

Exploring Gender differences to user experiences of Digital Agricultural Tools: A Case Study of IITA AKILIMO in Nigeria.

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Abstracts

This study explores the gender-based users experience to the utilization of digital agricultural tools in Nigeria, with a focus on IITA AKILIMO. The objective of the study is to ascertain the socioeconomic characteristics of respondents in the study area and examine the gender differences in the user's experiences of IITA AKILIMO tools usage in the study area. This study focuses on Ogun, Oyo, and Ondo States, Nigeria to explore gender disparities in user experiences with digital agricultural tools. The data for this study were collected through interviews and questionnaires distributed by randomly selecting 300 trained AKILIMO farmers using a multistage sampling technique. Descriptive statistics, Chi-Square, and ANOVA served as the basis for conducting the analysis. The study reveals that male farmers had higher adoption rates of the AKILIMO tools, at 81.3%, compared to female farmers, who adopted at 76.5%. The study draws on the experiences of 181 male and 119 female IITA AKILIMO users that understands the factors that influence the adoption of digital agricultural tools. The findings suggest that there is a significant gender gap in the utilization of IITA AKILIMO, with male users significantly more likely to adopt the technology. 71.3% of male users reported currently using IITA AKILIMO tools, while only 47.1% of female users reported doing the same. The hypothesis testing shows there's no significant Gender differences in User experiences in the utilization of AKILIMO Tools by Trained Cassava Farmers in Nigeria. With the value of 0.114 which indicates that the null hypothesis (H_0) cannot be rejected at the 5% significance level. it was concluded that while there are some differences in the adoption and utilization of AKILIMO tools for cassava production among male and female farmers in Nigeria while both genders report positive experiences and benefits from using the tools. It was recommended that to further promote adoption and utilization of digital tools among cassava farmers in Nigeria, it is necessary to address the social, economic, and gender-related barriers that limit access to and effective use of these tools.

Keyword: AKILIMO, Digital Technology, Utilization, User's Experience

Introduction: Agriculture has become the most important sector in the economy of developing countries and which has provides endless opportunities for economic growth, poverty alleviation and food security in Nigeria (FAOSTAT, 2021). Practically, in Q4 of 2020 and Q1 of 2021 respectively, it contributed 26.95% and 22.35% respectively to the nation's GDP, though showing a decline from Q3 of 2020 which was 30.77%. The sector also contributes to export earnings and employs over 70% of the nation's working population. Regardless of Nigeria's multiculturalism, agriculture remains the largest livelihood activity across rural areas where almost 50% of the population lives. Characteristically, the Nigerian agriculture is smallholder based; largely traditional in practice, predominantly rain-fed and low-yielding and practically low on technology use, thereby making it more vulnerable (FAOSTAT, 2021).

However, technological devices and techniques that facilitate control as well as comprehension of the

physical world are referred to as technology. Agricultural technology, sometimes referred to as agritech, is useful for precisely mapping, overseeing, and controlling agricultural decisions (Olufunke *et al*, 2025) the development of improved technologies, transfer to, and adoption by small holder farmers is critical to improving the productivity and income of farmers, and ultimately reducing poverty. The adoption of improved technologies has a positive and significant effect on the welfare of households (Ayenew *et al*, 2020). Digital technologies have proved useful in various sectors such as health, manufacturing, finance, and agriculture (Muhamad *et al*, 2021; Massaro *et al*, 2021; Mohapatra *et al*, 2022). Digital technologies increase productivity, enhance quality, and promote environmental sustainability in the agricultural sector (Saiz-Rubio and Rovira-Mas, 2020). Digital transformations through "Industry 5.0" are transforming agriculture through precise and real-time decision making in farming activities (Hrustek, 2020; Saiz-Rubio and Rovira-Mas, 2020). According to Sturgeon *et al* (2017), there is a

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chance that the “New Digital Economy” may lead to the creation of digital solutions for numerous problems facing agricultural development.

The application of digital technologies is, therefore, a welcome development for Nigeria's agricultural development, considering the current realities in the country. New digital technologies are being generated; however, the adoption process remains a challenge (Dissanayake *et al.*, 2022). This paper, therefore, focuses on assessing the awareness and willingness to adopt weed management and agronomy advisory digital application tools in Nigeria. The digital application tools considered in this study are the Akilimo. These tools were developed by the International Institute of Tropical Agriculture (IITA) in 2019. Digital technologies are central to disseminating real-time information to farmers about weather, farming, and harvesting techniques (Kumar *et al.*, 2021). Nyarkoa and Kozarib (2021) posited that adopting agricultural technology leads to increased efficiency and productivity through improved extension service delivery. Consequently, the productivity gains and income increase resulting from technology Adoption among genders significantly enhance the livelihoods of agricultural households in the country.

In many rural areas of Africa, agriculture serves as a primary source of livelihood, with both men and women actively involved in farming activities (Olalekan, 2021). However, gender disparities exist in access to resources, decision-making power, and participation in agricultural value chains. Understanding how these disparities impact technology adoption is crucial for addressing inequalities and promoting inclusive agricultural development. Women play a significant role in cassava production, both as primary caregivers in households and as active participants in farming activities (Payne, 2020). Despite their substantial contribution, women often face constraints such as limited access to land, financial resources, and extension services, while the digital world holds promises to advance social and economic outcomes for women and girls, it simultaneously poses challenges that can exacerbate existing inequalities and vulnerabilities (Devex partnership, 2024). Examining gender dynamics in technology adoption can help identify barriers that hinder women's full participation in agricultural innovation processes. Despite the growing adoption of digital tools in agriculture, gender disparities persist in their usage, affecting the efficiency and inclusivity of farming practices. This study aims to investigate how gender influences the adoption, usage, and perceived benefits of digital agricultural tools, specifically IITA AKILIMO, in selected Nigerian states.

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Understanding these differences is crucial for promoting equitable access and optimizing tool design to support all users. Gender inequality in digital agriculture hinders the potential of these tools to improve livelihoods and food security. Women farmers, in particular, may face barriers such as limited access to technology, digital literacy gaps, and societal norms that discourage their involvement in tech-driven farming. By examining gender-specific challenges and opportunities, this research seeks to inform strategies that bridge the digital divide and ensure digital agricultural tools like AKILIMO are beneficial for all users, regardless of gender (FAO 2021). Moreover, the problem can be expanded to include Limited research on gender-specific user experiences with digital agricultural tools in Nigeria; Insufficient consideration of gender needs in the design and implementation of these tools; Potential negative impacts on women's empowerment and agricultural productivity if gender disparities are not addressed. However, study will contribute valuable insights to address these issues and ultimately enhance the effectiveness of digital solutions for Nigerian farmers (IFAD, 2020). The objectives are: ascertain the socioeconomic characteristics of respondents in the study area; evaluate the gender differences in the user experience of Akilimo was by respondents.

Methodology: The study area : The research was carried out in Ogun State, Oyo State, Ondo State, Nigeria. Ogun State is located in the south west of the country and has 20 Local Government Areas (LGAs), Oyo State is located in the south west of the country and has 33 Local Government Areas, while Ondo state has 18 Local government Areas. Agriculture is the mainstay of the state's economy, and cassava is a major crop. Therefore, these states were chosen because it is a major cassava-producing state in Nigeria. The study was conducted in 3 Local government areas (LGAs) from each LGAs in each States. These LGAs were purposively selected as the LGAs where we Akilimo trained farmers resides.

Sampling procedure and sample size: The three States were chosen being a major cassava producing states in Nigeria. In addition, This study employs a mixed-methods approach, combining quantitative and qualitative data collection methods. It uses a survey of IITA AKILIMO users to collect quantitative data on the factors that influence adoption, and interviews with selected users to gather qualitative data on their experiences and perceptions of the technology. This study explores cassava farmers' experiences with digital tools in specific Local Government Areas (LGAs) across the chosen states in Nigeria. A purposive sampling method was used, The sample distribution consisted of 120 farmers from Oyo State,

120 from Ogun State, and 60 participants from Ondo State, arriving at the total of 300 respondents across the three states. This allocation ensured a balanced representation while considering regional differences and the concentration of AKILIMO cassava farmers in each area. Selection was made based on the population of trained AKILIMO users in each State. Criteria like cassava farming density, prior digital tool usage, and accessibility influenced the selection. Data was gathered using KoboToolbox, ensuring structured and efficient collection.

Analytical techniques: Descriptive statistics such as frequency tables, means, and standard deviation were used to describe the socio-economic characteristics of the AKILIMO trained cassava farmers in the study area. Also, the user experiences, and use of digital technologies/infrastructure were analysed using descriptive statistics. ANOVA were used to determine the relationship between the socioeconomic characteristics of the respondents and their users experience.

Results and Discussion: The result shows that 60.30% of the respondents were male and 39.70% were female which indicate that there's a gender gap in the adoption and use of AKILI MO Tools. This gender gap is due to a variety of factors, not limited to Access to technology; In some areas of Nigeria, men may have greater access to mobile phones and the internet, which could limit women's ability to use AKILI MO Tools.

Level of Education: In Nigeria, the largest proportion of farmers (31.1%) hold university degrees. This could indicate that there is a greater emphasis on formal education in Nigeria, or that farmers with higher education levels are more likely to engage in Cassava farming in Nigeria(Olufunke *et al*, 2025).

User's experiences in the gender distribution in the utilization of AKILIMO Tool(Nigeria): The findings suggest that Nigerian farmers are generally highly satisfied with most aspects of the tools, with most of the mean scores being between 4.39 and 4.57 on the 5-point scale. This indicates that the tools are perceived as user-friendly, effective, and valuable by Nigerian farmers. The statement with the highest satisfaction score is "The AKILIMO tools are easy to understand and use (user friendly)" with 63.3% of farmers strongly agreeing showing that Nigerian farmers are also highly satisfied with the ease of installation of the software (54.7% strongly agreeing), which suggests that the installation process is straightforward and user-friendly.

Aspects of AKILI MO Tools most valuable in Nigeria: The result shows mean value of 62.4% indicating that the majority of participants found AKILI MO Tools to be

valuable. This suggests that the tool is meeting many of the users' needs and providing useful information and support. The highest mean value was for the fertilizer blending recommendation aspect, which suggests that this aspect of AKILI MO Tools is particularly useful and valuable to users. This may indicate that the tool provides accurate and relevant information on fertilization techniques, which can be important for improving crop yields.

Features in the AKILIMO Tools as used before: The overall high mean value of 77.0% for the "Yes" responses to the various features of AKILI MO Tools indicates a significant level of user satisfaction and adoption among farmers in Nigeria. This high mean value also suggests that the AKILI MO Tools is addressing many of the informational and advisory needs of farmers, which is a key factor in driving the adoption and sustained use of agricultural technology tools.

Hypothesis: there's no significant Gender differences in Users experiences in the utilization of AKILIMO Tools by Trained Cassava Farmers in Nigeria.

The table below shows that there is no significant difference in User Experience between male and female users of AKILIMO Tools in Nigeria. The value of 0.114 indicates that the null hypothesis (H_0) cannot be rejected at the 5% significance level.

Therefore, There are no significant Gender differences in User experiences in the utilization of AKILIMO Tools by Trained Cassava Farmers in Nigeria

Conclusion: Trained IITA AKILIMO cassava farmers in Nigeria found the AKILIMO tools valuable and useful, with a mean response of 77.0% across all features. However, there was a notable gender gap in adoption and use of the tools, with only 39.70% of respondents being female. The feature with the lowest mean value was 'High root starch content recommendation,' which may suggest that this feature needs to be improved or revised. The gender gap in the use of AKILIMO tools may reflect broader systemic inequalities related to access to technology and social norms. Further research and analysis is needed to identify ways to address these inequalities and improve the effectiveness and accessibility of the tools for both male and female farmers. This research will contribute to the ongoing efforts to improve the sustainability and profitability of cassava farming in Nigeria, and ultimately to the development of the agricultural sector as a whole. In summary, the AKILIMO tools have the potential to improve the productivity and sustainability of cassava farming in Nigeria. However, the gender gap and the relatively low adoption rate of certain features highlight the

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need for ongoing innovation and improvement. By addressing these issues, the AKILIMO tools can become a more effective and inclusive tool for cassava farmers in Nigeria and a model for agricultural technology innovation in the region.

Recommendation: Increase outreach and education about the AKILIMO tools, particularly among female farmers, to promote greater awareness and adoption.; Work with community leaders and organizations to address broader systemic inequalities that may be contributing to the gender gap, such as access to technology and social norms.; Collaborate with local

Ayenew, W., Laken, T., & Kristos, E. H. (2020). Agricultural technology adoption and its impact on smallholder farmers' welfare in Ethiopia. *African Journal of Agricultural Research*, 15(3), 431–445. <https://doi.org/10.5897/AJAR2019.14302>.
Akilimo (2022), available at: <https://akilimo.org/> (accessed September 2023).

Dissanayake, C.A.K., Jayathilake, W., Wickramasuriya, H.V.A., Dissanayake, U., Kopyawattage, K.P.P. and Wasala, W.M.C.B. (2022), "Theories and models of technology adoption in agricultural sector", *Human Behavior and Emerging Technologies*, Vol. 2022, 9258317, doi: 10.1155/2022/9258317

(FAO, 2020). The Digitization of Food and Agriculture, FAO Regional Conference For Asia and the Pacific. <http://www.fao.org/3/nc580en/nc580en.pdf>.

Hrustek, L. (2020), "Sustainability driven by agriculture through digital transformation", *Sustainability*, Vol. 12 No. 20, 8596.

IFAD, 2010. Root and Tubers Expansion Programme. Project Report Digest. <https://www.ifad.org/en/web/operations/project/id/1100001016/country/nigeria/> Assessed August, 2020

Kumar, R., Kumar, P. and Pal, S. (2021), "Farmers' awareness regarding information and communication technology (ICT) based equipments in agriculture sector of Haryana", *UGCCare Group*, Vol. 1, pp. 172–183.

Matt Fishbeck, Sr. Business Analyst (2024) User Experience: A theoretical perspective by Modern Analyst Media LLC.

Muhamad, S., Kusairi, S., Man, M., Majid, N.F.H. and Kassim, W.Z.W. (2021), "Digital adoption by enterprises in Malaysian industrial sectors during COVID-19 pandemic: a data article", *Data in Brief*, Vol. 37

extension workers, NGOs, and agricultural researchers to gather more data and insights on farmers' experiences with the AKILIMO tools. This information can be used to improve the tools' design and functionality.; Consider developing gender-sensitive versions of the AKILIMO tools that address the specific needs and preferences of female farmers, such as incorporating information on child care or household management.; Develop partnerships with mobile phone and internet service providers to improve access to digital technology in rural areas, particularly for women farmers.

Mohapatra, B., Tripathy, S., Singhal, D. and Saha, R. (2022), "Significance of digital technology in manufacturing sectors: examination of key factors during COVID-19", *Research in Transportation Economics*, Vol. 93, 101134.

Massaro, M., Secinaro, S., Dal Mas, F., Brescia, V. and Calandra, D. (2021), "Industry 4.0 and circular economy: an exploratory analysis of academic and practitioners' perspectives", *Business Strategy and the Environment*, Vol. 30 No. 2, pp. 1213–1231, 107197.

Saiz-Rubio, V. and Rovira-Mas, F. (2020), "From smart farming towards agriculture 5.0: a review on crop data management", *Agronomy*, Vol. 10 No. 2, 207.

Sturgeon, T., Fredriksson, T. and Korka, D. (2017), "The 'New' digital economy and development", *UNCTAD Technical Notes on ICT for Development*, 8.

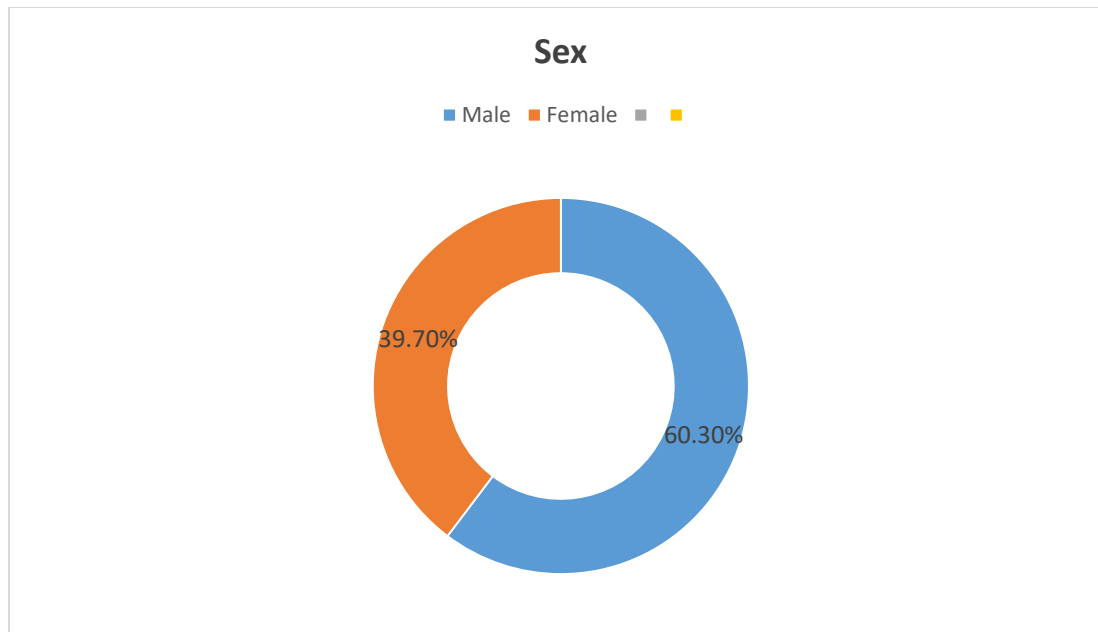
Nyarkoa, D.A. and Kozarib, J. (2021), "Information and communication technologies (ICTs) usage among agricultural extension officers and its impact on extension delivery in Ghana", *Journal of the Saudi Society of Agricultural Sciences*, Vol. 20 No. 3, pp. 164–172, doi: 10.1016/j.jssas.2021.01.002.

Olufunke C. O., Oluwatosin O. F., Omowunmi V.A., Abimbola T. F. (2025) Determinants of AKILIMO Adoption: A Comparative Study of Cassava Farmers in Nigeria and Ghana. *Journal of Agriculture, Environmental Resources and Management* ISSN 2245-1800 (paper) ISSN 2245-2943 (online) 7(9) 1-800; August 2025; pp 31– 88.

Olufunke C. O., Oluwatosin O. F., Abimbola T. F., Oluwaseun T. B. (2025) Prevalence of Digital Technology Utilization by Mechanized Farms in Ekiti State. *FUOYE Journal of Engineering and Technology*, Volume 10, Issue 1, March 2025 ISSN: 2579-0617 (Paper), 2579-0625 (Online).

Lists of Figures and Tables

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Socioeconomic Characteristics of Respondents in Nigeria

Nigeria (N=300)					
	Frequency		Percentage		Mean
Age (years)	Male n=181		Female n=119		45 years
	F	%	F	%	
≤ 30	25	13.8	20	16.8	
31-40	70	38.6	43	36.1	
41-50	46	25.4	28	23.5	
51-60	28	15.5	19	16.0	
≥61	12	6.6	9	7.6	
Marital Status					
Single	29	16.0	8	6.7	
Married	142	78.5	98	82.4	
Widow	1	6.0	10	8.4	
Divorced	4	2.2	1	0.8	
Separated	5	2.8	2	1.7	
Level of Education					
No formal education	0	0	5	4.2	
Polytechnic/College of Education	49	27.1	30	25.2	
Postgraduate study	11	6.1	4	4.2	
Primary Leaving Certificate	8	4.4	18	15.1	
University degree	57	31.5	24	20.2	
WAEC	56	30.9	38	31.9	

Source: Field Survey: 2025

Distribution of the Users experience of AKILIMO Tools in Nigeria

User experience	Strongly agreed	agree	undecided	Disagree	Strongly disagree	Mean
The application has improved my cassava yields	130 (59.4)	79 (36.1)	0 (0.0)	3 (1.4)	7 (3.2)	4.47
The AKILIMO tools are easy to understand and use (user friendly)	138 (63.3)	74 (33.9)	0 (0.0)	1 (0.5)	5 (2.3)	4.57
The software is easy to install	117 (54.7)	86 (40.2)	0 (0.0)	1 (0.5)	10 (4.7)	4.44

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The software is easy to update	116 (55.8)	81 (38.9)	0 (0.0)	0 (0.0)	11 (5.3)	4.45
It has a smooth, hassle-free registration	118 (54.6)	85 (39.4)	0 (0.0)	1 (0.5)	12 (5.6)	4.42
It has a smooth log-in processes	122 (56.2)	89 (41.0)	0 (0.0)	0 (0.0)	6 (2.8)	4.51
It improves based on user feedback	125 (58.7)	77 (36.2)	0 (0.0)	0 (0.0)	11 (5.2)	4.48
Easy to navigate the software features	125 (57.9)	81 (37.5)	0 (0.0)	1 (0.5)	9 (4.2)	4.48
AKILI MO Tools provides excellent customer support and training	124 (56.6)	85 (38.8)	0 (0.0)	0 (0.0)	10 (4.6)	4.47
Quick to load/ fast processing	127 (58.8)	78 (36.1)	0 (0.0)	0 (0.0)	11 (5.1)	4.49
Does not consume much data	120 (56.1)	82 (38.3)	0 (0.0)	0 (0.0)	12 (5.6)	4.45
Does not drain phone battery	115 (53.7)	84 (39.3)	0 (0.0)	2 (0.9)	13 (6.1)	4.39
It is available in local languages	114 (53.8)	88 (41.5)	0 (0.0)	0 (0.0)	10 (4.7)	4.44
AKILI MO Tools allows offline access	113 (52.8)	83 (38.8)	0 (0.0)	3 (1.4)	15 (7.0)	4.35
The Tool is compatible with other devices regardless of technological expertise	109 (51.4)	91 (42.9)	0 (0.0)	2 (0.9)	10 (4.7)	4.39
It gives a tailored agronomic advice/recommendations	119 (56.1)	83 (39.2)	0 (0.0)	1 (0.5)	9 (4.2)	4.46
Navigating through the AKILIMO App is Straight forward.	116 (55.8)	78 (37.5)	0 (0.0)	4 (1.9)	10 (4.8)	4.40
I have had consistent access to AKILIMO tools when needed.	114 (53.3)	91 (42.5)	0 (0.0)	1 (0.5)	8 (3.7)	4.44
I am satisfied with my overall experience using AKILIMO tools.	111 (51.4)	95 (44.0)	0 (0.0)	1 (0.5)	9 (4.2)	4.42

Field Survey: 2025

Figure in parentheses represent percentage

Aspects of AKILI MO Tools most valuable in Nigeria

What aspects of AKILI MO Tools do you find to be most valuable?	Most valuable	valuable	Less valuable	Not valuable	mean
Weather support	141 (61.8)	54 (23.7)	21 (9.2)	12 (5.3)	61.8
Fertilizer blending recommendatio	161 (71.9)	57 (25.4)	4 (1.8)	2 (0.9)	71.9
Inter-cropping recommendation	158 (69.9)	63 (27.9)	3 (1.3)	2 (0.9)	69.9
Scheduled planting/harvesting recommendations	163 (71.2)	62 (27.1)	3 (1.3)	1 (0.4)	71.2
High root starch content recommendation	135 (59.7)	78 (34.5)	11 (4.9)	2 (0.9)	59.7
Yield prediction	149 (66.2)	69 (30.7)	5 (2.2)	2 (0.9)	66.2
Customized advice	139 (62.3)	70 (31.4)	13 (5.8)	1 (0.4)	62.3
Six steps to cassava weed management and best planting	135 (60.3)	78 (34.8)	9 (4.0)	2 (0.9)	60.3
GPS location	149 (65.9)	71 (31.4)	5 (2.2)	1 (0.4)	65.9
Market information	133 (59.4)	81 (36.2)	8 (3.6)	2 (0.9)	59.4
Mechanization	143 (63.3)	77 (34.1)	6 (2.7)	0 (0.0)	63.3

Field Survey: 2025

Figure in parentheses represent percentage

Features in the AKILIMO Tools as used before

Features in the AKILIMO Tools as used before	Nigeria (N=238)		Mean
	Yes F (%)	No F (%)	
Fertilizer blending recommendation	141 (59.2)	97 (40.8)	74.8%
Inter-cropping recommendation	175 (73.5)	63 (26.5)	79.8%
Scheduled planting/harvesting recommendations	173 (72.7)	65 (27.3)	77.4%
High root starch content recommendation	64 (26.9)	174 (73.1)	48.1%
Yield prediction	179 (75.2)	59 (24.8)	77.3%

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Customized advice	170 (71.4)	68 (28.6)	73.9%
Access to extension services	163 (68.5)	75 (31.5)	79.9%
Access to Market information	179 (75.2)	59 (24.8)	79.9%
Mechanization advice	171 (71.8)	67 (28.2)	73.8%
Weather advisory support	174 (73.1)	64 (26.9)	83.2%

Field Survey: 2025

Figure in parentheses represent percentage

User's experiences in the gender distribution in the utilization of AKILIMO Tool(Nigeria)

User experience	Sum of Square	df	Mean Square	F	Sig
Between Groups	172.440	1	172.440	2.531	0.114
Within Groups	10151.996	149	68.134		
Total	10324.436	150			

Field Survey: 2025

Figure in parentheses represent percentage