Baseline Study Report

FOR THE EMPOWERMENT OF SMALLHOLDERS TO THRIVE AND BUILD CLIMATE RESILIENCE THROUGH REGENERATIVE AGRICULTURE (ESTRRA) PROJECT, BAUCHI STATE.

Report
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Foundation for Sustainable Smallholder Solutions

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Acronyms and Abbreviations

- **BDC** - Baseline Data Collection
- **ESTRRA** - Empowerment of Smallholders to Thrive and Build Climate Resilience through Regenerative Agriculture
- **FGD** - Focus Group Discussion
- **FSSS** - Foundation for Sustainable Smallholder Solutions
- **HH** - Household
- **IGA** - Income Generating Activities
- **KII** - Key Informant Interview
- **LGA** - Local Government Area
- **NGO** - Non-Governmental Organization

EXECUTIVE SUMMARY

Context and Purpose

Smallholder agriculture drives livelihoods in Northern Bauchi State but faces mounting challenges from climate variability, land degradation, and declining productivity. Women and youth contribute heavily to farm labour yet remain marginalized in decision-making and resource access. The ESTRRA Project seeks to empower smallholders, promote regenerative agriculture, and strengthen climate resilience across seven Local Government Areas—Katagum, Giade, Itas-Gadau, Gamawa, Zaki, Shira, and Jama'are of Bauchi North.

Methodology

The baseline study employed a mixed-methods approach, combining 1,508 household surveys, 88 farmer group assessments, and 54 Community-Based Organisation interviews across all seven LGAs. Households were selected via systematic random sampling, while farmer groups and CBOs were purposely sampled for relevance to seed systems and production. Data were collected by trained enumerators using digital tools, validated for accuracy, and analysed using descriptive statistics and thematic analysis. Findings were triangulated to ensure reliability.

Key Findings

Households are largely rain-fed and income-vulnerable, with a mean annual income of ₦738,604 (median ₦360,000). Post-harvest gaps are significant: 98% of farmers have no formal training, and 79% lack adequate storage or processing facilities. Awareness and adoption of climate smart and regenerative agriculture practices remain low, with 86% reporting limited knowledge. Constraints include technical gaps, labour intensity, land access, and delayed economic returns. Gender disparities persist: 60% of women have minimal influence over crop decisions, and leadership in farmer groups is predominantly male.

Implications for the ESTRRA Project

The findings reflect critical gaps in post-harvest management, institutional capacity, adoption of climate smart and regenerative practices, and gender inclusion. The project will enhance productivity, household incomes, access to inputs and outputs market and climate-resilient livelihoods through targeted capacity building, regenerative practice promotion, improved post-harvest systems, market linkages, and expanded participation of women and youth.

INTRODUCTION

Agriculture remains the backbone of rural livelihoods in northern Bauchi State, sustaining the majority of households and serving as a critical source of food security and income. However, the sector operates within a fragile ecological context characterised by increasing climate variability and environmental stress. Rain-fed production systems dominate, making farming activities highly sensitive to seasonal fluctuations and broader climatic changes. These conditions, combined with structural constraints within the agricultural system, continue to limit productivity, weaken market participation, and expose smallholder farmers to recurring risks.

The ESTRRA Project is being implemented across seven Local Government Areas: Katagum, Giade, Itas-Gadau, Gamawa, Zaki, Shira, and Jama'are, in Bauchi North Senatorial District. The region falls within the Sudan and Sahel savannah agro-ecological zones, where agricultural potential is considerable but remains underutilised. Systemic challenges, such as limited access to extension services, weak market linkages, and underdeveloped rural infrastructure, constrain farmers' ability to optimise production and respond effectively to changing environmental conditions.

In addition, social and institutional factors shape outcomes within the agricultural sector. While women and young people contribute significantly to farm labour, their participation in decision-making processes and access to productive resources remain uneven. These dynamics affect not only equity but also the overall efficiency and sustainability of agricultural systems.

Against this backdrop, there is increasing recognition of the need for more sustainable and adaptive farming approaches that can restore soil health, improve productivity, and strengthen resilience over time. The ESTRRA Project is designed to respond to these challenges by strengthening farmers' capacities, supporting more sustainable production systems, and expanding inclusive economic opportunities.

This report presents the findings of a baseline study conducted to establish benchmark conditions across the project areas. The study provides a structured understanding of household livelihoods, agricultural systems, farmer organisations, and inclusion dynamics, forming the foundation for evidence-based project design, implementation, and performance tracking.

Study Objectives

The primary objective of the study is to establish baseline livelihood and environmental conditions across key stages of the farming value chain..

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Specifically, the study sought to collect in-depth information on:

- Demographic and social characteristics of project participants.
- Household economic status, including income, expenditure patterns, and non-farm livelihood activities.
- Agricultural practices, land ownership, and the adoption of climate-smart and regenerative agriculture technologies.
- Post-harvest handling, processing capacities, and value addition opportunities.
- Women's participation in, and influence over, household economic decisions.
- The operational capacity, governance, and needs of farmer groups and cooperatives.
- Current seed production practices, as well as the functional capacity and operational status of community-based seed organisations (CBOs).

Methodology: Sampling Method

Study Design

The baseline study employed a mixed-methods approach, combining quantitative household surveys with qualitative Key Informant Interviews (KIIs). This design provided statistically robust household-level data while generating in-depth insights into institutional capacities among farmer groups and community-based organisations (CBOs).

1. **Household Survey**

The survey targeted approximately 14,000 farming households across seven Local Government Areas (LGAs) in northern Bauchi: Gamawa, Giade, Itas-Gadau, Jama'are, Katagum, Shira, and Zaki. A total of 1,508 households (11%) were surveyed, exceeding the initial 10% target to account for non-response and to maintain baseline reliability.

A systematic random sampling technique was applied. Household lists were compiled at the community level, and respondents were selected at regular intervals from a randomly chosen starting point, thereby minimising selection bias. Two communities per LGA were selected based on the presence of smallholder farmers, women-led households, and active farmer groups. Within each community, 100 households were surveyed to ensure geographic and demographic representation.

2. **Farmer Groups**

In addition to households, 88 farmer groups and cooperatives were surveyed. These groups were selected within the chosen communities to capture insights into collective capacity, governance, service

delivery, access to inputs, knowledge sharing, and market engagement.

3. **Community-Based Organisations (CBOs)**
A purposive sampling approach was used to identify 54 CBOs across 19 communities, selected for their relevance to seed systems and agricultural production. Selection criteria included the presence of organised farmer or seed producer groups, engagement in priority crops (millet, sorghum, cowpea, and groundnut), seed production capacity, willingness to participate, and geographic representation. KIIs with leadership focused on organisational structure, seed production, governance, market linkages, and training needs. This approach provided detailed insights into institutional performance and potential.

4. **Land Reclamation and Regenerative Agriculture**
The land reclamation assessment was conducted in Giade and Katagum LGAs, where suitable sites were available. Four KIIs were conducted with community leaders, extension agents, and farmer hub managers. The assessment focused on land degradation patterns, existing reclamation practices, and opportunities to integrate regenerative agriculture approaches.

Overall Sample Coverage
The study covered a total of 1,650 respondents and institutions: 1,508 households, 88 farmer groups, and 54 CBOs. Each category was analysed at its respective level (household, group, and institutional), ensuring methodological rigour, clarity, and reliable baseline insights.

Data Collection and Analysis

Data collection was conducted by a locally recruited team of trained enumerators and field supervisors, selected for their familiarity with the language, culture and geography of the study areas. Enumerators underwent structured training covering survey instruments, ethical standards, informed consent procedures, and the use of KoboToolbox for digital data capture, including practical sessions to ensure consistent questionnaire administration and recording.

All interviews were conducted in person. Household surveys targeted heads of households or knowledgeable adult members, while Key Informant Interviews (KIIs) engaged leadership from Community-Based Organisations (CBOs) to capture organisational structures, operations and governance practices. Field supervisors carried out routine monitoring, including spot checks and daily reviews, while real-time data validation on KoboToolbox ensured completeness, consistency and accuracy. Errors were promptly corrected through follow-up visits where necessary.

Ethical standards were strictly observed. Participation was voluntary, informed consent was obtained, and respondents' confidentiality and anonymity were maintained. Data were used solely for the purposes of this study.

Quantitative data were cleaned, validated and analysed using descriptive statistics, including frequencies, percentages and measures of central tendency, with cross-tabulations applied to examine relationships among variables. Qualitative data from KIIs were analysed thematically, with responses coded and grouped into recurring patterns to provide deeper insights into institutional capacity, production systems and constraints. Triangulation of quantitative and qualitative findings strengthened the validity and robustness of the study results.

SECTION A: SAMPLE CHARACTERISTICS

Demographic and Social Characteristics

Gender Distribution of Respondents
Figure 1 shows that female respondents constitute a larger share of the sample than male respondents. This reflects the project's emphasis on women's economic empowerment and its intention to strengthen women's participation in agricultural and value chain activities.

The dataset includes 1,508 households, of which 969 (64%) were female-headed or represented by female respondents, while 539 (36%) were male-headed households. This distribution reflects the strong participation of women in agricultural production and household livelihood activities within the ESTRRA project areas.

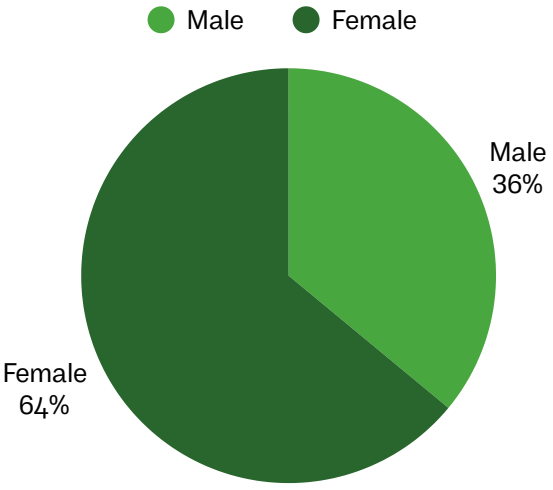


Figure I: % of respondents by gender

Age Distribution of Respondents
The population is predominantly youthful, with over half of the respondents aged between 18 and 35 years.

This demographic structure may create favourable conditions for the adoption of agricultural innovations and could support the long-term sustainability of agricultural interventions. Beyond on-farm production, a relatively young population may also facilitate greater participation in agricultural value chain activities such as aggregation, processing, transportation and marketing. Younger farmers may further engage in emerging agri-service opportunities, including input distribution, mechanisation services and digital agriculture platforms, which can enhance value chain efficiency and rural employment opportunities.

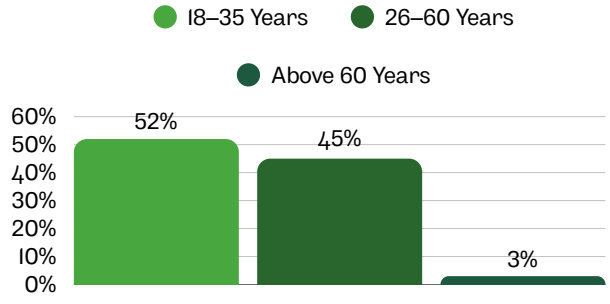


Figure 2: % respondents by age distribution (Source: ESTRRA Baseline Survey, 2025)

Marital Status & Education

The majority of respondents (74.67%) are married, reflecting the predominance of stable household units typical of rural farming communities. Educational attainment varies considerably: 35.01% of respondents have no formal education, while 27.79% have completed secondary education. This variation in literacy levels has important implications for extension and training programmes, suggesting the need for communication approaches that combine simple written materials with practical demonstrations and visual aids to ensure effective knowledge transfer.

Household Size and Composition

Households in the region are relatively large, with an average household size of 10 people. While this may reflect relatively high dependency burdens, it also suggests the potential availability of family labour to support agricultural production and other household livelihood activities. Larger households may provide flexibility in allocating labour across farm and non-farm activities, particularly during peak agricultural periods. However, they may also place greater pressure on household resources, increasing the need for improved productivity and efficient farm management.

Variables	Mean	Minimum	Maximum
Household Size	10.0	1.0	50.0
Youths (18-35)			
Children < 18 years	5.0	0.0	28.0

Table I: Household size and composition

No children (0)	Childless households	99	6.6%
Small family (1-2)	Low dependency	289	19.2%
Medium family (3-4)	Moderate dependency	450	29.8%
Large family (5-6)	High dependency	321	21.3%
Very large family (7+)	Very high dependency	349	23.1%
TOTAL		**1,508**	**100.0%**

Table 2: Household family size showing level of dependency

Agricultural Practices and Land Ownership

Farm Size and Land Ownership

The survey results indicate that the majority of respondents are smallholder farmers, with an average total farm size of 1.84 hectares, reflecting the small-scale nature of agricultural production in the study area. The small average farm size suggests that farmers may need to focus on sustainable intensification strategies to maximise productivity on limited land. Land ownership is diverse, with direct ownership being the most common, followed by inheritance.

Variables	Mean	Minimum	Maximum
Total Farm Size	1.84	0.00	20.00

Table 3: Total farm ownership size

Crops Cultivated

Millet and rice are the dominant crops in the region, followed closely by groundnut and sorghum. This crop mix reflects the ecological suitability of the Sudan/Sahel savannah for the production of diverse crops. Such diversity enhances production resilience by allowing farmers to spread risk across multiple crops and facilitates soil fertility management through crop rotation and intercropping, thereby contributing to more sustainable agricultural systems. Furthermore, cultivating a mix of staple and cash crops provides opportunities for income diversification and strengthens household food security.

Income Sources

Households rely on diverse income streams, primarily crop production and livestock rearing. While 55.04% of households rely on two income sources, a significant portion (24.93%) depends on a single source, increasing economic vulnerability.

Economic Status

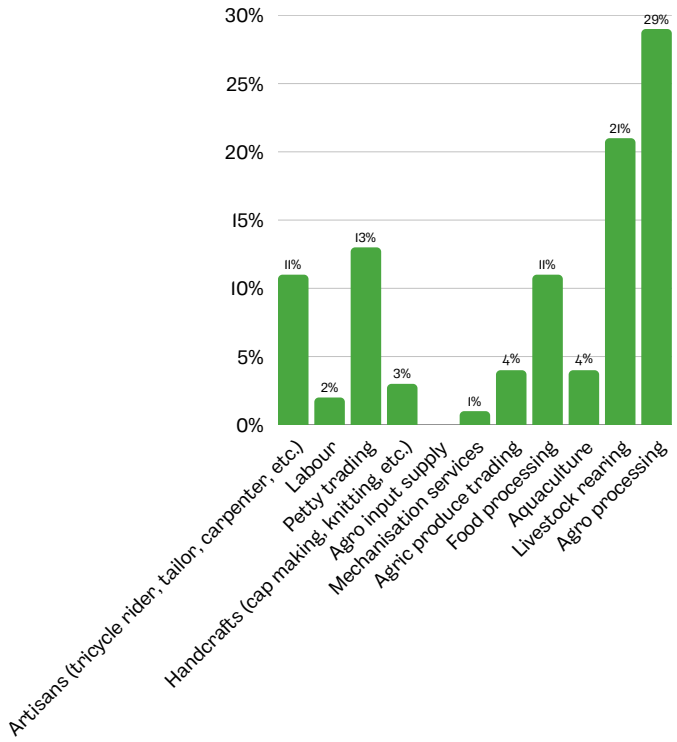


Figure 4: Primary income sources

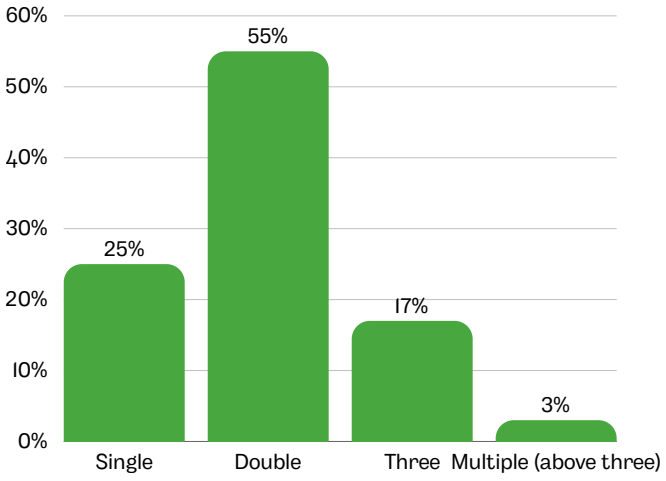


Figure 5: Number of income sources per household

Household Income

The mean annual household income stands at ₦738,604. When compared with the monthly expenditure mean of ₦75,000, many households (40%) operate with thin margins. The self-reported economic status indicates that over half of the respondents are struggling.

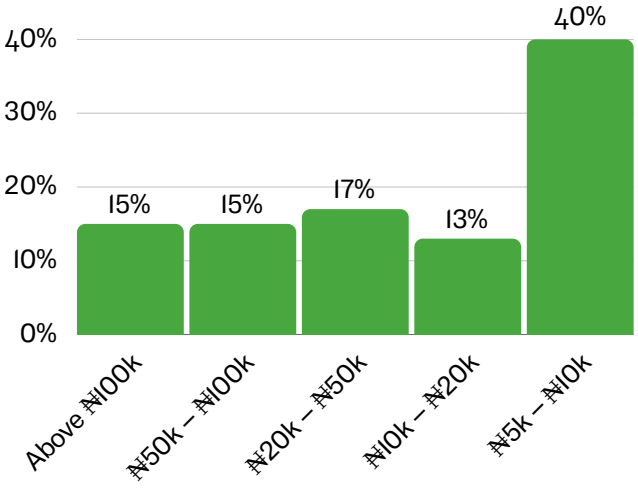


Figure 6: Household monthly expenditure

Figure 7 illustrates the proportion of total household income that is derived from farming activities and the percentage of households that fall within each contribution category.

The chart shows that for 38% of respondent households, farming contributes between 25-50% of their total household income, making this the most common income structure among surveyed households. This indicates that while farming is an important livelihood source, some households rely on additional income-generating activities beyond agriculture.

A further 29% of households obtain less than 25% of their total income from farming, suggesting that these households depend more heavily on non-farm activities, such as petty trading, artisan, or other off-farm sources as shown in figure 4.

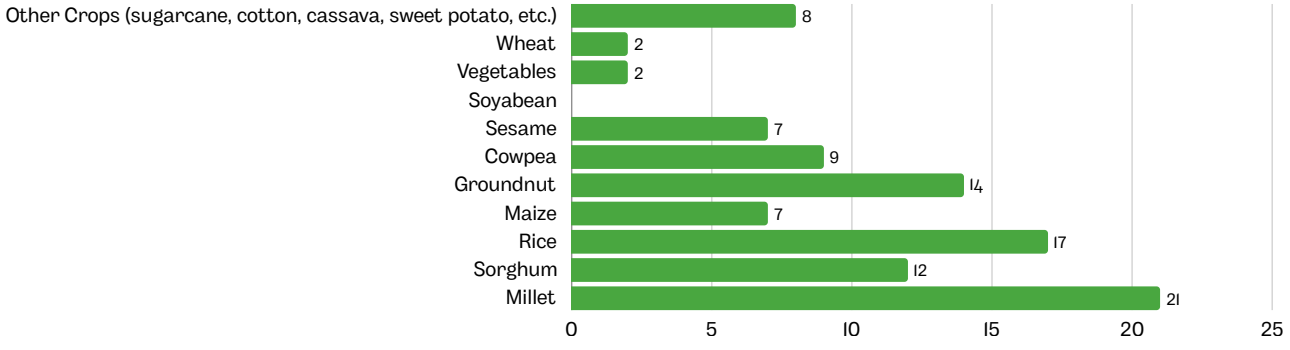


Figure 3: % of respondents by crops cultivated (Source: ESTRRA Baseline Survey, 2025 (*Multiple responses allowed))

Variable	Mean (₦)	Minimum (₦)	Maximum (₦)
Total Household Income	738,604.17 [€461.63]	10,000 [€6.25]	5,500,000 [€3,437.5]

Table 4: Household annual income

Non-Farm Activities

Engagement in off-farm activities offers households a means of income diversification and a buffer against agricultural shocks. Nevertheless, with 56.9% of respondents not participating in non-farm activities, as shown in Figure 8, many households remain heavily dependent on primary agricultural production, highlighting opportunities for programs that promote off-farm income generation and enhance rural resilience.

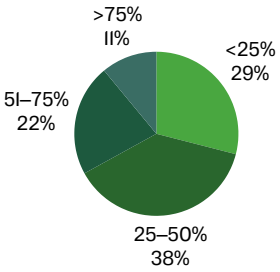


Figure 7: Income from farming activities relative to total household income

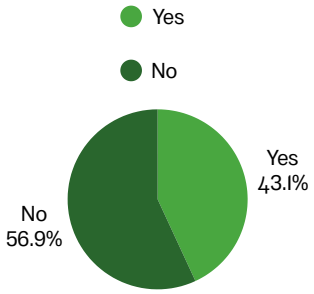


Figure 8: % of respondents by forms of non-farm activities

Capacity	Percentage
None	83%
1000 – 10,000 kg	13%
10,001 – 100,000 kg	3%
Above 100,000 kg	1%

Table 5: distribution of respondents by annual processing capacity (kg)

Agric Processing Activities

Only 22.77% of respondents have access to processing facilities, as shown in figure 9. Consequently, agricultural products are primarily sold in bulk with minimal packaging, limiting opportunities for product differentiation, higher market value, and income generation. In addition, the value addition is limited in the project area, as indicated by the relatively small processing capacity (Table 5).

Post-Harvest Handling and Storage

A critical finding is that over 80% of respondents report post-harvest crop losses of more than 50%.

Inadequate storage and processing facilities continue to drive substantial post-harvest losses, eroding farm incomes. Extension service coverage and formal training opportunities remain insufficient (figure 11), and although farmer groups are present, their ability to function as coordinated platforms for service delivery and learning is inconsistent.

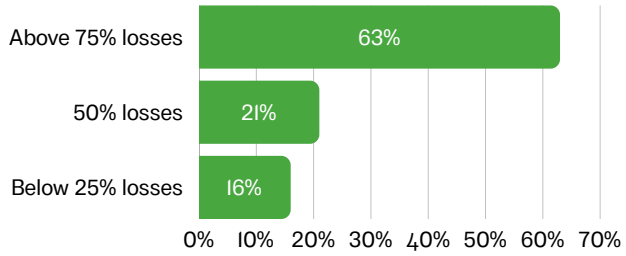


Figure 10: % of farmers reporting crop losses due to post-harvest storage/processing

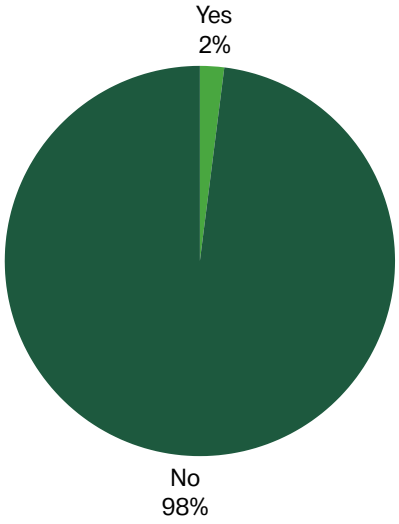


Figure 11: % of respondents by access to post-harvest training

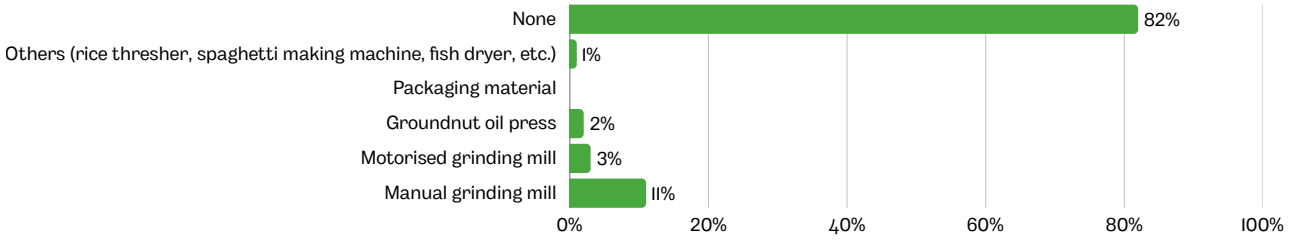


Figure 9: % of respondents by available processing facilities

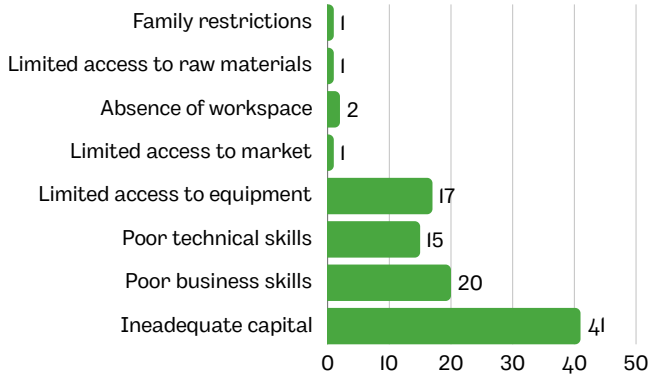


Figure 12: % respondents by main IGA challenges

Income Generating Activities (IGA)

Respondents reported several challenges that constrain the growth of income-generating enterprises, including inadequate start-up or expansion capital (41%), limited business skills, and restricted access to essential equipment (17%), among others.

SECTION B: FARMER GROUPS

Group Demographics and Composition

The survey engaged 88 farmer groups across the seven LGAs. These groups vary in composition and structure, ranging from informal community collectives to more structured cooperatives. They provide a critical social safety net and serve as a platform for knowledge exchange.

Climate-Smart Practices and Regenerative Agriculture Awareness and Adoption

Qualitative analysis from Focus Group Discussions (FGDs) with farmer groups and cooperatives reveals distinct patterns in the awareness and adoption of regenerative agriculture across different LGAs.

In Giade, farmer groups are predominantly male-dominated. Members exhibit limited practical understanding of regenerative agriculture, often viewing it as "soil restoration" based on lived experience. Over 60% are not using any climate-resilient or regenerative agricultural practices.

Katagum and Gamawa LGAs have groups with stronger female participation. Awareness of climate-smart and regenerative agricultural practices is rooted in ancestral knowledge. Practices such as intercropping cereals with legumes and using livestock manure are seen as a "return to old ways." However, a lack of technical know-how is cited as a key reason for low adoption. In the few areas where these practices are reasonably adopted, women play a significant role—for instance, in manure preparation and weeding—but often lack decision-making power over what is grown, as shown in figure 14.

In Itas-Gadau and Shira LGAs, farmer groups are mixed-gender and tend to view regenerative agriculture as an "innovation." There is cautious experimentation with reduced tillage and composting. Farmers reported groundnut, sorghum, guinea corn, and cowpea as the top crops affected by limited access to climate-smart and regenerative agricultural practices. However, adoption is slowed by the perceived risk of negative impacts on financial returns.

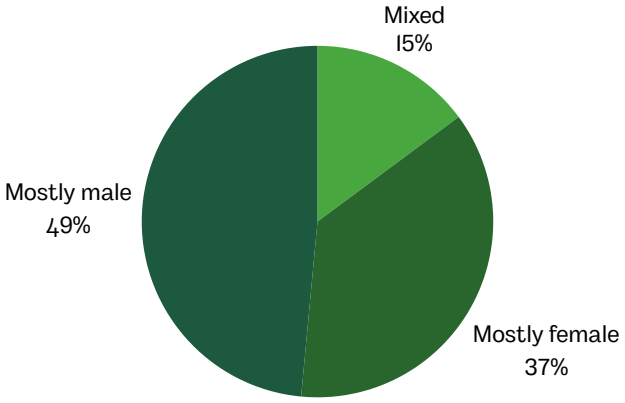


Figure 13: % of respondents by gender composition

Gender and Women Empowerment

Qualitative insights from FGDs reveal that while women are integral to farm labour (planting, weeding, processing), they remain underrepresented in leadership and decision-making regarding land use and income allocation. This underscores the need for targeted interventions to strengthen women's agency and influence within farm and household-level decision-making processes.

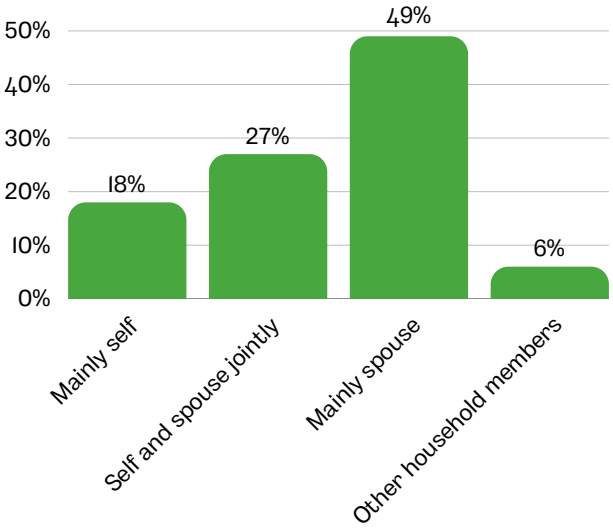


Figure 14: % of women by household decision to grow crops

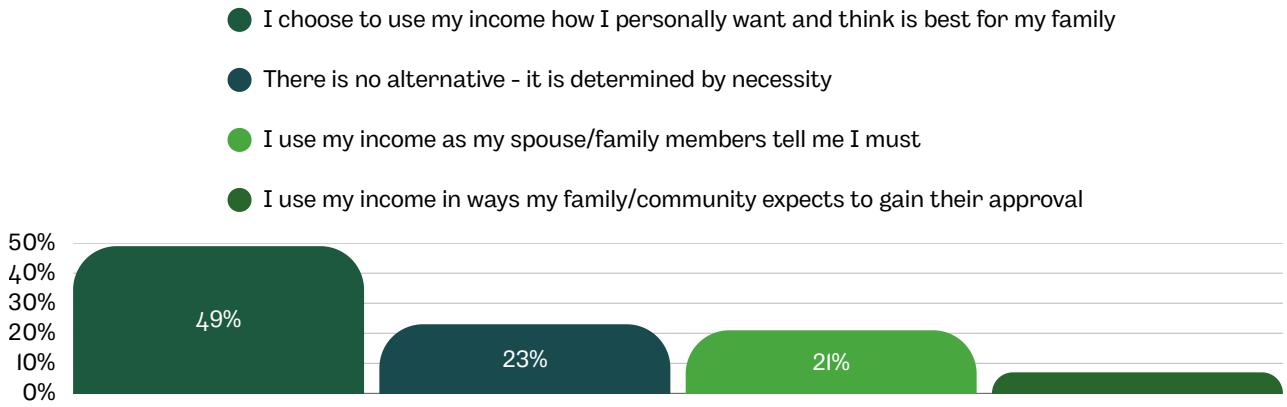


Figure 15: % of women by expenditure rights

SECTION C: CLIMATE RESILIENCE & ADOPTION OF REGENERATIVE AGRICULTURE

Climate Resilience

The survey data indicates that climate variability remains one of the most significant structural constraints to agricultural productivity in Northern Bauchi among project respondents. With over 80% of households dependent on rain-fed agriculture and approximately 41% of land degraded and 63% deforested (ESTRRA baseline study 2026), resilience to climate shocks is a foundational requirement for sustained livelihood improvement.

The data on post-harvest losses due to climate shocks show that a significant proportion of farmers are experiencing severe production losses:

- 36% report losing more than 50% of harvest
- 29% report losses between 35–50%
- 21% report losses between 26–34%

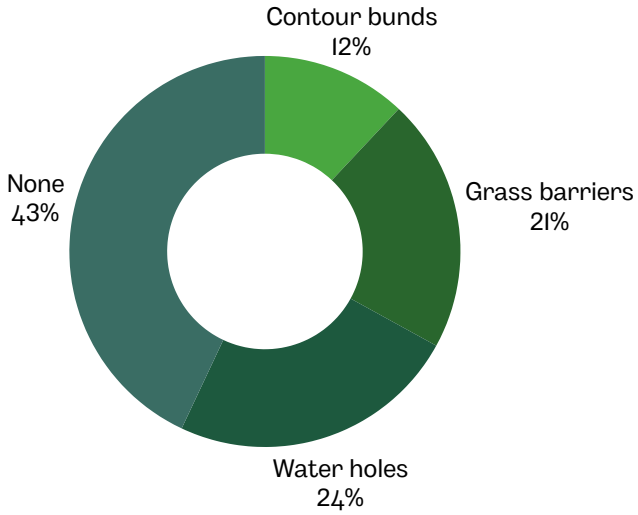


Figure 16: % of respondents by climate-resilient structures established

This means that over 85% of respondents are experiencing moderate to severe climate-related harvest losses. This is a major threat to both food security and income stability.

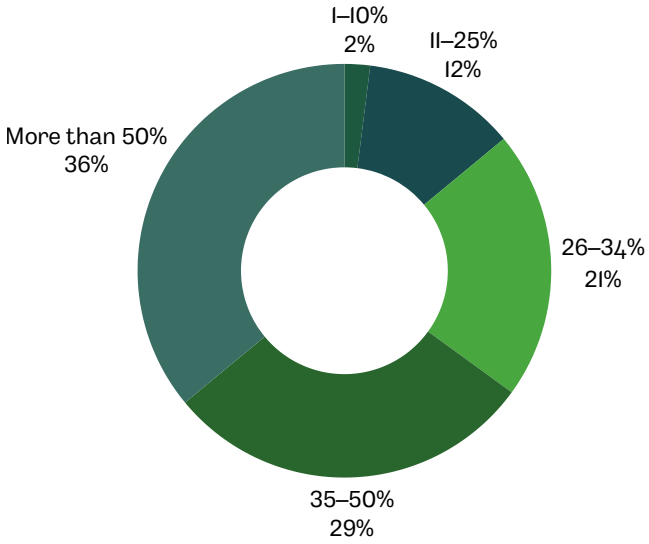


Figure 17: % of respondents by post-harvest losses

Regenerative Agriculture & Land Management

The baseline findings reveal a structurally fragile regenerative agriculture system within the ESTRRA project areas. While farming activity remains high, the ecological foundation upon which production depends shows clear signs of stress, degradation, and limited adaptive management.

Land Degradation and Ecological Stress:

Land degradation emerges as one of the most critical structural constraints affecting long-term productivity. Before respondents were asked to estimate the proportion of land that was degraded or eroded, enumerators provided a simple explanation of land degradation using locally understandable

indicators. Farmers were guided to consider observable signs such as soil erosion, declining soil fertility, reduced crop performance, visible gullies, nutrient depletion, and areas of land that no longer produce as well as before.

Enumerators were trained to give practical examples during interviews, including land where crop yields have declined over time, fields affected by erosion or flooding, or plots where soil fertility has visibly deteriorated. Farmers were then asked to estimate the approximate percentage of their farmland affected by such conditions. This approach ensured that responses were based on farmers lived experiences and observable field conditions, thereby improving the reliability of the estimates while minimising the risk of misinterpretation during data collection.

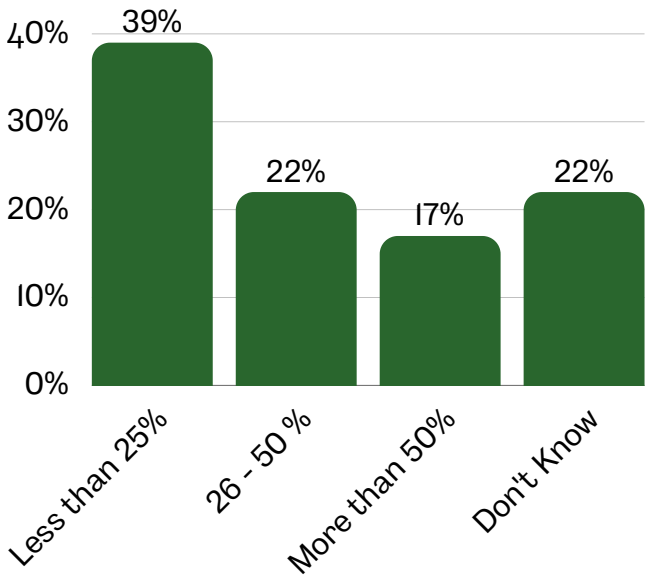


Figure 18: % of respondents by % of farm land degraded

The baseline survey data show that:

- 39% of respondents report that less than 25% of their land is degraded.
- 22% report 26–50% degradation.
- 17% report that more than 50% of their land is degraded.
- 22% are unsure of the extent of degradation.

Collectively, this indicates that a substantial share of agricultural land is either moderately or severely degraded. Even more concerning is the high percentage of respondents who are unable to estimate degradation levels, which suggests limited awareness of soil health indicators and ecological monitoring.

Crop Yield

Regarding crop yields over the last two years, responses show mixed performance:

- Over 80% of respondents reported lower or much lower yields.
- Two per cent reported the same yield.
- Only 17% reported much higher yields.

This indicates that climate variability and soil conditions are negatively affecting productivity.

When analysing crop variety diversity:

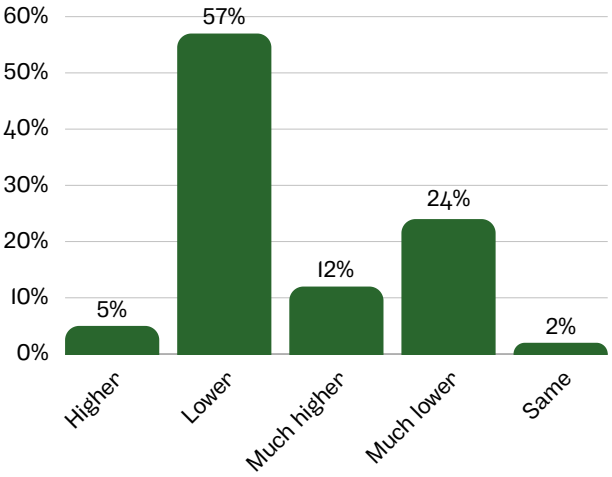


Figure 19: % respondents by crop yield over the past 2 years

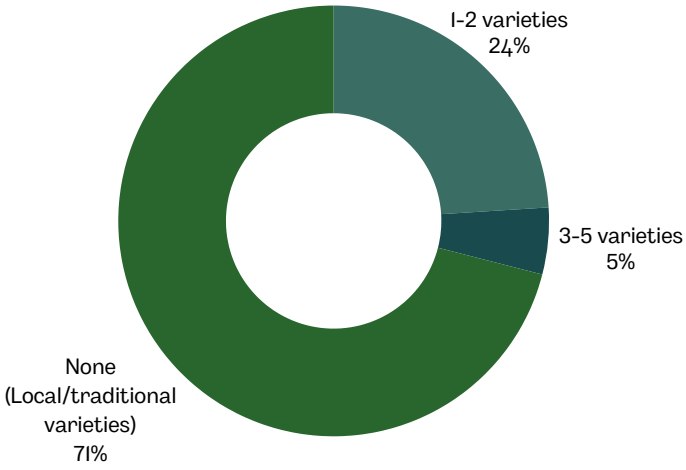


Figure 20: % respondents by crop variety diversity

- 71% of households rely solely on traditional or local varieties.
- 24% planted one to two varieties.
- Only 5% reported planting three to five varieties.

This low level of diversification reduces climate buffering capacity and market flexibility.
The regenerative agriculture landscape remains weak. Land degradation is significant, crop diversification is limited, and although pest control is widely practised, it is not necessarily ecological or sustainable.

Without scaling regenerative practices—such as soil restoration, diversified cropping, water management, and integrated pest management systems—the productivity and resilience of the farming system will continue to decline.

Agroforestry (Fruit Forest)

Overview of Existing Fruit Forest Systems

The baseline assessment of fruit forest systems was conducted to understand the ownership structures, management practices, and socio-economic characteristics associated with fruit forest production within the ESTRRA project intervention areas. A total of 14 fruit forest operators were surveyed across five Local Government Areas (LGAs). The assessment provides insights into the current state of agroforestry-based production systems and their potential contribution to household livelihoods, environmental sustainability, and agricultural diversification.

Fruit forests within the project areas function as integrated agroforestry systems where perennial fruit trees are combined with annual crops and other agricultural activities. These systems provide multiple benefits including food production, income generation, soil fertility improvement, and climate resilience.

Socio-Demographic Characteristics of Fruit Forest Operators

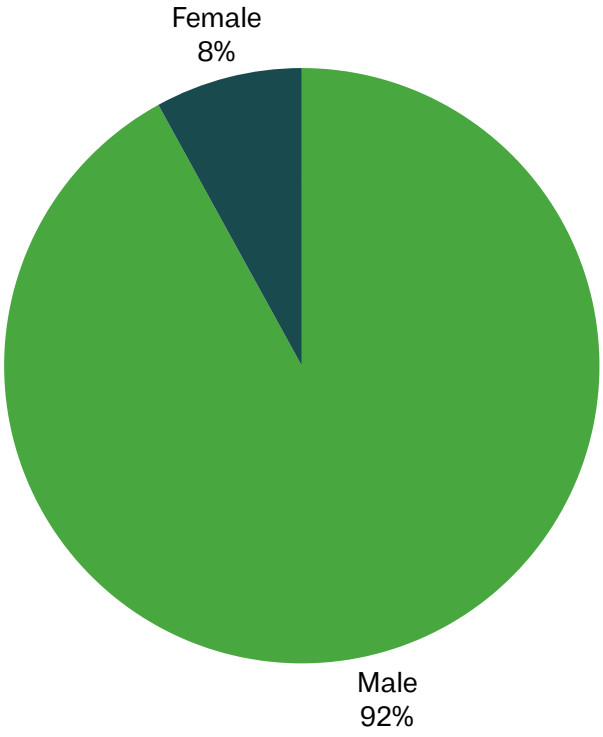


Figure 21: Ownership of fruit forests by gender

Gender Distribution

The management of fruit forest systems is overwhelmingly dominated by men.

The limited participation of women suggests that access to land and decision-making authority in fruit forest management remains largely male-dominated. However, this also presents an opportunity for the project to promote greater gender inclusion in agroforestry interventions.

Land Ownership and Tenure Arrangements

Land ownership patterns reveal that fruit forests are primarily established on family-owned land.

The predominance of inherited land suggests strong customary land tenure systems within the intervention communities. Secure family ownership may facilitate long-term investments in perennial crops such as fruit trees.

Many of the fruit forests are integrated within mixed farming systems, where fruit trees are combined with other crops. This practice reflects a traditional agroecological approach that allows farmers to maximise land productivity while diversifying income sources.

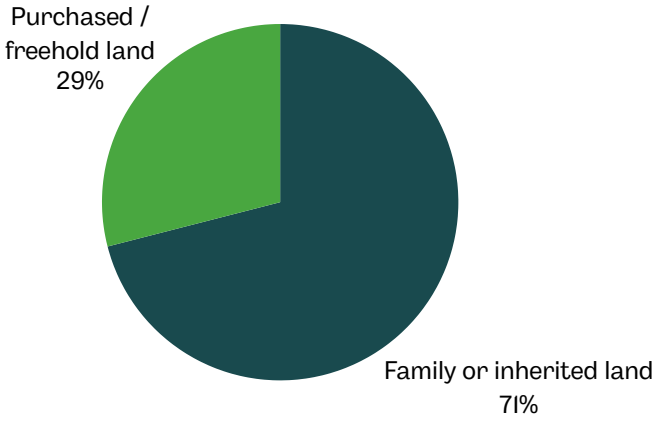


Figure 22: Fruit forest by land tenure type

Fruit Species Present

Figure 23 presents the distribution of fruit species identified within the surveyed fruit forest systems (multi-select responses, n = 14). The results show that mango is the most commonly present fruit species, reported by 8 respondents (57%), indicating its strong dominance within fruit forest systems in the project area. This is followed by baobab, which was reported by 7 respondents (50%), highlighting its importance both as a traditional food source and as a climate-resilient indigenous tree species.

Several other fruit species were moderately represented. Moringa, cashew, and tamarind were

each reported by 4 respondents (29%), suggesting that these species are fairly common components of the agroforestry systems practised by farmers. These species are known for their nutritional and economic value and may contribute to both household consumption and small-scale income generation.

In contrast, papaya and citrus species (such as orange, lemon, lime, and tangerine) were less common, each reported by 2 respondents (14%), indicating that these fruit trees are present but not widely cultivated across the surveyed fruit forests.

Overall, the findings suggest that fruit forest systems in the project area are dominated by a mix of indigenous and widely adapted fruit species, particularly mango and baobab, while other species are present at lower frequencies. This diversity reflects the multifunctional nature of agroforestry systems, where farmers combine fruit trees for food, income, and environmental benefits such as shade, soil improvement, and climate resilience.

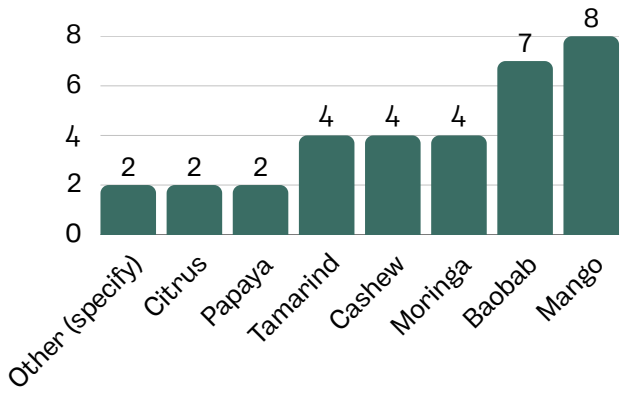


Figure 23: Existing fruit tree species

Agroforest Management Challenges

Figure 24 illustrates the key management challenges affecting fruit forest systems, as reported by respondents (multi-select, n = 14). The results show that theft of fruits is the most commonly reported challenge, cited by 8 respondents (57%), indicating that security issues significantly affect fruit production and harvesting. This suggests that farmers may experience losses during peak fruiting periods, when produce becomes particularly vulnerable to theft.

The second major constraint relates to climate-related challenges, such as droughts and floods, reported by 7 respondents (50%). This highlights the growing impact of climate variability on agroforestry systems, which can affect tree productivity, fruit yield, and overall farm resilience.

Another notable challenge is the lack of tools and equipment, reported by 6 respondents (43%), suggesting that many farmers lack the adequate resources needed for orchard maintenance, harvesting, and the general management of fruit trees.

Financial and labour constraints also play an important role. Insufficient funds for agricultural inputs and a lack of labour were each reported by 4 respondents (29%), indicating that limited financial capacity and workforce availability can hinder effective orchard management.

Other challenges reported include limited technical skills and animal intrusion from livestock or wildlife, each cited by 2 respondents (14%), while irrigation constraints were reported by 1 respondent (7%).

Overall, the findings indicate that fruit forest management in the project area is constrained by a combination of security issues, climate-related risks, resource limitations, and capacity gaps.

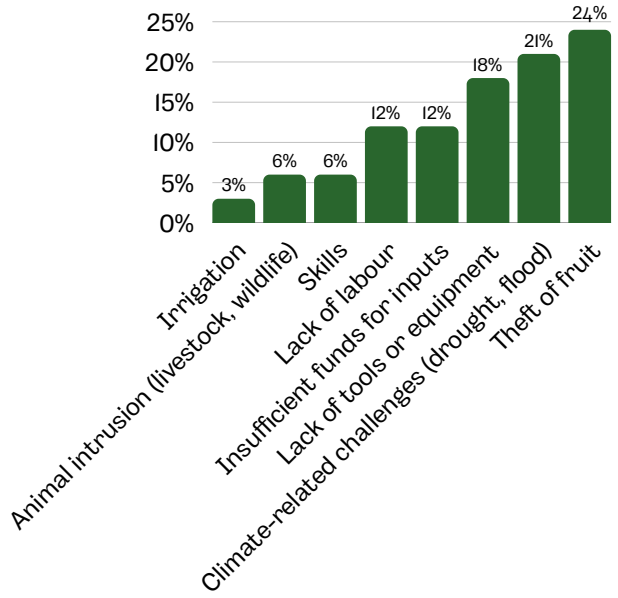


Figure 24: Current fruit tree management challenges

Fruit Tree-Yield Change Compared

Figure 25 illustrates farmers' perceptions of changes in fruit yields compared with three years ago. The results show that the majority of respondents reported an increase in yields, with 4 out of 8 respondents (50%) indicating that fruit yields are improving. This suggests that some farmers may be benefiting from favourable production conditions, improved management practices, or the gradual maturation of fruit trees.

However, 25% of respondents (2 out of 8) reported that yields have declined, indicating that some fruit forest systems are experiencing productivity challenges. These declines may be linked to factors

such as climate variability, pest pressures, poor management practices, or limited access to agricultural inputs and equipment.

Similarly, 25% of respondents (2 out of 8) indicated that yields have remained stable, suggesting that production levels for some farmers have not changed significantly over the past three years.

The findings indicate a mixed trend in fruit forest productivity, with half of the respondents observing improvements while others report either stagnation or decline. This variation highlights the need for targeted interventions under the ESTRRA project to strengthen fruit tree management practices, improve access to inputs and tools, and enhance climate resilience in farming practices.

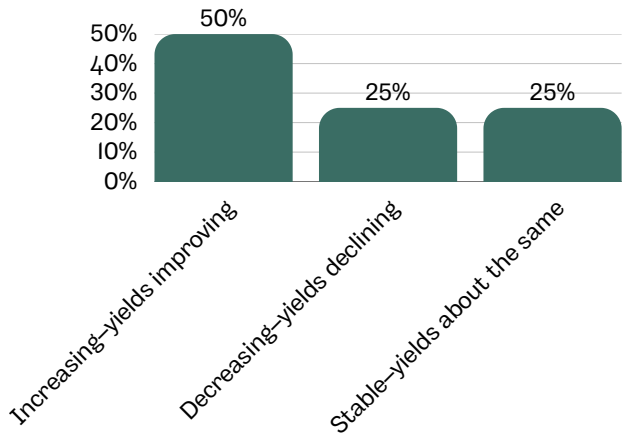


Figure 25: Fruit tree yield change compared to past 3 years

LAND SIZE OF FRUIT FOREST SITES ESTABLISHED FOR SEED SALES

Figure 26 illustrates the distribution of fruit forest sizes among respondents. The results indicate that most fruit forests are relatively small to medium in scale. The largest proportion of respondents reported fruit forest sizes of 1–2 hectares (38%) and 2–5 hectares (38%), showing that the majority of fruit forest operators manage areas between 1 and 5 hectares.

In contrast, a smaller proportion of respondents reported larger fruit forest sizes. Approximately 13% of respondents manage fruit forests between 5–10 hectares, while another 13% reported owning fruit forests larger than 10 hectares.

Overall, the findings suggest that fruit forest systems within the project area are predominantly smallholder-managed agroforestry systems, with most farmers operating on relatively modest land sizes. This highlights the importance of targeted technical support, improved management practices, and access to inputs to help small-scale fruit forest operators increase productivity and maximise the economic benefits of their orchards.

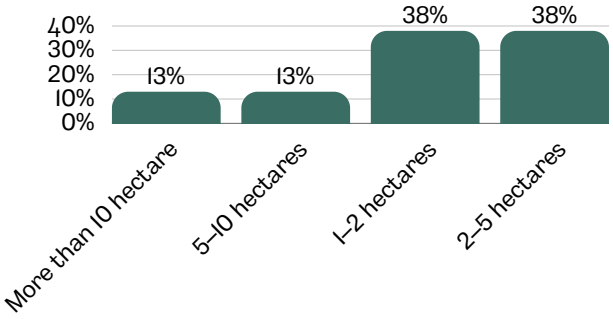


Figure 26: % of respondents by size of existing fruit forests

CLIMATE-SMART AGRICULTURE (CSA) ANALYSIS

Climate-smart agriculture (CSA) is central to the ESTRRA project's strategy for improving productivity, strengthening resilience, and enhancing household incomes in Northern Bauchi. Given the region's vulnerability to climate variability, declining soil fertility, and increasing production risks, understanding CSA adoption patterns and perceived benefits is critical for designing effective interventions. This section presents a comprehensive analysis of CSA adoption, including gender dimensions and farmer-prioritised benefits across three key domains: adaptation, mitigation, and profitability.

CSA Adoption Patterns

Analysis of CSA adoption shows that uptake remains generally low and uneven across the study population. Most households fall within low to moderate levels of adoption, indicating that CSA practices are not yet fully integrated into farming systems.

Disaggregation by gender reveals minimal variation in adoption levels between male- and female-headed households. This suggests that constraints to CSA adoption are largely systemic rather than gender-specific, affecting all households regardless of gender.

These constraints include:

- Limited access to extension services
- Low awareness of CSA practices
- Financial barriers to adopting improved technologies
- Weak institutional support systems

Farmer-Prioritised CSA Benefits (Weighted Analysis)

To better understand the drivers of CSA adoption, a weighted analysis of farmer responses was conducted, categorising perceived benefits into adaptation, mitigation, and profitability dimensions.

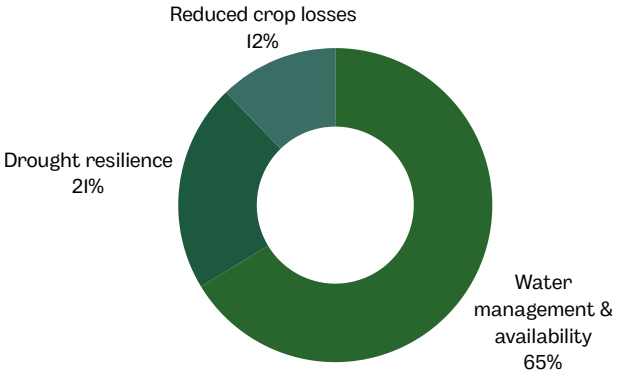


Figure 27: Adaptation benefits

Adaptation Benefits

The analysis shows that adaptation benefits dominate farmers' perceptions of climate-smart agriculture (CSA). The most frequently cited benefits relate to:

- Improved water management and availability
- Enhanced drought resilience
- Reduced crop losses

This indicates that farmers within the project area primarily view CSA as a risk management strategy, aimed at reducing vulnerability to climate shocks.

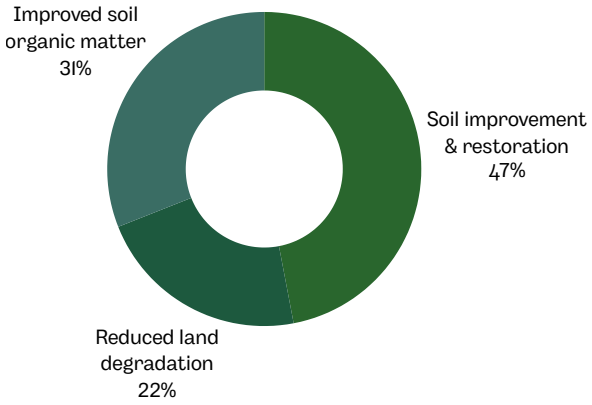


Figure 28: Mitigation benefits

Mitigation Benefits

Mitigation-related benefits are less prominently recognised by farmers. The key benefits identified include:

- Soil improvement and restoration
- Reduced land degradation
- Increased soil organic matter

However, these benefits are secondary in farmers' prioritisation, suggesting that environmental outcomes are often perceived as indirect or long-term gains rather than immediate incentives.

Resilience Benefits

Resilience remains an important driver of CSA adoption. Farmers associate CSA with:

- Increased crop yields
- Higher household income
- Reduced production costs
- Improved marketable surplus

This suggests that economic incentives play a significant role in adoption decisions, particularly when benefits are tangible and immediate.

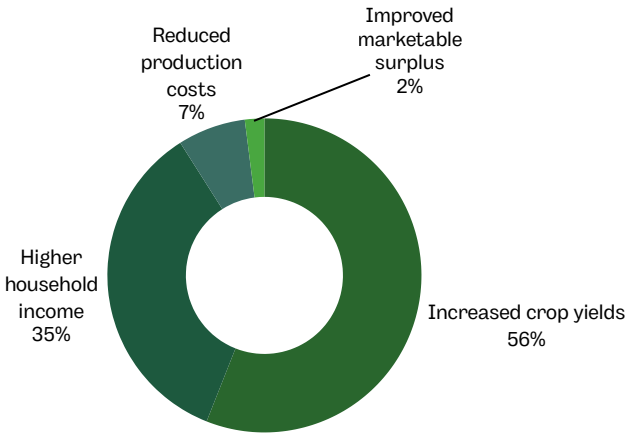


Figure 29: Resilience benefits

Across all three domains, a clear hierarchy emerges: adaptation, mitigation, and resilience. This indicates that CSA adoption is primarily driven by the immediate need to manage climate risk, the desire to improve income and productivity, and a secondary awareness of environmental sustainability benefits. This behavioural pattern reflects a rational response by smallholder farmers operating under high levels of uncertainty and resource constraints.

Link to Socio-Economic Outcomes

The CSA findings are closely linked to broader socio-economic patterns observed in the baseline:

- Low CSA adoption contributes to yield instability and income variability
- Limited soil restoration practices reinforce land degradation trends
- Weak climate resilience increases seasonal food insecurity
- Gender disparities in income persist despite similar CSA adoption levels

These interconnections highlight that CSA is not an isolated intervention but part of a broader livelihood system.

Overall, the baseline assessment confirms that CSA adoption among project participants in Northern Bauchi remains limited and is primarily driven by adaptation needs. Farmers prioritise practices that reduce climate risk and stabilise production, while profitability considerations also influence adoption decisions. Mitigation benefits, although present, are less recognised and require targeted awareness efforts.

Ultimately, CSA must be implemented as part of a broader system that combines climate resilience, economic empowerment, and institutional strengthening to achieve sustainable development outcomes under the ESTRRA project.

Statistical Modelling
The dataset reveals:

- Extension access – proxied using interaction with extension agents
- CSA adoption – proxied using crop diversification (number of crops cultivated)
- Gender – binary (female = 1, male = 0)

The interaction term between female-headed households and CSA adoption (β = -236,165) is also negative and significant, implying that the income gains from CSA adoption are substantially lower for female-headed households. In effect, while CSA adoption increases income overall, women benefit less from these gains compared with men. This reinforces the existence of gender-differentiated returns to agricultural innovation, a common finding in rural development literature.

Conversely, the interaction between extension services and CSA adoption (β = 186,667.4) is positive and significant, indicating that extension access

Variable	Coefficient	Std. Error	t-value	p-value
Intercept	62222.46	1717.358	36.23149	0
Extension	62222.46	1717.358	36.23149	0
CSA Index	186667.4	5152.075	36.23149	0
Female	-78721.8	4284.792	-18.3724	0
Female × CSA	-236165	12854.37	-18.3724	0
Extension × CSA	186667.4	5152.075	36.23149	0

Table 6: Regression analysis

Regression Results

The regression analysis provides strong evidence of the relationships between extension access, climate-smart agriculture (CSA) adoption, gender, and household income outcomes. The model is statistically significant, with all variables showing highly significant effects ($p < 0.001$), indicating robust associations within the dataset.

The coefficient for CSA adoption (β = 186,667.4) is positive and highly significant, suggesting that each additional CSA practice adopted is associated with a substantial increase in household income. This highlights the critical role of CSA as a driver of productivity and economic improvement among smallholder farmers. Similarly, the extension variable (β = 62,222.46) shows a positive and significant effect, indicating that access to extension services contributes positively to income levels, likely through improved knowledge, input use, and farm management practices.

However, the results reveal pronounced gender disparities. The coefficient for female-headed households (β = -78,721.8) is negative and statistically significant, indicating that female farmers earn significantly less than their male counterparts, even after controlling for CSA adoption and extension access. This suggests the presence of structural barriers such as limited access to land, capital, and markets that constrain women's economic outcomes.

amplifies the income effects of CSA practices. This suggests a complementary relationship, where extension services enhance farmers' ability to effectively implement and benefit from CSA technologies.

Taken together, these findings demonstrate that while CSA adoption and extension services are critical drivers of improved livelihoods, their benefits are not evenly distributed. Gender remains a key determinant of economic outcomes, with female-headed households experiencing both lower baseline incomes and reduced returns from agricultural innovations. This underscores the need for gender-responsive and extension-integrated CSA interventions to ensure equitable and inclusive development outcomes within the ESTRRA project area.

A one-unit increase in the CSA adoption index is associated with a β_2 increase in household income, suggesting that incremental adoption of climate-smart practices contributes positively to economic outcomes. Access to extension services (β_1) further enhances income levels, although the magnitude reflects both advisory effects and the targeting of vulnerable households. The negative coefficient for female-headed households (β_3) indicates persistent gender disparities in income, even after controlling for CSA adoption and extension access.

The regression results indicate that CSA adoption has a measurable effect on household income,

although the magnitude varies depending on access to extension services and gender. The interaction term between extension access and CSA adoption suggests that advisory services play a role in enhancing the productivity effects of climate-smart practices. Conversely, the gender interaction term highlights persistent disparities, indicating that female-headed households may not fully capture the economic benefits of CSA adoption. These findings underscore the importance of integrating extension services with gender-responsive programming to maximise the impact of CSA interventions.

SECTION D: COMMUNITY-BASED SEED ORGANISATIONS

The findings reveal both high potential and significant structural constraints that directly influence ESTRRA's core outcomes:

- **Outcome 1:** Improved agricultural productivity
- **Outcome 2:** Increased household income
- **Outcome 3:** Enhanced climate resilience
- **Outcome 4:** Strengthened market systems and institutional capacity
- **Outcome 5:** Improved gender and youth inclusion

Figure 27 presents the different types of seeds produced by respondents within the project area. The results indicate that millet and sorghum are the most commonly produced seeds, each accounting for 18% of the reported seed production. This highlights the importance of these drought-tolerant cereals within local farming systems and their central role in food security in the intervention areas.

Groundnut is the next most commonly produced seed, accounting for 17%, followed closely by cowpea (15%). These legumes are significant for household nutrition and income generation, as well as for their role in improving soil fertility through nitrogen fixation.

Other seeds produced include rice (12%) and maize (11%), which are also key staple crops within the region. Meanwhile, soybean production accounts for 8%, indicating moderate participation among farmers.

Only a small proportion of respondents reported producing other types of seeds, such as tomato and fruit seeds (1%), suggesting that seed production in the study area is largely concentrated on cereal and legume crops.

Overall, the findings demonstrate that seed production is dominated by staple cereals and key legumes, reflecting prevailing cropping patterns and the importance of these crops for both subsistence consumption and market opportunities within the ESTRRA project areas.

Institutional Coverage and Geographic Distribution

The KIIs covered 54 farmer groups across 19 communities in 7 LGAs.

Katagum accounted for the largest share (20.37%), followed by Gamawa (16.67%), while Jammare, Shira, and Zaki each contributed approximately 14.81%.

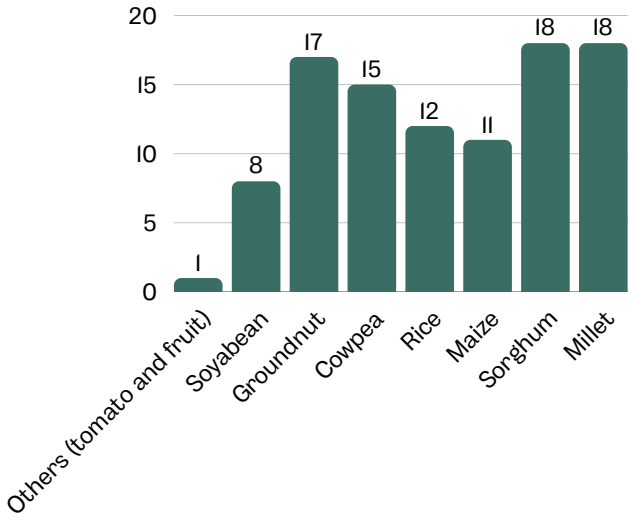


Figure 30: % of respondents by type of seeds produced

Implications for Project Intervention

The concentration of CBOs in Katagum and other high-agricultural-density LGAs aligns with areas of strong farming activity and potential seed multiplication hubs. However, the uneven distribution suggests differential institutional maturity across LGAs. This geographic variation mirrors the household-level productivity and poverty disparities identified in the broader baseline.

Organisational Formalisation and Governance Capacity

Registration Status and Institutional Maturity

The baseline findings from the KII reveal a fragmented institutional landscape among Community-Based Seed Organizations (CBOs) in the ESTRRA project areas. Only 43% of CBOs are formally registered with the Corporate Affairs Commission (CAC) or relevant state authorities, while 24% operate informally, and 33% are not yet formally structured as seed enterprises.

This distribution highlights a critical structural divide between semi-formal grassroots groups and fully institutionalised economic entities.

Institutional Implications

Formal registration represents more than administrative compliance; it is a gateway to economic participation in structured agricultural markets. Registered organisations are:

- Legally recognised entities capable of entering into binding contracts.
- Eligible to participate in field certification processes.
- Able to open institutional bank accounts.
- Positioned to access grants, credit facilities, and public procurement schemes.
- More likely to engage in long-term planning and structured governance.

By contrast, informal or unregistered groups face systemic exclusion from higher-value segments of the seed value chain.

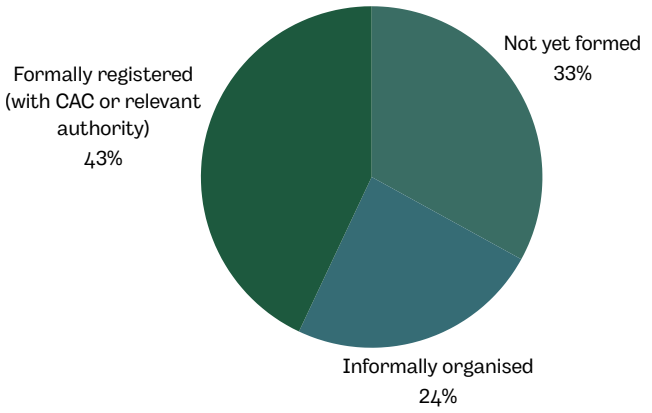


Figure 31: % of respondents by formal registration

Capacity Building Status

Figure 29 shows the previous trainings received by respondent CBOs over the past two years. It reveals that 50.7% did not receive any training, 12.68% received training in business management, 11.27% received training in seed production techniques, 8.45% received training in seed certification and regulations, while 5.63% received training in financial literacy and record keeping. This indicates a significant gap in training required to improve the capacity of CBOs in the project locations.

The chart presents the priority training needs identified by Community-Based Seed Organisations (CBOs), categorised into first, second, and third priority areas. The findings show that improved seed production techniques emerged as the most important training need, with the majority of respondents identifying it as their top priority. This highlights the strong demand among CBOs for technical capacity building to enhance the quality and productivity of locally produced seeds.

Another significant training area identified is seed quality control and certification, which appears prominently as a second-priority need among respondents. This indicates that CBOs recognise the importance of meeting quality standards and certification requirements to ensure the credibility and market acceptance of their seeds.

Training related to post-harvest handling, seed storage, record keeping, and data management were also mentioned as priority needs, although generally ranked as secondary or third-level priorities. These areas are important for improving seed preservation, maintaining seed viability, and strengthening organisational management practices.

Additionally, some respondents identified marketing and market linkages, as well as business and financial management, as training needs. This reflects the growing need for CBOs to strengthen their market participation and financial sustainability. However, these were generally ranked lower compared to technical seed production skills.

Overall, the results suggest that CBOs prioritise technical capacity building in seed production and quality assurance, while also recognising the importance of strengthening management, storage, and market-related skills to support the sustainability and effectiveness of community-based seed systems.

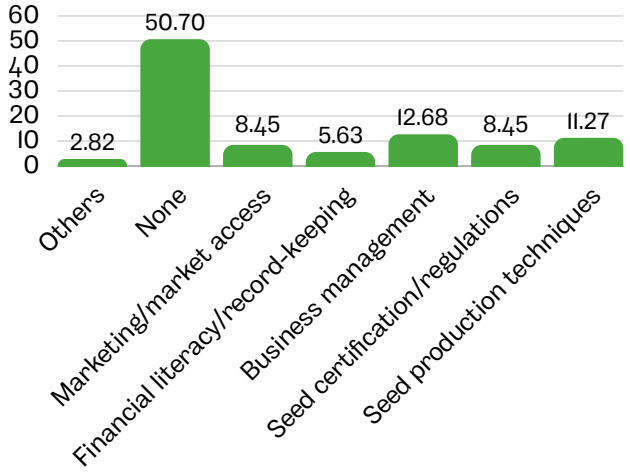


Figure 32: % of respondents by training received for past 2 years

Figure 33: % Training needs by priority areas I-3

Formalisation and Access to Certification Systems
Certification is central to commercial seed enterprise development. Without formal registration, CBOs are generally ineligible to:

- Apply for seed certification licences.
- Enter into formal supply contracts with seed companies.
- Participate in government-supported seed multiplication schemes.
- Meet regulatory requirements under national seed laws.

This limitation directly constrains the transition from subsistence or semi-commercial production to formal seed business operations.

Given that 71% of CBOs envision becoming certified seed producers within three years, the current registration gap represents a structural bottleneck to achieving this vision.

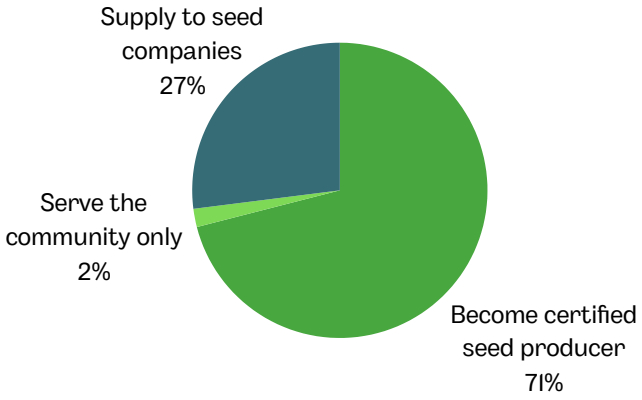


Figure 34: % respondents by projections for achievement (next 3 years)

Financial Inclusion and Institutional Credibility
The registration deficit is closely linked to broader financial management weaknesses observed in the baseline:

- 64.81% of CBOs do not have bank accounts (figure 32).
- 65% keep no financial records (figure 33).

Formal registration increases institutional credibility, which in turn influences:

- The ability to secure input credit.
- Trust from financial institutions.
- Partnerships with NGOs and agribusiness firms.
- Access to performance-based financing.

Without institutional recognition, financial exclusion persists, limiting capital accumulation and scaling potential.

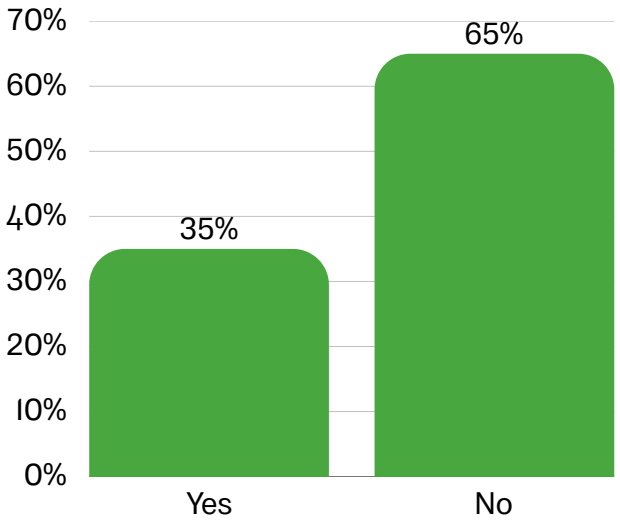


Figure 35: % respondents by bank account ownership

Cost and Return Estimates from Last Season's Seed Production
The average cost and return estimates from the last season's seed production by CBOs in the project areas are presented in Table 5. The mean seed quantity produced was 1,623.06 kilograms, while total revenue was estimated at ₦1,030,000 across all CBOs.

This indicates a relatively low level of production, which likely contributes to the low revenue generated. The average price per kilogram was estimated at ₦890.56, while annual income was estimated at ₦568,906.62.

Overall, the mean cost and return estimates are low; therefore, there is a need to enhance the seed production capacity of CBOs.

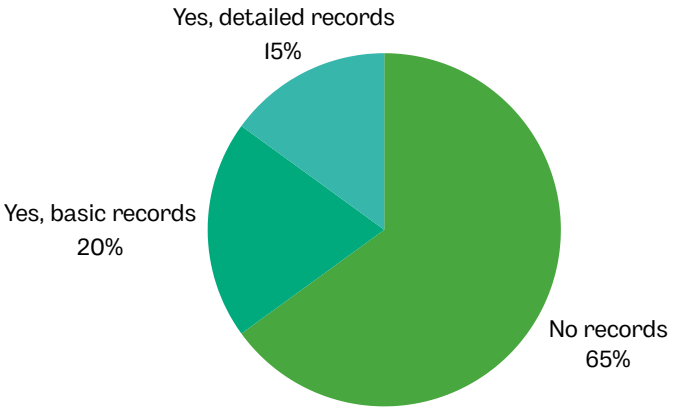


Figure 36: % of respondents by financial record keeping

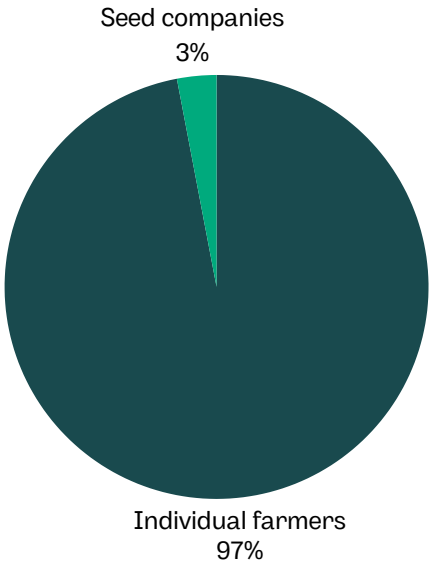


Figure 37: % of CBOs by seed sale channel

Variables	Mean
Seed quantity produced (kg)	1623.06
Revenue generated (₦)	1,030,000 [€643.75]
Price (₦)	890.56 [€0.56]
Annual income (₦)	568,906.62 [€355.57]

Table 7: Average Quantity, revenue, price, and annual income from last season's seed production

Revenue Growth and Income Multiplier Effects
The baseline shows that 96.86% of commercial seed sales are made to individual farmers, with only 3.13% sold to seed companies.

This reflects a market positioning problem directly linked to institutional maturity.

Governance Structure and Decision-Making
Institutional formalization also influences governance quality.

The baseline indicates:

- 40.74% of CBOs make decisions through consensus or voting.
- 24.07% rely primarily on leadership decisions.
- 16.67% lack a clear decision-making structure
- While consensus-based decision-making reflects participatory governance norms, the absence of structured processes in some
- CBOs may undermine:
- Accountability.
- Efficiency.
- Strategic direction.
- Conflict resolution mechanisms.

Formal registration often compels organizations to adopt:

- Constitutions.
- Defined executive roles.
- Financial oversight structures.
- Scheduled meetings and reporting systems.

These mechanisms are essential for transitioning from informal groups to sustainable agribusiness entities.

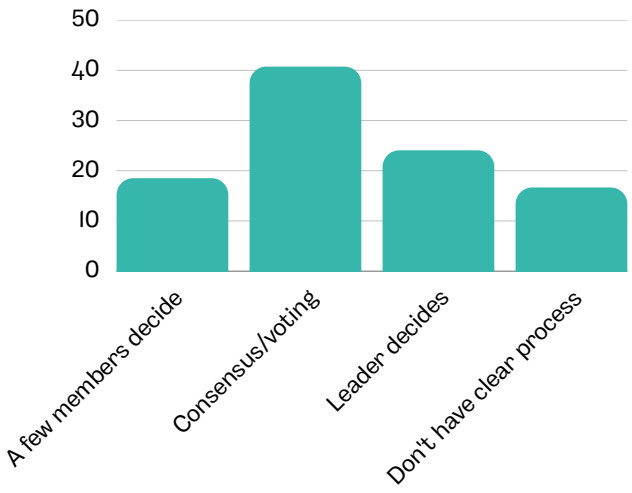


Figure 38: Distribution of Respondents by Decision-Making Ability

ACCESS TO LOCAL VS IMPROVED SEED VARIETIES

The baseline findings show that the majority (87%) of Community-Based Seed Organizations rely heavily on locally sourced planting materials, with seeds obtained from farmer-saved seeds, local markets, and fellow farmers. In contrast, only about 11.8% of seeds are sourced from improved seed channels such as research institutes, certified seed companies, government programs, and NGO projects.

This heavy reliance on informal seed systems suggests that many CBOs are using recycled or traditional varieties, which often have lower yield potential and weaker resistance to pests and climatic stress. Limited access to improved or certified seed varieties therefore represents a significant constraint to agricultural productivity within the project areas.

Strengthened Market Systems and Institutional Capacity
Results from the study also indicate limited integration of CBOs into formal seed production systems. Only 22% of CBOs have ever purchased early generation seeds, while 78% have never accessed such seeds.

Implication for Seed Market Systems

This result suggests that most CBOs operate within informal or semi-commercial seed markets, limiting their ability to scale seed production or participate in formal seed value chains where improved seeds are promoted.

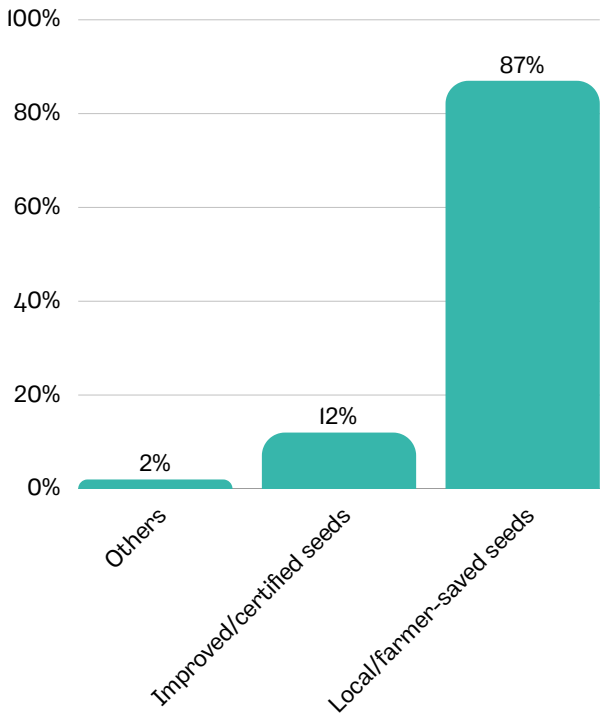


Figure 39: Sources of seeds used by CBOs

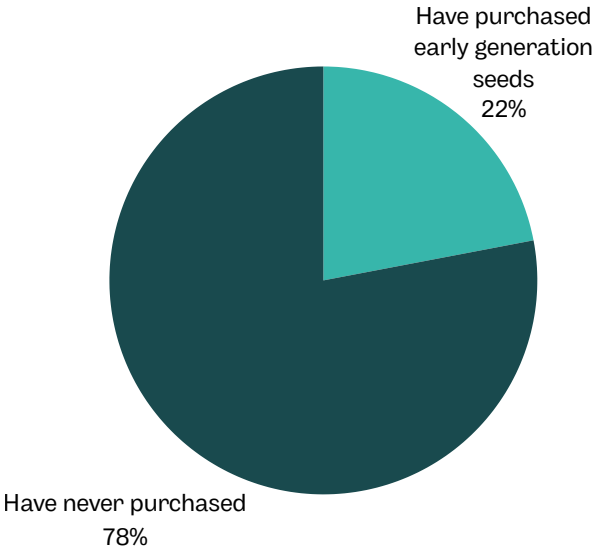


Figure 40:Access to Early Generation Seeds (EGS) / Improved seeds

Strategic Implications for the ESTRRA Project

The data suggest that institutional strengthening should precede or accompany technical seed production support. Specifically:

- Support formal registration processes for unregistered CBOs.
- Develop governance toolkits (constitutions, financial templates).
- Provide compliance and certification training.
- Link registration to financial literacy programming.
- Encourage structured leadership inclusion mechanisms.

Without institutional strengthening, investments in seed production may not translate into sustainable enterprise growth. Strengthening the institutional capacity of CBOs—particularly through training in seed certification, quality standards, and business management—will be critical to transforming these organisations into viable seed enterprises.

Furthermore, enhancing linkages between CBOs and formal seed systems, including research institutes, seed companies, and certified seed suppliers, will be essential for improving seed quality, increasing yields, and supporting the development of sustainable community-based seed enterprises.

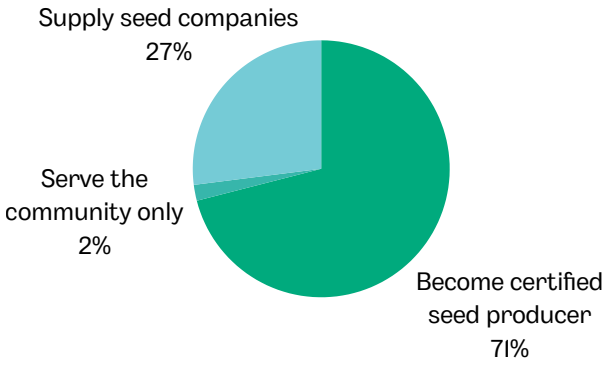


Figure 41: Vision for seed production in 3 years

SECTION E: FARMERS' HUBS (INPUTS/PROCESSORS)

The baseline survey assessed the operational capacity, socio-economic characteristics, and service delivery functions of the Farmers Hub Managers participating in the ESTRRA project. A total of 13 hub managers participated in the survey across several Local Government Areas (LGAs), providing insights into the structure of rural agricultural service hubs and their role in supporting smallholder farmers within the project's intervention areas.

Farmers' hubs serve as decentralised agricultural service points that facilitate farmers' access to farm inputs, aggregation services, processing, and advisory support. The baseline findings suggest that these hubs play an important intermediary role between smallholder farmers and agricultural markets, particularly in the provision of input supply, produce aggregation, and processing services.

Demographic Characteristics of Farmers Hub Managers

Gender Distribution

The Farmers Hub system is predominantly managed by men, with 76.9% of hub managers being male and 23.1% female. This gender imbalance reflects a common trend in rural agribusiness leadership structures, where men dominate managerial and commercial roles. However, the presence of female hub managers indicates opportunities to expand women's leadership within agricultural value chains.

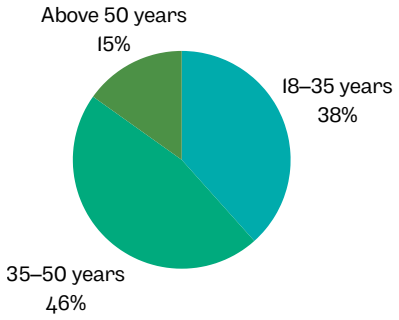


Figure 42: Distribution of Hub Managers by Age

Age Structure

The age distribution shows that hub managers largely fall within economically active age groups.

Nearly 84.7% of hub managers are below 50 years of age, indicating a relatively young and productive workforce capable of adopting improved agribusiness practices and innovations.

Education Levels

Educational attainment varies among hub managers but indicates moderate literacy and capacity for technical training.

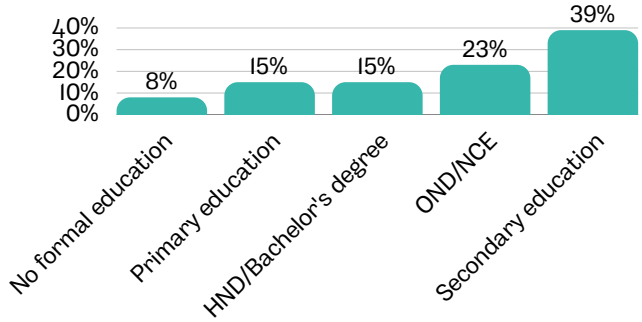


Figure 43: Distribution of Hub Managers by Level of Education

Overall, 76.9% of hub managers possess at least a secondary education, suggesting that the majority have the basic educational foundation necessary for agribusiness management and training interventions.

Agribusiness Profile of Farmers Hubs

Main Occupation of Hub Managers

Hub managers perform diverse agribusiness functions:

Occupation	Percentage
Processors	46.2%
Agro-dealers/Input suppliers	38.5%
Farmers	7.7%
Other (Livestock production)	7.7%

Table 8: % of hub manager respondents by business functions

The findings show that processing and input supply dominate hub activities, suggesting that hubs function primarily as value chain service providers rather than purely production entities.

Experience in Agribusiness

More than 76.9% of hub managers have over five years of experience in agriculture or agribusiness, indicating strong practical knowledge of local agricultural systems.

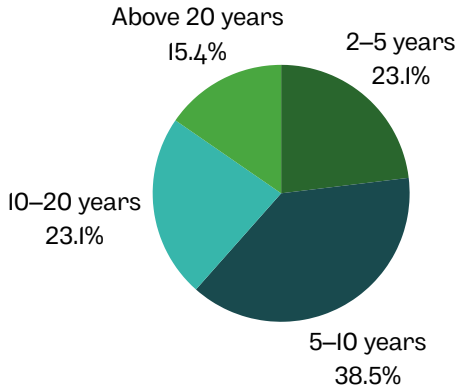


Figure 44: Distribution of Hub Managers by Years of Experience in Agribusiness

Agricultural Input Supply Services

Table 7 presents the different types of agricultural inputs sold by respondents within the project area. The results show that pesticides and herbicides are the most commonly sold agricultural inputs, accounting for 54% of responses. This indicates a high demand for crop protection products among farmers, likely due to pest and weed pressures affecting agricultural productivity.

Inorganic fertilisers are the second most frequently sold inputs, reported by 46% of respondents, highlighting the importance placed on soil fertility management in crop production. In addition, organic fertilisers and improved seeds are each sold by 39% of respondents, suggesting a moderate level of supply of soil-enhancing inputs and improved planting materials to farmers.

A smaller proportion of respondents reported selling seedlings (23%), which may support activities such as tree planting, horticulture, or vegetable production. Similarly, farm tools are sold by 15% of respondents, indicating relatively limited availability of farming equipment within local input markets.

Finally, animal drugs are sold by only 8% of respondents, suggesting that livestock-related inputs form a smaller component of the agricultural input supply in the study area.

Overall, the findings indicate that agricultural input sales are primarily concentrated on crop production inputs, particularly pesticides, fertilisers, and improved seeds. This reflects the dominant crop-based farming systems in the project area and underscores the important role of input suppliers and hubs in supporting farmer productivity.

Input Type	Percentage
Pesticides/Herbicides	54%
Inorganic fertilizers	46%
Organic fertilizers	39%
Improved seeds	39%
Seedlings	23%
Farm tools	15%
Animal drugs	8%

Table 9: % of respondent hub managers by type of agricultural input sold

Source of Capital for Input Supply

Figure 42 illustrates the main sources of capital used by hub managers to finance the purchase and supply of agricultural inputs. The findings show that personal savings constitute the primary source of capital, accounting for 84.6% of respondents. This indicates that the majority of hub managers rely heavily on their own financial resources to fund their input supply operations.

Only a small proportion of respondents reported accessing alternative sources of capital. Network manager credit accounts for 7.7%, while financial support from family or friends also represents 7.7% of the reported sources. These findings suggest that access to external financing mechanisms remains limited among hub managers.

Overall, the results indicate that hub managers largely operate their input supply businesses through self-financing, which may constrain their capacity to expand operations, stock larger quantities of inputs, or respond to increased farmer demand. Strengthening access to credit facilities and financial support mechanisms could, therefore, enhance the operational capacity of hub managers and improve the availability of agricultural inputs to farmers within the project area.

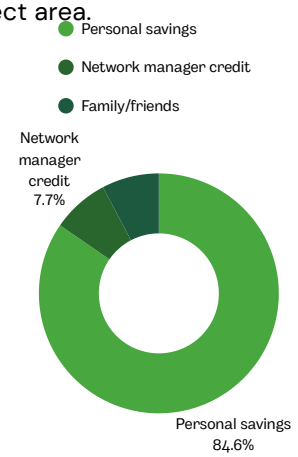


Figure 45: Distribution of Respondents by Sources of Capital for Input Supply

Agri-Produce Aggregation and Market Linkages

A significant proportion of hub managers are involved in produce aggregation. Figure 43 illustrates the primary sources through which Community-Based Seed Organisations (CBOs) aggregate agricultural produce. The results show that the majority of CBOs (69%) aggregate produce directly from individual farmers, indicating that direct farmer engagement is the most common approach used by these organizations to collect agricultural commodities.

A smaller proportion of respondents (8%) reported aggregating produce through cooperatives, suggesting that formal group-based aggregation mechanisms are less commonly utilised. This may reflect the predominance of informal or individual farmer networks within the project areas.

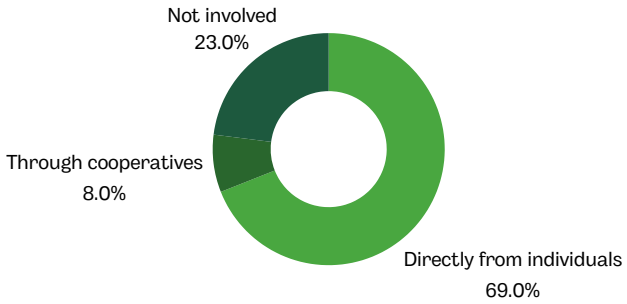


Figure 46: Distribution of Respondents by Primary Sources of Agri-Produce Aggregation

Additionally, 23% of respondents indicated that they are not involved in produce aggregation, implying that some CBOs focus primarily on other activities, such as seed production, input distribution, or farmer support services, rather than commodity aggregation.

The findings highlight that direct sourcing from individual farmers is the dominant aggregation model among CBOs, while cooperative-based aggregation remains relatively limited. Strengthening cooperative linkages and organised farmer groups could potentially improve efficiency, increase volumes aggregated, and enhance market access for both farmers and CBOs.

Commodities Aggregated

Table 8 presents the major crop commodities aggregated by Community-Based Seed Organizations (CBOs) within the project area. The results show that rice is the most commonly aggregated commodity, reported by 76.9% of hub managers (HMs). This highlights the central role of rice within the local agricultural value chain and suggests strong demand and market opportunities for this crop.

Other important commodities aggregated include maize, sorghum, and millet, each reported by 38.5% of hub managers. These cereals are staple crops widely cultivated in the region and play a significant role in both household consumption and market supply.

In addition, groundnut and cowpea are aggregated by 30.8% of hub managers, indicating moderate involvement in the aggregation of legume crops. These crops are valuable for income generation and nutritional benefits, as well as for contributing to soil fertility through nitrogen fixation.

Overall, these findings indicate that produce aggregation by CBOs is largely concentrated on staple cereals, particularly rice, while other cereals and legumes are also aggregated to support market supply and farmer livelihoods within the project area.

Commodity	% of HMs
Rice	76.9%
Maize	38.5%
Sorghum	38.5%
Millet	38.5%
Groundnut	30.8%
Cowpea	30.8%

Table 10: % respondents by type of commodities aggregated

Post-Harvest Handling and Storage Capacity

Figure 44 shows the types of post-harvest handling and storage services provided by Community-Based Seed Organisations (CBOs). The findings indicate that packaging and bagging are the most common post-harvest services, reported by 39% of respondents. This suggests that many CBOs play an important role in preparing agricultural produce for storage, transportation, and marketing.

Other post-harvest handling services are reported at similar levels. Storage and warehousing, drying, cleaning and sorting, and primary processing are each reported by 23% of respondents. These activities are essential for maintaining the quality of seeds and agricultural produce, reducing post-harvest losses, and improving market readiness.

Overall, the results suggest that CBOs provide basic post-harvest handling services, particularly in packaging and storage-related activities. However, the relatively moderate levels of engagement in services such as drying, processing, and cleaning indicate potential opportunities to strengthen the post-harvest capacity of CBOs through improved infrastructure, equipment, and training. Enhancing these capacities could help improve product quality, reduce losses, and increase market competitiveness for farmers within the project area.

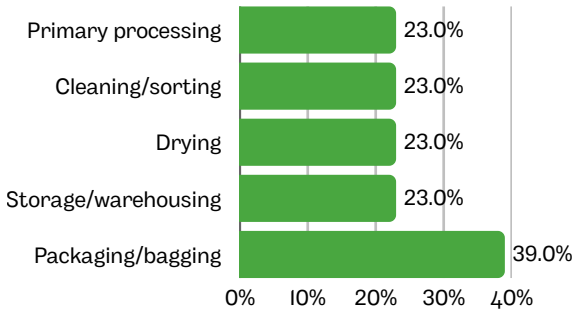


Figure 47: % respondents by CBOs post-harvest handling and storage capacity

Farmer Outreach and Training Services

The chart presents the average training capacity of Farmers' Hubs across various agricultural and business-related topics. The results indicate that business management has the highest average training capacity, suggesting that hub managers are relatively well positioned to provide training on financial planning, enterprise management, and agribusiness development for farmers.

Training capacity is also relatively strong in post-harvest loss prevention and digital literacy, indicating that Farmers' Hubs have a moderate capacity to support farmers in improving post-harvest handling practices and utilising digital tools for agricultural activities and market engagement.

Similarly, Farmers' Hubs demonstrate a reasonable capacity to deliver training on Good Agricultural Practices (GAP) and climate-smart agriculture, both of which are important for promoting sustainable farming practices and improving productivity under changing climatic conditions.

However, the capacity to provide training on livestock nutrition and feed formulation appears comparatively lower, suggesting potential gaps in livestock-related technical training within the hubs.

Overall, the findings suggest that Farmers' Hubs have moderate training capacity across several key areas, particularly in business and post-harvest management. Strengthening technical capacities in areas such as livestock management, climate-smart agriculture, and improved agronomic practices could further enhance the effectiveness of the hubs as centres for farmer learning and agricultural extension within the project areas.

Figure 48: % respondents by number of skilled areas for training facilitation

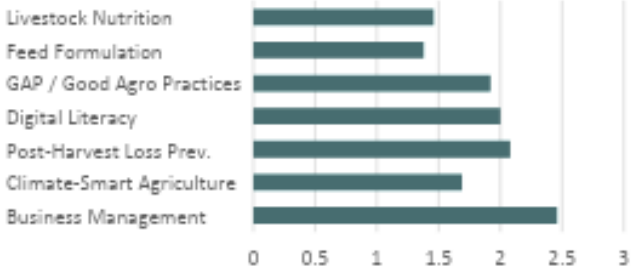


Figure 49: Distribution of Hub Managers by skill area for training facilitation

Agribusiness Revenue

Volume of produce purchased and revenue from input sales by Farmers' Hubs

Figures 47 and 48 show information on the volume of produce purchased by Farmers' Hubs during the last farming season and the total revenue generated from agricultural input sales over the past 12 months.

In terms of produce aggregation, the findings indicate that Farmers' Hubs are actively involved in purchasing agricultural commodities from farmers. The majority of hubs purchased between 1–4 tons, 5–10 tons, and more than 10 tons of produce, each category accounting for 30% of respondents.

Only 10% of hubs reported purchasing less than 1 ton during the last season. This distribution suggests that most hubs operate at moderate to relatively high aggregation volumes, demonstrating their role as important intermediaries linking farmers to markets.

Regarding revenue from input sales, the results show that 43% of Farmers' Hubs generated less than ₦1,000,000 in the last 12 months, indicating that a significant proportion of hubs operate at a relatively small scale in terms of input business turnover. Meanwhile, 28% of hubs reported revenues between ₦1,000,000 and ₦5,000,000, while another 28% generated between ₦5,000,000 and ₦10,000,000.

Overall, the findings suggest that while many Farmers' Hubs handle substantial volumes of agricultural produce, their input sales revenues vary considerably, with a larger proportion operating within lower revenue brackets. Strengthening access to finance, improving market linkages, and expanding input supply services could help enhance the commercial capacity of Farmers' Hubs and increase their contribution to local agricultural value chains.

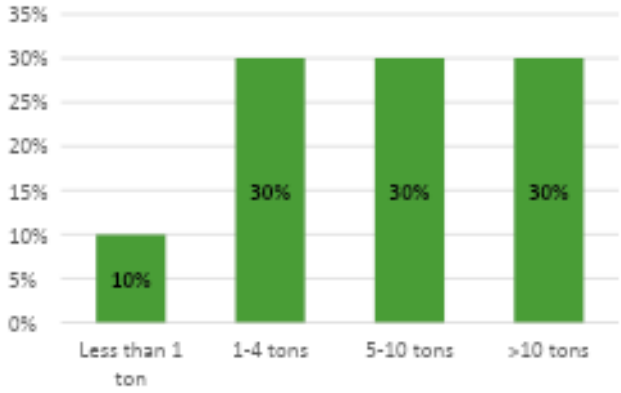


Figure 50: Distribution of respondents by volume of produce aggregated (previous farming season)

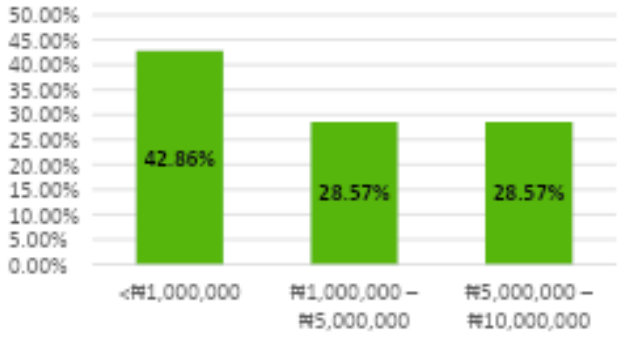


Figure 51: % respondents by total revenue from input sales (previous year)

Farmer Reach – Proximity to Hub

The chart illustrates the distribution of Farmers' Hubs based on the number of farmers they currently serve. The findings indicate that a substantial proportion of hubs reach a large number of farmers.

Specifically, 31% of hubs reported serving more than 2,000 farmers, while another 31% serve between 1,000 and 2,000 farmers. This suggests that the majority of hubs have broad outreach and play a significant role in supporting farmers within their communities.

Additionally, 23% of hubs reported reaching between 500 and 1,000 farmers, indicating a moderate level of engagement with farming households.
A smaller proportion of hubs (15%) serve fewer than 500 farmers, suggesting that only a limited number operate on a smaller outreach scale.

These results highlight the important role of Farmers' Hubs as key agricultural service and support centres, with over 60% of hubs reaching more than 1,000 farmers. This underscores their potential to effectively disseminate agricultural inputs, training, and market linkages to a large number of smallholder farmers within the project area.

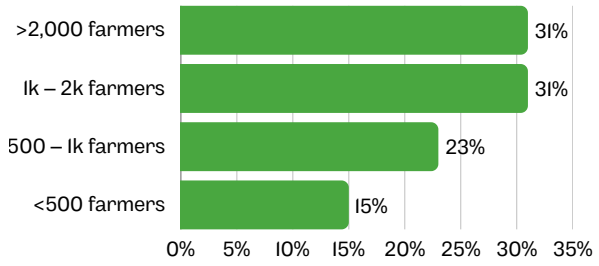


Figure 52: % Farmer's Hubs by number of farmers reached

KEY FINDINGS BY RELATED OUTCOMES

Household Survey Key Insights
The household survey reveals a population with strong potential for inclusive agricultural interventions but facing significant structural and economic constraints. Female participation stands at 63%, while youth (18–35 years) account for 52% of respondents, indicating a demographically active and productive population.

However, this potential is undermined by high economic vulnerability. Households are large, averaging 10 members, with relatively low annual incomes (₦738,604), placing sustained pressure on consumption and savings. Agricultural production is dominated by smallholder systems, with an average farm size of 1.84 hectares, primarily focused on millet and rice within diverse cropping systems.

Critical infrastructure and capacity gaps further constrain productivity and income. A majority of households lack access to essential post-harvest facilities, with 60% without processing equipment and 79% without adequate storage, contributing to significant post-harvest losses estimated at 84%. This is compounded by a near-total lack of technical capacity, as 97% of farmers have not received formal post-harvest training.

Farmer Group Key Insights
Findings from farmer groups highlight the coexistence of local knowledge and systemic limitations. Farmers demonstrate a practical, indigenous understanding of soil health and production systems; however, this knowledge is not complemented by sufficient technical expertise.

The adoption of regenerative agriculture remains limited, largely due to labour intensity and delayed returns, which discourage uptake among resource-constrained farmers. Gender disparities persist within these systems, as women—despite being central to production—remain underrepresented in decision-making structures.

Institutional support systems are also weak. Limited access to extension services and formal training creates a significant support gap, underscoring the need for structured, project-led capacity-building interventions.

Findings by Expected Project Outcomes

Outcome 1: *Improved Food Security and Household Income*
Households in Northern Bauchi operate within a context of high demographic pressure, moderate agricultural engagement, and persistent economic vulnerability. While agriculture remains the primary livelihood source, income levels are low and uneven, limiting households' ability to meet basic needs.

Food security conditions are particularly concerning. Key findings include:

- Over 90% of households experience moderate to high food insecurity (two meals or fewer per day).
- Only 4% of households report adequate food access (three or more meals daily).
- Seasonal food shortages peak between June and August (15–35%), with up to 82% of households affected during the lean period.

These patterns reflect:

- Seasonal hunger cycles
- Limited dietary diversity
- Cash-flow instability linked to agricultural seasons

Agricultural productivity remains constrained by small farm sizes, land degradation, and limited access to improved technologies. Fruit forest systems are similarly underdeveloped, operating on a small scale (1–5 hectares) with minimal management inputs.

Implication: Strengthening income diversification, improving farm productivity, and addressing seasonal food gaps are critical to enhancing household resilience and food security.

Outcome 2: *Environmental Sustainability and Climate Resilience*

The baseline findings indicate significant environmental stress across the project area. Over 30% of farmland is affected by land degradation and erosion, reducing agricultural productivity and increasing vulnerability to climate shocks. A smaller proportion of hubs (15%) serve fewer than 500 farmers, suggesting that only a limited number operate on a smaller outreach scale.

These results highlight the important role of Farmers' Hubs as key agricultural service and support centres, with over 60% of hubs reaching more than 1,000 farmers. This underscores their potential to effectively disseminate agricultural inputs, training, and market linkages to a large number of smallholder farmers within the project area.

Outcome 3: *Strengthened Farmer Capacity*

Capacity gaps are evident across the agricultural value chain, particularly in post-harvest management. High post-harvest losses are primarily driven by inadequate storage and processing facilities, limiting farmers' ability to preserve and market produce effectively.

Access to inputs, extension services, and formal training remains limited, leaving many farmers without the technical knowledge required to improve productivity, manage post-harvest processes, or engage in value addition. Although 88 farmer groups exist, their effectiveness as platforms for knowledge transfer and service delivery varies significantly.

Implication: Strengthening farmer hubs, improving access to extension services, and investing in post-harvest infrastructure and training are essential to reduce losses, increase incomes, and improve household nutrition.

Outcome 4: *Improved Economic and Nutritional Status of Women and Youth*

Women and youth play central roles in agricultural production but face structural barriers that limit their economic potential. While women are actively engaged in farming, approximately 60% report limited control over productive resources and decision-making.

Youth participation is similarly high; however, limited access to assets, skills development opportunities, and alternative livelihoods constrains their ability to fully contribute to economic growth.

Household income remains heavily dependent on smallholder agriculture, with minimal diversification into value-added activities. Farmer hubs demonstrate potential for improving incomes, but many operate on a small scale, with 43% generating less than ₦1 million annually from input sales.

Implication: Targeted interventions that enhance women's access to resources and decision-making, strengthen cooperative participation, and expand youth-focused skills and income opportunities are critical for inclusive and sustainable development.

HOUSEHOLD FOOD SECURITY STATUS

Outcome 1: *Social / Food Security*

Food Security Categories (Baseline Findings):

The household survey reveals that over 90% of respondent households experience moderate to high food insecurity, meaning they survive on two meals or fewer per day. Only 4% of households report adequate food security (three or more meals per day).

Seasonal trends, as shown in figure 51, reveal that food shortages are very low between the months of January and May (generally below 2%). This corresponds to the immediate post-harvest and early dry-season period, when households still have residual food stocks and relatively stable access. However, beginning in June, food shortages rise sharply:

- **June:** ~15% of respondent households
- **July:** ~28.8%
- **August:** Peak at ~35%
- **September:** ~11%

After September, food shortages decline rapidly:

- **October onward:** drops below 2%
- **November–December:** nearly negligible

While only 14% of households are categorised as highly food insecure year-round, the seasonal spike (June–September) shows that a much larger proportion of households (82%) temporarily experience food stress during the lean season.

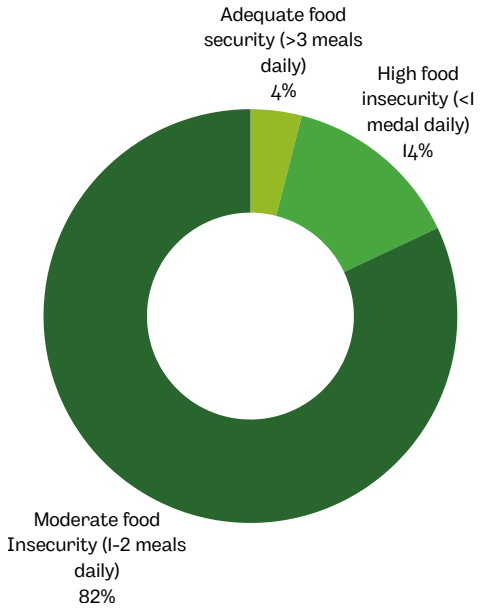


Figure 53: % of households reporting food security status

This indicates:

- Seasonal hunger cycles
- Limited dietary diversity
- Cash flow instability linked to harvest cycles

Agricultural productivity within the project area remains constrained by small farm sizes, degraded land, and limited access to improved production technologies. The baseline findings also indicate that crop yields have declined for a large proportion of farmers over the past two years (Figure 19), largely due to soil degradation, climate variability, and insufficient adoption of improved agricultural practices.

Additionally, fruit forest systems are predominantly small-scale agroforestry enterprises (1–5 hectares) with limited management inputs, suggesting significant scope for productivity improvements through better orchard management, improved input supply, and technical training.

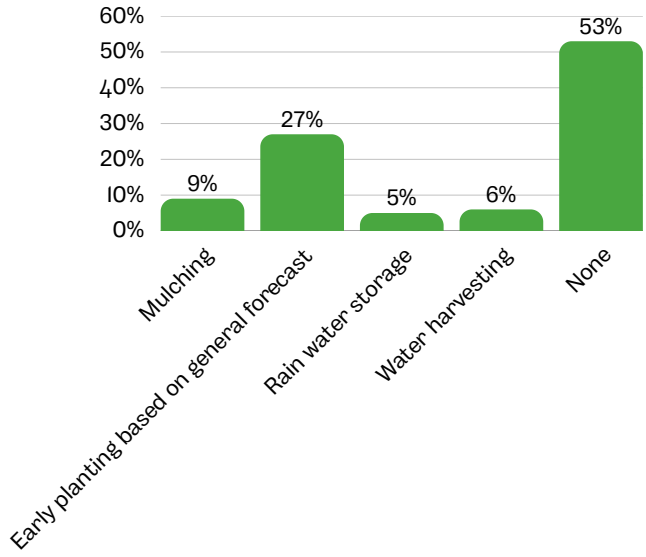


Figure 55: % of respondents by climate-smart practices

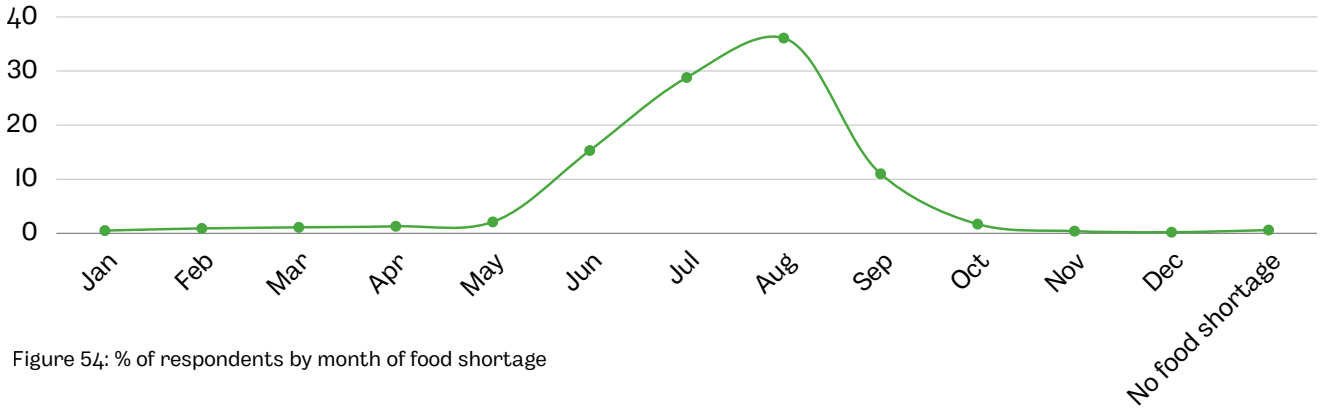


Figure 54: % of respondents by month of food shortage

Outcome 2: *Improved Environmental Sustainability and Climate Resilience of Farming Systems*

The study reveals significant environmental stress within the project area, with more than 30% of respondents reporting that a substantial proportion of farmland is affected by land degradation and erosion. Adoption of climate-smart and regenerative agricultural practices remains limited, despite some uptake of improved crop varieties in the past two years. Existing practices such as mulching (9%) and integrated pest management (14%) are applied inconsistently and at a small scale. Climate-resilient infrastructure, such as water harvesting structures (half-moons) and soil conservation measures, is largely absent or rudimentary, reflecting both knowledge and resource constraints among farmers.

Inference

At baseline, farming systems exhibit low resilience to climate variability and environmental degradation. Strengthening the adoption of regenerative agriculture, climate-smart practices, and resilient farm structures is critical to restoring land productivity, safeguarding agrobiodiversity, and ensuring sustainable production under increasing climate risks.

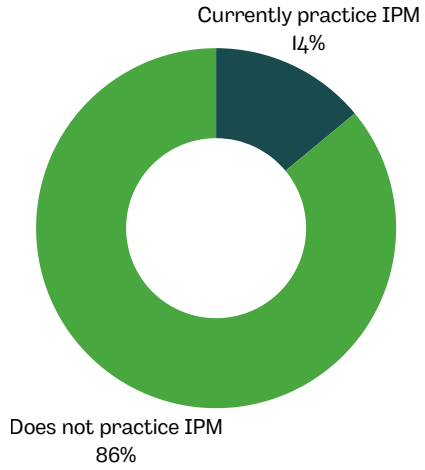


Figure 56: % of respondents by adoption of IPM practices

Outcome 3: *Strengthened Farmer Capacity through Farm Hubs, Extension, and Post-Harvest Services*

Post-harvest losses represent a major constraint to farm profitability, with a high proportion of crop losses attributed to inadequate storage and processing facilities.

Access to inputs, extension services, and formalised training is limited, leaving many farmers without technical guidance on improved production, post-harvest handling, or value addition. Although 88 farmer groups and cooperatives exist across the project area, their capacity to serve as effective platforms for knowledge transfer and service delivery varies significantly.

Inference
The baseline indicates critical capacity gaps across the production–post-harvest continuum. Strengthening farmer hubs, improving access to inputs and extension services, and expanding post-harvest infrastructure and training are essential to reducing losses, increasing incomes, and translating production gains into tangible household economic and nutritional benefits.

Outcome 4: *Improved Economic and Nutritional Status of Women and Youth*
Women play a central role in agriculture and household food production, as reflected in high female participation rates and involvement in crop production decisions. However, women's economic empowerment remains constrained by limited access to and control over productive resources, as well as income (figure 54), restricted expenditure rights (figure 15), and under-representation in cooperative leadership and decision-making structures (figure 14). Youth engagement is high in farming activities; however, access to productive assets, skills training, and alternative livelihood opportunities remains insufficient to fully harness their economic potential.

Inference
While women and youth are highly active within the agricultural system, their economic and decision-making power remains limited at baseline. Targeted interventions that enhance women's control over resources, strengthen cooperative participation, and expand youth-focused skills and income opportunities are necessary to achieve inclusive and sustainable improvements in household welfare.

Furthermore, household income generation within the project area remains highly dependent on smallholder agriculture, with limited diversification into value-added activities. Although farmers produce staple crops and engage in produce aggregation through hubs and CBOs, income potential is constrained by limited processing capacity, post-harvest losses, and weak market integration. Farmers' Hubs demonstrate the potential to improve rural incomes through produce aggregation and input supply services; however, many hubs operate at relatively small commercial scales, with 43% generating less than ₦1 million annually from input sales (Figure 46).

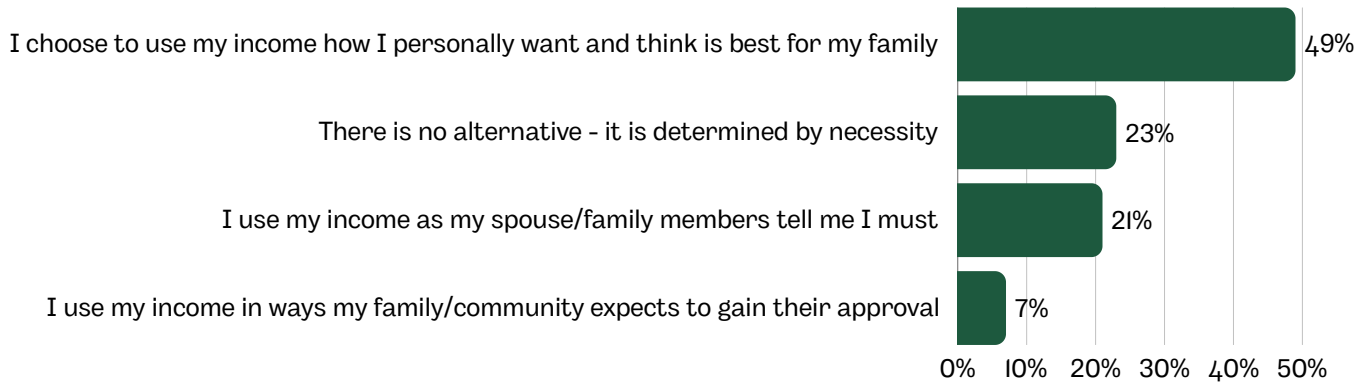


Figure 57: Women expenditure rights

ANNEX A: SURVEY INSTRUMENTS

Household Questionnaire

ESTRRA project Baseline Survey -Hou:

Farmer Group Focus Group Discussion Guide

Farmer group Hybrid Questionnaire- ESTRF

Land Reclamation Survey guide

Land Reclamation Site Assessment - FSS

CBOs survey questionnaire

CBO Questionnaire for ESTRRA Baseline S

ANNEX B: SAMPLING FRAMEWORK

Detailed breakdown of community selection and household listing procedures.

Sampling of participants for the Household / KII survey across the 7 Local Government Areas

s/n	LGAs	Communities	KII Conducted	Percentage
1	Gamawa	Gololo	1	1.85
		Kutunas	2	3.7
		Bulkachuwa	5	9.26
		Gamawa	1	1.85
2	Giade	Kurba	1	1.85
		Doguwa	2	1.85
		Fada	1	1.85
3	Itas-Gadau	Itas	3	5.56
		Diga	3	5.56
4	Jammare	Dogon jeji	4	7.4
		Zubuki	2	3.7
		Gongo	2	3.7
5	Katagum	Isawa	4	7.4
		Azare	3	5.56
		Gambaki	4	7.4
6	Shira	Faggo	4	7.4
		Yana	4	7.4
7	Zaki	Katagum	4	7.4
		Tashena	4	7.4
	Total	19	54	100

Table II: Sampling of participants for the Household / KII survey across the 7 Local Government Areas (Source: ESTRRA baseline survey, 2026)

Sampling of participants for the Land reclamation KII survey across the 7 Local Government Areas

s/n	LGAs	Communities	KII Conducted	Percentage
1	Giade	Low cost	2	50
2	Katagum	Dagaro	2	50
3	Itas-Gadau	-	-	-
4	Jammare	-	-	-
5	Shira	-	-	-
6	Gamawa	-	-	-
7	Zaki	-	-	-
	Total	2	4	100

Table I2: Sampling of participants for the Land reclamation KII survey across the 7 Local Government Areas

ANNEX C: STATISTICAL MODELLING

Statistical Modelling - simple regression linear model
$Yi=\beta O+\beta 1Exti+\beta 2CSAi+\beta 3Femalei+\epsilon i$

Where:
Yi= Total household income
Exti= Access to extension services (0/1)
CSAi= CSA adoption index
Femalei= Gender dummy (1 = female, 0 = male)
i= Error term

(a) Extension Access

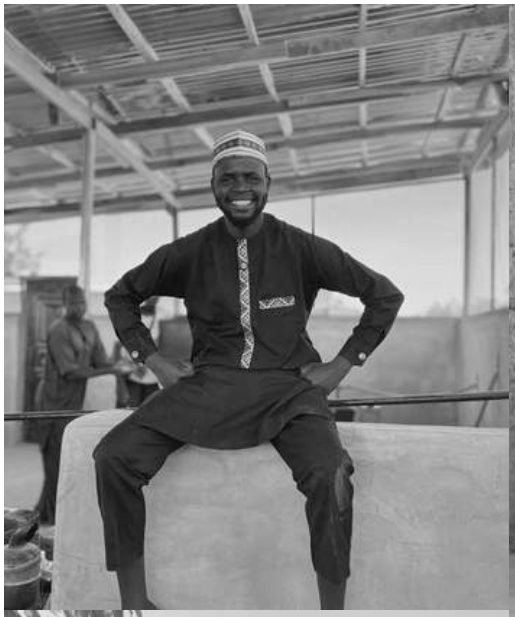
Exti={1 if household accessed extension services 0 if not

(b) CSA Adoption Index

CSAi=j=1kPracticeij

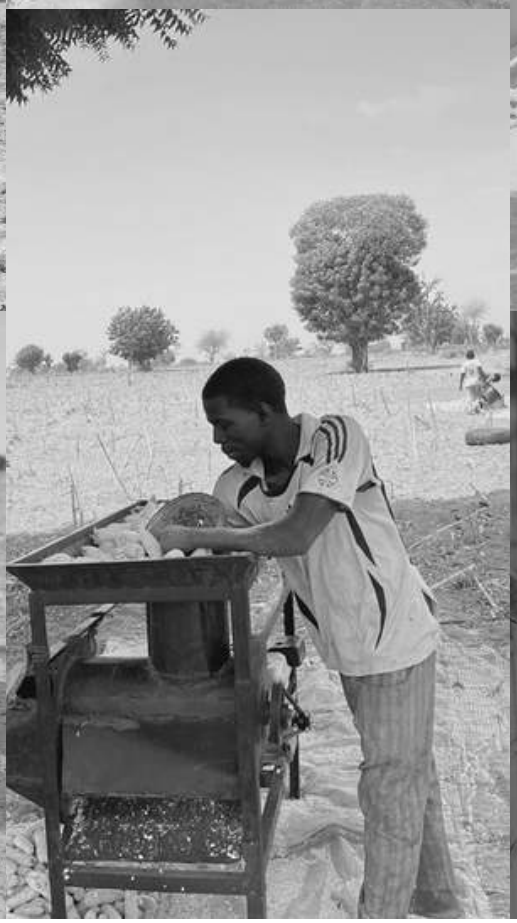
Where:
Practiceij = 1if farmer adopts CSA practice j
k= total CSA practices captured
Examples included:
Early planting
Mulching
Crop rotation
Composting
Water management
Pest management

ANNEX D: PICTURES



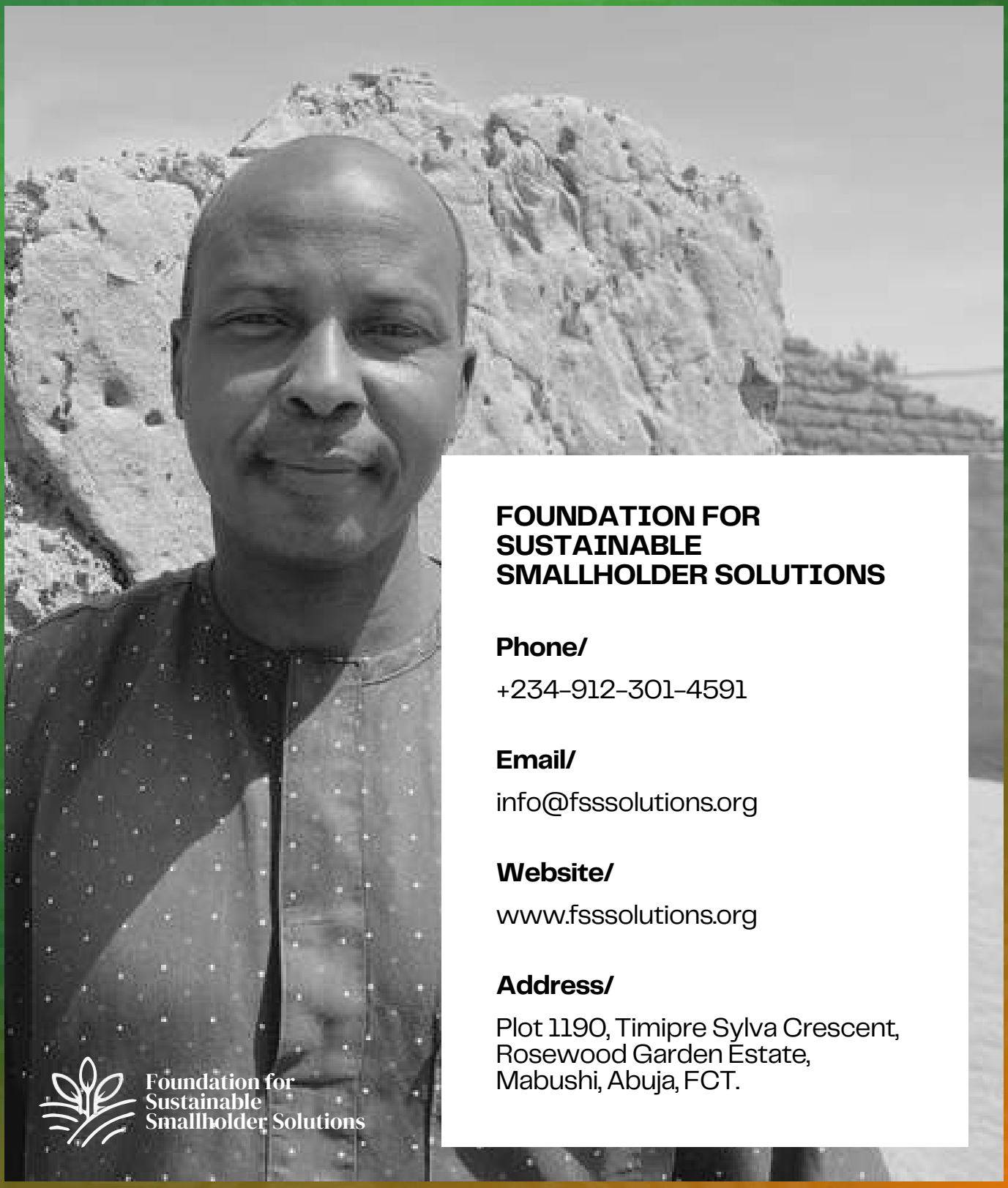





WE ARE ACTIVELY SEEKING COLLABORATIONS WITH COMPANIES, INSTITUTIONS, AND ORGANISATIONS. CONTACT US TODAY IF YOU'RE INTERESTED IN DRIVING SUSTAINABLE AGRICULTURAL SOLUTIONS

CONTACT US



FOUNDATION FOR SUSTAINABLE SMALLHOLDER SOLUTIONS

Phone/

+234-912-301-4591

Email/

info@fsssolutions.org

Website/

www.fsssolutions.org

Address/

Plot 1190, Timipre Sylva Crescent,
Rosewood Garden Estate,
Mabushi, Abuja, FCT.