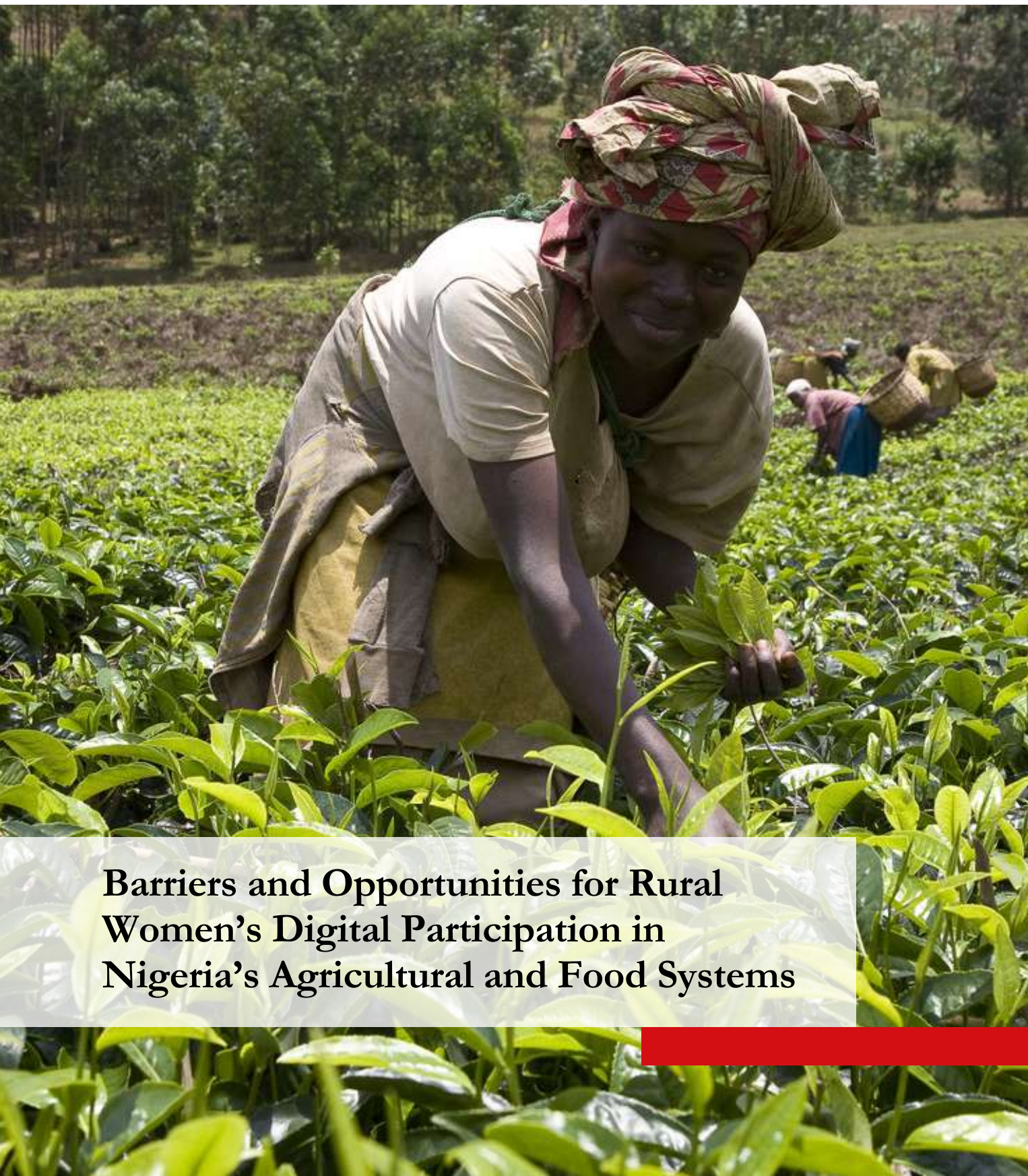




Barriers and Opportunities for Rural Women's Digital Participation in Nigeria's Agricultural and Food Systems

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Bonn, June 2026



Annexes, Figures and Tables

Annexes

Annex 1:	Terms of Reference
Annex 2:	Selected Study Locations
Annex 3:	State Ethical Approvals
Annex 4:	Details of Listed Participants
Annex 5:	Photos from the Interviews and FGD Sessions

FIGURES

Figure 1:	Map of Nigeria Showing the Two Study States of Kaduna and Ogun
Figure 2:	Conceptual Relationships Between Main Variables and Factors

TABLES

Table 1:	Research Questions and Hypotheses
Table 2:	Socio-Cultural Profile of Kaduna and Ogun States

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List of acronyms and abbreviations

CGIAR	Consultative Group on International Agricultural Research
DOI	Diffusion of Innovations
FAO	Food and Agriculture Organization
FAST	Feminist Agri-food Systems Theory
FCDO	Foreign Commonwealth & Development Office
FGD	Focus Group Discussion
FemHub	Feminist Approaches to Resilient Agriculture and Food Systems
FIA	Fund International Agricultural Research
FMAFS	Federal Ministry of Agriculture and Food Security
GBV	Gender Based Violence
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
H	Hypothesis
HREC	Health Research Ethics Committee
ICT	Information and Communication Technology
ID	Identification
IDI	In-depth Interview
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture

List of acronyms and abbreviations

KII	Key Informant Interview
LGA	Local Government Area
MVC	Maize Value Chain
MoLGCA	Ministry of Local Government and Chieftaincy Affairs
NDAS	Nigerian Digital Agriculture Strategy
NEEP	National Electronic Extension Platform
NGO	Non-Governmental Organization
NITDA	National Information Technology Development Agency
PLWD	Persons Living With Disabilities
R&D	Research and Development
RAAMP	Rural Access and Agricultural Marketing Product
RQ	Research Question
TGE	Trust Group Entrepreneur
ToR	Terms of Reference
VCDP	Value Chain Development Programme
WEAGov	Consultative Group on International Agricultural Research

TABLE OF CONTENT

Executive Summary	1
1.0 Introduction	7
1.1 Background	8
1.2 Goal and Objectives of the Study	9
1.3 Research Questions and Hypothesis	10
1.4 Scope of Work	11
2.0 Literature and Policy Review	14
2.1 Overview of the Agricultural Ecosystem in Nigeria	15
2.2 The Status of Women in Agrifood Systems in Nigeria	16
2.3 Socio-Cultural Factors and Gender Equality in Food Systems	20
2.4 Gender Digital Divide in Nigeria Agricultural Value Chains	22
2.5 Theoretical and Analytical Frameworks	26
2.6 Conceptual Relationships between Main Variables and Factors	28
3.0 Methodological Approach	29
3.1 Study Design	30
3.2 Study Participants	31
3.3 Sampling Approach	31
3.4 Approval to Conduct the Study and Ethical Consideration	33
3.5 Data Collection Procedure	33
3.6 Data Management Analysis	33
3.7 Implementation Timeline	34
4.0 Findings and Discussions	35
4.1 Barriers to Women's Digital Participation in the Maize Value Chain	36
4.2 Knowledge of Digital Solution Usage among Women and Men in the Maize Value Chain	44
4.3 Existing Digital Solutions for Agricultural Purposes in the Study Sites	50
4.4 Patterns of Use of Digital Solutions among Women and Men in the Study Sites	55
Relationship Between Women's Use of Digital Solutions and 4.5 Gender-Based Violence in the Study Sites	66

TABLE OF CONTENT

5.0	Conclusion, Recommendation And Limitations	69
5.1	Conclusion	70
5.2	Recommendations for Development Cooperation and Programme Implementation	72
5.3	Limitations and Future Research	74
6.0	Gallery	76

Executive Summary



Rural Women's Digital Participation in Nigeria's Maize Agricultural Value Chain

Background

The agricultural sector in Nigeria plays a strategic and vital role in the well-being of the nation through food production, employment, commerce and economic sustainability. According to the United Nations Food and Agriculture Organization, significant population of about 70% participate diversely as producers, processors of food and retailers.¹ A variety of crops are cultivated widely; one of them is maize, a staple crop with a robust value chain due to its many uses. Although men and women cultivate maize, contributing substantially to evolution of the maize value chain, differences ultimately abound in the experiences of women, who continue to face peculiar issues amplified by intersecting factors across the socio-cultural, structural and infrastructural levels.

Digital access is critical for smallholder farmers in the maize value chain because it improves productivity, reduces post-harvest losses, increases profitability, and provides access to extension advice. Without such solutions, smallholder farmers are left relying on inefficient traditional methods that limit their yields and income. Women make a significant contribution to production, processing and marketing, yet they are disproportionately excluded from digital solutions that improve productivity and market access. This mixed-

methods study assessed barriers and opportunities for rural women's digital participation in the maize agricultural value chain in Kaduna State (north) and Ogun State (south), Nigeria. Guided by five research questions, the study reveals that women's digital exclusion is no accident. It is the predictable outcome of intersecting structural, social-psychological, and institutional forces that, while not always intentionally coordinated, systematically favour men's digital inclusion while reinforcing women's disadvantage and vulnerability. This report identifies practical entry points such as consolidating interventions that support affordability of digital devices, improving digital literacy and stimulating policy advocacy for inclusive digital participation in Kaduna and Ogun.

Objective

The study examined factors limiting women's digital participation in the maize value chain including socio-cultural, economic and financial elements. It assessed differences in access and use of digital solutions among women and men, and analysed the link between women's digital participation and gender-based violence. More concretely, it identified the key barriers to women's digital participation in the maize value chain in Kaduna and Ogun states by focusing on;



Access and ownership of digital devices



Knowledge and capacity for use of digital solutions



Patterns of use of digital solutions among women and men



The relationship between women's digital participation and risks of GBV

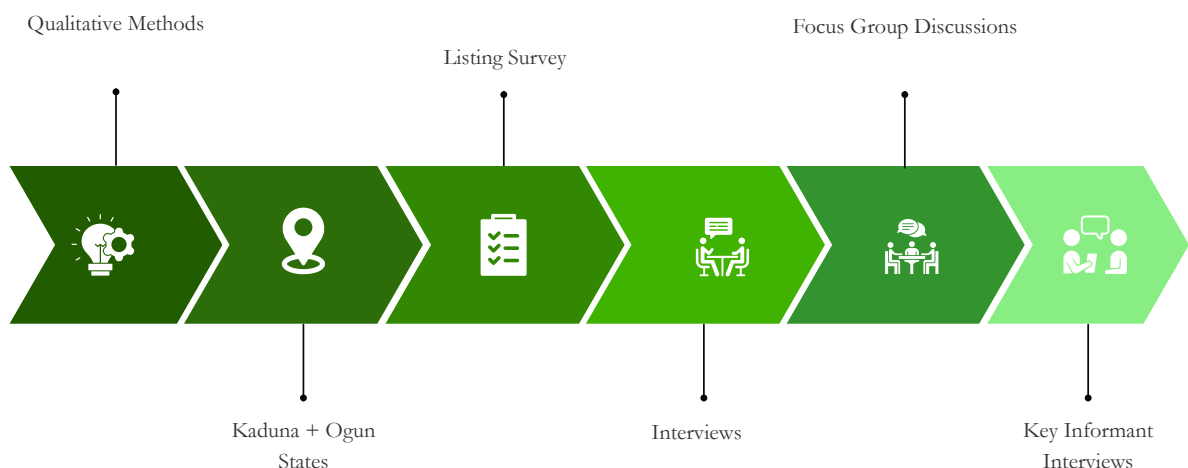
¹ [1] United Nations Food and Agriculture Organization (n.d) 'Nigeria Agriculture at a Glance' FAO (2024); The status of women in agri-food systems, p. 20.

The goal was to generate evidence-based recommendations for policies and interventions that promote safe and equitable digital participation among women smallholder farmers and agripreneurs.

Methodology

The study adopted an exploratory research design, using qualitative methods to examine the digital participation of women in the maize value chain in

Ogun and Kaduna States. Using a multi-stage and inclusive sampling approach, 100 In-depth interviews were conducted with 60 women and 40 men across nodes of the maize value chain. This was supplemented by Focus Group Discussions with participants in the maize value chain, as well as Key Informant Interviews with digital solution stakeholders in agricultural value chains, (including non-Governmental and civil society actors, service providers and policy advocates) and gender experts.



Findings

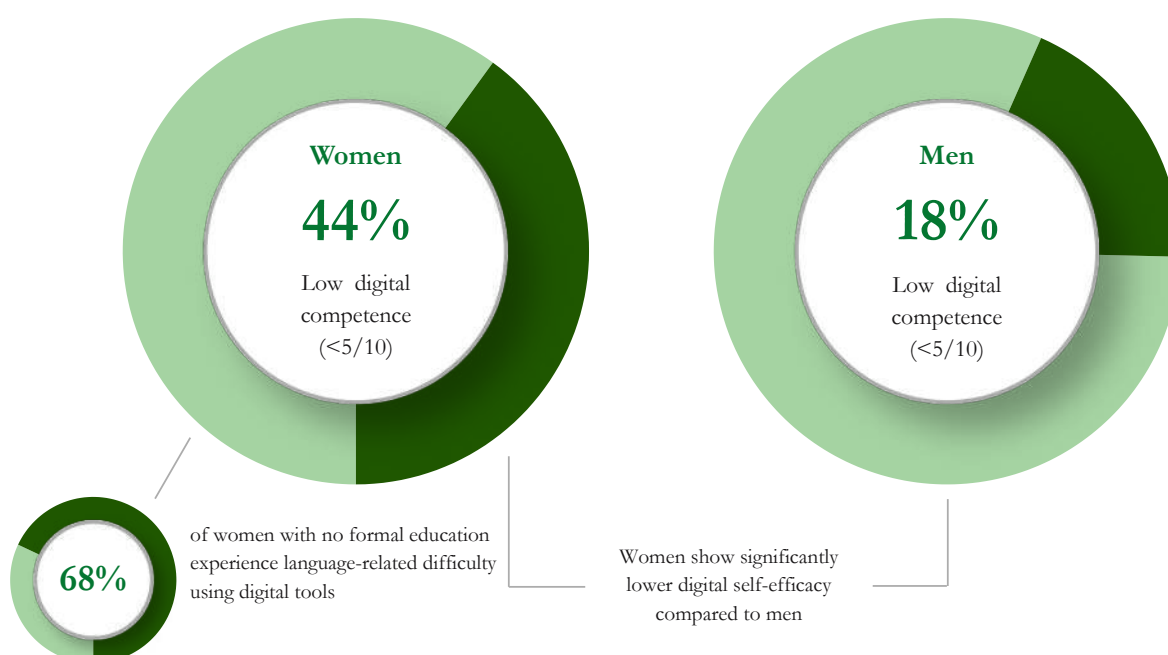
The greatest barriers are socio-cultural and normative. In both States, most women must obtain their husband's permission to purchase mobile phones, subscribe to data, or download apps; not as a matter of individual family negotiation, but as a social norm enforced through stigma and fear of violence. In Kaduna, Islamic religious norms further restrict women's mobility outside the home, making it harder to visit mobile money agents or attend training. In Ogun, jealousy, suspicion, and cultural norms produce the same outcomes, though without overt religious sanctioning. Widows enjoy more digital freedom than other women, while unmarried women are vilified and accused of promiscuity for using smart devices. The most extreme exclusion affects persons with disabilities, who face mobility constraints, are

excluded from mixed-gender trainings, and receive no support from the State, NGOs, or the private sector. Social control mechanisms such as accusations of infidelity (fifteen reported cases), gossip, and the confiscation or destruction of digital device (phones) by men serve to justify these restrictions. Long standing challenges metamorphose rather than disappear. Low literacy reappears as low digital literacy.

Limited land ownership shifts into exclusion from digital credit algorithms that require land titles or digital footprints. Restrictive gender norms become constraints on smartphone ownership and use, enforced through male control of devices. These transformations ensure that the growth in scale, sophistication and adaptiveness of digital tools is experienced differently by women and men.

Most women have limited literacy and low digital self-efficacy: 44% rated their digital competence below five on a scale of one to ten (compared to 18% of men), citing lack of confidence in using digital devices, fear of damaging phones, anxiety about making errors when transferring mobile money, and concern over fraud – all in the face of societal messages that women are not “technology literate”. The predominance of information and news delivered in English through digital interfaces further entrenches exclusion: 68% of women with no formal education reported high levels

of language-related difficulty. Men had significantly greater awareness of production-oriented tools such as weather apps, Global Positioning System, soil testing services, and agronomic advice services. Women's knowledge was largely confined to voice calls and passively receiving mobile money payments. In this context, multilingual voice-based services emerged as a positive innovation, resulting in an increase in women's active digital use after their introduction.



Lack of women's digital inclusion has economic implications within the value chain. Men strategically leveraged digital tools at several points such as price checking, input procurement, weather forecasting, and mechanisation coordination, while women were limited to voice-based customer coordination and financial activities. Women also face barriers to both traditional and digital credit. In traditional lending from financial institutions, lack of collateral such as land and properties constrains access to loans. While in digital credit, lower digital participation and data footprints constrains access. Additionally, algorithmic biases, inability to complete electronic Know Your Customers (e-KYC) requirements and non-robust transactions are interpreted as lack of credit

worthiness, maintaining the financial weakness of women. More significantly, digital technologies were almost non-existent at the processing and post-harvest stages where women are most active, indicating both a market failure and gender discrimination in technology development. Women demonstrated remarkable innovation in adapting to these exclusions. For example, they purchased phones in instalments, participated in seller-operated sharing or lending schemes, and used community-run phone distribution systems. However, these adaptations do not constitute pathways to equality. However, a critical product gap remains: there are almost no digital solutions for processing and post-harvest nodes, where women are concentrated.

Perhaps the most disturbing finding of this study is the gendered implication of women's digital independence. The use of digital device provoked physical violence, theft and damage of device, psychological violence through accusations of infidelity and economic violence through deliberate deprivation of data and airtime. In one extreme case, as reported, a phone-related argument resulted in homicide. Digital violence was under-reported because digital media received public attention only for their benefits, not their risks, and women alone bore the costs of preventing digital violence through secretive phone use, erasure of call logs, and cash-only dealings. Women-only digital programmes, in which all staff (including supervisors and agents) are women, were the most effective at mitigating gender-based violence

risk, as they removed spousal suspicion from the digital access chain.

Conclusion and Recommendations for Development Cooperation

Digital inclusion is primarily a social and normative challenge, not a technological one. Current approaches that assume "access equals use", that digital credit is neutral, or that mixed-gender training works everywhere are contradicted by the evidence. Sustainable participation requires an enabling environment where structural and normative barriers are deliberately and gradually removed.

For programme design, development actors should:



Mandate female only delivery models in culturally restrictive contexts



Embed GBV safeguards from the outset



Prioritise voice-based & local-language solutions



Co-design digital tools for processing and post-harvest nodes with women end users



Explicitly include persons with disabilities through home based services and accessible materials.

For implementation, actors should:



Systematically engage men and community gatekeepers through sustained parallel sessions



Integrate household level dialogue and negotiation skills into training,



Scale up flexible access models (instalment schemes, device lending, digital champions)



provide repeated, hands-on, peer-led digital literacy training.

For monitoring and sustainability:

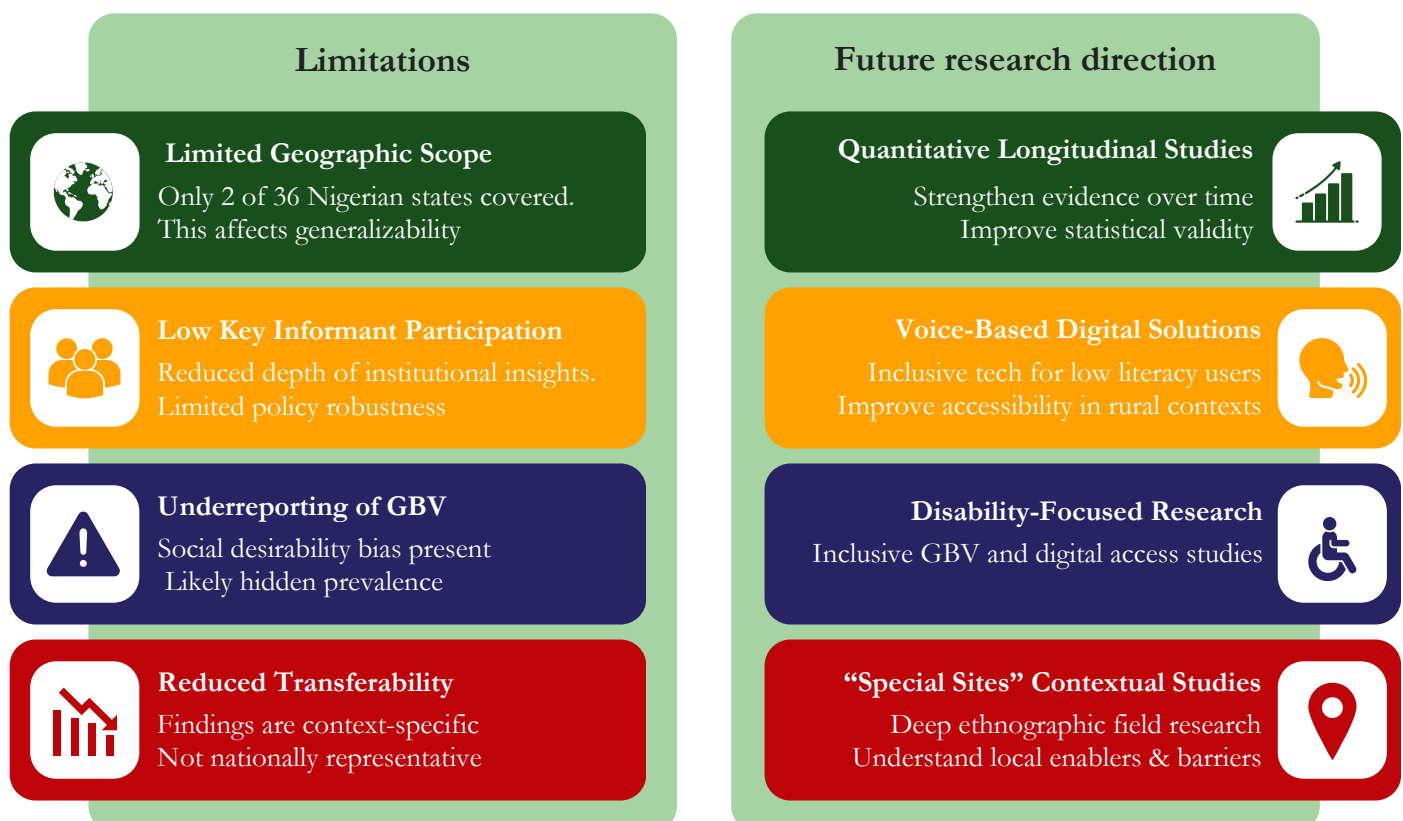


Limitations of the Study

The study used qualitative methods and had a limited

thirty-six States, thus affecting its generalizability and transferability. geographical scope, covering only two of Nigeria's

Research Limitations & Future Directions



Introduction

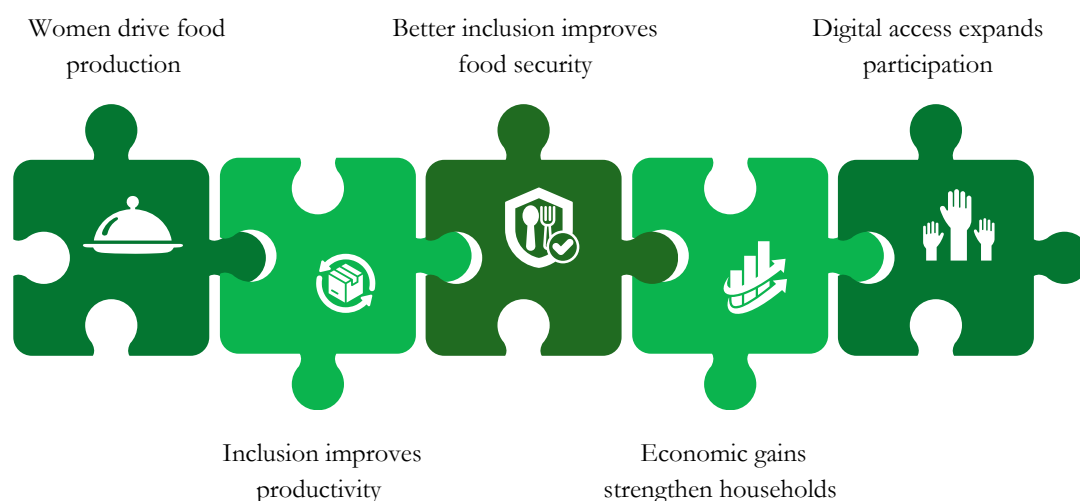
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1.1 Background

Women play a crucial role in agriculture and food systems, representing a substantial proportion of the labour force and contributing significantly to food production, processing, and marketing. Despite their critical role, women frequently face systemic barriers such as limited access to resources, essential services, education, and decision-making power. There are also peculiar contextual concerns that contribute integrally

to the barriers women face. Norms, as well as social conduct aligned with norms constitute material effects in the form of structural barriers. According to a study by the Food and Agriculture Organization (FAO) in 2024, closing the gender gap in agriculture and food systems not only improves women's well-being but also has a positive impact on food security, agricultural productivity, diets, and child nutrition.



For example, closing the gender gap in farm productivity, along with addressing the age disparities in agriculture and food systems, could increase global gross domestic product by at least 1 per cent - equivalent to approximately 970 billion euros. Such improvements have the potential to decrease the number of food insecure people by approximately 45 million.² An analysis by the FAO in 2024 of 68 countries' policy documents on agriculture and rural development reveals that while 75 percent acknowledge women's roles and challenges within these sectors, only 19 percent incorporate specific gender-related policy goals.³

This imbalance underscores the need for more robust and targeted policies that address gender-specific issues in the agriculture and food sector.

To address these issues, Germany's Feminist Development Policy⁴ and Third Gender Action Plan⁵ aim to eliminate discriminatory structural and systemic causes of gender inequality that prevent equal

participation of women and other marginalized groups in social, political, and economic life and strengthening their rights, resources and representation.

² FAO (2024): The status of women in agrifood systems, p. 20.

³ FAO (2024): The status of women in agrifood systems, p. 27.

⁴ BMZ (2023): Feminist Development Policy – For Just and Strong Societies Worldwide

⁵ Third Development Policy Action Plan on Gender Equality (2023–27)

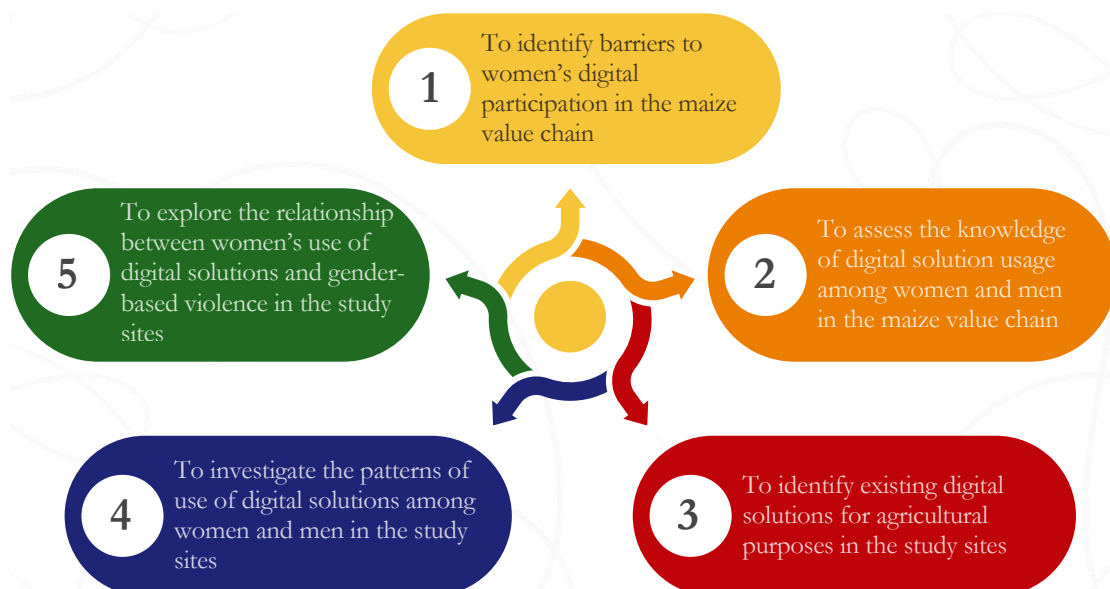


Rural Women Accessing Digital Solutions through Mobile Devices | © GIZ/Rossy Heriniaina

1.2 Goal and Objectives of the Study

The overarching goal of the study was to fill the knowledge gaps identified in previous research regarding barriers women face, which may be physical, infrastructural, psychological and sociocultural in the use of digital solutions⁶ for their agricultural enterprise. The study investigated issues of access and usage of

digital solutions among women and men in the study sites. An integral aspect of inquiry explored the relationship between access, usage and gender-based violence – an area not extensively examined in prior research. The specific study objectives were:



⁶ This study has defined digital solutions as including the following: weather apps, market platforms, digital extension services, mobile phones, tablets, laptops, desktop computers, GPS devices, smart watches, SMS, market price apps, WhatsApp/Facebook Groups for farmers, and Mobile Money/Banking for farming purposes, etc

The study revealed multifaceted barriers faced by women, including structural, infrastructural, socio-cultural, psychological and physical. The data collection instruments were designed to cover and capture a diversity of these barriers while maintaining an avenue for additional barriers to be documented. The study objectives provided the opportunity to explore barriers in maize value chain with depth and nuance, which ensured that power dynamics, women's agency and resilience was adequately captured and documented. The findings produced from the

objectives are integral to filling the contextual knowledge gaps of the subject matter, for policy analysis, implementation and targeted recommendations applicable to GIZ programs in Nigeria and beyond. The avenues for norms change are supported by data, thereby stimulating the design of gender transformative GIZ programs. This study has also illuminated an avenue for further research into impact evaluations and assessments of tools and solutions relevant to the study sites.

1.3 Research Questions and Hypotheses

This study is guided by the following research questions (RQs) and corresponding hypothesis (H), which provide a framework for analysing the barriers

and opportunities for rural women's digital participation in agriculture.

RQ1:	What are the perceived socio-cultural barriers that limit women's access to and use of digital solutions in the maize value chain in Kaduna and Ogun State?
H1:	Restrictive gender norms and male-dominated household power structures are the most significant perceived socio-cultural barriers limiting women's digital participation in the maize value chain in Kaduna and Ogun States.
RQ2:	What is the difference between women and men in their knowledge of the specific functionalities of digital solutions relevant to the maize value chain in Kaduna and Ogun States?
H2:	Men in the maize value chain in Kaduna and Ogun States will demonstrate significantly higher knowledge of the specific functionalities of digital solutions than women.
RQ3:	What digital solutions for agriculture exist in the study sites, and how accessible are they to women in the maize value chain?
H3:	There are existing digital solutions for agricultural purposes in the study sites that are accessible to women in the maize value chain.
RQ4:	How does the use of digital solutions in the maize value chain differ by gender in Kaduna and Ogun State?
H4:	There is a significant gender divergence in the application of digital solutions. Women predominantly use them for communication and mobile money functions in the marketing and sales stages, whereas men use them for a wider range of activities, including accessing credit, farming information, and input procurement across various stages of the maize value chain.

- RQ5:** How does a woman's independent ownership and use of digital solutions for agricultural activities correlate with her experience of gender-based violence from intimate partner, family members or relatives in Kaduna and Ogun State?
- H5:** A woman's independent ownership and use of digital solutions will correlate with a higher likelihood of experiencing psychological and controlling behaviour from intimate partner family members or relatives.

1.4 Scope of Work

The scope of work for this study entailed a comprehensive, mixed-methods investigation (desk review and qualitative study) into the barriers and opportunities for rural women's digital participation in Nigeria's agriculture and food systems. The research was conducted in two distinct States – Kaduna in the north and Ogun in the south – to ensure geographical and socio-cultural diversity (Figure 1).

The study was executed in two sequential phases. The inception phase involved a thorough desk review of existing literature and policies to generate preliminary insights that informed and finalized the study protocol and data collection tools. This was followed by the data collection phase (listing of MVC actors and main data collection), which employed a participatory approach to ensure the inclusion of diverse voices. Other key activities included (a) development of

survey tools, (b) conducting 60 in-depth interviews (IDIs) with women and 40 IDIs with men smallholder farmers and agripreneurs, 4 focus group discussions (FGDs) with community members and local authorities, and 15 key informant interviews (KIIs) with relevant stakeholders such as non-governmental organisations (NGOs) and digital solution providers

The study specifically analysed knowledge and usage patterns of digital solutions, psychological and socio-cultural barriers – including household power dynamics and digital self-efficacy and explored the relationship between women's use of digital solutions and gender-based violence in the study sites. An intersectional lens was applied throughout to understand how factors such as age, education, and marital status compound digital exclusion.

Figure 1: Map of Nigeria Showing the Two Study States of Kaduna and Ogun

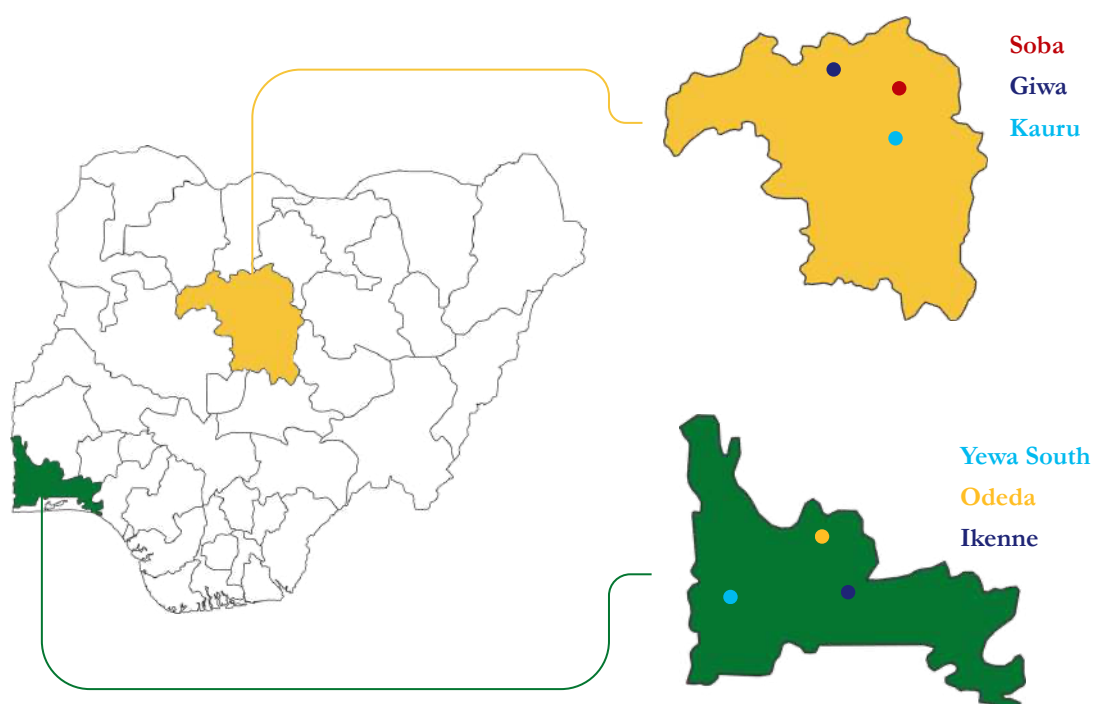


Table 1 complements **Figure 1** by highlighting key socio-cultural characteristics that define the diversity within and between the two States.

Table 1: Socio-Cultural Profile of Kaduna and Ogun States

Socio-Cultural Characteristics	Kaduna State	Ogun State
• Geopolitical Zone	• North-West	• South-West
• Primary Livelihood	• Agriculture (grains, maize, cotton), Livestock rearing, Trade	• Agriculture (cash crops: cocoa, kolanut; maize, staples: cassava), Commerce, Manufacturing
• Major Ethnic Groups	• Hausa, Fulani, Gbagyi, Atyap (Kataf), Bajju, Jaba, Kgoro	• Yoruba (Sub-groups: Egba, Ijebu, Remo, Awori, Yewa)
• Dominant Religion	• Predominantly Islam (North), Christianity & Traditional Religions (South)	• Predominantly Christianity, with significant Islam and Traditional religions
• Common Language Spoken	• Hausa Language	• Yoruba Language
• Senatorial Districts	• Kaduna Central, Kaduna North and Kaduna South	• Ogun central, Ogun East and Ogun West
• Major Urban Centers	• Kaduna (capital), Zaria, Kafanchan	• Abeokuta (capital), Sagamu, Ijebu-Ode, Ilaro

Kaduna State is a top maize-producing State, topping the charts as the highest maize producing State in 2019. Ogun State similarly produces significantly more maize than eleven states out of the 36 states and the Federal Capital Territory (FCT).⁷ Maize is a widely cultivated crop that has been adapted and grown significantly in most regions. It is a staple crop that is invaluable for food security and economic welfare of

both producers and consumers. It is particularly important to focus on maize because, despite women and youth producing 80% of maize for household consumption and local sales, men often reap more economic benefits.⁸ It is also documented that women faced constraints in decision-making regarding the use and maximization of benefits from Improved Maize Varieties, and other agency issues

⁷ PWC (2021) Positioning Nigeria as Africa's leader in maize production for AfCFTA. Marechera G, Sedi M, Adebayo MA, et al. (2022) Assessment of Existing Gaps among Genders in Maize Value-Chain in Northern Nigeria. Int J Agriculture Technology 2(1): 1-10.
National Agricultural Extension and Research Liaison Services Federal Ministry of Agriculture and Rural Development (NAERLS) (2019). Wet Season Agricultural Performance in Nigeria. www.naerls.gov.ng

⁸ Marechera G, Sedi M, Adebayo MA, et al. (2022) Assessment of Existing Gaps among Genders in Maize Value-Chain in Northern Nigeria. Int J Agriculture Technology 2(1): 1-10.

such as social norms around mobility.⁹ Research highlighting pathways for women to boost their economic gains from farming maize is therefore key.

Women also participate significantly in the maize value chain in Southwest and Northern Nigeria, producing food, snack, and animal feed, and their participation has been noted as an avenue to improve their socio-economic status with agricultural extension interventions.¹⁰ There are various digital solutions, such as Akilimo, Stepwise, and Verdant Agritech, used in the maize value chains that support farmers with crop advisory and management, disease monitoring,

market access, and value chain coordination. Digital solutions can be applicable to other value chains when they offer an essential service such as weather forecasting, financing and market access useful for farmers who cultivate other crops

The detailed scope of work is contained in the Terms of Reference (ToR) (**Annex 1**). However, the study objectives were revised to fill the knowledge gaps identified in previous studies regarding the gender digital divide within the agriculture and food sector in rural Nigeria.



Women Trading Agricultural Produce at a Local Market | © GIZ/Shilpi Saxena

⁹ Farnworth, C. R., Badstue, L., Williams, G. J., Tegbaru, A., & Gaya, H. I. M. (2020). Unequal partners: associations between power, agency and benefits among women and men maize farmers in Nigeria. *Gender, Technology and Development*, 24(3), 271–296. <https://doi.org/10.1080/09718524.2020.1794607>

¹⁰ Awoyemi, Adeseye & Adesiji, Gbolagade & Omotesho, K.F. (2023). Rural Women Farmers' Participation in Maize Value Chain and Socio-Economic Empowerment in South-West Nigeria. *Jambura Agribusiness Journal*. 5. 43-55. 10.37046/jaj.v5i1.21880.

LITERATURE AND POLICY REVIEW

2



2.1 Overview of the Agricultural Ecosystem in Nigeria

The agricultural sector in Nigeria has always played an important role in contributing to the well-being of the nation by way of food production and a source of economic sustainability for many who participate diversely as producers, processors of food and retailers. Although it has often occupied a secondary role as the pillar of the Nigerian economy, with oil being the first, attention has continued to shift towards stimulating the sector for several reasons. One of the motives for the deliberate investment in agriculture is the urgent need for diversification of the Nigerian economy, particularly with concerns about the finite nature of oil as well as the continued demand for it amidst impressive technological innovations.¹¹

Nigerian agricultural ecosystem provides significant opportunity for economic and social transformation, considering that about 70.8 million hectares of land are available for cultivation of various major crops like maize, cassava, guinea corn, yam beans, millet and rice. The agricultural sector accounted for 24.94% of the Gross Domestic Product (GDP) in 2021, a proof of its capacity and potential to deliver robust gains to the country's economy despite the many challenges it faces.¹² Agriculture is a very common venture among the Nigerian populace, it is therefore straightforward to infer the possibilities that a thriving system could deliver for individuals, households and the wider society.



The Nigerian General Household Survey reports that approximately seven out of 10 households participated in crop farming activities, with male headed households more likely than female-headed households. Livestock farming is also a very functional aspect of agriculture in Nigeria, accounting for 48% of households involved in it. Poultry is the most owned livestock among female-headed households

aspect of agriculture in Nigeria, accounting for 48% of households involved in it. Poultry is the most owned livestock among female-headed households while goat, sheep and pigs are associated more with male-headed households.

Cassava and Maize are the most popular crops cultivated, with cassava cultivation more prevalent

11 Mayowa Saheed Sanusi, Odewole Michael Mayokun, Musliu Olushola Sunmonu, Suleiman Yerima, Dare Mobolaji & Joshua Olanrewaju Olaoye (2025) Transformative trends: commercial platforms revolutionizing rice farming in Nigeria's agricultural value chain, International Journal of Agricultural Sustainability, 23:1, 2473757, DOI:10.1080/14735903.2025.2473757

12 [12] Doris, D. S. (2023). Contribution of agriculture to GDP in Nigeria 2019-2021. Statista. Retrieved September 23, 2024: from <https://www.statista.com/statistics/1193506/contribution-of-agriculture-to-gdp-in-nigeria/>

among female-headed households.¹³

The agricultural sector boasts of diverse value-chains, and the agri-food sector is particularly instrumental in creating a robust eco-system of smallholder farmers, processors, traders, input suppliers, and consumers, both within the domestic economy and across international markets. The value chains of staple commodities like maize, rice cassava, cocoa, poultry, yam etc. are very active and continually evolving. There is a shift from simpler processes of bringing produce from farm to table to more complex ways of leveraging technology and innovation to stimulate local and international market-oriented outputs.¹⁴

The system is characterized by changes and evolution

occurring concurrently, but also by the metamorphosis of long-standing challenges. Low literacy reappears as low digital literacy, evident in difficulties navigating text-heavy apps or verification steps. Limited land ownership becomes exclusion from credits that rely on land records. Restrictive gender norms evolve into constraints on smartphone ownership and use, often enforced through male household control of devices¹⁵, ensuring that the growth in scale, sophistication and adaptiveness is experienced differently by women and men. Ultimately, the experiences of women and men within this changing landscape are amplified based on the intersecting factors of their lives and identities within the social context in which they live.

2.2 The Status of Women in Agrifood Systems in Nigeria

2.2.1 Gender Dimension of Structural Challenges in Agri-food Systems

Women form a very important part of the Nigerian agri-food system; however, their involvement is limited by structural inequalities that curtail their overall contribution in the economy. Several studies emphasize that as women inject a lot of labour into farming, processing, and marketing activities, they are often faced with systemic barriers that restrict access to resources and opportunities, resulting in low productivity and income. As noted by Food and Agriculture Organization, agri-food systems are a significantly larger source of livelihood among women as compared to men in the sub-Saharan African region. This dependence is further heightened in Nigeria by the significant number of women concentrated in smallholder production and informal processing, which are not given much value in

agricultural policy and budgetary frameworks.¹⁶

Empirically, it is proven that women smallholder farmers produce an average of 30% less than males per hectare, and the main factors that contribute to this productivity gap are the lack of input supply, the absence of extension services, and the production of low-value crops¹⁷.

Furthermore, it has been discovered that, despite the significant participation of women in the food value chains, women are better represented in the processing and marketing nodes which are less profitable and have limited access to technology. With the movement of food commodities between farm and market, women's share of the income tends to reduce because they have poor bargaining power and limited mobility.¹⁸

13 Nigerian Bureau of Statistics (n.d) Nigeria General Household Survey-Panel (Wave 5) 2023/2024 Tracking Nigerian Households to Understand Their Resilience Over Time.

14 Sanusi et. al. (2025)

15 FAO. (2023). The status of women in agrifood systems. <https://doi.org/10.4060/cc5343en>

16 FAO. (2023). The status of women in agrifood systems. <https://doi.org/10.4060/cc5343en>

17 World Bank. (n.d.). Gender gaps in agriculture productivity and public spending in Nigeria. Nigeria Gender Innovation Lab. <https://documents1.worldbank.org/curated/en/099091823113036874/pdf/P175095086510b001080e30d147463456d6.pdf>

18 Ejike, R. D., Osuji, E. E., Effiong, J. A. I., & Agu, C. G. (2018). Gender dimension in agricultural food value chain development in Nigeria: The women perspective. *International Journal of Agriculture and Earth Science*, 4(3),

The other aspect of structural inequality is the accessibility of resources vital for production including land and financial services like loans, due to many women's weak credit worthiness. Evidence obtained from Oyo and Benue States, show that there are severe disparities in land ownership: 19.8% of women and 49.6% of men owned the land respectively.

Similarly, only a small share of women (16.1%) obtained credit, compared to nearly half of men. These disparities are aggravated by lack of pay, and cultural practices that confine women to domestic and low wage agricultural work, where they do not have decision-making power over income¹⁹.



Farmers Planting Maize in a Farm | © GIZ/Rossy Heriniaina

¹⁹ Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (n.d.). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States.

The effects of these systemic constraints have a wider impact on household revenues since they are useful for predictions of food security. For instance, gendered limitation in the smallholder farming structures negatively impact on food security in the households in Osun State. While the potential resides with women to make significant contributions in food production, issues of resource ownership, training, and access to opportunities restricts them, thereby limiting the consolidation of these efforts. Consequently, food security at the household level is weakened, proving that gender inequality is hardly a women's issue exclusively, but rather a systemic agricultural one that has health and human development implications.²⁰

Policy-making in agri-food sector shows clear gaps: inefficient processes foster structural inequalities and entrench gender-based disadvantages. Women are underrepresented in governance and decision-making structures, and their perspectives are insufficiently reflected in policy formulation and implementation. As a result, policies and budgets do not adequately address women's key concerns — particularly land rights, agricultural extension, and access to finance.

The “Women Empowerment in Agri-food Governance (WEAGov)” instrument piloted in Nigeria highlights concrete entry points for increasing women's policy influence and control²¹ The WEAGov is an important addition to interventions aimed at women's participation in agriculture because it evaluates the extent of women's empowerment across the policy cycle in agri-food systems. Based on the pilot results, key entry points include increasing women's influence, incorporating binding participation mechanisms, institutionalizing consultations, and strengthening capacity-building formats. However, these levers are not yet systematically applied, perpetuating a cycle of disadvantage. Studies²² indicate that the position of women in the agri-food systems in Nigeria is mainly determined by

structural disparities that revolve around access to resources, neglect around acknowledging women's contributions, and policy making inclusion.

Even though women maintain a significant amount of agricultural labour, their efforts are not institutionally recognized, under-appreciated, uncompensated which continues to foster disparities of inequality that limits productivity and food security of households.²³

Although there is substantial evidence of structural challenges faced by women, this research provides an opportunity to examine the intersection of these identified factors with the digital participation of women. A case in point would be the influence of digital solutions on women's participation in the processing and marketing nodes which are considered less profitable. Another area of focus is how digital solutions can close the gaps in access to resources, financial services and skills that women have been identified as lacking. More broadly, the availability of evidence that points to digital solutions being used to stimulate women's resilience amplifies the need for more decisive action through governance to increase digital participation of women.

2.2.1 Gender Gaps in Food Systems in Nigeria

Gender gaps in the food systems in Nigeria are best highlighted by differences in the fields of education, income, land ownership and access to technology. As indicated, women make up a high proportion of the agricultural workers, but their working conditions are often determined by the imbalance in bargaining power in the family and within communities. As such, disproportionate allocation of resources results in lopsided productivity and earning disparities²⁴

Quantitative evidence from the cassava value chain highlights pronounced gaps: 39.5% of female-headed households had no formal education, compared to

20 Atere, H. A. (2023). Gender contribution to rural household food security: An investigation of the role of women in smallholder farming systems in Osun State, Nigeria (Master's thesis, Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences)

21 Ragasa, C., Kyle, J., Onoja, A. O., Achike, A. I., Adejoh, S. O., Onyenekwe, C. S., Koledoye, G. F., Ujor, G. C., & Nwali, P. N. (2023). Women's empowerment in agrifood governance (WEAGov) assessment framework: A pilot study in Nigeria. IFPRI Discussion Paper No. 02222.

22 FAO (n15); World Bank (n16)

23 Ejike R.D., Osuji, E.E., Effiong, J. A. L. and Agu, C. G. (2018). Gender Dimension in Agricultural Food Value Chain Development in Nigeria: The Women Perspective. *International Journal of Agriculture and Earth Science* Vol. 4 No. 3, 37-45; Ajani, Olubunmi Idowu Yetunde, 'Gender dimensions of agriculture, poverty, nutrition, and food security in Nigeria', *International Food Policy Research Institute (IFPRI)*, Abuja, Nigeria, 2009; Ajadi, A.A., Oladele, O.I., Ikegami, K. et al. Rural women's farmers access to productive resources: the moderating effect of culture among Nupe and Yoruba in Nigeria. *Agric & Food Secur* 4, 26 (2015). <https://doi.org/10.1186/s40066-015-0048-y>

24 FAO. (2023). The status of women in agrifood systems. <https://doi.org/10.4060/cc5343en>

14.2% of male-headed households. Credit access was similarly unequal, with only 16.1% of women obtaining credit versus 48.7% of men. These disparities are reflected in incomes: 74% of female-headed households fell into the lowest income bracket. The findings underscore a clear linkage between educational disadvantage, constrained financial access, and widening income inequality within food systems.²⁵

Global evidence also implies that the productivity gaps can be associated with input utilization and crop selection. The World Bank discovered that the women in Nigeria produce crops of lesser quality and use less productive labour force, hence, increasing the productivity and income gap. The unequal distribution of budget allocation by gender also contributes to inequalities because the four value chains that were given the greatest budgetary allocations have the lowest participation of women, namely cotton, rice, sorghum and cocoa.²⁷

Other than inputs and resources, there are also gender disparities in the form of agricultural technology and information. There is claim that agriculture is extremely information-intensive, and low access to market and logistical information impedes productivity. Women farmers who are less likely to be absorbed by the extension systems are those affected disproportionately. Limited access to information impairs their capacity to exploit new productive opportunities in production or profitable market opportunities, which can widen the structural productivity gap.²⁸

There is marginalization of women in the high-value

nodes of food systems, which is also present in select commodities, indicating both a horizontal and vertical gap in the agricultural ecosystem. Women in Southwest Nigeria are widely involved in the maize value chain; however, they lack empowerment due to factors like the high cost of transportation, and poor level of extension services. Although the improvement of maize processing and marketing has enhanced the socio-economic empowerment scores, women's voice in decision-making is weak and they also face the constraints of structural inability to contribute to decision-making.²⁹

The same tendencies were observed in a dairy system in Zaria, Kaduna State, where women were restricted in their access to credit and technical knowledge, compounded by household workload responsibilities. These factors limit their participation in high value nodes, even though women acknowledged the beneficial effects of participation on their incomes and household food security³⁰.

Collectively, these results highlight that despite women's significant contributions to agriculture and food systems, persistent gender disparities in access to resources, technology and decision-making opportunities limit their benefits and confine them to less profitable sectors.

Women in Southwest Nigeria are widely involved in the maize value chain; however, they lack empowerment due to factors like the high cost of transportation, and poor level of extension services.

25 Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (n.d.). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States.

27 World Bank. (n.d.). Gender gaps in agriculture productivity and public spending in Nigeria. Nigeria Gender Innovation Lab. Ragasa, C., Kyle, J., Onoja, A. O., Achike, A. I., Adejoh, S. O., Onyenekwe, C. S., Koledoye, G. F., Ujor, G. C., & Nwali, P. N. (2023). Women's empowerment in agri-food governance (WEAGov) assessment framework: A pilot study in Nigeria. ITPRI Discussion Paper No. 02222.

28 Okediran, O. O. (2019). An e-agriculture framework for inclusive agricultural value chains in Nigeria. *Annals. Computer Science Series*, 17(2),

29 Awoyemi, A. O., Adesiji, G. B., & Omotesho, K. F. (2023). Rural women farmers' participation in maize value chain and socio-economic empowerment in South-West Nigeria. *Jambura Agribusiness Journal*, 5(1). Okediran, O. O. (2019). An e-agriculture framework for inclusive agricultural value chains in Nigeria. *Annals. Computer Science Series*, 17(2),

30 Lai-Solarin, W. I., Bamidele, J., Joel, O. J., Mohammed, A. U., Olaitan, M. A., Joel, A. F., & Sennuga, S. O. (2024). Factors limiting rural women participation in dairy value chain activities in Zaria Local Government, Kaduna State, Nigeria. *International Journal of Environmental & Agriculture Research*, 10(9).

2.3 Socio-Cultural Factors and Gender Equality in Food Systems

The socio-cultural determinants such as education, societal norms, religion and traditions are extremely influential determinants affecting the participation of women in agrifood systems in Nigeria. Several studies document that discriminatory social norms in agrifood systems constrain women's bargaining power and concentrate them in informal, labour-intensive and lower-paid roles. Limited access to education, extension and technology further restricts women's capacity to adopt innovations and to participate in decision-making at household, community and market levels.

The nature of norms is such that they constrain and facilitate the behaviour of a set of people, such as women as a group, fitting them into "social positions and relations that are typified by particular expectations, rules and procedures."³¹ Norms therefore shape the behaviour of a group and of individuals within and outside the group, becoming legitimized as material expressions in structures and systems. The diffusive power of norms means they permeate and are reinforced across domains, both privately and publicly.³² This study considers norms as ideals, values and beliefs that create concrete and material conditions where women are treated differently and experience different outcomes. Differences in treatment produce exclusion, barriers, and denial of services integral for capability and productivity.

Evidence shows that restrictive gender norms and

unpaid care work limit women's mobility and confine them to lower-margin processing activities, rather than higher-return farming or trading.³³ As products move along the value chain, women tend to lose income and influence, largely due to constrained market access and comparatively lower mobility.³⁴

These constraints are socially reinforced by gendered expectations that assign women domestic roles, reducing the time and opportunities available to participate in broader agri-food systems. Education interacts with these norms: higher educational attainment is associated with greater participation by women in value-chain activities (e.g., dairy), indicating that education can help mitigate cultural and structural barriers.³⁷

Nevertheless, because the level of education among women in many rural communities is lower than among men, opportunities for participation and empowerment remain scarce.

Religion and tradition also shape women's involvement in agri-food systems. In many rural areas, the patriarchal customs determine land ownership, inheritance rights, and authority. Women owned very little land, and a persistent cultural norm gives men greater control over productive resources³⁸. This social exclusion is strengthened by traditional practices that deprive women of the right to inheritance or require male permission to use land.

31 Staveren, Irene van, and Olasunbo Odebode. (2007). "Gender Norms as Asymmetric Institutions: A Case Study of Yoruba Women in Nigeria." *Journal of Economic Issues* 41:903–925.

32 Ibid.

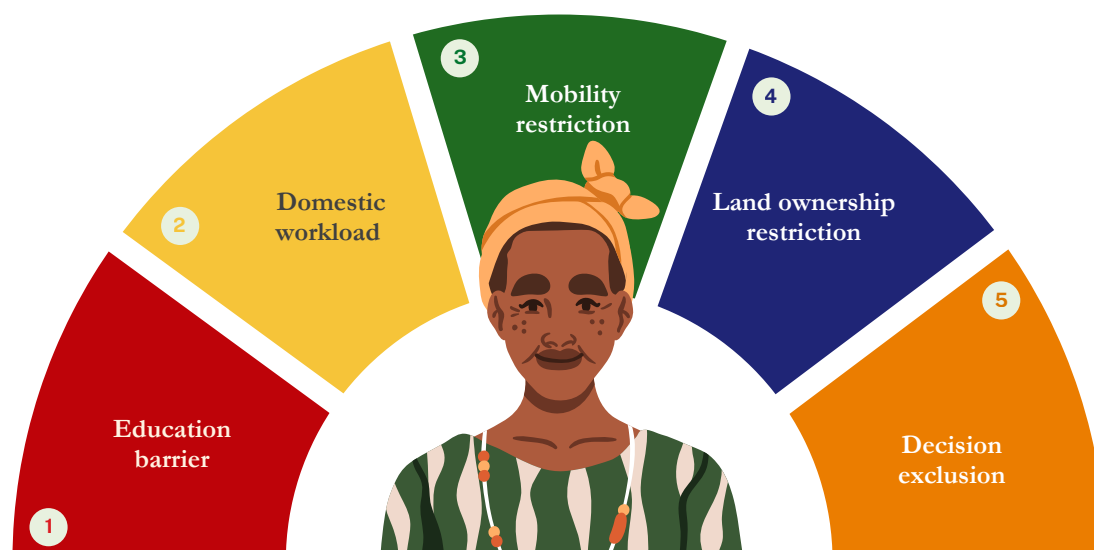
33 Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (n.d.). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States.

34 Ejike (no 23) 17

37 Lai-Solarin, W. I., Bamidele, J., Joel, O. J., Mohammed, A. U., Olaitan, M. A., Joel, A. F., & Sennuga, S. O. (2024). Factors limiting rural women participation in dairy value chain activities in Zaria Local Government, Kaduna State, Nigeria. *International Journal of Environmental & Agriculture Research*, 10(9).

38 Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (n.d.). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States. <https://papers.ssrn.com/sol3/Delivery.cfm/5414938.pdf?abstractid=5414938&mirid=1&type=2>

Barriers Rural Women are Facing



Time-use analyses consistently identify household and care responsibilities as a major constraint on women's economic and digital participation. In rural Nigeria, traditional gender roles, limited access to education and training, and inadequate infrastructure contribute to unequal access to digital technologies for women. These dynamics link socio-cultural norms with structural and digital inequalities, illustrating how women's roles restrict their ability to access and benefit from new agricultural equipment, services, and digital platforms. Although these challenges exist, other studies present spheres of resilience and adaptation. It has been established that cultural norms in Osun State had both negative and positive correlations with food security outputs, and the role of women in smallholder systems in this State is not insignificant despite the limitations. Women play a critical role in ensuring household food security, exercising agency even within constraining socio-cultural contexts. However, prevailing norms overall perpetuate unequal access to resources, limited

market participation, and reduced decision-making power. For example, women are typically excluded from community-level land allocation processes, which directly shapes their cultivation opportunities and yields. Likewise, the distribution of key inputs such as seedlings and herbicides is often controlled by men, with women rarely involved in allocation decisions — resulting in systematic disadvantages for female producers.⁴⁰

As it is seen in the literature, women in Nigeria cannot be overlooked in agri-food systems, but they operate within a highly unequal context filled with gender disparities and socio-cultural practices. Women suffer due to structural issues such as unequal access to land, inequality in access to credit, and lack of access to extension services, these reduce their productivity and income potential^{41 42} The socio-cultural component reinforces these barriers and confine women to poorly remunerated work,

40 Aniche, A., McKee, K., & Bruce, J. (2025). Effect of Cultural Norms and Traditional Beliefs on the Lived Experiences of Women in Agriculture in Rural Communities. *Journal of International Agricultural and Extension Education*, 32(3), 388-405. DOI: <https://doi.org/10.4148/2831-5960.145610>

41 Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (n.d.). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States

42 Aniche, A., McKee, K., & Bruce, J. (2025). Effect of Cultural Norms and Traditional Beliefs on the Lived Experiences of Women in Agriculture in Rural Communities. *Journal of International Agricultural and Extension Education*, 32(3), 388-405. DOI: <https://doi.org/10.4148/2831-5960.145610>

restricted mobility, and limited access to education^{43 44}. As a result, there is an entrenched gender gap leading to women being undermined in food systems, as well as limiting agricultural productivity and national food security^{45 46}.

Research has converged around the necessity to do structural reforms; especially in land ownership, accessibility to credit and gender-sensitive extension

services and to change socio-cultural norms through education and inclusive policies. As noted in Osun State, this study offers contextual knowledge about the resilience of women in the study sites.

Documenting resilience is empowering; it also gives clarity on the angles that projects and initiatives can focus on to strengthen women's inclusivity in agri-food systems.

2.4 Gender Digital Divide in Nigeria Agricultural Value Chains

2.4.1 The Mobile Gender Gap

The most apparent aspect of gender digital divide in the agricultural value chain in Nigeria is the unequal access of men and women to mobile technologies and internet access. Digital solutions have proven vital for improving agriculture, bringing farmers closer to markets, financial services, and vital extension information. Nonetheless, most Nigerian smallholder women farmers continue to face fundamental issues

in the adoption and use of these technologies, creating an ongoing mobile gender gap.

Globally, women are 14% less likely to use mobile internet than men, with sub-Saharan Africa registering one of the largest gender disparities of 29%⁴⁷. Such inequalities are evident in Nigeria, where women use technological services less due to affordability, lower education and literacy rates, safety and security factors and prevailing social norms.

43 Ejike, R. D., Osuji, E. E., Effiong, J. A. L., & Agu, C. G. (2018). Gender dimension in agricultural food value chain development in Nigeria: The women perspective. *International Journal of Agriculture and Earth Science*, 4(3),

44 Lai-Solarin, W. I., Bamidele, J., Joel, O. J., Mohammed, A. U., Olaitan, M. A., Joel, A. F., & Sennuga, S. O. (2024). Factors limiting rural women participation in dairy value chain activities in Zaria Local Government, Kaduna State, Nigeria. *International Journal of Environmental & Agriculture Research*, 10(9).

45 FAO. (2023). The status of women in agrifood systems.

46 Atere, H. A. (2023). Gender contribution to rural household food security: An investigation of the role of women in smallholder farming systems in Osun State, Nigeria (Master's thesis, Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences)

47 GSMA. (2025). The mobile gender gap report 2025. <https://www.gsma.com>

Although women understand the importance of mobile internet, they are less inclined towards using and adopting it vigorously because of limited financial resources and weak digital literacy skills. The consequence of this gap is immense for agricultural value chains, since mobile internet is the foundation of numerous digital agricultural services and platforms.

A study by Uneze and others found how digitalization in the rice value chain in Anambra State was enabled largely using primitive mobile applications, including SMS and calls.⁴⁸ However, women were constrained in their use of more advanced digital services that demanded higher digital literacy. This is especially true when financial constraint and infrastructural deficits further limit women's engagement with digital platforms.⁴⁹ As a result, women farmers are more prone to remain restricted to simple phone use and missing out on the wider benefits of the mobile internet like financial inclusion, online markets and climate information services.

The Gender Mobile Gap Report documents the declining number of women using internet-enabled phones, including smartphones. More facts were offered regarding the challenges female users face in incorporating mobile-based agricultural systems. For example, a review of the KasuwaGo mobile application found that female adoption and usage of the application were significantly lower than male even though the application has the potential to improve market participation.

Women were willing to pay modest subscription fee but had fewer opportunities to use smartphones and lacked digital literacy for widespread uptake. Interestingly, when women were exposed to youth-led Information and Communication Technology (ICT) support agents, women's involvement improved, indicating that targeted interventions can bridge the gender mobile gap.⁵⁰

The impact of the mobile gender gap is far reaching in agricultural value chains. Agriculture is an information-intensive industry, and without timely access to information on the market, weather, and logistics, women are disadvantaged in decision-making and income generation⁵¹. Limited digital connectivity impacts their propensity for innovations that could boost productivity and profitability. This undermines women's capacity, productivity and the overall inclusiveness of agricultural systems.

While this study does not delve into gender gaps in usage of specific tools, it revealed the current rates of digital solution usage in the study contexts. Preliminary information on specific tools was also gathered, informing future research on usage patterns and the identification of constraints, leading to innovations and interventions that target those concerns.

2.4.2 Gender Inequality in Agricultural Technology

In addition to the mobile access, the digital divide between the genders becomes further entrenched by poor access by women to agricultural technologies. These include digital extension, mobile financial-inclusion applications, e-commerce and digitalized input-delivery technologies. Empirical studies conducted across Nigeria show that there is a trend in which women are underrepresented in the utilization of modern agricultural technologies, mainly due to structural, economic, and cultural issues.

Although women make up more than half of the agricultural labour force in Nigeria, they are deprived of access to critical technological opportunities. Barriers such as land rights, credit access and lack of training on digital solutions have been documented⁵². These factors contribute to women not having full access to ICT-enabled extension services, mobile

48 Uneze, C. U., Egor, H. I., & Otaokpukpu, N. J. 2024. Digitization in agricultural cooperatives: A perspective from members in rice value chain of Anambra State, Nigeria. *Journal of Agribusiness and Rural Development*, 71(1), 93–101. <https://doi.org/10.17306/JJARD.2024.01800>

49 Sufian, F., Nico, G., & Azzarri, C. 2023. September. Examining the gender digital divide: A case study from rural Nigeria. GCAN Policy Note No. 16. Gender, Climate Change, and Nutrition Integration Initiative. <https://www.feedthefuture.gov>

50 Toyin B, Ajibade, 2024. "Enhancing Women Participation in Virtual Marketing in Nigeria: Evidence from "KasuwaGo" Mobile App ICT Support Services Agent Programme in Legume marketing," IAAE 2024 Conference, August 2-7, 2024, New Delhi, India 344400, International Association of Agricultural Economists (IAAE).

51 Okediran, O. O. (2019). An e-agriculture framework for inclusive agricultural value chains in Nigeria. *Annals. Computer Science Series*, 17(2)

52 Dennis, A., Akpoilih, O. A., Emekumeh, S. O., & Nwankwo, W. (2024). Empowering women in Nigeria's agricultural sector through digital technologies and economic innovation: Challenges and policy directions. *Delta Journal of Computing, Communications & Media Technologies*, 1, 58–75.

microfinance systems, and value chains platforms.

The Capability Approach, coupled with the Gender and Development theory, indicates that mere provision or availability of agricultural technologies does not guarantee access. To foster equitable access for women, structural conditions must be adapted so that availability can deliver the dividends of successful technology utilization. This idea informs the Feminist Agri-food Systems Theory, where gendered power dynamics and the intersectional identities of women are used to study food systems for a more succinct understanding of the patterns of constraints they face.

This argument is supported by the evidence provided by certain value chains. A study on the maize value chain revealed that women's empowerment remains poor despite high involvement in processing and marketing activities,⁵³ implying that failure to use modern technologies for storage, processing, and transport curtails their income-generation potential. The same is true for the dairy value chain in Zaria, where women are disadvantaged due to technical-knowledge deficits. Their inability to access innovations that could increase efficiency in production and marketing keeps them at a disadvantage.⁵⁴ The fact that these barriers remain depict how the digital divide transcends connectivity and extends to technical training, financial ability, and institutional backing.

While ICT has been researched as a solution to gaps in

agricultural value chain, women continue to harness the least from its potential. In Imo State, women farmers were found to be over-dependent on radio and mobile resources for agricultural information but had limited access to more advanced ICT devices, which prevented them from participating in higher value nodes of the chain⁵⁵. In the same vein, digitalization has been documented as a measure to enhance market-farmer connections by minimizing the input of middlemen. Edging out women is not the challenge in itself; the real challenge lies in their capability to transition into more sustainable and profitable roles. This problem is amplified by poor technical skills and expensive digital services which women cannot access easily.⁵⁶

Sanusi and others highlighted how digital platforms have been transformative in the Nigerian rice industry and documented how processors, Agric-Tech apps, and marketers interlink through e-commerce⁵⁷. Nevertheless, uptake by women was slower because of a two-fold problem: lack of digital literacy and low internet penetration in rural communities. This gap aligns with the FAO's observation⁵⁸, of women facing a triple divide: digital, rural and gender, where cultural and economic restrictiveness meets geographic limitations. Thus, the exclusion of women is not only technological but also structural, rooted in several overlapping inequalities.

Digital divide also has connections with socio-cultural backgrounds. In a multi-country study, it was

- 53 Awoyemi, A. O., Adesiji, G. B., & Omotesho, K. F. (2023). Rural women farmers' participation in maize value chain and socio-economic empowerment in South-West Nigeria. *Jambura Agribusiness Journal*, 5(1).
- 54 Lai-Solarin, W. I., Bamidele, J., Joel, O. J., Mohammed, A. U., Olaitan, M. A., Joel, A. F., & Sennuga, S. O. (2024). Factors limiting rural women participation in dairy value chain activities in Zaria Local Government, Kaduna State, Nigeria. *International Journal of Environmental & Agriculture Research*, 10(9).
- 55 Nwamaka, Atoma Charity Dr; Agu, Onoh Peter Dr; and Emily, Emerhirhi Abibetu Mrs, "Information and Communication Technology Roles in Agricultural Value Chain Promotion Among Peri-Urban Women Farmers in Imo State, Nigeria" (2018). *Library Philosophy and Practice* (e-journal). 2061. <http://digitalcommons.unl.edu/libphilprac/2061>
- 56 Uneze, C. U., Egor, H. I., & Otaokpukpu, N. J. 2024. Digitilization in agricultural cooperatives: A perspective from members in rice value chain of Anambra State, Nigeria. *Journal of Agribusiness and Rural Development*, 71(1), 93–101. <https://doi.org/10.17306/J.JARD.2024.01800>
- 57 Sanusi, M. S., Odewole, M. M., Sunmonu, M. O., Yerima, S., Mobolaji, D., & Olaoye, J. O. (2025). Transformative trends: Commercial platforms revolutionizing rice farming in Nigeria's agricultural value chain. *International Journal of Agricultural Sustainability*, 23(1), Article 2473757. <https://doi.org/10.1080/14735903.2025.2473757>
- 58 FAO. (2018). Gender and ICTs: Mainstreaming gender in the use of information and communication technologies (ICTs) for agriculture and rural development (S. Treinen & A. Van der Elstraeten). FAO.

discovered that the influence of cultural norms and education regarding empowerment of participation in value chains with the help of technology exists⁵⁹. This may be true for Nigeria, specifically in rural areas, such that the introduction of technologies alone to empower nations is possible only in cases where structural and cultural obstacles are mitigated. For instance, in many rural parts of Nigeria, women who are not well educated i.e., those who have not gone through formal education are less likely to embrace the use of digital solutions even where they exist.⁶⁰ It is pertinent to note that access to education is not guaranteed merely by availability of education and training facilities. In these rural contexts, girls grow up to become uneducated women because it is culturally embedded to dismiss and even overtly oppose the education of women and girls.⁶¹

The importance of bridging the digital divide is enhanced by a growing amount of literature. As shown digital technologies can improve the attention of smallholder farmers in sub-Saharan Africa to the market, productivity, and income, which can be transformative in case of the removal of challenges like connectivity and literacy⁶². In Nigeria, where farming people are predominantly women who are

not provided with an equal opportunity to adopt advanced digital technologies, bridging such gaps is a way to implement gender equality, as well as enhance agricultural growth.

There is robust evidence that the agricultural value chains of Nigeria are profoundly influenced by the gender digital divide, from the mobile gender gap to women's limited exposure to agricultural technologies. Women are less inclined to own smartphones, less apt to utilize the mobile internet, and less capable of utilizing advanced digital instruments to produce, process, or market^{63,64}.

These gaps have been reinforced by structural inequalities such as land rights and credit deficiency,⁶⁵ cultural norms restricting women's mobility and decision-making^{66,67} and infrastructural deficiencies in rural areas^{68,69}.

Meanwhile, there are also promising opportunities of focusing on interventions to reduce the gap. The bridging may be done using initiatives, such as ICT-support agents⁷⁰, gender-sensitive extension services⁷¹ and digital literacy programmes⁷². Nevertheless, if

- 59 Quisumbing, A., Heckert, J., Faas, S., Ramani, G., Raghunathan, K., Malapit, H., & The pro-WEAI for Market Inclusion Study Team. (2021). Women's empowerment and gender equality in agricultural value chains: Evidence from four countries in Asia and Africa. *Food Security*, 13(6), 1101–1124. <https://doi.org/10.1007/s12571-021-01193-5>
- 60 Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (n.d.). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States. <https://papers.ssrn.com/sol3/Delivery.cfm/5414938.pdf?abstractid=5414938&mirid=1&type=2>
- 61 UNICEF (2022) Education Opportunities for Girls in Nigeria. UNICEF Nigeria.
- 62 Choruma, D. J., Dirvui, T. L., Mutenje, M. J., Mustafa, M., Chimonyo, V. G. P., Jacobs-Mata, I., & Mabhaudhi, T. (2024). Digitalisation in agriculture: A scoping review of technologies in practice, challenges, and opportunities for smallholder farmers in Sub-Saharan Africa. *Journal of Agriculture and Food Research*, 18, 101286. <https://doi.org/10.1016/j.jafr.2024.101286>
- 63 GSMA. (2025). The mobile gender gap report 2025. <https://www.gsma.com>
- 64 Dennis, A., Akpoiloh, O. A., Emekumeh, S. O., & Nwankwo, W. (2024). Empowering women in Nigeria's agricultural sector through digital technologies and economic innovation: Challenges and policy directions. *Delta Journal of Computing, Communications & Media Technologies*, 1, 58–75.
- 65 Adebayo, W. G., Silberberger, M., Osabuohien, E., Osabohien, R., & Adediran, O. (n.d.). Gender dynamics in the cassava value chains in Nigeria: A case study of Oyo and Benue States. <https://papers.ssrn.com/sol3/Delivery.cfm/5414938.pdf?abstractid=5414938&mirid=1&type=2>
- 66 Ejike, R. D., Osuji, E. E., Effiong, J. A. L., & Agu, C. G. (2018). Gender dimension in agricultural food value chain development in Nigeria: The women perspective. *International Journal of Agriculture and Earth Science*, 4(3),
- 67 Sufian, F., Nico, G., & Azzarri, C. (2023, September). Examining the gender digital divide: A case study from rural Nigeria. GCAN Policy Note No. 16. Gender, Climate Change, and Nutrition Integration Initiative. <https://www.feedthefuture.gov>
- 68 Izuogu, C. U., Olaolu, M. O., Azuamairo, G. C., Njoku, L. C., Kadurumba, P. C., & Agou, G. D. (2023). A review of the digitalization of agriculture in Nigeria. *Journal of Agricultural Extension*, 27(2), 47–64. <https://doi.org/10.4314/jae.v27i2.5>
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more profound socio-economic inequalities remain, women will not be included in the digital revolution of agriculture; this will have an impact on productivity, food security, and national development.

This study revealed the presence and patterns of identified factors in the study sites. Studying the maize value chain in Ogun and Kaduna revealed the assertion about women's economic empowerment to be true in the study contexts.

2.5 Theoretical and Analytical Frameworks

This study employed three interconnected conceptual frameworks to analyse the barriers and opportunities for rural women's digital participation in Nigeria's agriculture and food systems. These frameworks allow for a multi-dimensional approach that examines not only the adoption of digital solutions but also the underlying systemic power structures and gendered contexts that influence their use and impact.

2.5.1 Diffusion of Innovations Framework

The Diffusion of Innovations (DOI) theory, developed by Rogers⁷³, provides a foundational model for understanding how, why, and at what rate new ideas and technologies spread through a social system. The framework posits that adoption is not a simultaneous event, but a process that unfolds over time, where individuals in a social system fall into categories ranging from innovators and early adopters to the late majority and laggards. The rate of adoption is influenced by five key perceived attributes of an innovation: its relative advantage over existing solutions, its compatibility with socio-cultural values and past experiences, its complexity, its trialability on a limited basis, and its observability of results. This study used DOI to understand the diffusion patterns of digital agricultural tools among rural women, identifying the characteristics of different adopter categories and the communication channels (e.g., social networks, community leaders) that are most effective in promoting uptake within their specific cultural contexts. The theory supported the study's enquiry into how innovations spread through social systems, especially at the community level to understand the dynamics of adoption in the study contexts.⁷⁴

2.5.2 Feminist Agriculture Food Systems Theory

The Feminist Agric-food systems theory (FAST), developed by Carolyn Sachs et al.⁷⁵, is a conceptual framework for understanding the dynamic workings of Agric-food systems, particularly from the perspective of how gender relations, power structures and social inequalities determine the form and workings of agricultural production and food systems.⁷⁶ Built on feminist political ecology, FAST presents a way to understand how gender, labour and the environment interact to create the state of food justice in a particular context. According to the FAST, the food system is a gendered system, where every component is shaped by how gendered power relations operate and subsequently produce material effects of who controls and influences production and labour, consumption, resources and profits.

Due to the gendered nature of food systems, structural gender issues embedded in power relations become a critical area of focus of interrogation, alongside intersectional issues that deepen or influence the experiences of women in some manner. The intersection of ethnicity, class, disability, nationality, age and other distinctions with gender interact to determine women's experience in agriculture. Within the context of this study, the understanding that Agricultural technologies are not gender neutral necessitated an approach where a feminist and intersectional lens is applied to how gender relations rooted in power dynamics shape the experience of women with digital technology in Agric-food systems.

⁷³ Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

⁷⁴ Lami, A. 2025. Enhancing Agricultural Productivity in Nigeria Through Technological Innovations the Study of Predictive Tools and Smart Farming. *International Journal of Research and Innovation in Social Science*, 8(12): 1716-1733.

⁷⁵ Sachs, C., Ehlers, M., Hovorka, A., Perillo, G., Brondo, K., Thompson, A., & Van Der Burg, M. (2016). *The rise of women farmers and sustainable agriculture*. University of Iowa Press.

⁷⁶ Sachs, Carolyn, Patricia Allen, Jennifer Terman, Kathleen Hayden, and Christiane Hatcher. 2016. "Feminist Food Justice: Crafting a New Framework." *Gender, Place & Culture* 23 (12): 1636–1653

FAST therefore offers an avenue for women's perspectives, needs and knowledge systems to be integrated into technology design. Ultimately, co-designed solutions and strategies are more effective for women's work within the agri-food systems ecosystem, promoting inclusive and transformative agricultural structures.⁷⁷ It was applied in the Nigerian context to understand the unique perspective of women agricultural entrepreneurs as they navigate financial institutions to obtain necessary support.⁷⁸ It was also applied to understand the gender gaps in vocational training education needs in Taraba state.⁷⁹

2.5.3 Capabilities Approach

The Capabilities Approach, developed by Amartya Sen⁸⁰ and Martha Nussbaum⁸¹, provide a framework for evaluating human well-being and social

arrangements. This approach prioritizes the expansion of individuals' capability sets, enabling them to lead lives they value. Rather than focusing solely on access to digital solutions, the Capabilities Approach emphasizes the importance of real capabilities. The study investigated whether digital solutions genuinely enhance women's capabilities to make informed decisions about crop sales, access loans, participate in new farmer networks, and build resilience to climate, economic, and market shocks. Further it identified the "conversion factors" such as social, personal, and environmental factors that enable or prevent a woman from converting a digital resource into a valued capability. For instance, a digital solution is only valuable if a woman has the digital literacy to use it effectively and the social enablement to access it independently.

2.6 Conceptual Relationships between Main Variables and Factors

This study established the conceptual framework to analyse the factors affecting rural women's digital participation in agri-food systems. The framework identifies four interrelated variable groups (Access, Capability, Usage, and Enablers) that interact to influence this participation (**Figure 2**).

Rural Women are a peculiar group affected in specific ways in the context of this study. The numerous barriers women face in agriculture have been

highlighted in several studies. Based on these studies, the variables identified interact with the subject of rural women's digital participation. Within this framework, Access and Capability variables can constitute potential barriers, while Usage and Enablers variables can create opportunities for intervention. Findings are useful for strategic interventions, enabling GIZ programs to target key leverage points for enhancing digital inclusion among rural women in agri-food systems.

⁷⁷ Bezner Kerr, R., Hickey, C., Lupafya, E., & Dakishoni, L. (2022). Feminist agri-food systems: Transforming gender relations, agroecology, and food sovereignty. *Journal of Peasant Studies*, 49(2), 279–301.

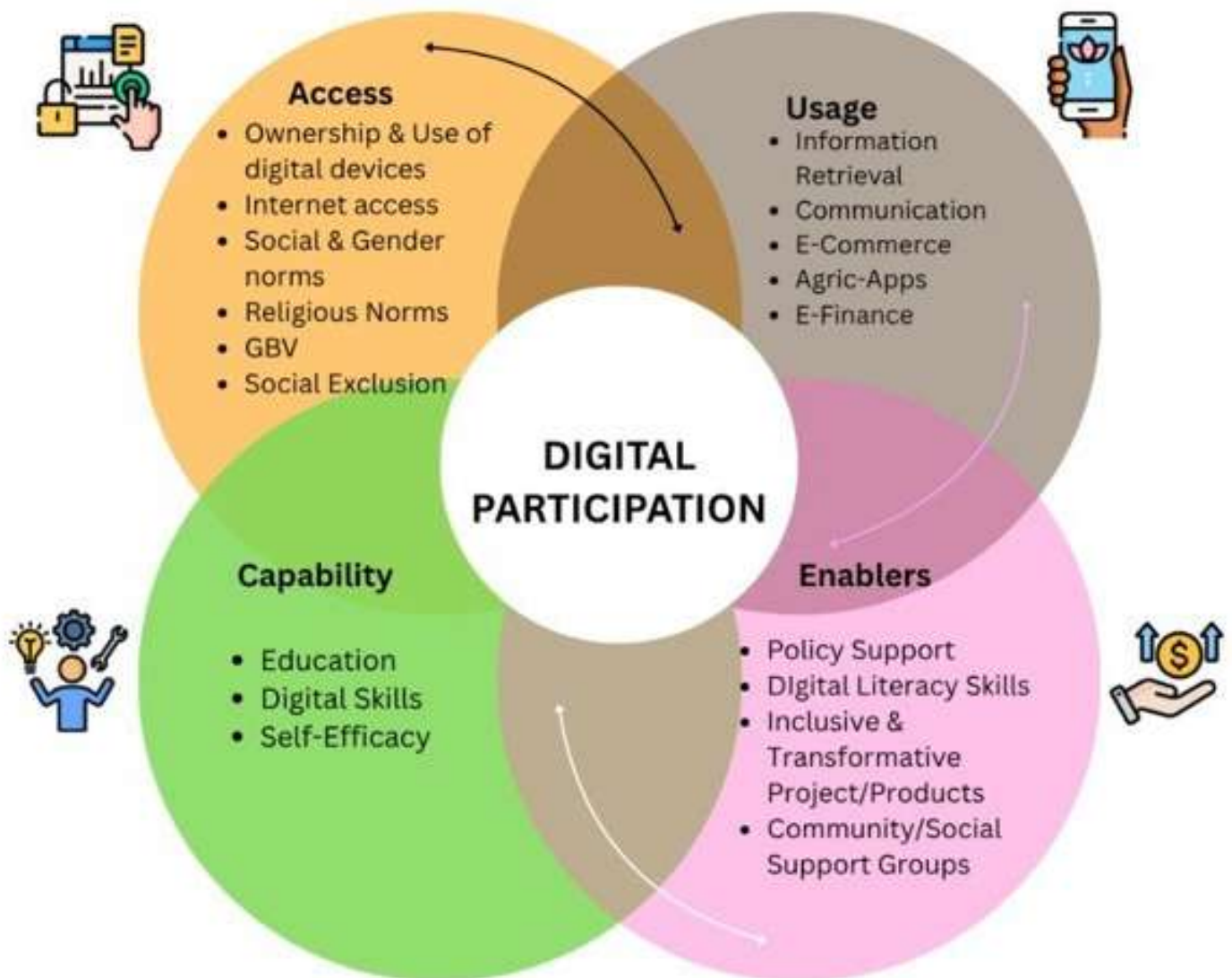
⁷⁸ Adefare T, Adeola O, Mogaji E, Nguyen NP, Mogaji S.A 2024. "Empowering women agriculture entrepreneurs: banks' role in achieving sustainable development goals". *International Journal of Bank Marketing*, Vol. 42 No. 4 pp. 692–724, doi: <https://doi.org/10.1108/IJBM-03-2023-0128>

⁷⁹ Wombo, A.B. and Azuaga, C.I. (2021). Emerging gender issues as correlates to sustainable vocational agriculture education in Taraba State, Nigeria. *African Journal of Gender and Women Studies* Vol. 6 (1), pp. 001-007

⁸⁰ Sen, A. (1999). *Development as freedom*. Alfred A. Knopf.

⁸¹ Nussbaum, M. C. (2000). *Women and human development: The capabilities approach*. Cambridge University Press

Access–Capability–Usage–Enablers (ACUE) Model for Rural Women in Agri-Food Systems



Methodological Approach



Female Maize Farmer Participating in an In-depth Interview | © Hanovia Limited

3.1 Study Design

This study adopted a mixed-methods, explanatory design to provide a comprehensive understanding of the barriers and opportunities for rural women's digital participation in Nigeria's agriculture and food systems. This design leveraged the strengths of qualitative approach, ensuring that the research was representative, contextual, and detailed. The analytical process aimed to build an explanatory framework from the data. The study consisted of three distinct, sequential phases:

1. Inception and desk review phase: A comprehensive review of existing literature, policy documents, and previous research findings (e.g., CGIAR study, GSMA reports, national policies) was conducted to establish a robust foundational understanding of the gender digital divide. This review guided the study's focus towards enhancing knowledge of the barriers confronting women's digital participation

in the maize value chain, the usage of digital solutions among the study population and specifically, the relationship between women's digital participation and GBV.

2. Listing of maize value chain actors and digital solution providers: A comprehensive listing survey was concluded to identify the MVC actors in the study communities and digital solution providers in the study Local Government Areas (LGAs).

3. Primary data collection and analysis phase: This phase involved systematic collection of empirical data from the field, gathering qualitative insights that explained and elaborated on patterns identified in the desk review. A participatory approach was used to ensure that the voices and experiences of target communities were captured, supporting findings grounded in lived realities.



Female Maize Value Chain Actors in a Focus Group Discussion | © Hanovia Limited

3.2 Study Participants

A diverse range of stakeholders was engaged to holistically understand the gender digital divide in the maize value chain of Nigeria's agricultural sector. The participants were categorized into three primary groups. The core group comprised rural women and men

smallholder farmers and agripreneurs in the maize value chain, selected through a rigorous, multi-stage stratified random sampling design to ensure representativeness and minimize bias. The three primary groups of study participants were:



Rural women and men
smallholder farmers
and agripreneurs



Community members
and local authorities



Institutional and
expert stakeholders

The participant selection process was designed to capture perspectives from the individual, community, and institutional levels, aligning with the study's objectives.

3.2.1 Intersectional Approach

The study took an intersectional approach to its investigation by ensuring that different social groups were considered and involved as participants and co-creators of knowledge. Following the listing survey, this approach guided the recruitment process, ensuring the inclusion of women and men from diverse backgrounds, including varying ages, education levels,

marital statuses, and types of agricultural engagement (e.g., smallholder maize farmers, maize agripreneurs). Persons living with disabilities (PLWD), minority ethnic or religious groups, and social classes and categories were also involved in the study.

3.2.2 Users and Non-Users of Digital Solutions

Due to the intersectional approach of the study, the participants included users and non-users of digital solutions. Users were categorized as those who have used digital solutions in the last 12 months and non-users as those who have not used digital solutions in the last 12 months.

3.3 Sampling Approach

This study employed a multi-stage stratified random sampling design to arrive at a representative and diverse sample of rural women and men maize farmers and agripreneurs from the two selected states (Kaduna and

Ogun). This approach systematically narrowed the geographical scope from state to individual participant, ensuring both randomness and adherence to key selection criteria.

3.3.1 Sampling Stages

The sampling strategy was conducted in four distinct and sequential stages:

Stage 1 - Selection of States
Kaduna in Northern Nigeria and Ogun in Southern Nigeria States were pre-selected for the survey due to their contrasting agro-ecological zones, socio-cultural profiles, and levels of agricultural development for the purpose of providing valuable comparative insights. This deliberate selection provided a crucial comparative framework, enabling the study to uncover how varying contextual factors – from climate and dominant crops to cultural norms and infrastructure – distinctly shape the digital participation of rural women.
Stage 2 - Selection of LGAs
A total of four LGAs were selected in each state, resulting in eight LGAs for the study. This selection was guided by specific, pre-defined criteria including the agricultural significance of the LGA, particularly with reference to maize production, its socio-cultural diversity (encompassing ethnicity, religion, and socio-economic status among others), and a varied level of access to digital and communication infrastructure. Furthermore, consideration was given to the security and accessibility of the LGAs to guarantee the safety of the research team. To ensure geographical spread within each State, three primary LGAs were selected for the study – one from each of the State's senatorial districts. An additional LGA was selected to serve as a backup in the event of unforeseen access issues, such as community unrest or insecurity.
Stage 3 - Selection of wards and communities
This involved the random selection of wards and communities within the selected LGAs that were predominantly maize-farming areas. First, one ward was randomly selected from each LGA, then two communities were randomly selected within each selected ward. This random selection at the sub-LGA level was crucial for minimizing selection bias and ensuring the research captured a representative cross-section of rural communities.
Stage 4 - Listing and Selection of Study Participants
The final stage was the listing and selection of study participants for IDIs and FGDs using an intersectional approach. Using the sampling frame generated from the listing exercise, participants – specifically rural women and men engaged in maize farming and maize agripreneurs – were randomly selected. In addition, other actors in the maize value chain, such as input suppliers, processors, wholesalers, retailers and support service providers were recruited as participants. This method ensured that participants were those actively engaged in the maize value chain while introducing randomness to avoid the biases that could arise from leaders selecting specific participants. The KII participants were digital solution providers found in the study LGAs and stakeholders provided by the GIZ team.

The list of selected study locations – LGAs, wards and communities – are presented as **Annex 2**.

3.4 Approval to Conduct the Study and Ethical Consideration

Prior to study launch, the survey firm obtained ethical approval from the HRECs of the survey States. (**Annex 3**). In line with ethical requirements, informed consent was obtained from participants before the commencement of

interviews and focus groups during field data collection. Participants were assured of confidentiality of the information that they provided to the interviewers. This process perpetuated during the listing and main data collection.

3.5 Data Collection Procedure

3.5.1 Listing Survey

A comprehensive listing survey was concluded to identify the MVC actors in the study communities and digital solution providers in the study LGAs. This held in February 2026. Within each of the selected communities, listing survey was conducted using a programmed listing questionnaire to capture the details of all participants involved in the maize value chain within the communities. The details of the listed participants are presented in **Annex 4**.

3.5.2 Main Data Collection

Main data collection commenced immediately after the listing survey and took place between February and March 2026. Study participants included maize value chain actors, digital solution providers, policymakers, and gender experts. Data were collected through face-to-face interviews using approved protocols for IDIs,

KIIs, and FGDs. Male respondents were interviewed by male interviewers, and female respondents by female interviewers. Interviews were conducted at participants' homes or offices, while FGDs were held in central, private, and quiet locations. Virtual interviews were also conducted for GIZ partners. The interview procedure began with a consent process prior to deploying the study tool. At the end of each interview or focus group, participants were provided with refreshments and a non-cash incentive for their participation. The field team comprised state supervisors, interviewers, and note-takers, with support from the team leader and data manager. Communication channels such as phone calls, emails, Teams, and WhatsApp were open and used throughout the survey period. Weekly check-in meetings were held with the GIZ team to discuss study progress. Photos from the interviews and FGD sessions are presented in **Annex 5**.

3.6 Data Management and Analysis

3.6.1 Data Management

The data management strategy ensured the collection of reliable, high-quality data.

i. Labelling of Audio Devices and Files:

Recording devices were assigned unique IDs based on location. A consistent file naming convention was developed to (a) track media files returned from the field, and (b) create naming forms for assigning files to transcribers.

ii. Protocol for Transcription:

A transcription protocol was developed before data collection began. It covered text formatting, source labelling and anonymity, content handling, storage, confidentiality, and proofreading. The protocol was shared with all transcribers to ensure uniformity.

iii. Transcription and Translation of Audio Recordings:

Transcribers and translators were recruited to convert audio recordings from interviews and focus groups into written text, preserving the original context of quotes. The data manager assigned uploaded audio files to transcribers and translators, who produced

English transcripts. Completed transcripts were reviewed for quality assurance on a rolling basis.

iv. Uploading and Tracking of Audio Files and Transcripts:

A designated Dropbox folder was created for secure upload of audio files and transcripts. State supervisors uploaded the files, and the data manager tracked their status. Each transcript received a unique identifier to link it with its corresponding audio file.

3.6.2 Data Analysis

Data analyses included a series of progressive steps after qualitative data collection and transcription.

3.6.2.1 The Iterative Coding Process

The analysis followed a progressive, iterative process involving three key stages, with the objective of developing a coherent explanatory framework that moves beyond description to explain how and why identified barriers and opportunities interact to shape women's digital participation.

i. Descriptive Coding: Coding of data began by using pre-defined categories from the research questions and applying deductive and inductive coding (e.g., access to digital solutions, male permission for use, etc.). This established the foundational descriptive layer of the key factors.

ii. Interpretive Coding: This followed the descriptive coding. Interpretive coding was applied to identify underlying concepts, social patterns, and meanings (e.g., digital self-efficacy, gendered control of resources, restrictive social norms, etc.). Norms were deduced based on relational and ideational features while structural barriers were identified by material effects or manifestations from beliefs, values and social behavioural expectations.

iii. Explanatory Analysis and Model Building: The final stage involved a rigorous explanatory analysis to synthesize the relationships between the descriptive and interpretive codes. Using the analytical tools in ATLAS.ti, a logical model that visually and narratively explains the causal pathways, interactions, and dynamics between the main variables (Access, Capability, Usage, Enablers) and the outcomes is demonstrated. This model articulates the mechanisms through which structural, socio-cultural, and psychological factors combine to either inhibit or promote rural women's digital participation in agri-food systems.

3.7 Implementation Timeline

The study on Barriers and Opportunities for Rural Women's Digital Participation in Nigeria's Agriculture and Food Systems was conducted from September 2025 to May 2026. Key

implementation phases included inception, data collection, data management and analysis, and reporting.



Findings and Discussion

4



Confidentiality, and proofreading. The protocol was shared with all transcribers to ensure uniformity. This section of the report presents a synthesis of the barriers faced by women in the use of digital solutions in the maize value chain in Ogun and Kaduna States.

The findings according to the five objectives of the research are comprehensively discussed, providing a coherent perspective of the condition of women and men in the maize value chain regarding digital participation.

4.1 Barriers to Women's Digital Participation in the Maize Value Chain

The first objective of the study was to **identify barriers to women's digital participation in the maize value chain**. The barriers to participation that confront women are varied, there are socio-cultural barriers that target women's agency, psychological barriers that position women to doubt efficacy, skills barrier that are a result of women's limited knowledge of digital technology.

The socio-cultural barriers are concretized with social norms, religious norms and maintained with social mechanisms of control. In Kaduna, religion plays an influential role in promoting the normalization of women's limited agency, including around mobility and external social relations.



"Accessing digital service providers is harder for women because they do not move around like men. Cultural and religious reasons make it stringent for women."

- IDI Female Farmer, Kaduna

"We do not approve them." (Religious leaders' stance on women's digital use)

- KII Digital Solution Provider, Kaduna

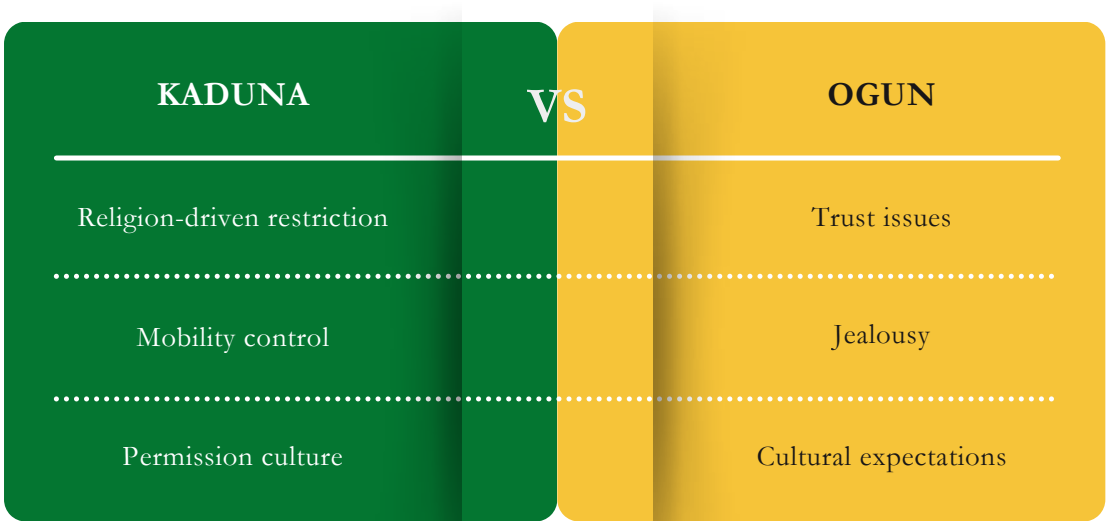
Female Farmer Harvesting in her Farm | © GIZ/Sven Schuppener

Religious references, particularly to Islamic teachings appear frequently in participants' explanations of gender norms, household authority structures, and women's roles. Respondents invoke religious principles to justify husbands' authority over wives, to explain why women should not travel alone or interact with unrelated men, and to frame women's submission as divinely ordained. One digital solution provider explicitly noted, "Because of the kind of environment and region we come from, I am very sensitive to religion." Another respondent noted that "the Hausa culture limits us. Out of 100

female farmers, at least 80% are Christian," suggesting that religious status may enable women's digital participation but contextualeffects ensure that local gender norms shape the belief, attitude and behaviour of people who may not be a majority in a community or society.

In contrast, Ogun State respondents rarely mention religion when discussing digital access or gender barriers, instead framing barriers in terms of individual jealousy, lack of trust, or cultural tradition. This divergence reflects the different religious landscapes of the two states.

Regional Differences in Women’s Digital Participation Barriers



4.1.1 Socio-Cultural Barriers

Gendered Agency

Women’s access to digital solutions is affected by complex relational factors, where depending on the interpersonal relationship dynamics, access can be severely constrained. One of the most critical factors for access is agency. Women’s agency is significantly constrained regarding access because they require at the most fundamental level, their husband’s authorization to purchase digital devices. Women’s weak economic power and gendered social norms contribute to the curtailment of women’s agency as they rely on their husbands to provide the funds to purchase a phone. Across Kaduna and Ogun states, the husband's role as the household head translates directly into control over technology access. Women cannot independently acquire smartphones, subscribe to data plans, or

even receive business calls without spousal authorization. Therefore, the consent of men is paramount to women’s access to and use of digital solutions. This normative standard manifest differently across regions. In Kaduna, it is strictly enforced through religious and cultural norms, while in Ogun, women experience slightly more flexibility but still face serious consequences for non-compliance.

The explicit requirement that women must obtain spousal consent before purchasing or using digital devices demonstrates the lack of or constrained agency of women. Women across both states consistently reported that permission-seeking is not optional, but a mandatory household protocol enforced through social norms and potential conflict.

Furthermore, because men's position as the head of households is finite, regardless of the economic influence of women within the home,

their decisions are unquestioned. Therefore, the more pronounced male dominance is, the lower the agency of women.

“

"If the wife is submissive and tells her husband what she is doing, like 'I've heard this information' or 'I received this message,' then the husband won't be suspicious."

- FGD Male MVC Actors, Ogun

"The husband is the head of the family, so he has to know what she wants to do."

- IDI Male Processor, Ogun

"Yes, there are challenges. Some women need permission from their husbands to buy a phone or to buy data."

- IDI Female Farmer, Ogun

"She should have carried the husband along. She is married; she should have let her husband know her movement and plans."

- IDI Female Farmer, Ogun

"My husband makes most decisions. If he wants to buy something, he tells me. If I want to buy something, I have to ask him."

- IDI Female Farmer, Ogun

"Anything a woman is doing, she should inform her husband. I am not saying she should give her husband all her capital; she should carry him along, so that if there are side talks, her husband will know that she is not doing the wrong thing."

- IDI Female Processor, Ogun

"Before a woman buys a phone, she usually has to seek permission from her husband. Also, if she wants to download applications like WhatsApp or Facebook, she may still need her husband's consent."

- IDI Female Farmer, Kaduna

"I made the decision in this household."

- FGD Male MVC Actors, Ogun

”

After women cross the hurdle of obtaining permission to purchase and use digital devices, the expectation to maintain the hierarchy of control continues to rest on women. This compels women to actively report on their activities with the devices, failure to perform this act of respect and submission become a precursor to conflict from suspicion.

Conversely, the dynamics around women's agency is not applicable to men. Men do not require permission to purchase a digital device, nor are they required to report on their activities when using the devices. Men's financial and social capital, including their higher level of education and exposure ensures that their agency is intact.

Within the domain of gendered agency, the heterogeneity of women is reflected in the reality of women who have agency by virtue of their relationship status. Women who are not in traditional marital relationships, including widows and unmarried women have significantly higher levels of digital autonomy, independent phone ownership, and freedom to make business decisions without seeking permission or facing surveillance. Widows emerge as a category of women who have achieved digital independence because the traditional household structure was disrupted by death. One widow from Ogun explained, "I am the boss of myself. I don't need permission for anything. My husband is dead, so I make all the decisions." Another stated, "My children are my husband now."

Unmarried women, like widows do not face spousal control, however, they face social scrutiny and are susceptible to accusations of promiscuity, while not facing spousal control, still contend with social scrutiny and family

oversight, particularly from mothers who fear accusations of promiscuity.

Intersectional Agency and Resilience

PLWD are actively engaged in farming despite significant physical challenges and lack of institutional support. Across Kaduna and Ogun States, farmers with disabilities have employed adaptive strategies such as kneeling to weed when they cannot stand or hiring labourers to handle tasks their physical condition

conditions do not permit.

In addition to their disadvantage and exclusion, they receive no grants, training digital tools, and agricultural input from any source government, NGO, or private sector. Women with disabilities face compounded exclusion, as they are often homebound and cannot attend training sessions.

These challenges nevertheless co-exist with farmers living with disabilities taking pride in their work and explicitly preferring farming to begging, which is a common alternative for disabled individuals in Nigeria. One respondent contrasted disabled farmers with "those who are begging for alms," noting that disabled farmers "have made up their mind to stand on their own hard-earned business."

PLWD however have access only to basic phones for voice calls and possess no digital agricultural solutions tailored to their needs. They cannot access weather information, market prices, agronomic advice, or mobile money services. Their digital exclusion is nearly exhaustive, and they continue to rely on manual labour for farming tasks that digital tools could simplify. Voice-based services, mobile money, and remote communication tools would allow PLWD to manage farms, hire labourers, and coordinate sales without requiring physical mobility.

Social Mechanisms of Control

Scrutiny is a form of social control that ensures that unmarried women's agency is curtailed, such that they are reluctant to pursue the use of digital devices and in some cases to attach shame to them. In some cases, other adults such as mothers exert agency over women's ownership of digital devices. Women who are married are also suspected of promiscuity and infidelity and this often leads to monitoring, interrogation, and restriction of women's phone use.



I don't have a husband. I depend on my small business. A smartphone costs a lot. Also, people talk. If I buy a big phone, people will say I am showing off or looking for men.



IDI Female Processor, Ogun



My mother decides. If I want a new phone, I have to ask her. She will say yes or no.



IDI Female Processor, Ogun

Women are often accused of "talking to other men" or being "promiscuous" simply for owning or using a phone. This barrier is powerful because it directly threatens the stability of the marriage, forcing many women to self-censor or avoid phone use altogether to maintain peace in the home. Fifteen specific incidents of infidelity accusations were documented, with women in Kaduna reporting higher rates of such accusations (62%) compared to Ogun (38%), suggesting stricter gender segregation norms in northern Nigeria.

Accusations about infidelity is a cross-cultural phenomenon because of men's fear that women's digital independence will cause them to lose control over household decision-making or cause them to have less agency over women's activities. Gossip is also used to compel women to conform to expected social behaviour.



If you are using your phone and people see that you are getting money, they will start saying all sorts of things. They will say you are sleeping with men to get that money.



FGD Female MVC Actors, Kaduna



Some men will not allow their wives to use digital solutions because they fear she will become independent and not listen to them anymore.



FGD Female MVC Actors, Ogun

Closely tied to men's resistance to women's agency regarding the use of digital devices is the displeasure abhorred for women's superior economic power. Some husbands explicitly prevent their wives from using phones because they fear being economically surpassed. This manifests as refusal to buy smartphones, denying data/airtime requests, or actively sabotaging wives' business communications.

Men actively resist women's agency around access and use of digital devices and solutions by seizing phones, smashing them on the ground or throwing them into water. These violent reactions send a clear message that women's digital autonomy will not be tolerated, creating an atmosphere of fear that extends beyond individual incidents.

4.1.2 Psychological Barrier and Women's Self Efficacy

Women face psychological barriers that significantly make them doubt their capacity to handle digital devices. They have anxiety about breaking of phones, sending money to wrong accounts, or being victims of fraud. Women report being "afraid to press things" and needing repeated hands-on training before gaining confidence. About 44% of women respondents self-rated confidence below 5/10, compared to only 18% of men. This concern is understandable, given that 12 cases of mobile money fraud and 8 cases of erroneous transfers affecting women were recorded. Although technology enabled fraud is common, women's fear is compounded because they are aware of their lack of training. Another factor that fuels the lack of confidence in women is that men and the society consistently infantilize women and communicate this lack of confidence, so that women have internalized it. Critically, women who receive patient, hands-on training from trusted sources (children, female field agents) show rapid confidence gains.



I am afraid of using it because I might break it. My brother has a smartphone, but he doesn't let me touch it. He says I will break it.



IDI Female Processor, Ogun



Some women are like me we are afraid. We think we will do something wrong and the phone will spoil.



IDI Female Processor, Ogun



I don't have the boldness because things can get spoilt along the way, and I am scared of mistakes.



IDI Female Processor, Ogun

Women predominantly scored themselves low in their assessment of capacity to use digital solutions. Women who successfully use basic phones express low confidence in transitioning to smartphones, citing lack of training, fear of complexity, and absence of patient teachers as primary barriers.



I have no confidence at all. I have never done those things. I don't even know how to start. I will rate myself 2.



IDI Female Processor, Ogun



Some women are like me we are afraid. We think we will do something wrong and the phone will spoil.



IDI Female Processor, Ogun



I don't have the boldness because things can get spoilt along the way, and I am scared of mistakes.



IDI Female Processor, Ogun

Women predominantly scored themselves low in their assessment of capacity to use digital solutions.

Women who successfully use basic phones express low confidence in transitioning to smartphones, citing lack of training, fear of complexity, and absence of patient teachers as primary barriers.



I have no confidence at all. I have never done those things. I don't even know how to start. I will rate myself 2.



IDI Female Processor, Ogun



For a smartphone, I am not confident. I will say 2. For my small phone, I am confident 8.



IDI Female Processor, Ogun



I will rate myself 1. I have no confidence at all. It is not everything one is knowledgeable about, especially as a woman."



IDI Female Processor, Kaduna

English Language proficiency is another crucial factor affecting women and men's use of digital solutions. About 68% of women with no formal education rated English language difficulty as "10/10," while educated women (secondary+) rated 4/10. This creates a cascading exclusion: women cannot read app interfaces, misunderstand SMS alerts, and cannot navigate USSD menus.

When apps are in local languages, they use "textbook words that people don't use colloquially," rendering the information inaccessible. . Critically, women demonstrate strong demand for Yoruba/Hausa language interfaces, and those who receive voice-based services show 3x higher adoption rates. The gender gap in literacy is stark: men in the study sites are twice as likely to have completed secondary education, directly translating into higher digital confidence and broader usage patterns.



I will rate myself 10. I did not go to school. I cannot read English. If an app is in English, I cannot understand it at all.



IDI Female Farmer, Ogun



English is the main challenge. 10.



FGD Female MVC Actors, Ogun



I cannot read in English, only Yoruba. It is difficult for me to read in English, but my children can.



IDI Male Farmer, Ogun

The voice note function of phones has however proved to be a great resource for navigating literacy barriers because voice-based services bypass literacy requirements entirely. Women who cannot read find audio messages accessible and trustworthy, and digital providers report that voice services have increased women's active usage by 150% in two years.



"The use of English language is a major challenge because most platforms use English, and the majority of us cannot read and understand the language. I would rate it 7⁸² out of 10 for women."

- IDI Male Farmer, Ogun

"For uneducated users, we rely heavily on voice and audio. The USSD platform uses simple icons and minimal text. Our field agents provide hands-on demonstrations."

- KII Digital Solution Provider, Kaduna

"We use voice and audio formats extensively because many women have lower literacy levels."

- KII Digital Solution Provider, Kaduna

"The voice note I send to customers is the most helpful on the phone."

- IDI Female Processor, Ogun

Female Farmer Planting Seeds in her Farm | © GIZ/Sumi Teufel

82 Scale range: 1 being no difficulty and 10 being most difficult.

Women however navigate knowledge and skills gaps as well as digital exclusion with intergenerational learning. Children, particularly sons and daughters in school serve as digital intermediaries, reading messages, making transfers, and explaining app functions. This reliance, while enabling access, also reinforces women's dependency and limits their

autonomous use.

The first hypothesis of this study “Restrictive gender norms and male-dominated household power structures are the most significant perceived socio-cultural barriers limiting women's digital participation in the maize value chain in Kaduna and Ogun States” is supported by the data

4.2 Knowledge of Digital Solution Usage among Women and Men in the Maize Value Chain

The second objective of the study is to assess the knowledge of digital solution usage among women and men in the maize value chain. The knowledge of digital solutions among women and men in Kaduna and Ogun States is varied and depends on the gendered realities of maize value chain workers. It is influenced by social, structural and institutional factors that have produced specific patterns which have been documented.

4.2.1 Language and Digital Participation of Women

Language is a critical factor that can support or inhibit knowledge. For women in Kaduna and Ogun States, the dominance of English in mobile phones, applications, and digital services poses significant barrier to their independent use of technology. Because user interface language is not local and understandable, basic tasks and commands such as “cancel,” “send,” or “delete” are difficult for women to perform. Particularly if they have no formal or an incomplete education.

This language barrier makes women to perpetually depend on other people, in most cases their children, husbands, or neighbours to interpret messages, make transfers, and troubleshoot problems. The ripple effect of women's inability to read is their inability to use and navigate USSD menus, comprehend SMS alerts about market prices, get vital information from WhatsApp farmer groups, complete mobile money registrations, or interpret error messages when transactions fail. Women considered the use of English difficult, causing them to lose interest overall. While literacy is a decent skill to possess, the importance of an intersectional and

decolonial approach improving women's digital participation is that it must strive to meet women at the point where they are.



The biggest challenge is education. Most rural women are not educated. Using digital tools requires someone who can read and write. Imagine giving a woman a smartphone. A smartphone comes with commands like 'cancel' or 'send.' She cannot know what 'cancel' or 'send' means



KII Digital Solution Provider, Kaduna

Women expressed strong demand for Yoruba and Hausa language interfaces, stating that information delivered in their local languages would be immediately understandable and usable. Voice prompts can be used to mitigate this challenge. However, with voice prompts, issues of privacy, safety and security need to be considered. Hearing impaired persons will particularly not be able to use this solution.

4.2.2 Gendered Differences in Knowledge of Digital Solutions

Knowledge of digital solutions in the Ogun and Kaduna is not gender neutral. Women engaged with digital solutions differently because they know about them inequitably. Men demonstrated significantly higher knowledge of

specific digital solution functionalities than women, such as more familiarity with weather forecasting apps soil testing tools, digital extension services, precision agriculture GPS, and tractor hiring platforms. Men actively use weather applications to guide planting decisions, monitor weather patterns during growing seasons, and access advice on fertilizer application and pest control functionalities that remain largely unknown to women. Production-oriented digital tools, particularly agronomic advice applications to guide planting decisions, fertilizer application, and pest management are commonly used by men but largely unknown to women.



The male farmers have the machine that removes maize grain from the maize plant



FGD Female MVC Actors, Ogun



I have heard about farming apps that tell you about weather, but I have never used them. I don't have that kind of phone.”



IDI Female Farmer, Ogun



I use about four weather forecast platforms. In the morning, I check if it will rain; in the evening, I confirm if the rain actually came. I send that report directly to management.



KII Digital Solution Provider, Kaduna

Women however possess knowledge about Global Positioning System (GPS), though their use appears limited. GPS has positive implications for precision agriculture, land measurement and farm mapping. This knowledge can support them to better optimize farm layouts, calculate input requirements accurately, and avoid being cheated by hired labourers.



Yes, I have heard about GPS. People use it to find directions. I have not used it for farming.



IDI Female Farmer, Ogun



I have heard about GPS. It is used to measure the size of the farm. They measure the size of the farm.



IDI Female Farmer, Kaduna



We were taught how to measure the size of a farm using GPS, so as to know the size of the farm, in case they want to be cheated by people who work on the farm too.



IDI Female Farmer, Ogun

Women on the other hand have knowledge of basic communication with mobile devices, mobile money receipts and have limited awareness of how digital tools can support production, post-harvest processing, or market intelligence. The services that women access is closely tied to their low literacy levels, because they are typically voice-based. The men who prefer text-based services like SMS and USSD menus conversely have higher literacy levels. Only a limited number of women use digital tools to get better planting yields.

While communication and financial transactions are valuable, particularly for women with specific needs, they represent only a fraction of digital solutions’

potential, and women who lack knowledge of other applications miss opportunities for productivity gains, cost savings, and market expansion.



I use Plantix app to detect diseases on my crops. You take a picture of the leaf, and the app tells you what the problem is and what chemical to use



IDI Female Farmer, Ogun



I use it mainly for communication. It makes my work easier because whenever I want to sell maize, I simply call someone instead of traveling around looking for buyers



IDI Female Wholesaler, Kaduna



We have a farmer named [name of farmer] who uses a wheelchair due to polio. Through our voice-based service, she receives advice directly on her phone. She told us that for the first time, she feels included in agricultural development



IDI Female Wholesaler, Kaduna



I have heard of OPay. People use it to send and receive money. Some of the buyers at the market use it. But I do not know how to use it.



IDI Female Farmer, Ogun

Differences in literacy levels and knowledge demonstrate structural issues of access and to training, information networks, and the types of digital tools marketed to each gender. Due to limited digital solutions in processing and post-processing despite women being significantly present in the processing space there is consequently lean knowledge about tools supportive of processing and post-harvest techniques among women, there. This implies two things; solution providers' failure to close a critical tools gap that can correct inequality in gendered digital participation because of weak gender-lens in product design, market research and distribution. Furthermore, because women are socially constrained, there is less visible demand from women, leading providers to underestimate the market. The result is a critical tools gap that perpetuates unequal digital participation and limits women's access to value chain-relevant knowledge. The constraints are both issues of availability (insufficient supply) and access (barriers to uptake), structural in nature and rooted in gender discrimination.

4.2.3 Gendered Differences in Awareness and Use of WhatsApp and Social Media Farmer Groups

Digital devices stimulate connectivity and expansion of networks among farmers. This can be very beneficial for women farmers because of its potential to reduce exclusion and shrink disadvantage. Many women and men participants were aware of WhatsApp and Facebook farmer groups; however, this awareness does not translate to women's active participation nor yield material benefits in the long-term. This is because women's active participation in WhatsApp is low due to smartphone access barriers, low literacy and concerns about their husbands' suspicion. Despite high awareness of WhatsApp groups, women's substantive participation in them remains passive because of self-consciousness. Most read messages without engaging or relying on children to interpret.



We have a WhatsApp group for maize farmers. If you have a problem with your farm, you can post a picture, and people will tell you what to do.



IDI Female Farmer, Ogun



I belong to several WhatsApp groups for sweet corn, maize, habanero, and other crops. For almost every crop we farm, there are groups where we share ideas.



IDI Female Farmer, Ogun



I am in three different WhatsApp groups one for maize traders in [study LGA], one for wholesalers in Ogun State, and one for women in agribusiness. We share prices, we ask questions, we help each other.



IDI Female Wholesaler, Ogun

Men, in contrast, actively participate in multiple crop-specific groups where they share real-time market prices, agronomic advice, and buyer contacts. These groups have become learning sites for men, offering a receptive platform for questions on various issues including pest control and avenues to collectively coordinate purchases, reducing cost of procurement.



We have a WhatsApp group for maize farmers. If you have a problem with your farm, you can post a picture, and people will tell you what to do.



IDI Female Farmer, Ogun



I belong to several WhatsApp groups for sweet corn, maize, habanero, and other crops. For almost every crop we farm, there are groups where we share ideas.



IDI Female Farmer, Ogun



Yes, I have heard about WhatsApp groups for farmers, but I am not a member. I don't have a smartphone.



IDI Female Farmer, Ogun



I know it exists, but I haven't done it before. It is meant especially for big farmers.



IDI Female Processor, Ogun



I belong to a WhatsApp group for women farmers in my area. We share information about prices and farming techniques.



IDI Female Farmer, Ogun



No, I am not in any WhatsApp group. My phone is a small phone, it doesn't have WhatsApp.



IDI Female Processor, Ogun



We have a women-only WhatsApp group where they can share experiences and support each other. These are designed to address specific challenges women face, such as limited access to information, lack of collateral for loans, and cultural barriers.



IDI Female Wholesaler, Ogun

Women have navigated fears for scrutiny and false accusations through joining female only WhatsApp groups. Female only groups have provided a safe space for women to ask questions, share experiences and gain knowledge without fear of male and wider community judgement. They are often coordinated by female field agents, further reducing women's discomfort in the mainstream group. Although, the usefulness of these groups is uncontested, physically access markets may remain an issue, particularly for persons with mobility challenges.



The women-only group is good because you can ask anything without men laughing at you or thinking you are flirting.



IDI Female Processor, Ogun

4.2.3 Knowledge of Digital Solutions Across the Value Chain Production vs. Processing Gaps

The concentration of digital knowledge is at the production stage dominated by men demonstrates the gender division of labour in maize value chain. It also reveals the priority market forces give to activities performed by men.



There's very little presence of digital solutions in processing and post-processing. It's very limited. Most solutions are at production level.



KII Gender Expert



Our products provide timely information that helps farmers make better decisions. For example, a farmer who receives a weather alert can decide whether to plant or wait.



KII Digital Solution Provider, Kaduna



I don't know any digital solution for processing. I just grind the maize and take it to the market to sell. If I had a phone that could help me find buyers, it would help.



IDI Female Processor, Ogun



We have a USSD-based platform that works on any mobile phone, even basic phones. Farmers can dial a code and get information on planting times, pest control, fertilizer application, and market prices.”



KII Digital Solution Provider, Kaduna



No, I have not heard of any digital tools for processing. I only use my phone to call customers when I have finished processing



IDI Female Processor, Ogun

Women overcome knowledge barriers by using existing tools not tailored to processing and marketing towards achieving their goals, thereby demonstrating innovation and adaptability. These success stories demonstrate latent demand and the transformative potential of digital solutions when made accessible, but they remain outliers rather than the norm.

Women dominate processing, yet they rely entirely on physical market visits and word-of-mouth, missing opportunities for value addition and market expansion. The few women who have innovated such as the processor who learned to make rice cakes from YouTube and now runs an Instagram page demonstrate the untapped potential when knowledge barriers are overcome. PLWD farmers face even greater exclusion, with respondents noting that they “have phones but they don't have more than the phones, they still use their hands to cut the weeds.”



I use YouTube to learn new processing methods. That is how I learned to make plantain flour and children's cereals



IDI Female Processor, Ogun



A woman was telling how she watched a YouTube video and learned to make rice cakes. It turned out so good that people started placing orders from the neighbouring village. Now she also has an Instagram page where you can place orders.



KII Gender Expert



I saw a video online about how to store potatoes in a sack. I tried it and it worked. That is how I learned.



IDI Female Wholesaler, Kaduna

Women dominate processing, yet they rely entirely on physical market visits and word-of-mouth, missing opportunities for value addition and market expansion. The few women who have innovated such as the processor who learned to make rice cakes from YouTube and now runs an Instagram page demonstrate the untapped potential when knowledge barriers are overcome. PLWD farmers face even greater exclusion, with respondents noting that they “have phones but they don't have more than the phones, they still use their hands to cut the weeds.”



Small Holder Farmer Sharing her Experiences During an Interview | © GIZ/Gaël Gellé

4.3 Existing Digital Solutions for Agricultural Purposes in the Study Sites

The third objective, to identify existing digital solutions for agricultural purposes in the study sites was achieved, and the findings revealed that digital solutions targeted at technical, financial and communication needs of maize value chain

value chain workers exist. However, their use is not gender neutral across Ogun and Kaduna states.

4.3.1 The Diversity of Digital Solutions Across the Study Sites

Diverse digital solutions are known and used across Kaduna and Ogun States, and they have been used extensively by maize value chain workers but not gender equitably. The use of solutions by men and women vary due to the type of application- whether supported by internet connectivity or compatible with basic mobile network.

Identified solutions include USSD platforms from organizations like Babangona and Thrive Agric that offer no-internet access to agronomic advice; mobile money services such as OPay, PalmPay, Moniepoint, Paga, WhatsApp and Facebook groups for price sharing. Other solutions include weather apps, digital extension videos on YouTube and agri-apps like Plantix. USSD based platforms are well known and accessible to women because they predominantly own basic phones. Mobile money services have a substantial presence in Ogun and Kaduna states, with women also having knowledge of them.



I have heard of OPay. People use it to send and receive money. Some of the buyers at the market use it. But I do not know how to use it.



IDI Female Farmer, Ogun



I have heard about USSD codes for banking, but not for farming. Nobody has told me about that.



IDI Female Farmer, Ogun



For the USSD platform, farmers use code prompts. It is menu-driven and very simple. They select options like 'weather,' 'prices,' or 'advice' and receive information instantly. This works without data or internet.



KII Digital Solution Provider, Kaduna

Social media-based farmer groups are prevalently and active as sites for informal information sharing around digital solutions. While most digital solutions are known to women, even if they do not use them on the same scale as men, specialized agricultural applications for weather forecasting, market prices, and disease diagnosis are often unknown to women because of a lack of smart phones. There is little presence of digital solutions in the processing and post-processing node, therefore there is low awareness of their existence as well.



We have a WhatsApp group for maize farmers. If you have a problem with your farm, you can post a picture, and people will tell you what to do.



KII Digital Solution Provider, Kaduna



I have heard about farming apps that tell you about weather, but I have never used them. I don't have that kind of phone.



IDI Female Farmer, Ogun

4.3.2 Accessibility to Existing Solutions

Structural barriers severely limit women's accessibility to existing digital solutions, even when those solutions are technically available in their communities. Most women use analogue phones, compared to men who predominantly own smartphones. Cost of phones and data are factors in this. Women are not capable of consistently purchasing data. This, coupled with poor network infrastructure significantly lower women's vast opportunity to learn about existing solutions. Women in Kaduna face particularly acute infrastructure challenges, with some reporting having to walk significant distances to find network signal. Aside from the time this takes, they are put at risk. These intersecting barriers mean that even when digital solutions exist, women's practical ability to access them is severely compromised. PLWD face compounded accessibility barriers, as they cannot easily travel to find network signal and may lack the financial resources to purchase multiple SIM cards from different providers.



Data is expensive. I have to budget for it every month. Sometimes I have to choose between buying data and buying other things for my business.



IDI Female Wholesaler, Ogun



If I have not eaten enough, I can't buy data. From two weeks now, I can't buy data.



IDI Female Processor, Ogun



The challenge is having money to buy data. Once you can get data, going on the internet would not be a problem again.



IDI Female Farmer, Ogun

Another critical accessibility issue is the existence of male-dominated farmers' associations which essentially exclude women from training, input subsidies, and digital solution access these associations provide. Women report being unable to join or receiving fewer benefits than men.



The association is mainly for men. Very few women are members. No, they mainly provide farm inputs to men.



IDI Female Farmer, Kaduna



In this community, it is only the men who get to be registered in the association.



IDI Female Wholesaler, Kaduna



Yes, it is just for men. Yes, it is for maize farmers. Yes, strictly for men.



IDI Female Producer, Kaduna

However, development and private sector organizations providing digital solutions are propagating practices that are effectively promoting the inclusion of women. These organizations often mandate specific percentages of women participants, provide female-only training sessions, and employ female field agents.



Most partners come with their own structure: we need a certain percentage of women and youth, say 30% men, 40% women, 30% youth.



KII Digital Solution Provider, Kaduna



We have a women-focused program that targets female farmers with tailored content and support. We also have a separate platform specifically designed for women farmers, which we launched two years ago.



IDI Female Processor, Ogun



We have a program called 'Women in Agriculture' that deals with women by providing training on how to create food value chains.



KII Digital Solution Provider, Kaduna

Their mode of operation is addressing policy gaps at the local government level aptly reported.



At the local government level, it is not all that equal. There is no policy that says in your engagement you must have a specific percentage. But other NGO partners come with their own structure: we need a certain percentage of women and youth.



KII Digital Solution Provider, Kaduna

4.3.3 Gender-Differentiated Service Provision

The organizations and individuals providing digital solutions contribute to awareness of existence; this is different from existence on a generic level because it impacts on the dynamic of the service provided. Some service providers have been able to improve on the quality of their service by providing access points for women and men differently. Differentiated access points are necessary of the realities of mobility for women and men, especially in contexts where religious norms restrict women. Men can travel to banks and agent locations independently, while women face mobility restrictions and may need other women. PLWD face the most severe access difficulty, as they cannot easily travel to service points and require specialized assistance that is rarely available. Restricted mobility limits the ability to access digital solution service points and hinders the avenues to gain more direct experience with using digital solutions, a very important marker of awareness.



Some women cannot travel to the town centre to register for mobile money because their husbands will not allow them.



IDI Female Retailer, Ogun



Accessing digital service providers is harder for women because they do not move around like men. Cultural and religious reasons make it stringent for women.



IDI Female Farmer, Kaduna



We don't have a bank here. People usually go to Zaria when they need to open a bank account. But as a woman, I cannot just go to Zaria by myself. I have to wait for my husband to take me.



IDI Female Farmer, Kaduna



If you want to open a mobile money account, you have to go to the agent in the market. But some women are afraid to go to agents alone.



IDI Female Farmer, Ogun

4.3.4 Navigating Access through Innovative Models

Women employ creative strategies like Instalment Schemes and Device Sharing to access digital solutions despite economic and structural barriers. The most significant innovation is “easy buy” instalment purchase schemes, which have enabled many women to acquire smartphones through weekly or monthly payments rather than lump-sum

purchases. These schemes are offered by phone vendors who visit communities, require an initial deposit and National Identification Number (NIN) registration, and then allow women to pay in instalments. Additionally, many women report borrowing phones from family members as a coping strategy, though this limits their autonomy and consistent access.

However, the Trust Group Entrepreneur (TGE) model provides Android phones to trusted women leaders, who then serve as digital champions in their communities. The “Phone for Her” campaign crowdfunded to buy phones for women farmers, each coming with a pre-loaded SIM and training, and these women have become digital champions in their communities. These innovative models demonstrate that accessibility is not solely about technology availability but about flexible financing, trust-based distribution, and social infrastructure that accommodates women's economic realities.

Widows report greater ability to access these schemes as they control household finances independently. Women also borrow phones from family members as a coping strategy for lack of personal device. While this enables occasional access, it limits women's autonomy, as they cannot use the phone whenever needed and may be subject to the owner's restrictions. Lack of ownership of phones interferes with knowledge acquisition about solutions.

The third hypothesis that “there are existing digital solutions for agricultural purposes in the study sites that are accessible to women in the maize value chain” is partially supported by data. While existence is a reality, access has not been substantively realised.



They allow us to pay in instalments at Easy Buy. You pay an initial deposit, then pay weekly or monthly until you complete the payment.



FGD Female MVC Actors, Ogun



Women Employ Device-sharing Strategies to Access Digital Solutions | © GIZ/Rossy Heriniaina

4.4 Patterns of Use of Digital Solutions among Women and Men in the Study Sites

According to the fourth objective, to investigate the patterns of use of digital solutions among women and men in the study sites, findings point to the significantly robust use of digital solutions among men that is not demonstrated by women in Ogun and Kaduna States. Gender differences in the use of digital solutions reflect the evolving nature of knowledge about and access to digital tools.

4.4.1 Women's Coordination Prowess and Communication

Women's digital use is predominantly focused on voice calls for customer coordination, sales arrangements, and supplier communication. Most women who use digital tools do so primarily for making and receiving calls related to their agricultural businesses. Women call customers to inform on product availability, negotiate prices, arrange delivery times, and confirm orders. This communication function, while valuable, represents a fraction of digital solutions' potential. Women who only use phones for calls miss opportunities for market intelligence, weather forecasting, agronomic advice, digital credit, and post-harvest management. Women use voice services more regularly throughout the year, while men use digital tools during peak seasons. Women's consistent usage pattern is commendable as it reflects their ongoing coordination responsibilities across the value chain. For instance, women processors and wholesalers particularly rely on phone calls to maintain customer relationships and ensure consistent supply chains.

However, their narrow usage shifts concern to the vast potentials for growth lost in this gap. Women with disabilities particularly have limited choice as they must rely entirely on voice calls for all business transactions, since they cannot easily facilitate physical sales. For many women, the phone has replaced needless physical travel to markets, saving time and transport costs. This pattern is consistent across both states and across different value chain roles.

“

I use it to call my customers to let them know farm products are available for sale.

”

IDI Male Farmer, Ogun

“

I use it to call my customers, so they can come for their products.

”

IDI Female Farmer, Ogun



I use the phone to speak with my customers, to confirm sales and supply. I also use it to snap my products and send it to customers.



IDI Female Farmer, Ogun

Women communicate with business associates over a variety of issues.



I use it to call the farmers. If my market finishes, I will call them to come and supply.



IDI Female Farmer, Ogun



When I need fertilizer, I call the supplier and tell them. Sometimes I send them the money through transfer, and they bring the fertilizer to me.



IDI Female Producer, Kaduna



"I use it to call the person that will buy the maize for me, grind it, and bring it back to me.



IDI Female Producer, Kaduna

The shrewd business acumen of these women is evident in the fact that they consistently use digital tools throughout the year to manage customer relationships, stock levels and household finances.



Women use voice services more regularly throughout the year, while men use digital tools during peak seasons.



KII Digital Solution, Kaduna



I call my customers regularly, not just when I have products. I need to maintain the relationship, so they remember me when they need maize.



IDI Female Farmer, Ogun



Even when I don't have goods to sell, I still use my phone to check on my customers and see when they will need supply.



IDI Female Farmer, Ogun



I use my phone every day for my business. I cannot imagine going back to the old way.



-IDI Female Wholesaler, Ogun

4.4.2 Men's Use of Digital Solutions Across the Value Chain

Men's use of digital tools is broader in scale because of the diverse range of activities across multiple stages of the maize value chain they engage in. They facilitate input procurement, credit access, farming information, production management, weather forecasting, soil testing, tractor hiring coordination, and market price comparison across different states. Men actively use weather apps, WhatsApp groups for market intelligence, and digital platforms for accessing input loans. Men also demonstrate more strategic use of digital tools: they compare prices across different markets before deciding where to sell, check weather forecasts before planting, and use GPS for land measurement to avoid being cheated by labourers. This broader usage pattern translates into greater economic benefits from digital adoption, including higher yields, better prices, and reduced input costs. Men with disabilities, while still facing mobility challenges, have greater access to group trainings and peer learning compared to women with disabilities because of their association with groups that are dominated by men or exclusive to men.

Men get the benefit of access to agricultural credit, purchase of fertilizers, seeds, and chemicals on credit, digital lending platforms, input credit schemes, and bulk purchasing coordination through WhatsApp groups services that women rarely access.



We offer three things to our members: farm inputs on credit, good markets, and trade. Members pay in instalments. If we give them inputs like hybrid seeds, fertilizer, herbicide, and other support, they pay a very low price.



KII Digital Solution Provider, Kaduna



We are in WhatsApp groups where we coordinate buying fertilizer in bulk. That way, we get a cheaper price



IDI Male Farmer, Ogun

Men's strategic use of digital tools also involves them comparing prices across different markets and states, enabling them to sell at the highest possible price. Men access price information through WhatsApp groups, market price apps, and calls to traders in other locations a practice that women rarely engage in due to limited networks and lower digital confidence.



I use my phone to check market prices across different locations. If the price is higher in another place, I can decide to sell my product there



IDI Female Farmer, Kaduna



I am in WhatsApp groups where people share prices from Lagos, Ibadan, and Kaduna. That helps me know where to sell.



IDI Female Wholesaler, Ogun



Before, you would just sell to the first buyer. Now I can call three different buyers and ask for their prices before deciding.



IDI Male Farmer, Ogun

Men additionally use digital tools to coordinate mechanization services, including tractor hiring, planter rental, and sprayer services. Men call equipment owners, negotiate prices, and schedule services activities that women rarely engage in due to physical strength barriers and limited access to equipment owner networks.



I call the tractor owner to come and plow my farm. He charges per hectare. I can negotiate the price on the phone before he comes.



IDI Male Farmer, Ogun

4.4.3 Women and Mobile Money Platforms

Women use mobile money predominantly as a receipt tool rather than for active financial management. While many women report using mobile money, their usage is largely passive: they receive payments from customers but rarely initiate transfers, pay for inputs digitally, or use mobile savings features. The data reveals that women often rely on children, husbands, or POS agents to make transfers on their behalf, citing fear of making mistakes, literacy barriers, and lack of confidence. Women who have experienced mobile money fraud or failed transactions often abandon digital payments entirely, reverting to cash.

Other factors that inhibit women's interaction with electronic payment is collateral deficit

among women. A lot of women don't have land titles, which serve as crucial collateral. Due to this, they cannot access loans through digital platforms. This passive usage pattern means women miss opportunities for building credit histories, accessing digital loans, and maintaining financial autonomy. Women processors, who handle frequent small transactions, are particularly affected by this limitation.



I use mobile banking to receive payments. My customers send money through OPay or PalmPay. I don't have to go to the bank anymore. But when I need to send money, I ask my son to do it for me.



IDI Male Farmer, Ogun



I receive money through OPay from my customers. But when I need to pay someone, I give cash. I don't know how to send money from my phone.



IDI Female Farmer, Ogun

Women's experience with technical glitches, mobile money fraud has caused distrust in digital financial services which has led some to abandon digital payments entirely, representing a significant barrier to financial inclusion.



I used OPay before, but I stopped about three years ago after losing more than 100,000 naira from my account.



IDI Female Wholesaler, Kaduna



Agricultural Produce Displayed at a Local Market | © GIZ/ Chancy Alfred Nthowela

“

I don't trust mobile money. I prefer cash. If I send money and it doesn't arrive, who will help me? I will just lose my money.

”

IDI Female Wholesaler, Ogun

“

OPay bank sometimes faces network challenge. I sent some money and the money did not deliver; it was after 24 hours before the money dropped. That is a huge fear for me.

”

IDI Female Farmer, Ogun

Due to women's limited use of digital financial platforms, they are consequently excluded from digital credit. Besides the issue of women's lack of collateral, gender bias in lending algorithms affect

women's access to credit. Eligibility for loan often places the loans beyond women's reach and without consideration for the structural constraints that affect women differently.

“

A lot of women don't have land titles. Without collateral, they can't access loans through digital platforms. It defeats the entire purpose.

”

KII Gender Expert

“

I have heard about digital loans, but I cannot apply because I don't have a bank account. To open an account, you need ID, and my husband has my ID.

”

IDI Female Farmer, Ogun

4.4.4 Gender and Voice/Text-Based Digital Tools

There is a significant gender difference in preferred digital interfaces: women overwhelmingly prefer voice-based services, while men are more comfortable with text-based services. One of the participants noted that “women tend to prefer voice-based services because many have lower literacy levels. Voice services that bypass literacy barriers are more accessible to women with basic phones and feel more natural and trustworthy to women who are not comfortable reading English or navigating text menus. This peculiarity has important implications for digital solution design: voice-based platforms have shown significant growth in women's active usage, while text-based platforms continue to exclude women with low literacy.

Women also prefer to receive information through radio and voice notes on WhatsApp, rather than written messages. Additionally, videos accompanied by audio are more effective for many women, regardless of local language use, as many cannot read their local language. Women with disabilities, particularly those with visual impairments, rely almost exclusively on voice-based services.



Women tend to prefer voice-based services because many have lower literacy levels. They are more likely to use the call-in service and listen to voice messages. Men are more comfortable with text-based services like SMS and the USSD menus.



KII Digital Solution Provider, Kaduna



The voice note I send to customers is the most helpful on the phone.



IDI Female Processor, Ogun



I prefer when they use voice messages. I cannot read English well, but I can listen and understand.



IDI Female Farmer, Ogun

Men are more comfortable with text-based services like SMS and the USSD menus. Their higher literacy levels and greater familiarity with smartphone interfaces enable them to navigate text-based services that exclude many women.



Men are more comfortable with text-based services like SMS and the USSD menus.



KII Digital Solution Provider, Kaduna



I use SMS to get information about market prices. They send me messages, and I can read them myself. I don't need anyone to interpret for me.



IDI Female Wholesaler, Kaduna



The USSD menu is easy for me. I just type the code and select the options. I don't need to speak to anyone.



IDI Male Farmer, Kaduna

4.4.5 Gender, Marketing and Production with Digital Tools

A significant difference in the use of digital application by women and men is that women use digital tools predominantly for marketing and sales, while men use them for production-stage activities. The majority of women's digital use is concentrated on customer communication, sales coordination, and payment receipt activities associated with moving products to market. In contrast, men's digital use is concentrated on weather forecasting, agronomic advice, soil testing, and input procurement activities associated with crop production. This reflects the gendered division of labour in the maize value chain as men dominate production decisions, while women dominate marketing and sales. Apps useful for processing and post-harvest activities have not received as much attention, creating a gap. This product gap may be due to less motivation on the part of developers to invest in aspects of the value chain deemed less profitable because of the limited social visibility of women, in addition to other constraints surrounding women's ability to scale up in these nodes. Women processors face the most severe gap, as they have less digital tools for quality control, storage management, or buyer connection. They report no digital solutions for quality control, packaging, storage management, or buyer connection, forcing them to rely entirely on physical market visits.



The only digital thing I use for processing is my grinding machine. But that is not a phone app.



IDI Male Processor, Ogun



We need information about how to store maize so it doesn't get weevils. I lose a lot of maize to insects.



IDI Male Processor, Ogun

PLWD women farmers face compounded exclusion, as they cannot easily access production-stage digital tools that require mobility.

They cannot access production-stage digital tools that require mobility, cannot easily travel to markets for sales, and have no accessible digital solutions tailored to their needs. They rely entirely on voice calls and basic phones.

Hypothesis four, which states that there is a significant gender divergence in the application of digital solutions is supported by data. Women predominantly use them for communication and mobile money functions in the marketing and sales stages, whereas men use them for a wider range of activities, including accessing credit, farming information, and input procurement across various stages of the maize value chain.



They have phones but they don't have more than the phones, they still use their hands to cut the weeds.



FGD Female MVC Actors, Ogun



Yes, it will improve their efficiency.



IDI Male Processor, Ogun

4.5 Relationship Between Women's Use of Digital Solutions and Gender-Based Violence in the Study Sites

The fifth objective, **to explore the relationship between women's use of digital solutions and gender-based violence in the study sites** produced findings that demonstrate the contentious space that digital participation represents for women in reality. Digital participation is a measure of agency for women; however, women's increasing agency is not accepted by men or society at large. Violence is one of the ways in which the patriarchal system resists women's growing autonomy.

4.5.1 Relationship between Digital Participation and Violence

Women's independent ownership and use of digital solutions correlate with a heightened risk of experiencing physical assault, psychological violence, and controlling behaviours from intimate partners. In Ogun and Kaduna states, gender-based violence is linked to phone use and physical assault. Phone ownership and use contribute significantly to autonomy and increased agency for women which triggers feelings of jealousy in men.

Husbands physically assault wives over phone calls, destroy phones when they smash the devices or throw them into water. They also confiscate them, refusing to return the devices. False infidelity accusations triggered by unknown callers or WhatsApp usage occur, causing marital dissolution where women are sent back to their parents' homes and economic control where husbands refuse to pay for data or airtime. The violence is often triggered by unknown callers, WhatsApp usage, suspicion of male buyers contacting wives, and wives out-earning husbands. The dimension of WhatsApp usage implies that the more digitally literate, demonstrated by the sophistication of the device, the higher the propensity for tension between couples. Perceived inappropriate communication is responded to with violence.



I have seen a man who beats his wife because a man chatted with her on phone.



IDI Female Farmer, Ogun



I heard a woman used her phone to call another man and the husband beat her up. I heard another one that left the house and went to live elsewhere.



IDI Female Farmer, Ogun



He seized her phone, used it to hit her, and damaged the phone. He did not stay with her again.



IDI Male Processor, Ogun

Husbands use phone destruction and confiscation as tools of intimidation, sending a clear message that women's digital autonomy will not be tolerated and destroying the woman's business tool and customer contacts. Confiscation is used to punish perceived infractions, prevent further communication, and assert dominance. Women whose phones are confiscated lose their business tool and customer contacts, damaging their livelihoods.



The husband collects the phone, and sometimes even smashes it on the ground.



IDI Male Farmer, Ogun



There are many people that we heard that their husband threw their phone into the water because of it.



IDI Female Farmer, Ogun



There are challenges... I can call someone now and ask if they are at home... my husband may decide that he wants to know the person who called me... at that moment he will seize my phone.



IDI Female Processor, Ogun

Women face psychological violence from constant accusations of infidelity, based solely on phone use, forcing them to constantly justify their communications.



Generally, men see them as promiscuous women.



IDI Female Farmer, Ogun

Economic violence is also an offshoot of women's phone use. Men consequently withhold financial support by refusing to pay for data, denying airtime, or withdrawing financial contribution domestically as a form of gender-based violence against wives who use digital tools. This control tactic undermines women's ability to maintain digital access.



A woman told her husband she needed data, and he said 1GB should be enough for the whole month. He sent only 1GB, but 1GB is not enough, especially if you watch YouTube.



IDI Female Farmer, Ogun



Some men, after buying a phone, relent. Some find it difficult when it comes to buying things for their wives.



IDI Female Farmer, Ogun

The most severe consequences of digital-related GBV in Ogun and Kaduna states include marital dissolution and fatal violence. Divorce directly linked to phone use, where husbands accused wives of infidelity based on call logs or WhatsApp messages.

Digital surveillance can also escalate into lethal violence, making GBV safeguarding protocols within digital inclusion programs an urgency. Women who experience marital dissolution due to phone-related conflicts often lose not only their marriages but also their livelihoods and social standing due to stigmatization.

“

I heard of a recent experience, it was the wife who checked her husband's phone and heard a female recorded voice note. She took a cutlass and injured her husband on the neck and the husband in return stabbed her to death.

”

-FGD Female MVC Actors, Ogun

“

The thing which is spoken very less is about the risk, the privacy challenges which no one talks about. The digital violence, no one talks about. The digital safety, but I think those are very, very critical... Everyone wants to only portray the good part of it, where they're talking about how wonderful this whole digital space is. But no one wants to talk about the risks and challenges that are associated with it, which are equally very, very critical and something that one needs to address.

”

KII Gender Expert

“

Some women have been beaten to death because of it. Men are so wicked; they don't want their wives to work and want to have more money than their wives.

”

IDI Female Processor, Ogun

“

There are equally a lot of challenges when you talk about the digital aspects. Like you get involved in scams, you lose money, you deal with digital violence, people are using your pictures for wrong reasons.

”

KII Gender Expert

Digital violence, privacy violations, and scams are systematically underreported because of widespread optimism about digital technology's benefits. This underreporting means that the true prevalence of digital-related GBV is likely much higher than documented.

4.5.2 Women's Resilience in the Face of GBV

Women demonstrate resilience and agency despite facing violence and control, employing diverse strategies to navigate digital-related GBV while maintaining access to phones for business purposes. Documented coping strategies include using phones secretly, deleting call logs and message histories, handing phones to husbands for inspection upon request, avoiding smartphone purchase altogether, involving community leaders for mediation, and switching to cash transactions to avoid digital traces.

Women show husbands their call logs, introduce them to customers, and explain their business communications. This transparency

builds trust and reduces the risk of false accusations, though it also reduces women's privacy. While this strategy enables continued access, it also reinforces the normalization of surveillance and places the burden of avoiding violence on women.



I don't use my phone when my husband is around. I wait until he is not home or when he is sleeping.



IDI Female Farmer, Ogun

community leaders mediated and explained that calls were from female field agents, leading to husbands becoming supportive. Women who have supportive husbands report using transparency as a strategy: showing husbands their call logs, introducing them to customers, and involving them in business decisions to anticipate suspicion. Some women avoid smartphones totally, sacrificing the benefits of digital solutions to maintain marital harmony.

Other women resolved to revert to cash transactions to avoid leaving digital traces that might trigger husband's suspicion, sacrificing the convenience and security of digital payments.



I sat him down and showed him what I was doing. I showed him my WhatsApp messages they were all about business. I showed him how I receive payments on OPay. When he saw the money coming in, he changed his mind.



IDI Female Retailer, Ogun



I prefer cash now. If I receive a transfer, my husband will see the alert and ask who sent the money. With cash, I can keep my business private.



IDI Female Farmer, Ogun



I delete my call log every day. If my husband sees numbers he doesn't know, he will ask me who called. So I just delete them.



IDI Female Farmer, Ogun



If I have to pay someone, I give them cash. I don't want my husband to see my bank transactions.



IDI Female Wholesaler, Ogun



I stopped using mobile money because my husband was always asking who sent me money. Now I just take cash.



IDI Female Retailer, Ogun

There have been successful interventions where community leaders, religious authorities, or digital providers mediated between husbands and wives to resolve digital-related conflicts. These interventions have successfully changed some men's attitudes and reduced violence. Thrive Agric reported successful interventions where

4.5.3 Digital Education and Literacy

Several factors protect women from digital-related GBV and enable them to use digital solutions without fear. Educated men are significantly less likely to perpetrate digital-related violence compared to men with no formal education. They are also more likely to understand the benefits of digital tools, trust their wives' business communications. Nevertheless, trust between spouses is identified as the most critical protective factor: women who report high marital trust experience no digital-related violence. The presence of supportive husbands who actively encourage wives' digital use is documented among married women's responses. These supportive husbands buy phones for their wives, pay for data, teach them how to use apps, and defend them against community gossip.



Educated men are usually more supportive. They understand that the phone is for business. They don't suspect their wives like uneducated men do.



IDI Female Farmer, Ogun



The ones that are educated know the importance of these devices. They even buy phones for their wives and teach them how to use them.



IDI Female Producer, Kaduna



My husband trusts me. He never asks to see my phone. He knows I am using it for business. That is why I have no problems.



IDI Female Farmer, Ogun

Women with supportive husbands report no digital-related violence and higher business success.



Farming Couple during Harvest | © GIZ/Gaël Gellé

4.5.4 Female-Only Programs Reducing GBV Risk

Female-only digital programs have been effective in allaying men's fears, consequently eliminating male suspicion entirely by removing men from the digital access chain. These programs have successfully enabled women to use digital tools without triggering husbands' fears about infidelity or loss of control.



Our female-only program solves the cultural limitation because there are no men involved.



KII Digital Solution Provider, Kaduna



Female Supervisor Conducting Farm Visit | © GIZ/Rossy Heriniaina



We have a female-only program in Lere that is entirely female from supervisor to FO to MSC to operator to TGE to member.



KII Digital Solution Provider, Kaduna



The women-only group is good because you can ask anything without men laughing at you or thinking you are flirting.



IDI Female Wholesaler, Ogun

4.5.5 Community Gossip Drives GBV

Community gossip plays a strong role in triggering or exacerbating digital-related GBV. Trust may exist between couples, however, persistent rumours from neighbours, family members, and other men create pressure to restrict women's phone use. Specific cases of GBV were directly triggered by community gossip, with neighbours reporting to husbands that they saw wives “always on the phone” or heard them “talking to men.” Women who succeed economically through digital tools face more intense scrutiny, with gossip framing their success as evidence of infidelity or impropriety. This creates a double bind: women need digital tools to succeed economically, but economic success triggers gossip that can destroy their marriages. Rather than being celebrated, successful women are suspected of using immoral means to achieve their success, creating a powerful disincentive for women to pursue economic advancement.



The whispers are a concern. In our community, when a woman starts doing well, people talk. They say bad things. Ibrahim's friends are saying, 'Who is she talking to in Lagos?' That can cause problems. The whispers can make a husband suspicious even when there is nothing wrong.



IDI Female Wholesaler, Ogun

Women have nevertheless employed the strategy of ignoring community gossip to maintain their digital access and business focus. Women who have achieved economic success through digital tools report developing resilience to gossip, focusing on their business results rather than community opinion. However, this strategy requires strong marital trust to be effective.



The biggest concern are those men backbiting, saying things behind her back without verifying what she is doing. All this is happening because they were all surprised by her income.



IDI Female Wholesaler, Ogun

The fifth hypothesis, that “a woman's independent ownership and use of digital solutions will correlate with a higher likelihood of experiencing psychological and controlling behaviour from intimate partners family members or relatives” is supported by data.



Conclusion, Recommendation and Limitations



5.1 Conclusion

5.1.1 Core Analytical Findings

This study examined rural women's digital participation in the maize value chain across Kaduna State in northern Nigeria and Ogun State in the south. The findings reveal a structured set of barriers that can be grouped into socio cultural, economic, psychological, literacy related, technological, infrastructural, institutional, and GBV categories. Socio cultural and gender norms were the most pervasive: across both states,

women must obtain their husband's permission to buy or use a mobile phone, subscribe to data, or download applications. This mandatory permission seeking is enforced through stigma, gossip, and the threat of violence. In Kaduna, religious norms further restrict women's mobility, making it difficult to visit mobile money agents or attend training programmes. In Ogun, jealousy and cultural tradition produce the same outcomes without overt religious sanctioning.



Economically, the high cost of smartphones and data, combined with women's limited independent income and lack of collateral for credit, severely restricts access. Psychologically, women exhibit low digital self-efficacy: 44% of women rated their confidence below five on a scale of one to ten, compared to only 18% of men, citing fear of breaking phones, making errors in mobile money transfers, or becoming victims of fraud. Literacy and language barriers are equally acute: 68% of women with no formal education rated English language difficulty as ten out of ten, meaning they cannot read app interfaces, USSD menus, or SMS alerts. Voice based services have proven highly effective in bypassing this barrier, yet most digital solutions remain text dependent.

A critical technological gap emerged: there are almost no digital solutions for the post-harvest, processing, or marketing nodes of the maize value chain, despite women being heavily concentrated in these activities. Existing digital

tools overwhelmingly target production, a domain dominated by men, consequently leaving women with no access to digital support for storage, quality control, packaging, or buyer matching. Infrastructural barriers, particularly poor network coverage, are more severe in Kaduna, where women reported walking significant distances to find signal. Institutionally, male dominated farmer associations exclude women from training, input subsidies, and digital solution access, and local government policies contain no mandates for women's participation. Digital credit algorithms that require land titles or data footprints systematically exclude women who lack both.

Several patterns were consistent across both states. Widows enjoy significantly more digital freedom than married women, while unmarried women face social scrutiny and accusations of promiscuity. Persons with disabilities are almost entirely excluded: they receive no



Smallholder Farmer Weeding her Farm | © GIZ/Sumi Teufel

tailored digital solutions or institutional support and rely on manual labour despite physical challenges. Digital participation directly increases the risk of gender-based violence: women's independent phone ownership correlates with physical assault, phone confiscation or destruction, economic violence (denial of data or airtime), and psychological violence through accusations of infidelity. Fifteen specific incidents of infidelity accusations were documented, and one extreme case of phone related argument resulted in homicide. Finally, female only digital programmes – where all staff, from supervisors to field agents, are women – were the most effective at mitigating GBV risk because they remove male suspicion from the digital access chain entirely.

5.1.2 Interpretation and Implications for Digital Agriculture Interventions

The findings challenge several common assumptions underpinning current digital agriculture interventions. The first assumption,

that providing access to digital devices automatically translates into use, is false. Women who receive phones without corresponding changes in household permission structures, literacy support, and safety mechanisms often lock the devices away, use them secretly, or have them destroyed by husbands. The second assumption, that digital credit algorithms are neutral, ignores how women's lack of land titles, digital footprints, and ability to complete electronic know your customer requirements is interpreted by algorithms as credit unworthiness, thereby maintaining financial exclusion. Third, the belief that mixed gender training works everywhere is contradicted by evidence from Kaduna, where religious norms make mixed sessions inappropriate, and from Ogun, where women self-censor due to fear of gossip and infidelity accusations. Fourth, the focus on smartphone only applications ignore the reality that most rural women own basic phones and cannot afford data; USSD and voice-based services compatible with any phone have far greater reach but remain underfunded. Fifth, while

women only WhatsApp groups provide valuable safe learning spaces, they do not by themselves change men's controlling behaviour at home or community gossip. Therefore, male engagement is essential.

These findings imply that digital inclusion is primarily a social and normative challenge, not a technological one. Interventions must therefore start with household level power dynamics and community norms. Gender based violence safeguards cannot be an afterthought; they must be embedded from programme design, including anonymous reporting mechanisms, female only delivery models, and mediation protocols. One size fits all digital solutions fail because women's needs differ by marital status, disability, literacy level, and value chain node. Voice and local language are not optional features but essential requirements for reaching the majority of rural women. Finally, partnerships with male gatekeepers like husbands, religious leaders and community elders are as important as direct

engagement with women themselves.

Critically, the evidence demonstrates that sustainable digital participation for rural women is only stimulated in an enabling environment where structural and normative barriers are gradually and deliberately removed. This is not an abstract ideal but a practical finding: programmes that fail to address permission seeking, mobility restrictions, literacy gaps, and GBV risks leave women no better off than before, or actively worse off due to violence. Removing these barriers requires intentional, sequenced action. For example, starting with female only training to build confidence, then engaging couples in household negotiation, then linking women's new digital skills to visible income gains, and finally using those gains to shift community norms through public recognition. It is a deliberate process, not an automatic outcome of distributing phones.

5.2 Recommendations for Development Cooperation and Programme Implementation

The following recommendations are prioritised based on evidence strength and feasibility, and are directed at GIZ, implementing partners, digital solution providers, and donors – not primarily at national government, though some have policy implications.

Recommendations for programme design:

First, development actors can commit to female-only delivery models in Kaduna and similar culturally restrictive contexts. Programmes with all female staff from supervisors to field agents can eliminate male suspicion and have been shown to increase women's safe participation. Where mixed programmes are unavoidable, parallel female only sessions should be provided. Second, gender-based violence safeguards must be integrated from the outset, not added as a referral pathway. This includes anonymous in app reporting, couple-based negotiation training on phone use, and mediation protocols involving community leaders. Third, all digital solutions should be voice based, use local languages, and be compatible with basic phones.

USSD, interactive voice response, and radio-based services reach far more women than smartphone apps. Fourth, development actors should urgently fund the co design of digital solutions for processing and post-harvest nodes, where women are concentrated but currently have no tools. Participatory design sprints with women processors can produce storage monitors, quality control aids, buyer matching platforms, and inventory management tools. Fifth, persons with disabilities must be explicitly included through home-based voice services, accessible training materials, assistive devices, and the hiring of disabled women as field agents.

Recommendations for implementation:

Development actors should systematically engage men and community gatekeepers, not through one off sensitisation but through sustained parallel sessions that frame women's digital inclusion as an economic benefit for the entire household. In Kaduna, religious leaders can help reframe digital use for business as

halal. Household level dialogue and negotiation skills should be integrated into women's training, since women who show husbands their call logs and income gain support, while secrecy triggers suspicion. Flexible access models such as instalment purchase schemes, device lending circles, and community digital champions have proven successful and should be scaled up. Finally, digital self-efficacy requires patient, hands on, repeated training by trusted female facilitators, not one-off workshops. In addition, using peer mentoring within women only WhatsApp groups can support learning and motivation.

Strategic priorities for monitoring, partnerships, and sustainability: Monitoring must move beyond counting the number of women trained or phones distributed, as access without agency and safety is meaningless. Useful metrics include permission to use digital devices, independent ownership, GBV incidents, active use of more than two digital functions, income increases, and participation patterns in mixed versus female only spaces. Development actors should partner with digital solution providers to co design with women end users, especially for

processing nodes, and should require gender inclusive design as a condition of funding. To avoid donor dependency, inclusion mechanisms must be institutionalised beyond project cycles: this includes training local women as paid digital champions, linking women's groups to local government extension services, and creating community-based dispute resolution committees for phone related conflicts.

Based on the evidence, several implementation models should be avoided. Mixed gender digital training in Kaduna should not proceed without female only parallel sessions. Smartphone only applications should not be deployed in low literacy, low-income communities without basic phone compatibility. Digital credit applications that require land titles or electronic know your customer completion will systematically exclude women and should be replaced with alternative collateral models such as group guarantees, savings history, or voice-based reputation systems. One-off digital literacy workshops produce no lasting behaviour change and should be replaced by repeated, hands on, peer learning formats.



Smallholder Female Farmer Set for Harvest | © GIZ/Fabiana Anabel Woywod

Gender-Transformative Digital Agriculture:

Practical Elements. A gender transformative approach is not a label but a specific way of designing and implementing interventions that change underlying power relations and norms, not just individual behaviours. Why is this needed here? Because the study shows that even when women gain access to digital tools, men's control, community gossip, and institutional exclusion persist. A gender transformative approach addresses these root causes. In practice, it would include the following elements: It would engage men and women together in structured household dialogue about phone use, financial control, and mobility, for example, through couple-based negotiation exercises during home visits by female field agents. Training curricula would address norms explicitly, asking why husbands fear wives' phones use and how families can benefit from shared access. Household level economic planning would be integrated so that women's digital income is tracked and data costs are budgeted as a household expense rather than a personal luxury. GBV sensitive safeguards can be embedded through a rapid alert system for phone related violence, safe spaces for reporting, and mediation by trained community members including religious leaders in Kaduna. Long term community-based support structures would be created beyond training activities, such as women-led phone sharing libraries, peer savings groups for device purchase, and ongoing mentorship by female digital champions. Finally, digital inclusion would be explicitly linked to tangible economic benefits; for instance, using voice-based market platforms to directly increase women's sales, and hereafter documenting and

publicly commending those gains publicly to shift norms. This is what a gender transformative approach means in operational terms for digital agriculture.

Advocating for Policy Reform: Engagement Priorities for Development Actors.

Development actors are well positioned to engage with Nigeria's Federal Ministry of Agriculture and Food Security and the National Information Technology Development Agency on the ongoing implementation of the Nigerian Digital Agriculture Strategy. Based on the study's findings, three specific advocacy priorities emerge. First, development actors should advocate for gender-disaggregated data to be collected and reported under the strategy's research and development objective, enabling follow-up interventions to address the distinct challenges women and men face at each value chain node. Second, they should promote capacity-building models that directly respond to structural and normative barriers. This can entail supporting women-only training formats in regions such as Kaduna where cultural and religious norms limit mixed-gender participation. Third, they can promote the adoption of accessibility criteria for any digital solution funded or endorsed under the strategy, including voice-based and local language interfaces, compatibility with basic (feature) phones, and built-in, anonymous mechanisms for reporting gender-based violence. By raising these points systematically in policy dialogues, development actors can help ensure that the NDAS does not inadvertently embed the very exclusions this study has documented.

5.3 Limitations and Future Research

The study is qualitative, prioritises depth over breadth of representation. Additionally, it is limited in geographical scope, as it covers only two States in Nigeria. This means that interventions should be tailored to the specific research contexts to adequately address the issues discovered. Transferability is also limited. A major limitation, however, was the setback encountered with the Key Informant category of participants. Majority of those invited to participate

in the study were either unavailable or unresponsive. Therefore, the perspectives captured may not fully reflect the diversity of experiences and viewpoints across all relevant stakeholder groups. The implication of this limitation is that certain institutional and policy-level insights may be underrepresented, limiting the comprehensiveness and balance of the findings.

Future research would benefit from broader key informant engagement through extended fieldwork, stronger institutional partnerships, or alternative recruitment strategies. Also, future research should include quantitative, longitudinal studies to measure the impact of digital inclusion on women's income and GBV. Specific digital solutions, particularly voice-based platforms, should be evaluated for adoption rates and safety outcomes. Dedicated research on persons with disabilities is urgently required to design accessible digital agriculture tools tailored to different types of impairment.

Additionally, future research should conduct in depth studies in “special sites” – for example, communities with existing digital agriculture programmes, areas with unusually high or low levels of women's digital participation, locations

with varying digital infrastructure, or sites with different religious and ethnic compositions. Such focused studies would help develop a more detailed understanding of contextual enablers and barriers, and allow testing of specific interventions (e.g., female only training, couple-based dialogue, GBV mediation protocols) under controlled conditions before scaling. These special-site studies would complement broader surveys by explaining not just what happens, but why and under what conditions.

Finally, future research should evaluate digital solutions' adoption and impact on agripreneurship. A focus on persons with disabilities can also yield robust insights into specific challenges and inform exclusive programme design for this group.



Rural Woman Preparing Processed Maize Meal Outdoors | © GIZ/Gaël Gellé



GALLERY



6



Female Maize Farmer Participating in an in-depth interview in Ogun State | © Hanovia Limited



Input Supplier Participating in an in-depth interview in Ogun State | © Hanovia Limited



Female Maize Farmer Participating in an in-depth interview in Kaduna State | © Hanovia Limited



Male Maize Farmer Participating in an in-depth interview in Kaduna State | © Hanovia Limited



Input Supplier Participating in an in-depth interview in Kaduna State | © Hanovia Limited



Female Maize Farmer Participating in an in-depth interview in Kaduna State | © Hanovia Limited



Male Maize Value-chain Actors Participating in Focus Group Discussion in Ogun State | © Hanovia Limited



Male Maize Value-chain Actors Participating in Focus Group Discussion in Kaduna State | © Hanovia Limited



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