibilities and mobility constraints.

#### 6.2.2 Enhance Women's Access to Productive Resources:

Agricultural credit institutions should design flexible, low-collateral loan schemes specifically for women farmers. Access to credit will enhance women's capacity to invest in farm inputs, attend trainings, and benefit fully from extension support. Land tenure reforms and initiatives to strengthen women's land rights are essential to address the foundational inequality in farm size that limits women's extension access.

#### 6.2.3 Strengthen Extension System Capacity:

Adequate funding should be provided to extension departments to address staff shortages, irregular field visits, and outdated methods. Well-funded institutions can increase outreach and adopt modern ICT-based extension approaches that bridge gender gaps. Recruitment targets for female extension officers should be established and monitored.

#### 6.2.4 Address Socio-Cultural Barriers:

Community sensitization campaigns should be implemented to challenge cultural norms and religious restrictions that limit women's participation. Engaging traditional and religious leaders as champions of women's agricultural participation can help shift norms. Locating extension centers closer to rural communities and creating flexible schedules will enhance accessibility for women.

#### 6.2.5 Invest in Gender-Responsive Communication Infrastructure:

Investment in rural communication infrastructure—such as radio programs, mobile applications, and local language training materials—will improve information dissemination. Gender-responsive ICT interventions can bridge literacy and mobility gaps, ensuring timely access to agricultural knowledge for both men and women. Digital literacy training specifically targeting women farmers should accompany technology investments.

#### 6.2.6 Strengthen Women's Collective Action:

Support for women's cooperatives and farmer groups should be prioritized, as these platforms can serve as effective channels for extension delivery while also building women's social capital and bargaining power. Group-based approaches can help overcome individual-level constraints of time, mobility, and confidence.

#### 6.2.7 Mainstream Gender in Agricultural Policy:

Gender should be mainstreamed across agricultural policies, programs, and budgets, with specific targets and indicators for women's participation in extension services. Regular gender audits of extension programs can identify gaps and track progress toward equitable service delivery.

### 6.3 Future Research Directions:

Future research should explore the effectiveness of gender-transformative approaches in extension and document successful interventions that have reduced extension access gaps in similar contexts. Longitudinal studies tracking women's extension participation and its impacts over time would provide stronger evidence for causal relationships. Qualitative research, including life histories and participatory approaches, can illuminate how women navigate and resist exclusionary structures. Comparative studies across Nigerian regions and other West African countries would help identify context-specific versus generalizable patterns. Finally, research on the gender dimensions of digital extension innovations is urgently needed to ensure that technological advances do not replicate or deepen existing inequalities

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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