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Gender-Responsive Utilization of Indigenous Knowledge for Climate-Smart Organic Agriculture in Abia State, Nigeria

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ABSTRACT

This study examined gender-responsive utilization of indigenous knowledge (IK) for climate-smart organic agriculture among rural households in Abia State, Nigeria. Multi-stage sampling procedure was used to select 120 respondents, and data were collected using structured questionnaires and analyzed with descriptive and inferential statistics. The findings revealed that indigenous knowledge remains central to climate change adaptation, with widespread use of traditional weather forecasting, crop management practices, mixed cropping, and community-based early warning systems. However, significant gender differences exist in the utilization of IK. Male farmers dominated decision-making and access to resources, while female farmers, despite possessing valuable knowledge, faced constraints related to land access, limited resources, and reduced decision-making power. Socio-economic factors such as age, education, and farming experience also influenced IK utilization. Major constraints identified include poor documentation, low youth engagement, gender bias, and resistance to change.

The study concludes that while IK is vital for sustainable and climate-resilient organic agriculture, its effective utilization is hindered by gender inequalities and systemic barriers. Policy implications include the need for gender-inclusive extension services, improved access to resources for women, documentation and integration of IK into agricultural policies, and youth-focused programs to sustain indigenous knowledge systems for long-term resilience.

Keywords: *Extension, gender, adaptation, practice-oriented, indigenous*

INTRODUCTION

Climate change remains one of the most pressing global development challenges, disproportionately affecting vulnerable rural populations whose livelihoods depend directly on climate-sensitive sectors such as agriculture, forestry, and fisheries. In sub-Saharan Africa, including Nigeria, high exposure to climate hazards, limited adaptive capacity, and heavy reliance on rain-fed agriculture amplify rural vulnerability (Filho *et al.,* 2022). In response to these challenges, attention has increasingly shifted toward locally grounded and culturally embedded adaptation systems, particularly indigenous knowledge (IK).

Indigenous knowledge represents a cumulative body of skills, practices, beliefs, and innovations developed and sustained across generations within specific ecological and cultural contexts. It embodies deep understanding of local climate patterns, biodiversity, soil systems, and sustainable resource management practices (Bello-Odofin, 2023). Across rural communities in Nigeria, indigenous ecological knowledge, referred to as "*Imo*" among the Yoruba, "*Amamihe*" among the Igbo, and "*Ilimi*" among the Hausa continues to inform agricultural decision-making and environmental stewardship. Such knowledge systems provide practical climate adaptation strategies including traditional planting calendars, crop diversification, soil fertility management, water conservation techniques, and ecosystem-based farming practices (UNESCO, 2018; Tume *et al.,* 2019).

The integration of indigenous knowledge into climate-smart and organic agriculture presents significant opportunities for enhancing resilience. Organic agriculture, which emphasizes ecological balance, biodiversity conservation, and minimal external inputs, aligns strongly with traditional ecological principles embedded in indigenous farming systems. When effectively utilized, indigenous knowledge supports crop diversification, natural pest control, soil regeneration, and adaptive water management core components of climate-smart organic production systems (UNESCO, 2018).

However, the utilization of indigenous knowledge is not gender-neutral. Gender dynamics, defined by socially constructed roles, responsibilities, power

relations, and access to resources, shape how men and women access, interpret, and apply knowledge within rural households (Umeh *et al.,* 2020). In many rural settings, women play central roles in seed selection, food processing, soil management, and household nutrition, while men often dominate land ownership, large-scale production decisions, and income control. These differentiated roles influence the type and extent of indigenous knowledge utilized for climate adaptation. Empirical studies in Nigeria have demonstrated gender-based differences in adaptation responses and technology adoption (Umeh *et al.,* 2020).

Despite growing recognition of indigenous knowledge in climate adaptation discourse, limited empirical attention has been paid to how gender influences its practical utilization within climate-smart organic agricultural systems in southeastern Nigeria. In Abia State, where altered rainfall patterns, rising temperatures, and environmental degradation pose significant challenges to agrarian livelihoods (Akpokodje *et al.,* 2010), understanding gender-responsive knowledge utilization is critical for designing inclusive and effective extension strategies.

This study therefore examines gender differences in the utilization of indigenous knowledge for climate-smart organic agriculture among rural households in Abia State, Nigeria. By situating indigenous ecological practices within a gender-responsive adaptation framework, the research contributes to ongoing debates on sustainable agriculture, climate resilience, and inclusive rural development.

OBJECTIVES OF THE STUDY

The broad objective of this study is to examine gender differences in the utilization of indigenous knowledge for climate-smart organic agriculture among rural households in Abia State, Nigeria.

Specifically, the study endeavoured to;

i. describe the socio-economic characteristics of rural farmers by gender.
ii. identify indigenous knowledge-based climate adaptation strategies relevant to organic agriculture in the study area.
iii. examine gender differences in the utilization of indigenous knowledge for climate adaptation.
iv. identify constraints to the, utilization, and integration of indigenous knowledge in climate-smart organic agriculture.

Hypotheses

H01: There is no significant difference in the utilization of indigenous knowledge for climate-smart organic agriculture across gender.

Methodology

This study was conducted in Abia State of Nigeria. Abia State with Umuahia as its capital has seventeen (17) Local Government Areas, three senatorial zones namely, Abia South, Abia Central and Abia North and many communities. It is one of the five states in the South East geo-political Zone of Nigeria. The total land area of Abia state is 4,900 Km^2 (Wikipedia, 2021). The State has a population density of 580 persons per square kilometer and a population of 3,727,300 persons. Historically, Abia was carved out of the former Imo State in 1991. It lies between latitude4°45' and 06°07' N and longitude 07°00' and 08°10' East of the equator (NBS, 2020). The climate is tropical and humid with minimal rainfall ranges of 2000mm to 2500mm.

The population of the study comprises farmers residing in Abia State, Nigeria. This includes individuals engaged in agricultural activities within the communities of the state.

The research adopted Abia State Agricultural Development Programme (ADP) zoning pattern, while multi-stage sampling procedure were used in selecting 180 respondents for the study. The sample was a selection of all the three (3) agricultural zones that make up Abia State, two ADP blocks from each of the zone, two ADP circles from each of the block and finally fifteen farmers randomly selected from each of the of the circle. This brought the sample size to one hundred and eighty (180) farmers. Questionnaire administration was employed in collecting data from the farmers while descriptive statistics (namely frequency counts, percentages, mean) and Ordinary Least Square regression analysis were used to analyze the data obtained.

Socioeconomic attributes of respondents which influence utilization of indigenous knowledge in climate change adaptation among respondents will be described in this study, the socio-economic characteristics that were considered are;

= age (years) as provided by the respondents
= gender (male=1, female =0)
= educational level (years)
= marital status (married=1, single=0)
= Farm Income (Naira)
=household size (number of people eating from one pot)
= occupation (full time farming =1, part-time farming=0)
= farming experience (years)
= major cropping pattern (sole cropping=1, mixed cropping=2)
= mode of land ownership (Inheritance=4, purchase= 3, hire/lease=2, gift=1)
= Membership of social organization (yes=1, no=0)
= extension contact (number of times)
= previous training on CSA (yes=1, no=0)
= access to credit facilities (yes=1, no= 0)

= income per year from the farm (Naira)
= farm size (hectare)
= Other source of income (artisan=4, civil service=3, trading=2, others=1).

Indigenous knowledge-based climate adaptation strategies relevant to organic agriculture will be identified using percentages, frequency and mean score where applicable. Gender differences in the utilization of indigenous knowledge for climate adaptation was realized using a five-point Likert scale of strongly agree (5), disagree (4), neutral (3), disagree (2), strongly disagree (1) with a midpoint of 3.00. The decision rule is that mean scores of 3.00 and above imply that the farmers agree with the statements expressing influence of gender dynamics (gender roles, decision making power, access to resources and social norms) on utilization of indigenous knowledge in climate change adaptation across gender, while mean scores of less than 3.00 indicate disagreement.

Furthermore, pooled mean within the gender dynamic variables will be used to decide agreement or disagreement of the variable as having influence on utilization of indigenous knowledge on climate change adaptation across gender.

Constraints to utilization, and integration of indigenous knowledge in climate-smart organic agriculture were captured using a four-point Likert-type scale of strongly agree (4), agree (3), disagree (3) and strongly disagree (1). Based on the weights assigned, a midpoint of 2.50 was obtained. The decision rule is that a mean score of 2.50 and above indicates agreement with the statement while a mean score of less than 2.50 posits disagreement with the statement.

Hypotheses 1 was analyzed using Z-test statistical tools, the study will compared the mean of utilization of indigenous knowledge among male and female farmers using z-test.

Results and discussion

Socioeconomic Characteristics of the Respondents:

The study assessed key socio-economic characteristics of respondents across gender, including age, farming experience, household size, education, farm size, income, and access to resources. Male-headed households (MHHH) had higher mean age (54.50 years) and farming experience (22.39 years) compared to female-headed households (FHHH) with 47.14 years and 15.21 years, respectively. This suggests that while men are older and more experienced, both groups remain within the active farming population. Greater age and experience were associated with improved recognition and transmission of indigenous knowledge (Ayenew and Tilahun, 2022).

Household sizes were moderate (5.68 for males and 5.04 for females), supporting family labour use. However, small farm sizes (4.80 and 4.30 plots) indicate subsistence-level production. Male farmers had higher farm income (₦70,466.67) and better access to land, while women faced constraints in land ownership but had slightly better access to credit, irrigation, and CSA training. Most respondents were married, enhancing labour availability and knowledge sharing within households, Aboaba et al. (2020).

All farmers practiced mixed cropping, reflecting indigenous adaptation strategies (CARE, 2019). Educationally, most respondents had secondary education, indicating a relatively literate population capable of adopting improved practices. Overall, gender differences significantly influence access to resources, knowledge utilization, and climate adaptation capacity.

Table 1: Socioeconomic Characteristics of the Rural Male and Female Household Head in Abia State, Nigeria

Variables	Male	Female	Pooled
Age	54.50 (7.35)	47.14(8.98)	50.82(8.97)
Farming experience	22.39(10.40)	15.21(8.48)	5.35(1.33)
Household size	5.68(1.24)	5.044(1.340)	4.55(3.56)
Farm size	4.80(4.43)	4.30(2.40)	1.38(2.18)
Number of extension contact	1.59(1.73)	1.18(2.53)	56400.00(28467.09)
Farm income	70466.67(28047.79)	42333.33(21047.29)	
Dummy (%)			163(90.60)
Marital status (married)	86(95.60)	77(85.60)	65(36.10)
Member of cooperation (Yes)	30(33.30)	35(38.90)	81(45.00)
Primary occupation (full time)	49(54.40)	32(35.60)	180(100.00)
Major cropping pattern (mixed)	90(100.00)	90(100.00)	21(11.60)
Access to credit (yes)	12(13.30)	9(10.00) 14(15.50)	61(33.90)
Ownership of land (Yes)	47(52.20)	18.76(10.12)	
Access to irrigation facilities (yes)	30(33.30)	38(42.20)	68(37.80)
Participated in the training on CSA	16(17.80)	13(14.40)	29(16.10)

Source: Field survey, 2025; Figures in parentheses are percentage values

Indigenous knowledge-based climate adaptation strategies relevant to organic agriculture:

The study identified various climate change adaptation strategies derived from indigenous knowledge among rural households, with high adoption across gender. A majority of male (97.80%) and female (92.20%) farmers relied on traditional weather forecasting methods such as observing animal behavior, cloud patterns, and wind direction. This knowledge supports timely farming decisions, especially in areas with limited access to modern weather information (Tfwala *et al.,* 2023).

Similarly, most respondents (96.70% male; 95.60% female) adopted indigenous crop management practices, including traditional planting calendars, crop rotation, intercropping, and soil management. These practices enhance resilience and productivity through the use of locally adapted crop varieties as observed by Maru *et al.* (2019).

Water management strategies such as rainwater harvesting and irrigation were more prevalent among male-headed households (95.60%) than female-headed households (71.10%), reflecting gender differences in resource access (Olawuyi *et al.,* 2024).

Both groups also reported high use of traditional ecological knowledge and indigenous building techniques for climate resilience.

Notably, all respondents (100%) utilized community-based early warning systems and medicinal plants for health and environmental resilience. These findings confirm that indigenous knowledge remains central to climate adaptation and sustainable agricultural practices in the study area.

Table 2: Climate Change Adaptation Strategies Derived from Indigenous Knowledge in the Study Area

Indigenous knowledge related to climate change	Male (N=90)	Female (N=90)	Pooled (N=180)
Traditional Weather Forecasting: Observations of animal behavior, cloud formations, wind patterns, and celestial events	88(97.80)	83(92.20)	171(95.00)
Crop Management and Adaptation: Indigenous knowledge guides such as Traditional planting calendars, crop rotations, intercropping, and soil management techniques	87(96.70)	86(95.60)	173(96.10)
Water Resource Management: includes rainwater harvesting, storage techniques, and efficient irrigation methods	86(95.60)	64(71.10)	150(83.30)
Traditional Ecological Knowledge: Rural household's knowledge about the local flora and fauna, their roles in the ecosystem, and traditional conservation practices.	76(84.40)	80(88.90)	156(86.70)
Traditional Building Techniques for Climate Resilience: Indigenous construction methods utilize locally sourced and climate-appropriate materials eg, natural ventilation, insulation, and thermal comfort.	84(93.30)	82(91.10)	166(92.20)
Community-based Early Warning Systems: crucial for preparing and responding to extreme weather events like floods, storms, and droughts.	90(100.0)	90(100.0)	180(100.0)
Use of Medicinal Plants for Health Resilience: Indigenous knowledge includes the use of various medicinal plants to treat ailments associated with changing climatic conditions.	90(100.0)	90(100.0)	180(100.0)
Fire Management and Prevention: Indigenous communities have developed traditional fire management practices to prevent and control wildfires, especially during dry seasons.	90(100.0)	64(71.10)	139(77.20)
Cultural Practices that Promote Environmental Stewardship: Cultural beliefs and practices and care for the environment which encourage sustainable resource use and conservation.	88(97.80)	90(100.00)	178(98.90)
Sustainable Livelihoods and Traditional Livestock Management: Indigenous knowledge for integration of livestock farming with agriculture, contributing to diversified and sustainable livelihoods.	84(93.30)	86(95.60)	170(94.40)

Source: Field survey, 2025; Figures in parentheses are percentage values

Gender differences in the utilization of indigenous knowledge for climate adaptation:

The study revealed that gender dynamics significantly influence the utilization of indigenous knowledge (IK) in climate change adaptation. Both male and female respondents agreed that men are primarily responsible for implementing traditional weather forecasting and related IK practices, with mean scores of 4.26 and 4.20 respectively, exceeding the acceptable threshold. This reflects the cultural positioning of men, particularly as "rainmakers," in providing accurate and timely weather predictions that guide community preparedness (Tfwala *et al.,* 2023).

In terms of decision-making, male-headed households demonstrated higher control over the use of IK (mean scores of 4.58 and 4.40) compared to female-headed households (2.93 and 3.38). Although some level of joint decision-making was reported, the findings indicate that men dominate key decisions related to climate adaptation practices. This imbalance limits women's full participation and benefits, highlighting persistent gender inequalities in access to and control over indigenous knowledge systems (Ngoma-Kasanda *and* Sichilima, 2016). Limited access to resources and social networks affects both men and women's use of indigenous knowledge, although participation in its implementation is generally encouraged and accepted across all genders.

Table 3: Mean Distribution of Influence of gender dynamics on utilization of indigenous knowledge

Response	Male (N=90)	Female (N=90)	Pooled (N=180)
Gender roles			
Men are responsible of implementation of traditional weather forecasts and other indigenous knowledge related to climate change in the community	4.26	4.2	4.23
Women are responsible of implementation of traditional weather forecasts and other indigenous knowledge related to climate change in the community	2.72	2.84	2.78
Men and women are responsible of implementation of traditional weather forecasts and other indigenous knowledge related to climate change	2.90	2.50	2.70
Decision-Making Power			
Male headed household have more decision-making power on the utilization of traditional weather forecasts and other indigenous knowledge related to climate change 4.58 Female headed household have more decision-making power on the utilization of Traditional Weather Forecasts and other Indigenous knowledge related to climate change	4.4	4.49	
men and women Decision-making power on the utilization of Traditional Weather Forecasts and other Indigenous knowledge related to climate change	2.93	3.38	3.16
Access to resources	3.96	3.97	3.96
Limited access to resources, social networks and connections influences men on use of Traditional Weather Forecasts and other Indigenous knowledge related to climate change in the community	4.21	4.00	4.11
Limited access to resources, social networks and connections influences women on use of Traditional Weather Forecasts and other Indigenous knowledge related to climate change in the community	4.18	3.40	3.79
Limited access to resources, social networks and connections influences men and women on use of Traditional Weather Forecasts and other Indigenous knowledge related to climate change in the community	3.81	3.17	3.34
Social norms			
It is encouraged and acceptable in my community for men to actively participate in implementation of traditional weather forecasts and other indigenous knowledge related to climate change	3.31	4.31	3.81
It is encouraged and acceptable in my community for women to actively participate in implementation of traditional weather forecasts and other Indigenous knowledge activities related to climate change	4.4	3.74	4.07
It is encouraged and acceptable in my community for men and women to actively participate in implementation of traditional weather forecasts and other Indigenous knowledge activities related to climate change	3.47	3.94	3.71

Source: Field survey, 2025; Benchmark mean =3.00 and above

Constraints Militating Against Utilization of Indigenous Knowledge

A major constraint identified was the limited involvement of youth, as younger generations show The study identified several constraints affecting the utilization of indigenous knowledge (IK) for climate change adaptation, with all factors rated above the acceptable mean score, indicating that both male and female farmers experience similar challenges. This suggests that constraints to IK utilization are not gender-specific but broadly shared across households.

Declining interest in traditional knowledge systems, this threatens the continuity and effective use of IK, especially as older farmers dominate rural agriculture (Mark, 2024; FAO). Additionally, gender biases were reported, particularly the undervaluation of women's indigenous knowledge despite their expertise in areas such as seed selection and crop management. This limits full utilization and recognition of their contributions (Ozor, 2016).

The study also highlighted poor documentation of indigenous knowledge, as most practices are transmitted orally, making access and preservation difficult (Umeh *et al.,* 2025). Furthermore, resistance to change among farmers, driven by cultural norms and preference for modern practices, hinders integration of IK into adaptation strategies. Limited awareness and understanding of IK further exacerbate this challenge. Overall, these constraints significantly limit the effective utilization of indigenous knowledge in climate adaptation.

Table 4: Constraints militating against utilization of indigenous knowledge of climate change adaptation in the study area

Constraints to utilization of indigenous knowledge in climate change adaptation	Male	Female	Pooled
Limited Engagement of Youth	4.09	3.98	4.03
Gender Disparities	4.67	4.01	4.34
Lack of Documentation	4.2	4.64	4.42
Resistance to Change	4.24	4.51	4.38
Lack of Recognition	4.33	4.03	4.18
The erosion of traditional practices and knowledge due to cultural shifts, 3.87 globalization, or modernization can reduce the availability and relevance of indigenous knowledge for both genders		3.66	3.76
Limited Access to Resources	4.27	4.27	4.27
globalization, or modernization can reduce the availability and relevance of indigenous knowledge for both genders			
Limited Access to Resources	4.27	4.27	4.27

Source: Field survey, 2025; Benchmark mean =3.00 and above

Test of Significant Differences in the utilization of indigenous knowledge for climate change adaptation across gender in the study area

The Table 5 showed the test of significant differences between utilization of indigenous knowledge for climate change adaptation across gender in the study area. The results showed that the mean level of utilization of CCA for male and female farmers were 1.9299(SD = 0.2694) and 1.9967(SD= 0.2596) respectively with a Z test value of 0.9319 < 0.05. According to the Z-test result, we accept the null hypothesis that there were no significant differences between level of utilization of indigenous knowledge for climate change adaptation for male and female farmers in the study area.

Table 5: Test of Significant Differences in the utilization of indigenous knowledge for climate change adaptation across gender in the study Area

Variables	Mean	Std. error	Std. dev	Z test
utilization of indigenous knowledge for CCA				
Male	1.9299	0.0284	0.2694	0.9319
Female	1.9667	0.0274	0.2596	

Source: Field survey, 2025

Conclusion

The study examined gender-responsive utilization of indigenous knowledge (IK) for climate change adaptation among rural households in Abia State, Nigeria. The findings revealed that indigenous knowledge remains a critical and widely utilized resource for climate adaptation, with farmers actively applying practices such as traditional weather forecasting, crop management techniques, mixed cropping, water conservation, and community-based early warning systems.

The results further showed that gender dynamics significantly influence the utilization of indigenous knowledge, thereby leading to the rejection of the null hypothesis which stated that gender does not influence IK utilization. Male farmers were found to dominate in decision-making and implementation of certain indigenous practices, particularly in weather forecasting and resource-intensive adaptation strategies. In contrast, female farmers, despite possessing valuable indigenous knowledge, faced limitations in access to land, resources, and decision-making power.

Socio-economic factors such as age, farming experience, education, and access to extension services were also found to influence the recognition and utilization of indigenous knowledge. Older and more experienced farmers demonstrated higher levels of IK use and transmission. However, key constraints, including limited youth engagement, gender bias, poor documentation, resistance to change, and limited access to resources significantly hinder the effective utilization of indigenous knowledge across both genders.

Overall, the study concludes that while indigenous knowledge is vital for climate-smart organic agriculture, its optimal utilization is constrained by gender inequalities and systemic barriers that must be addressed to enhance sustainable agricultural resilience.

Recommendations:

Based on the findings of the study, the following recommendations are made:

1. Promote Gender-Inclusive Extension Services

Agricultural extension programs should be redesigned to ensure equal participation of men and women, with deliberate efforts to empower women in decision-making and access to indigenous knowledge systems.

2. Strengthen Documentation and Preservation of Indigenous Knowledge

Government agencies, research institutions, and development organizations should support the systematic documentation and digitization of indigenous knowledge to prevent its loss and enhance accessibility.

3. Promote Community-Based Learning and Knowledge Sharing Platforms

Establish farmer field schools, community dialogues, and cooperative groups to facilitate intergenerational knowledge transfer and collective learning.

4. Integrate Indigenous Knowledge into Climate and Agricultural Policies

Policymakers should formally recognize and incorporate indigenous knowledge into climate change adaptation frameworks and organic agriculture policies.

5. Capacity Building and Awareness Creation

Training programs should be organized to improve farmers' understanding of indigenous knowledge and its integration with modern climate-smart agricultural practices.

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