tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

IGNITE & AATF

Time savings from farm mechanization in Nigeria – how is it spent and who benefits?

Final Report

May 2022

Contents

Photo: Agridrive tractor plows a field in Ayetoro, Ogun State; John DiGiacomo

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

1. Context

Qualitative study on time use and mechanization

Engagement: IGNITE & AATF

Laterite led the research, working closely with AATF, Agridrive, and Tanager

The research was conducted by the **Impacting Gender and Nutrition through Innovative Technical Exchange in Agriculture (IGNITE) project** on behalf of **AATF**.

IGNITE Partners

Tanager: Leading partner on the IGNITE project, providing gender and nutrition technical expertise.

Laterite: Research and learning partner on IGNITE. Laterite led the research on this study.

60 Decibels: Research and learning partner on IGNITE.

IGNITE Client

African Agricultural Technology Foundation (AATF): a client under IGNITE, receiving technical assistance, capacity building, and decision-focused research.

Privately held subsidiary of AATF, formerly known as the CAMAP program.

Agridrive Limited: providing mechanization services for farmers in Nigeria. Agridrive's work is the focus of this study.

Study: Research on Time Savings

IGNITE & AATF's research on time savings from mechanization for women and men

Time savings from farm mechanization in Nigeria – how is it spent and who benefits?

- Mechanization has the potential to alleviate **drudgery** and **time-consuming manual labor** for women and men, allowing farmers to focus on other productive and nutrition-sensitive activities.
- IGNITE is working with AATF & Agridrive to understand:
  1. The **time savings** gained for women and men who use mechanization, compared to manual farming
  2. How the time savings is **re-allocated** to other activities for women and men (e.g., other income-generating activities, childcare, leisure)
- The focus is on **smallholder cassava farmers** in Southwest Nigeria who are receiving mechanization services from Agridrive
- The research explores **gendered** behaviours on re-allocation of time saved for women and men; and **nutrition**-sensitive practices such as time spent on care practices and food preparation

Photo: A young cassava field in SW Nigeria; Jaye Yekini, Agridrive

AATF PROSPERITY THROUGH TECHNOLOGY

Agridrive Empowering Dreams

Study: Research Questions

The following research questions were investigated

For **smallholder cassava farming households** in Nigeria:

Primary Research Questions

1. Does access to Agridrive mechanization lead to time savings on cassava farming activities for women and men, compared to households without mechanization?
    a) If so, how are these time savings reallocated to other activities among women and men?

Secondary Research Questions

2. Are these time savings reallocated to nutrition-sensitive activities for women and men (e.g., care practices, food preparation, hygiene practices, nutritious food production)? Which practices?
3. What farm and non-farm activities do women and men in smallholder cassava farming households in Nigeria spend their time on? How does this differ for households accessing mechanization?
4. Which farm and non-farm activities do women and men in smallholder cassava farming households in Nigeria find enjoyable and not enjoyable? Which activities do they find to be hard work?
5. Which cassava farming activities are performed by other household members (including girls and boys) and/or hired labor?

Study: Participants & Eligibility

Smallholder cassava households with dual adults are the focus of the study

To be considered eligible for the study, listed households must meet the following criteria:

Smallholder farmers

The focus of the study is smallholder households farming on **3 hectares of land or less.**

Cassava farmers

Eligible households must be farming cassava as their primary crop.

Agridrive customer in 2021

Eligible mechanized households must have paid for any Agridrive services in 2020 or 2021. (Only applies to mechanized farmers)

Other adults in the household

Eligible households must have at least one male and one female adult living in the household.

Photo: Focus group discussion with mechanized women farmers in Ayetoro, Ogun State

Study: Scoping & Listing

To identify a sample of smallholders farmers and viable locations for the study

Scoping Exercise

Two week trip to Nigeria in September 2021

Goal of the exercise was to gather necessary technical information required to decide on a research design for the study, and gather information relevant to the research through meetings with farmers, cooperatives, and field visits.

Listing Exercise

Conducted in Nov-Dec 2021

To list all the smallholder households in SW Nigeria who were customers of Agridrive in 2021 season, and collect basic information. This included 9 clusters of smallholders in Ogun, Oyo, and Osun states.

In total, 402 smallholder households were listed. This list represented the sampling frame for the mechanized farmers in the study. Two viable locations were identified as a result of the listing exercise.

Statistics of Listed Households

402 households listed

210 were deemed eligible

80% primarily farm cassava

82% of primary Agridrive customers were male

96% of Agridrive customers received ploughing as a service

1.8 hectares was the average reported farm size for eligible HHs

Study: Locations

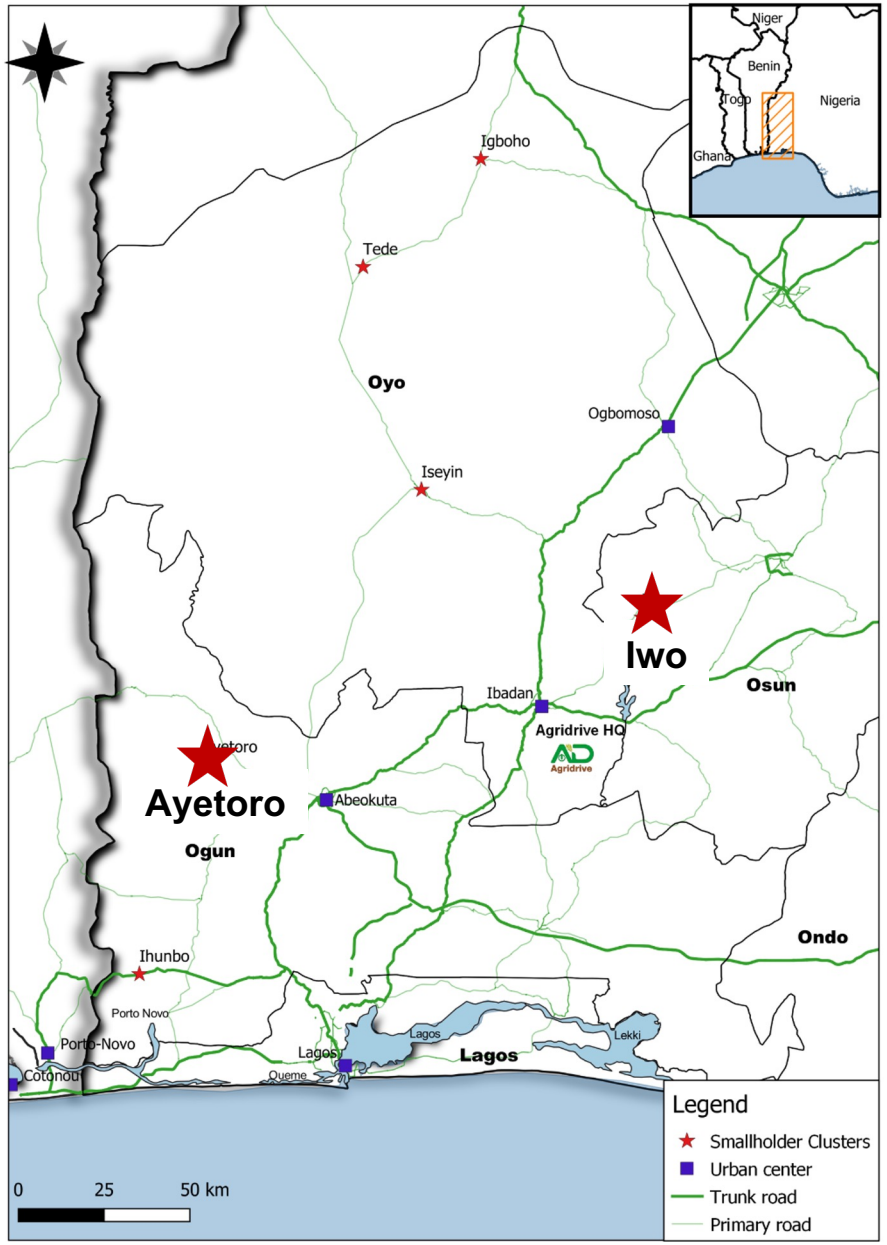
Two locations were identified in the listing as having the highest concentration of smallholders

Ayetoro
Ogun State

- Ayetoro was visited as part of the scoping exercise in Sep 2021, and is a priority location for Agridrive, where machinery is often domiciled.
- 90 smallholder households were listed in Ayetoro, 60 of which were deemed to be eligible for the study
- 32 participants (17 male; 15 female) from Ayetoro were included in the FGDs and IDIs

Iwo (and neighbouring clusters)
Osun State

- 3 smallholder clusters (Iwo, Olupona, Lanye) are geographically close to one another, and were considered one combined location for the study.
- 111 smallholder households were listed in the 3 clusters, 80 of which were deemed to be eligible for the study
- 32 participants (17 male; 15 female) from Iwo, Olupona, and Lanye were included in the FGDs and IDIs



Study: Methodology

A qualitative methodology was employed

Focus Group Discussions

6-8 participants each; ~100 minutes in length
Conducted in Dec '21 – Feb '22

- **56 participants** in total (28 male; 28 female)
- 2 FGDs with male mechanized farmers
- 2 FGDs with female mechanized farmers
- 2 FGDs with mixed-sex mechanized farmers
- 3 FGDs with mixed-sex non-mechanized farmers

Photo: Focus group discussion with mixed sex mechanized farmers in Iwo, Osun State

In-Depth & Key Informant Interviews

All interviews were ~60 minutes in length
Conducted in Dec '21 – Feb '22

- **8 participants** in total (6 male; 2 female)
- 2 in-depth interviews (IDI) with male mechanized farmers
- 2 IDIs with female mechanized farmers
- 4 key informant interviews (KII) with government extension agents (all male)

Photo: In-depth interview with female mechanized farmer in Iwo, Osun State

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

2. Insights

Findings from the study

Insights: Sections

Qualitative insights in this report have been grouped into 7 sections

2.1 Benefits & Barriers of Mechanization

2.2 Cassava farming challenges

2.3 Gender

2.4 Time Savings

2.5 Dietary Intake

2.6 Income

2.7 Summary of Key Findings

Photo: Cassava stems arranged in preparation for planting, while Agridrive tractor ploughs the field in the background. Ayetoro, Ogun State.

Insights: Methodology

Qualitative insights were generated through thematic analysis using MAXQDA

- All **25 hours** of FGD, IDI, and KII conversations were recorded and transcribed word-for-word, and then translated into English by a team of native Yoruba speakers
- All transcriptions were **thematically coded** using a qualitative data analysis software called MAXQDA
- Participants in the focus group discussions were tagged by gender in the data, allowing for **gender disaggregation** of qualitative findings, even in the mixed sex FGDs
- All coded themes in the data were **summarized** by a team of Laterite researchers, and individual insights were identified for further investigation

Unless otherwise stated, all insights in this report were generated through this analysis

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

2.1 Benefits & Barriers of Mechanization

Benefits of Mechanization: 3 primary benefits

Benefits are clear to women and men, and mechanization is in high demand

Across the board, both women and men spoke highly of the benefits of mechanization, highlighting **3 primary benefits**:

Time savings on farming activities

Most farmers reported being able to conduct their farming activities in less time.

"The work that machine will do in a day, laborers might not finish it in two months."
– Female farmer

"If we farm manually, you can be on the farm from morning till night. You don't have time for family, neighbors or friends; mechanization has given us the time"
– Female farmer

Increase in yields and income

Mechanization allows for an increase in yield, which translates in more income for the household, and possibility for expansion.

"Now that we are mechanizing our farm, we have more yield and can expand."
– Male farmer

"If we farm manually, one might not even have any income, or might even run at a loss… at the end of the farming season, but there's always income from mechanized farming."
– Female farmer

Reduction in workload and stress

Farming is made easier by mechanization as workload is less, leading to reduction in physical and mental stress.

"I won't go to the farm in a month when I use the tractor, but if farming manually, I will be stressed and riding bikes up and down and back and forth."
– Male farmer

"[Manual farming] causes this waist pain when you bend down all the time."
– Female farmer

Benefits of Mechanization: 3 primary benefits

More quotes on time savings, yield and income increases, and stress reduction

"Stress wise, we are less stressful and it makes our wives happy that we don't stress ourselves. We are looking good and it also promotes a good relation between us and our wives because when we come back from the farm even if we don't have food at home, we are happy, we don't have to work till midnight."

– Male farmer, on **reduced stress**, **time savings**, and **improved relationship** with his wife

"The reason why we are using tractors is because it is too much stress to farm manually. Before, we made use of our children, we would go to the farm on the weekend with them or sometime when they come back from school, but they cannot do two things at the same time. We want them to do their education. The stress was getting too much so that is why we use tractors."

– Female farmer, on **reduced stress** and the impact on **children's education**

"Take for instance when we were using hand, we don't make much profit, we cannot even afford to pay school fees on time but since we started using mechanization, it has boosted our farm yield and we make more money so now we are able to afford to pay our children school fee an also put enough money for food."

– Male farmer, on **increased yields** and **incomes** to pay for food and school fees

"[Mechanization] has really impacted… it saves time and even in terms of money, when you engage manual labourers you spend a lot but when you do mechanization you spend less, we do feed the labourers too so when you look at the money you will rather do mechanization. It is still bearable, it will not be that stressful."

– Female farmer, on **time savings**, **reduced costs**, **reduced stress**

Benefits of Mechanization: Other benefits

Apart from the 3 main benefits, other commonly mentioned benefits were:

Land expansion

Some farmers mentioned that the increased yield and income has allowed them to expand the amount of farm under cultivation.

"All of us have expanded our farmlands. Due to the use of machines we have been able to expand our farm land and from there we get more income."

– Female farmer

Feeling and looking healthier

Some farmers mentioned that by farming with mechanization, they look and feel healthier physically, which makes them feel good about themselves.

"Look at those of us here, we don't have such physique because of the tractors we are using. Look at everybody, we have good skin and we are good looking."

– Male farmer

Less dependence on hired labor

Some farmers mentioned that having less dependence on hired manual labor was a benefit, as hired laborers are not dependable and do poor quality work.

"If we use labourers, we can employ like 10 people to cultivate, they can collect money and run away or if they don't it takes longer time to finish the work."

– Male farmer

Farm benefits: soil, timing, spacing

Some farmers mentioned that with mechanization their soil is more fertile and retains water, spacing of rows is consistent, and they can time their planting better.

"The cassava setting is equal… the stalks are layered and fine. Then the soil retains water better when we use a tractor even when there is no rain the crop will still get water in the soil."

– Female farmer

Note on soil: Mechanization on its own does not make soil more fertile; in fact, there is evidence that over time mechanization can also accelerate soil erosion and compaction, encouraging the over-use of chemical inputs.

Benefits: For women

Women mentioned some benefits that were unique to them

Food preparation

Some women discussed their role in food preparation, and how mechanization allows them to spend less time on the farm so they can prepare food more conveniently for their husbands and the workers.

"Now, women can rest well because now the husband will go to the farm while the women prepare food and take some food to our husband and people working. Before we had to leave the house early in the morning at the same time, now you prepare your food conveniently and your mind is at rest."

– Female farmer

Sexual activity

One woman discussed how farming with mechanization means they can be more sexually active, as they are not weak from working on the farm.

"When I usually cultivate my farm manually, when I go to the farm, by the time I come back I will be weak. If my husband wants to have sex with me I cannot do it, I will not be able to satisfy him because I am weak and tired and also my children will have to prepare the food on their own because when I am back from the farm I will be so weak that I cannot also prepare food. So the children will have to prepare the food. But now there is changes, I satisfy my husband well."

– Female farmer

Home & child care

Many women mentioned their roles in the household and in caring for children, and how mechanization allows them to devote more time to these activities, which many find enjoyable.

"It has really changed, now we women are engaged with homework or house chores… when the mechanized farming was introduced, it saved time to focus more on house chores and take care of the home so it has really helped."

– Female farmer

"The time that we spend on the farm will be reduced so we will have time to do other things like taking care of the children and the home."

– Female farmer

Affordability: The main barrier to mechanizing

Mechanization services are expensive for smallholders to afford

Mechanization is expensive for smallholder households to afford, as payments are **upfront** and smallholders do not benefit from **economies of scale**.

1 hectare of ploughing alone (2 rounds) costs **$116 USD**, which represents the majority of cassava profits from an entire season for manual farming smallholders.

In the **following slides**, we will explore this barrier in more detail

"If you want to use mechanization it is not something you can do with small money – you need capital."

– Male farmer

"Unavailability of funds is a major problem."

– Male farmer

"Instead of using the money to call a tractor, we will use it to eat. [Mechanization] was less before."

– Female farmer

Note: Non-mechanized farmers more commonly mentioned affordability as a barrier, compared to mechanized farmers.

Affordability: Cassava Farming Economics

Mechanized farms have higher yields and higher income, but more upfront costs

Note: This analysis was first prepared after the scoping exercise, and has been updated with information from the qualitative work. The analysis uses Agridrive's pricing, 2021 market prices for cassava and inputs in SW Nigeria, and rough estimates from Agridrive. Full details and assumptions available in the Appendix.

Estimates of Profitability of Cassava Farming in South West Nigeria

Manual farming | Mechanized Ploughing Only | Full mechanization

Yield	7 tonnes per ha.	10 tonnes per ha.	20 tonnes per ha.
Revenue [1] (per ha.)	₦ 315k	₦ 450k	₦ 900k
Costs (per ha.)			
Mechanization	-	₦ 58k	₦ 190k
Hired Manual Labor [2]	₦ 100k	₦ 60k	₦ 30k
Inputs [3]	₦ 153k	₦ 223k	₦ 223k
Profit for Year per hectare	**₦ 62k / $150**	**₦ 109k / $265**	**₦ 457k / $1,110**

[1] Assumes cassava is sold as unprocessed tubers at a rate of ₦ 45k per tonne; which is an average of the high (70k) and low (20k) prices seen in 2021. Most cassava is actually sold as processed products (e.g., garri) which fetch higher prices, so likely these figures are under-estimated.
[2] Assumes daily rate of ₦ 2,000 for laborers. 50 days per year for Manual; 30 days per year for partial; 15 days per year for fully mechanized.
[3] Includes cost of cassava stems, fertilizer, herbicides, land leasing, transport, and security.

Key Insights

- Manual farming requires more spending on **hired manual labor**, which reduces profits.
- However, the cost of hired labor is spread out over the season, whereas mechanization cost is required **upfront.**
- Fully mechanized farms can earn more profit each year, mainly driven by **higher yields**.

Affordability: 1 hectare farm example

How affordable are Agridrive mechanization services for smallholder farmers?

Note: This analysis uses the same assumptions as the previous slide. Full details and assumptions available in the Appendix.

Most smallholder farmers only opt to purchase **ploughing** (2 rounds). The rest is done manually.

Agridrive price per hectare (2021)

1st Ploughing	₦ 24,000 / $58
2nd Ploughing	₦ 24,000 / $58
Total	**₦ 48,000 / $116**
+ Machine Transport[1]	₦ 10,000 / $24

Therefore, a typical cost for a smallholder farmer to plough 1 hectare is ₦ 58,000 or $140

- Agridrive requests 100% payment upfront, but if not able to pay, the minimum is 70% upfront.
  - → Therefore, for a 1 hectare farm, the minimum upfront payment for ploughing alone is **₦ 40,600** or **$100**
- From previous slide: 1 hectare farm using all manual farming can expect to earn ₦ 62,000 or $150 profit for the entire cassava growing season

Key Insights

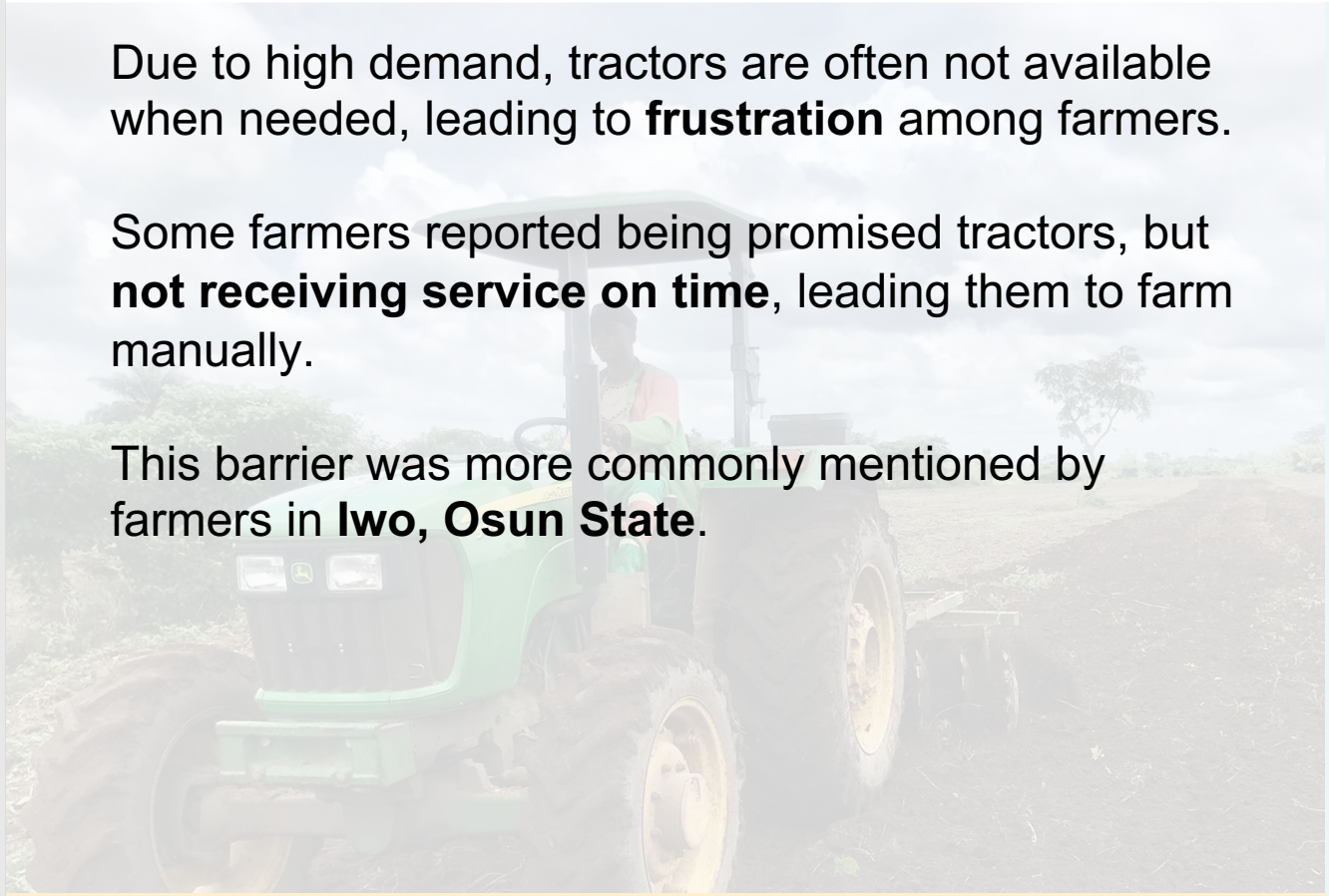
→ Therefore, for manual farmers to switch to mechanized ploughing only, they would need to spend **2 / 3** of their entire previous year's cassava income **upfront**.

→ As a result, mechanization might be **difficult to afford**.

[1] Assumes smallholder is clustered with 15 neighbours in order to afford ₦ 150k Naira cost

Tractor Availability: Another major barrier

There is a limited supply of tractors, leading to delays and lack of service



Due to high demand, tractors are often not available when needed, leading to **frustration** among farmers.

Some farmers reported being promised tractors, but **not receiving service on time**, leading them to farm manually.

This barrier was more commonly mentioned by farmers in **Iwo, Osun State**.

Note: Farmers in Iwo, Osun State mentioned tractor availability being a barrier more often than farmers in Ayetoro, Ogun State. According to Agridrive, this is likely due to service delivery challenges in Osun State in 2021, where fewer tractors were deployed.

"We are short of machines. The number of machines available is not much, demand is greater than supply, and there is not enough machines to work."

– Male farmer

"They are not always available, even when you pay ahead you might not see them."

– Male farmer

"They are not reliable, when the rain comes and we want to plough, when you call them, they will tell you they are not coming so we need to find an alternative."

– Female farmer

Barriers: Non-mechanized farmer perspective

Farmers agree on the main benefits of mechanization, but are limited by barriers

Non-mechanized farmers generally agreed with the benefits of mechanization, despite not using mechanization themselves. However, they did raise additional barriers that were not raised by mechanized farmers.

Non-mechanized farmers were more likely to mention affordability as a barrier to mechanization.

Non-mechanized farmers also mentioned other reasons why they do not mechanize:

Land and nutrient deterioration

Some non-mechanized farmers mentioned that they believed using mechanization would deteriorate their land and remove nutrients from the soil.

"I believe that when you use tractor to clear the land it will kill the nutrient on the farm but when we use hand the nutrient on the land will be retrained."

– Female farmer

Inaccessible land

A few non-mechanized farmers mentioned that their farms were inaccessible to tractors, or had trees or obstacles that made mechanized farming not possible.

"I have small land and it is not accessible for tractors. That is why I farm manually."

– Female farmer

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

2.2 Cassava Farming Challenges

Challenges: Cassava farming in general

Farmers raised six major challenges in cassava farming in South West Nigeria

Timing of Income

Since cassava requires 10-12 months after planting to mature, farmers are left **without cassava income for a year**. Therefore, they must supplement income through others crops and **additional sources of income**.

Drudgery

Manual cassava farming is drudgerous. It requires hundreds of hours of **hard physical labor** under the sun, leading to physical pain, health issues, and leaves less time for caring for the family, sleep, and leisure.

Climate Change

Rainfed agriculture is dependent on predictable rains, as planting must be done in rainy season. Climate change is **making the rains less predictable**, leading to farmers losing entire seasons' worth of crops as the fields dry out.

Expenses, Expensive!

Smallholder farmers have numerous other expenses including school fees, healthcare, and food for the family. This leaves **little money behind** for investing in new land or investing in mechanization, which could increase income.

Spoilage

Cassava tubers start to **spoil immediately after harvesting**. Therefore, farmers must either sell and transport their produce immediately to an off-taker or must process the cassava into another product (e.g., flour, starch, garri, fufu)

Volatile Prices

Cassava fetches nearly **2x the price in the dry season**. Most farmers harvest in the rainy season when the price is low. Storage of unprocessed cassava is not possible, so this means that in order to sell at the high price, farmers must process cassava into another product.

Challenges: Health issues

Numerous health challenges were reported with manual cassava farming

Both men and women reported various injuries and health issues resulting from manual cassava farming

- Some **male** mechanized farmers hold the belief that manual farming can cause high blood pressure, swelling of hands, difficulty walking, arthritis, or advanced aging
- Some **female** farmers reported injuries from cassava processing such as wounds from grating cassava.

"Farmers usually suffer from wick-low (swelling of the fingers) a hand diseases when they use hand to cultivate the land, or some of them would not be able to walk upright because of consistent bending due to farm activities."

– Male farmer

"When we farm manually it can cause sickness like high blood pressure, arthritis or aging on time. Someone will be 40 years and will be looking 50 but when we use a tractor it is better for us."

– Male farmer

"Then you can see my hand. I got the wound when I was grating the cassava manually."

– Female farmer

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

2.3 Gender

Gender: Farming Roles of Women and Men

Farmers in the FGDs agreed that women and men have distinct gender roles

Note: There were no clear differences in opinion on farming roles between women and men who participated in the study. These findings were estimated using the frequency of mention by participants in the FGDs and interviews.

When farming cassava <u>manually</u>:

- Men's roles
- Women's roles
- Support from hired manual labor (usually men)
- Support from children

Land Preparation	Majority **men** + **hired support**
Planting	Majority **men** + support from all
Fertilizer Application	Both **men** + **women**
Weed Spraying	Majority **men** + **women** involved
Weeding by hand	Both **men** + **women**
Harvesting (uprooting)	Majority **men** + **women** and **support**
Harvesting (collecting)	Majority **women** + **child support**
Loading for transport	Majority **women** + **child support**
Processing[2]	Majority **women** + **child support**
Marketing / Selling	Majority **women**
Record keeping	Majority **women**
Monitoring & supervision	Both **men** + **women**

[1] The roles displayed are community normative roles for women and men, as expressed by the farmers in the FGDs. However, these differ at an individual household basis, and may especially differ for female-headed households.
[2] Processing can include numerous activities: washing, peeling, grating, slicing, drying, frying

Gender: Farming Roles of Women and Men

Quotes on farming roles

"When we are looking for cassava stems, [women] know where to find them because they are the ones that go to the market to sell and relate with people. So they try to build relationships and ask people where they can find cassava stems, so they connect us with them. When we are planting, they will supply the stems, they will place it on the heaps or ridge, where it supposed to be planted so it makes it easier for the planter."

– Male farmer, on **women's roles – selling, relationship building, stem arranging**

"[Land clearing] is a job that requires strength and women can't really handle that.

– Male farmer, on **land clearing**

"Whatever we do there is a cultural part. Here, we care about women. We think that it is not good for them to do much stress, so we usually help them to get laborers."

– Male farmer, on **women's role and culture**

"If the women are not available it really affects our farming. They are a helping hand and they make the work faster, like during harvesting they will carry the cassava to the vehicle."

– Male farmer, on the **vital role of women**

"My children fetch water when we want to spray the farm, and when we want to plant the cassava they help in planting too. In fact you won't know the difference between the female and male children when they help with planting."

– Female farmer, on **children's roles**

Gender: Summary of women's farming roles

Women lead on numerous essential farming activities

Farming activities where <u>women</u> usually play a leading role

Processing

Women are heavily involved in processing cassava into products like fufu, garri, amala. This involves washing, peeling, grating, slicing, drying, and frying cassava tubers. These roles are usually not mechanized, and are very time consuming.

Collecting & loading

At harvest time, women take lead in collecting the uprooted cassava tubers, carrying them and loading them onto trucks for transport. Cassava tubers start spoiling directly after uprooting, so this must be done immediately.

Marketing & selling

Women are usually responsible for taking the processed cassava products to market and selling. Some men noted that women fetch higher prices when selling. Many farmers noted that this is a source of income for women, but is unclear from our data how much income women keep.

Note: The roles displayed are community normative roles for women as expressed by the farmers in the FGDs.
These differ at an individual household basis, and may especially differ for female-headed households (not the focus of the study).

Gender: Summary of women's farming roles

Women play a supporting role on some activities

Farming activities where women usually play a supporting role

Stem arranging for planting

Cassava is planted using stems from previous harvests, which must be cut and buried in rows. Women commonly arrange stems in rows in the field so that those who are planting need not carry or space out the stems, which makes the planting process more efficient.

Fetching water for spraying

When spraying the field with herbicides and pesticides, the chemicals must be mixed with water. While men more commonly conduct the spraying itself, women are often responsible for fetching the water needed for the preparation of the chemicals.

Note: The roles displayed are community normative roles for women as expressed by the farmers in the FGDs.
These differ at an individual household basis, and may especially differ for female-headed households (not the focus of the study).

Gender: Summary of shared farming roles

Activities where it is common for both women and men to be involved

Farming activities where women and men are both involved

Fertilizer application

When farming cassava manually, both women and men are involved in applying fertilizer to the base of the young cassava plants. When planting with tractors and planters, fertilizer is applied automatically at the same time as planting.

Weeding by hand

Weeding cassava is a crucial step for improving yields. Weeding can be done manually or by spraying herbicides. Most farmers we spoke with were weeding with herbicides, but some still weeded manually. Both women and men reported being involved in manual weeding.

Monitoring & supervision

It is very common to hire external support – either hired manual laborers or machine operators – to support on farm work. Both women and men play a role in monitoring and supervising this work when it is happening to ensure it is done well.

Note: The roles displayed are community normative roles for women as expressed by the farmers in the FGDs. These differ at an individual household basis, and may especially differ for female-headed households (not the focus of the study).

Gender: Summary of men's farming roles

Men lead on numerous essential farming activities as well

Farming activities where men usually play a leading role

Land preparation

Both land clearing and ploughing are male-dominated roles. They are arguably the most physically demanding roles when farming cassava manually, which is why they are also the most frequently mechanized roles.

Planting

Unlike other crops which are planted with seeds, cassava is planted with stems from previous harvests. These stems must be cut and buried under the soil, requiring significant physical labor and bending over. Men usually take lead on planting, but are supported by women who arrange stems.

Harvesting (uprooting)

Harvesting cassava involves multiple steps. Digging and uprooting the cassava tubers out of the ground is the first step, and is usually led by men. From there, women usually collect the tubers and load them on to a truck for transport.

Note: The roles displayed are community normative roles for women as expressed by the farmers in the FGDs. These differ at an individual household basis, and may especially differ for female-headed households (not the focus of the study).

⚠ **Keep in mind**: these roles do not necessarily apply to all households

"When I cultivate land some men are amazed. The cassava that I planted last year, I achieved 5 tons there, even the man that helped me to harvest was amazed. He was like, "you did this all alone?!"

There was a man that was passing by and he was like what a man cannot do this woman does. So, there are women that play more roles than men when it comes to farming now."

- Female farmer, on taking over men's roles

Gender: Household roles

Women take lead on essentially all household related roles

Women usually lead on non-farming household activities, including:

- Child care
- Food purchasing
- Food preparation
- Washing pots and dishes
- Cleaning and sweeping
- Fetching water

These roles can be **time consuming**, leaving women with **less time than men** to devote to farming activities.

Note: The roles displayed are community normative roles for women as expressed by the farmers in the FGDs.
However, these differ at an individual household basis, and may especially differ for female-headed households (not the focus of the study)

Gender: Food preparation

The ‘behind the scenes’ farming role of keeping workers and operators nourished

Women are heavily involved in food preparation for everyone on the farm. This includes husbands, hired labor, and tractor operators.

“The roles that women play on the farm make farming possible. Before we go to farm, they make food for us. Without food, it affects our work for the day.”

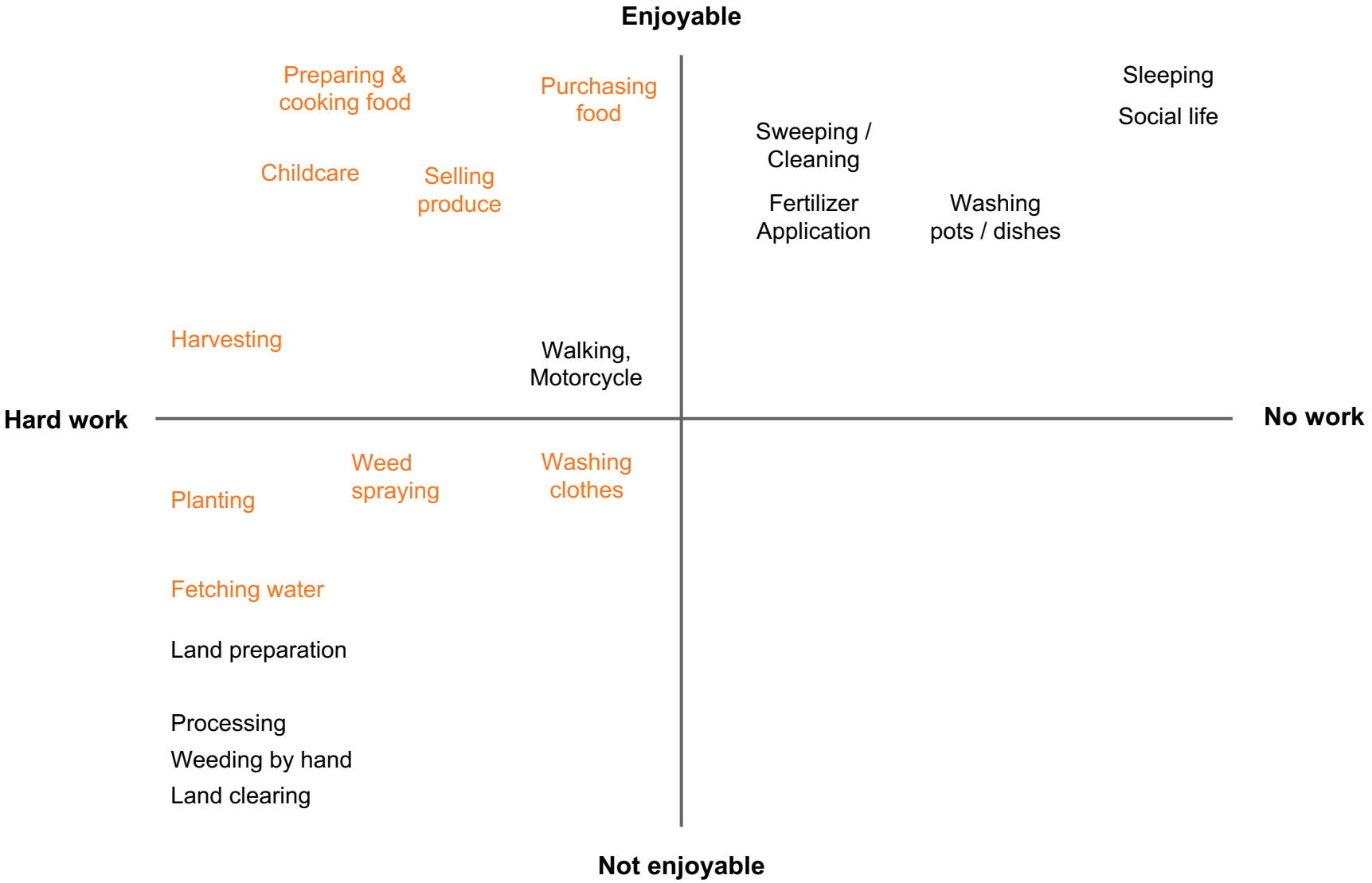
– Male farmer

Photo: Traditional cooking in Nigeria; Source: Wikimedia Commons

This ‘behind the scenes’ activity is essential, given the physical intensity of manual farming.

Enjoyability & Difficulty: Men's perceptions

What farming and household activities do men enjoy? Which do they find difficult?



Men

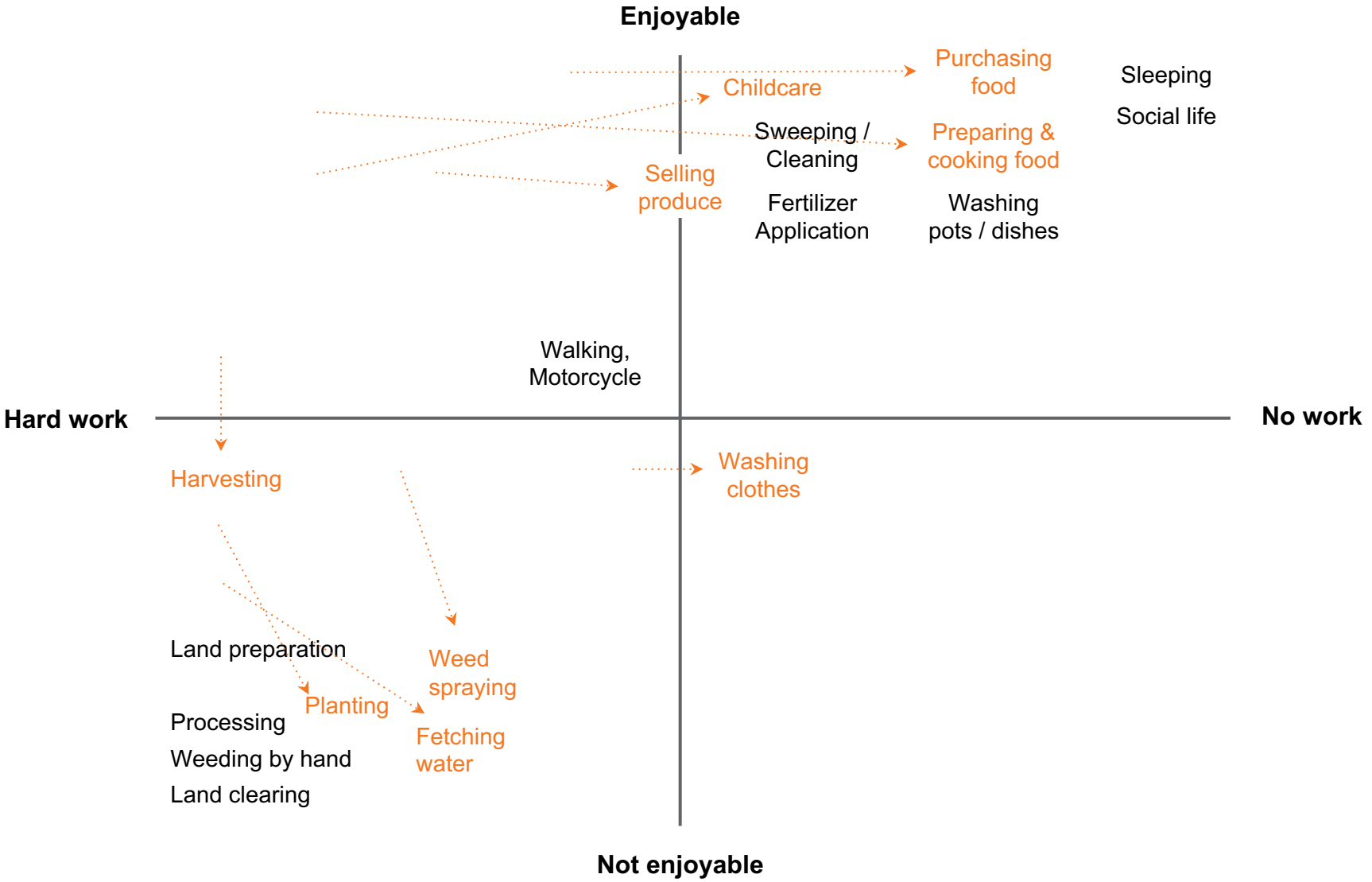
In the FGDs, participants were asked to place farm and household activities on a 2x2 matrix using post-it notes.

Displayed here are the average answers provided by **men**.

Any significant differences as compared to women are highlighted in **orange.**

Enjoyability & Difficulty: Women's perceptions

What farming and household activities do women enjoy? Which do they find difficult?



Women

In the FGDs, participants were asked to place farm and household activities on a 2x2 matrix using post-it notes.

Displayed here are the average answers provided by **women**.

Any significant differences as compared to women are highlighted in **orange.**

Enjoyability & Difficulty: Gender differences

Women find some activities to be less work, and some to be less enjoyable

Women and men generally agree on the placement of 10 of the activities.
This slide provides an overview of the 9 activities where women and men disagree.

Activity	Activity Type	Different perceptions from women	Possible Explanation
Preparing & cooking food	Household	**Less work**	Commonly a women's role, therefore women consider it easier
Childcare	Household	**Less work, more enjoyable**	Commonly a women's role, therefore women consider it easier
Purchasing food	Household	**Less work**	Commonly a women's role, therefore women consider it easier
Planting	Farming	**Less enjoyable, less work**	Women usually arrange and pass stems, which is less work but might be boring
Fetching water	Household	**Less enjoyable, less work**	Commonly a women's role, therefore easier; more physically demanding task than other household activities
Weed spraying	Farming	**Less enjoyable**	Women fetch water to mix with chemicals, which may be less enjoyable than spraying; fetching water seen as not enjoyable
Selling produce	Farming	**Less work**	Commonly a women's role, therefore women consider it easier
Harvesting	Farming	**Less enjoyable**	Women collect and load for transport, which may be less enjoyable than uprooting
Washing clothes	Household	**Less work**	Commonly a women's role, therefore women consider it easier

Enjoyability & Difficulty: Gender differences

Quotes pertaining to the activities where men and women disagree

"When it comes to washing, we stay in the house. We don't have to do it under the sun, so it is in a conducive environment."

– Female farmer, on washing

"The reason why it is no work to take care of our children: the way we take care of our children is the way they look, they are like our image outside that people see. Even if it is just the clothes that are bad they can tell the kind of home they came from so we are always happy to take care of our children and when they see them they can say that this is the child of so-so."

– Female farmer, on child care

"Someone cannot give birth to a child and not take care of the child…"

– Female farmer, on child care

"It gives you joy when you want to harvest and then you take your product to market to harvest. I will be smiling all through."

– Female farmer, on harvesting and marketing

"[Men] find it enjoyable but for women it is not. Take for instance, I can plant 1 acre in a day, there is no woman that can do that."

– Male farmer, on planting

"Some people can have a source of water close by, that is easy, but some have to go far to get the water, that is hard work and it is not enjoyable."

– Female farmer, on fetching water

Enjoyability & Difficulty: Least enjoyable

General agreement on what the least enjoyable and most difficult activities are

Women and men generally agree on the least enjoyable and most difficult activities.

Land clearing

Land preparation

Planting

Weeding by hand

Weeding by spraying

Processing

Fetching water

Enjoyability & Difficulty: Most enjoyable

General agreement on what the most enjoyable and least difficult activities are

Women and men generally agree on the most enjoyable and least difficult activities.

Sleeping

Social life

Purchasing food

Preparing & cooking food

Washing pots & dishes

Fertilizer application

Child care

Decisions: Who decides on mechanization?

Men are the primary decision-makers, but joint decisions are also common

Both women and men reported that men are most often primary decision-makers on mechanization.

Joint decision-making was also commonly reported, more so by women

Sole decision-making by women was not commonly reported, and were mainly reported when the female owned the farm

"I am the head of the family; I am meant to do the payments."
– Male farmer

"I handle household chores and some other things so he does it, besides he knows these people better than me"
– Female farmer

"We decided together because there is civilization now, people don't suffer anymore, we have the belief that it is better for us to use machines on the farm than doing it manually."
– Female farmer

"Yes, my husband cannot do anything on his farm without involving me, we will sit down together and do the planning."
– Female farmer

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

2.4 Time Savings

Time Savings: Rough Estimates

Mechanization targets men's roles; it is likely that women save less time than men

Note: This analysis uses time estimates from AATF's CAMAP Impact Assessment and other sources, paired with the gender roles described in FGDs.

Agridrive Services

Estimated time per hectare	Gender Roles[1]	Manual farming	Mechanized farming
Ploughing (2X)		216 hours	3 hours
Planting		64 hours	1.8 hours
Fertilizer Application		56 hours	Done with planting
Weed Spraying[2] (2X)		80 hours	1.4 hours
Harvesting (uprooting)		53 hours	0.7 hours
Harvesting (collecting)		10 hours	Not offered
Loading for transport		5 hours	Not offered
Processing[3]		300+ hours[4]	Not offered
Marketing / Selling		?	Not mechanizable
Record keeping		?	Not mechanizable

Key Insights

- In Ayetoro and Iwo, most households opt for mechanized **ploughing**. Some add planting and spraying. Only a few mechanize harvesting.
- These activities are commonly led by men, so it is likely **men are saving more time**.
- Women's primary roles (e.g., processing, selling) are **not mechanized**.
- However, women play **supporting roles** during ploughing, planting, and spraying, so they are saving some time as well.

[1] The majority responsible gender is shown for each role
[2] Weeding is assumed to be done using herbicide. Manual weeding is therefore manual spraying of weeds, not manual pulling of weeds.
[3] Processing can include numerous activities: washing, peeling, grating, slicing, drying, frying
[4] Estimate is for washing and peeling. IITA and IFAD estimate that a women can wash and peel 20-25 kg per hour; At 7 tons/ha. = 7,000kg; 7,000 / 22.5 = 311 hours

Time Savings: Are men saving more time?

Directly yes, but women possibly also save time through direct and indirect effects

In the FGDs and IDIs, <u>both</u> men and women mentioned saving time from mechanization, despite the fact that men's roles are overwhelmingly the ones that are mechanized.

So, through what pathways might women be saving time?

Mechanization

Direct effects

Men save lots of time.
Mechanized activities (e.g., ploughing, planting, spraying) are mainly led by men, so men are saving time directly.

Women save time, but less.
Despite being male-dominated, many women still directly participate in ploughing, planting, and spraying. For those women who do participate, there are direct time savings.

<u>More</u> time spent monitoring.
Both men and women now spend more time monitoring work on the farm by operators.

Indirect effects

Women save some time through support roles.
Women play supporting roles during ploughing, planting, and spraying through food preparation, stem arranging, and water fetching. So they are also saving time in this way.

Men may use their saved time to support women.
It is possible that men are spending their saved time supporting women on female-dominated tasks like child care or household activities. Numerous men mention using their saved time to spend time with their family. If true, this may save women some time.

Women may be spending <u>more</u> time on selling and processing
Due to increased yields from mechanization, it is likely women are now spending <u>more</u> time on processing and selling than before. This was mentioned a few times in the FGDs.

Time Savings: Farmer Perspective

Quotes pertaining to time savings by women and men

"It saves more time for men because when you look at work shared among men and women, machines cannot do work for women like fetching water and packing firewood. But when it comes to men, even harvesters are the work of men."

– Government extension agent (male), on less time savings for women

"Now women can rest well because now the husband will go to the farm while the women prepare food and take some food to our husband and people working. Before we had to leave the house early in the morning at the same time, now you prepare your food conveniently and your mind is at rest."

– Female farmer, on time savings via less trips to the farm, more time spent on food preparation

"The frequency at which women go to the farm has reduced but it has increased their work in the sense that we see more yield so during harvesting and processing they do more work – but it is positive."

– Male farmer, on more time spent for women, due to increased yields

"It saves a whole lot of days. If we are to work manually for 1 month the machine can do that same work in 2 days, you can see the time saved."

– Female farmer, on time savings in general

"[Mechanization does not save] much time [for women]. When the men do their role, we women also do ours at the same time."

– Female farmer, on low time savings for women

Time savings: How are they being spent?

Mainly in social life, side businesses, planting new crops, and monitoring

More time for children, family, friends, religion, social life

Numerous farmers mentioned that they now have more time to spend with children, family, and their community.

"As a husband, I now have time for my family. I believe I can do my religion well, and also help my neighbors when we see them. I can render help to them whenever they need it."

– Male farmer

More opportunity to plant other crops

Many farmers, especially women, mentioned that mechanization has allowed them to plant more diversified crops like beans and vegetables.

"It has given us the opportunity to be able to plant little beans, pepper, tomatoes and yam on a small scale beside the cassava on the farm."

– Female farmer

More time for other businesses

Numerous farmers mentioned that by farming with mechanization, they now have the time to spend on other income-generating activities.

"The time is used for other work like buying and selling for more income."

– Female farmer

More time spent monitoring the farm, rather than directly farming

With mechanization, the type of work shifts from farming work to monitoring work. Both women and men reported spending more time supervising tractor operators and laborers to ensure they are doing good work.

"Now that we are using mechanization, we only supervise, the stress has reduced drastically.

– Male farmer

Time Savings: Mechanized cassava processing

Farmers, particularly women, were interested in the possibility of mechanized processing for cassava

Women play a major role in cassava processing (e.g., washing, peeling, grating, frying). Currently, Agridrive does not offer mechanization services for processing, but the machines do exist in Nigeria.

- Women view mechanized cassava processing as something that would **reduce their stress levels** and allow them **more time** to engage in other activities.
- It will also give them the assurance that they will not lose cassava due to **spoilage** and the slow manual process.
- Women also reported numerous **injuries** as a result of processing, so mechanized processing would mitigate this.

Photo: A group of women peeling cassava tubers by hand, Nigeria; Source: R4D Review

"The [machine] they use for cassava processing, most especially for frying garri, I have seen before. It is very fast, you can fry plenty of garri within 5 hours compared to the one we do locally. It is incomparable."

– Female farmer, on mechanized cassava processing machines

“[Mechanization is] positive for both [men and women]. Women have more time to spend with their husbands and they have a peaceful family. If you have more time you dedicate for your wife and children, the children will be happy.”

- Male farmer, on spending more time with the family.

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

2.5 Dietary Intake

Recap on Theory: Nutrition Pathways

Mechanization can lead to nutritional benefits through two pathways

Mechanization provides an opportunity for improved dietary intake through two pathways:

1. **Purchase of nutritious foods** (e.g., vegetables, animal-sourced foods) using cassava production income, which may be higher due to greater yields and more land under cultivation with mechanization.

2. **Time savings** that can be used for nutrition-sensitive activities like food preparation and caring for children

Cassava nutrients

→ Cassava is not a nutrient dense crop but it is an important source of **carbohydrates**.

→ There is need to support crop diversification and create awareness to use income from cassava to **purchase other nutritious foods**.

Photo: Cassava tubers; Source: Crop Life International

Consumption: Major Foods Consumed

Farmers mentioned eating the following foods regularly

Cassava products + maize or yam flours

Cassava was the most common food consumed in both Ayetoro and Iwo locations. These products include garri, fufu, semo, amala, and others. Maize and yam (elubo) flours were also considered staple foods.

Beans and rice

Beans and rice were also commonly mentioned, but less than cassava, maize, and yam products.

Vegetables & fruits

Vegetables (e.g., pepper, cucumber) and fruits (e.g., melon, mango, orange, pawpaw (papaya)) were mentioned frequently, but are not consumed as regularly as cassava or maize products.

Animal-source foods

Animal-source foods were less commonly mentioned. Those that were mentioned were chicken, beef, bush meat, and cheese. Fish was also mentioned, but was considered expensive.

Cassava selling or consumption?

Most cassava farmers we spoke with grew cassava mostly for **selling**, but **also consumed** a portion.

"At least once in a day we must eat a food made with cassava."

– Male farmer

Garri (flakes)

Fufu / Semo

Amala

"Yes, [food consumption] has changed [since mechanization], although we cannot eat much but the way it has changed is this: when I was farming manually, I usually take small portions for household consumption but now that I am using mechanization, I can take as much cassava as possible and it does not affect my sales or profit."

- Male farmer, on cassava consumption with mechanization

Consumption: Changes since mechanization

Changes in quantity of food, affordability of food, and types of food were reported

Farmers reported three types of changes to their food consumption since mechanizing

More cassava and other foods consumed

Many farmers noted increased consumption of foods since starting mechanization, both by consuming more food they grow, and by using their increased income to buy more food.

"The money to buy food has increased since mechanization."

– Female farmer

"We now have more processed food from cassava in the house – we have more garri, more cassava flour. We have enough to sell and enough to eat."

– Female farmer

Same consumption, but more affordable

Others noted consumption level is the same, but that it is more affordable when using mechanization, as yields and incomes are higher.

"There's no difference [in consumption]. It's just that it's easier to eat what you want to eat now with mechanization."

– Female farmer

"Yes it has influenced it, because mechanization has increased income so there is enough money to go around and our husbands can provide for the family with ease."

– Female farmer

Different foods consumed

Some farmers noted that abundant cassava leaves money for vegetable purchases. Others noted greater consumption of beef when incomes were high, and consumption of vegetables when low.

"When there's money, we buy a lot of beef and when there isn't we eat lots of vegetables."

– Female farmer

"Now that we have garri and cassava flour in the house, we can now go to the market and buy vegetables to prepare soup, eat and be fine."

– Female farmer

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

2.6 Income

“Women have the ability to sell at better prices than we men, so their role is very vital.”

- Male farmer, on women selling and fetching higher prices

Cassava income: For women

It is unclear how much cassava income women keep and control

Women are commonly responsible for marketing and selling processed cassava products (e.g., garri, fufu), with one man explaining women fetch higher prices.

However, there were mixed responses on who keeps the proceeds, with some men saying women keep the profits, and others saying they return the money to men:

"Most times it is women that go to sell and they give us the money."

– Male farmer, on women selling and returning money to men

"You asked if the women are making profit – yes, they make more profit because they are the ones that sell. We have more output now when we use mechanization so definitely, they will make more profit."

– Male farmer, on women keeping more profits as a result of increased yields

"When we harvest more yield and our wife goes and sell, they will be happy. Usually they make little money because usually the buyers give them money for food. We don't collect such money from them, it is like appreciating them so that they can continue to take the produce to the buyer, for continuous patronage."

– Male farmer, on women keeping more profits as a result of increased yields

Note: Most cassava is sold as processed products as those fetch higher prices. However, some households choose to sell unprocessed tubers at farmgate, and this can be done by either men or women.

Other Income-Generating Activities

Side businesses usually differ for women and men

Farming alone often does not provide enough income. Most farmers supplemented their farming income through other sources, which differed for women and men.

Other income-generating activities, in order of frequency of response:

Men

1. **Manual labor** like bricklaying, farm support, or well digging
2. **Okada** (motorcycle) **drivers**
3. **Skilled labor** like electrician, mechanic, carpentry
4. **Petty trading**
5. **Barbers**

Women

1. **Petty trading** of provisions, foods, clothes
2. **Tailors** or **hairdressers** or **artisans**
3. **Event planning**
4. **Teachers**
5. **Civil servants** for the government

Note: It's not clear from our data why only women mentioned working as civil servants, and what type of work this entails. Some women mentioned that working for the government did not provide enough income; hence the need to do farming.

Other Income: Farmer Perceptions

Quotes from farmers describing their other sources of income

"It is not only farming that I do, I have other work that I do so the income that I generate from my other work I use it to support the farm and I use to pay loans."

– Female farmer

"I told you I have other things that I do, I am a decorator, I am an event planner so I had to look into other things, rather than spending 100% time on the farm when I engage labourers but I know if I use mechanization, it saves me time."

– Female farmer

"Yes, I have a shop where I sell food. Once the tractor finishes working I will go back home and tell the children to go to shop while I do cooking or I can wash clothes or clean the house and I can go to market as well."

– Female farmer

"I work for the government, although it is not enough to pay school fees and do other things hence the need to farm."

– Female farmer

"Yes, but it's not as much as what I make from cassava farming; but yes, I make money."

– Male farmer

Other Income: Amount of income

Some farmers shared how much they earn for some income activities

Some farmers mentioned that their side businesses earn them approximately 30-50% of their total income, with the rest coming from farming.

- Men mentioned that motorcycle (okada) driving earned them **₦ 1500 – 2000 per day** ($3.60 – $4.80 USD per day)
- Women mentioned that their provision businesses earned them ₦ 15,000 – 17,000 per month, which translates to **₦ 500 – 600 per day** ($1.20 – $1.50 USD per day)

Photo: A woman and boy ride a motorcycle loaded with peeled cassava, Nigeria; Source: Michael Awala on Unsplash

Note: Recall that a 1 hectare farm which does everything manually and sells cassava unprocessed might expect to earn $150 USD profit for the entire cassava season. Mechanized farms earn more.

tanager

an ACDI/VOCA affiliate

laterite

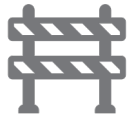
DATA | RESEARCH | ANALYTICS

2.7 Summary of Insights

Key Insights: Summary (1 of 4)

All of the insights from this report are summarized here

1. **Benefits of mechanization.** Benefits are clear to women and men, and mechanization is in high demand. Three main benefits farmers mentioned were time savings, higher yields and incomes, and a reduction in workload and stress. Other benefits mentioned were land expansion, less dependence on hired labor, feeling and looking healthier, and general farming benefits for soil and timing. There were some benefits unique to women, including more time for food preparation and child care, and more energy for sexual activity.



2. **Barriers to adoption of mechanization.** For smallholders, affordability is the main barrier to adoption. For manual farmers to switch to mechanized ploughing only, they would need to spend 2 / 3 of their entire previous year's cassava income upfront. Tractor availability is another common barrier as tractors are often not available when needed, leading to frustration among farmers, particularly in Osun State.

3. **Challenges in cassava farming.** Farmers noted six general challenges to cassava farming, including: timing of income being 10-12 months after planting; drudgery and health impact; climate change; lack of financial resources for expenses; quick spoilage of tubers; and volatile market prices.

Key Insights: Summary (2 of 4)

All of the insights from this report are summarized here

4. **Gender roles.** Women and men have distinct roles in cassava farming and household activities. Women play a leading role in processing, marketing & selling, collecting & loading. Men play a leading role in land preparation, planting, and uprooting. Women support men in planting through stem arranging and through water fetching for weed spraying. Both women and men are involved in monitoring & supervision. Women lead all household activities like child care, food preparation, and cleaning. All of these roles are community normative roles and differ at an individual household basis, and may especially differ for female-headed households.

5. **Enjoyability & difficulty.** Women and men generally agree on the enjoyability and difficulty of 10 of the reported activities. However, on the other 9 activities, women found some to be less work, and some to be less enjoyable. Activities where there was disagreement include preparing & cooking food, child care, purchasing food, planting, fetching water, weed spraying, selling, harvesting, and washing clothes. Many of these are commonly women's roles, or involve support tasks for women (e.g., stem arranging).

Key Insights: Summary (3 of 4)

All of the insights from this report are summarized here

6. **Decisions on mechanization.** Both men and women reported that men are most often the primary decision-makers on mechanization. Joint decision-making was also commonly reported, more so by women. Sole decision-making by women was not commonly reported.

7. **Time savings.** Both women and men reported that mechanization was saving them time. However, mechanization primarily targets men's roles, so it is likely that women save less time than men directly. Most roles where women lead (e.g., processing, selling) are not mechanized or not mechanizable. Men save most of their time from 'direct' time savings from farming activities like ploughing. Women save time on 'direct' activities as well, but likely less than men. Women may save time indirectly as well, through supporting roles and knock-on effects from men's time savings. Women may spend *more* time on selling activities, due to increased yields from mechanization. Both men and women spend more time on monitoring and supervision activities when farming with mechanization.

8. **How are time savings spent?** 1) more time for family, friends, religion, and social life; 2) more opportunity to plant other crops; 3) more time for other businesses; 4) more time spent monitoring the farm, instead of farming directly

Key Insights: Summary (4 of 4)

All of the insights from this report are summarized here

9. **Dietary intake.** Cassava, maize, and yam were the most common foods consumed, including garri, fufu, semo, amala, elubo and others. Most cassava farmers grew cassava mostly for selling, but also consumed a portion. Beans and rice were also commonly mentioned, as were vegetables (e.g., pepper, cucumber) and fruits (e.g., melon, mango, orange, pawpaw (papaya)), but these are not consumed as regularly as cassava or maize products. Animal-source foods were less common, but included chicken, beef, bush meat, fish and cheese. In terms of consumption, changes in quantity of food, affordability of food, and types of food were reported as a result of mechanization.

10. **Income.** Women are commonly responsible for marketing and selling processed cassava products but there were mixed responses on who keeps the proceeds, with some men saying women keep the profits, and others saying they return the money to men. Farming along often does not provide enough income. Most farmers supplemented their farming income through other sources, which differed for women and men. Men work in manual labor like bricklaying or well digging, or as okada (motorcycle) drivers or skilled labor. Women work in petty trading, or as tailors, hairdressers, or artisans, or as event planners or civil servants.

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

3. Recommendations

Ideas to consider

Ideas to Consider: Mechanized Processing

Agridrive can save women time and drudgery by offering mechanized processing

1 AATF / Agridrive to consider offering mechanization for women's roles e.g., cassava processing

- Processing was considered by both women and men to be one of the **least enjoyable** and **most difficult** activities in cassava farming, and it is also one of the **most time-consuming tasks**.
- By offering mechanization for cassava processing (e.g., peeling, grating, chipping), women can benefit from more **time savings** and **less drudgerous work**.
- For example, according to a study by IITA & IFAD[1], a woman may peel **20 – 25 kg** of tubers in one hour and peeling loss could be between 22 – 30%. Mechanical peelers in Nigeria can peel between **600 – 800 kg** of tubers per hour, removing 60-90% of peel.
- Therefore, there are large potential **time savings for women** using mechanization, which could have positive gender or nutrition outcomes
- Mechanizing cassava processing could also lead to **reduced post-harvest losses**, and allows farmers to store and sell at a higher price, which may also have positive nutrition outcomes through the income

However, note that this may lead to an unintended consequence – **driving more men into women's roles**[2] and potentially **removing a source of income for women**.

Therefore, Agridrive should encourage and empower women to operate these machines, by providing training and hiring female operators for processing machines.

Link to a video of a cassava washing and peeling machine in action

Photo: cassava washing and peeling machine

[1] **Abass, Towo, Mukuka, Okechukwu, Ranaivoson, Tarawali & Kanju. (2014).** IITA. Growing cassava: A training manual from production to postharvest. IITA, Ibadan, Nigeria. https://cgspace.cgiar.org/handle/10568/80992
[2] **Doss. (2001).** Designing Agricultural Technology for African Women Farmers: Lessons from 25 Years of Experience. World Development Vol. 29, No. 12, pp. 2075-2092

Ideas to Consider: Affordability & Opportunity Cost

Smallholders need support to afford and to understand long-term benefit

2 Help make mechanization more affordable for smallholders, and increase financial literacy on opportunity cost

- The timing of cash flows is an issue for smallholders, as they pay **upfront** for numerous costs (e.g., inputs, mechanization), and wait up to a year before receiving income from their crops
- Another issue is the lack of financial literacy among farmers, specifically around **opportunity cost**.
- For some farmers, they must make difficult choices at the beginning of the season on whether to mechanize, or purchase food for the family, which has which may have consequences on **dietary diversity and intake**

IGNITE's estimates indicate that the upfront cost of partial mechanization (ploughing only) could represent up to **2/3 of a smallholder's yearly cassava income** (if farming manually). This upfront cost makes even partial mechanization difficult to afford, and farmers hesitate to invest even if it would earn more in long run.

Allowing smallholder farmers to pay less upfront, and more after selling, has two benefits:

1. Makes mechanization **more affordable** by spreading out the timing of payments, meaning more farmers can benefit from the **extra income** and **yield** that mechanization brings
2. Leaves more income at the start of the season for the purchase of **more nutritious foods** and to pay for other expenses like school fees, healthcare, or housing

To further support smallholders and reduce hesitation, Agridrive should support farmers on **financial literacy** around **opportunity cost**, to help farmers understand the long-term financial benefit, despite upfront costs.

Photo: An Agridrive tractor ploughs a field for a 400 hectare plot in Ayetoro, belonging to Legacy Cooperative – a cluster of 400 smallholders.

Ideas to Consider: Diversified Diets

Encourage planting and consumption of vegetables and fruits alongside cassava

3 Partnerships and incentives to promote vegetable or fruit farming and consumption, together with cassava

- Cassava and maize products remain the staple foods in the study locations
- Cassava is not a nutrient dense crop but it is an important source of carbohydrates. There is need to support **crop diversification** and create awareness to use income from cassava to purchase other nutritious foods, such as vegetables and fruits.

Cassava is commonly intercropped with vegetables and fruits such as peppers, pumpkin, okra, beans, or melons. There is an opportunity for AATF / Agridrive to encourage the planting and consumption of vegetables and fruits, together with cassava.

This can be accomplished by:

1. Partnerships with other organizations that create awareness and provide inputs for crop diversification to allow for fruit and vegetable farming, alongside cassava farming
2. Provide incentives for fruit trees to be planted in cassava farming areas
3. Support field days where nutritious cassava recipes are showcased, including recipes with local vegetables and fruits

By doing this, Agridrive may encourage more farmers to **consume more nutritious foods**, and also provide an **additional source of income** (at more regular intervals than cassava) which can be used to purchase other nutritious foods.

Photo: An intercropped cassava field; Madelline Romero, CIAT

Ideas to Consider: Target women's groups

Encourage more women to be primary customers of Agridrive

4 Specifically target women's farmer groups for mechanization services, highlighting benefits for women

- Of the farmers listed for the study, only **18% of primary customers were women**
- However, many women reported being involved jointly in decision-making on mechanization, and it is clear that women see the benefits of mechanization in terms of time savings, stress reduction, and increased yield and profits

Non-mechanized women farmers represent a large opportunity. If AATF / Agridrive can specifically target women's farmer groups and cooperatives in the study locations to market mechanization services, it could translate into more demand for Agridrive services and empower women to influence decisions that are usually made by men.

This can be accomplished by:

1. Creation of **gender-specific marketing materials**, highlighting the benefits of mechanization for women in terms of time savings, stress reduction, and increased yields and profits, and depicting women taking part in all farming activities and roles, including male-dominated roles
2. Conduct **outreach to women's farmer groups** – led by female representatives from Agridrive – to encourage women to consider mechanized farming

This could be paired with Social Behaviour Change Communication (SBCC) training for Agridrive staff and farmers as well as inclusive Information, Education and Communication (IEC) materials to ensure that the message is delivered in an appropriate and sensitive manner (see next slide).

Photo: Women in maize field, Nigeria; USAID

Ideas to Consider: Address gender barriers

Train staff and farmers to be aware of norms and barriers and address them

5 Conduct trainings and create educational materials for women and men to address norms and gender barriers

- Socio-cultural norms and gender barriers exist which prevent women from taking part in all farming activities and decisions around mechanization
- This was evident in the study with some men (not all!) at times characterizing women as weaker or fragile, or not responsible or capable for decisions, or not being able to complete certain farming roles

It is clear from the study that most women do not characterize themselves this way. Many women do take on men's roles, and many are involved in decision-making on mechanization. AATF / Agridrive can take strides to address these socio-cultural norms and gender barriers.

This can be accomplished by:

1. Conducting **Social Behaviour Change Communication (SBCC) training** through a Training of Trainers (TOT), where trainers go on and provide training directly to Agridrive farmers.
2. Create inclusive **Information, Education and Communication (IEC) materials** for women and men highlighting the distinct roles that women and men play in farming and in the household and addressing common misconceptions

The focus of the training will be to provide simple, action-oriented messages to promote improved behaviours for different household members. The goal will be **enhanced female participation in decision-making** with respect to mechanization, and more female primary Agridrive customers.

Photo: Discussion with mechanized women farmers in Ayetoro, Ogun State

tanager
an ACDI/VOCA affiliate

laterite
DATA | RESEARCH | ANALYTICS

Thank you

Meet the Laterite Team

Based in Nairobi, Kampala, and Amsterdam

laterite
DATA | RESEARCH | ANALYTICS

John DiGiacomo

Senior Research Associate

Nairobi

Tessa Ahner-McHaffie

Senior Research Associate

Nairobi

Joshua Wegoye

Senior Field Supervisor

Kampala

Pietro Franchi

Research Associate

Kampala

Sachin Gathani

Managing Partner

Nairobi

Dimitri Stoelinga

Managing Partner

Amsterdam

Data collection in Nigeria was led by Qualiquant Services

tanager

an ACDI/VOCA affiliate

laterite

DATA | RESEARCH | ANALYTICS

5. Appendix

Additional information and insights

Cassava Farming Economics

Assumptions used in the profitability model

Assumptions Used

Line Item	Assumption Source	Assumption
Revenue		
Yield	Agridrive + Literature	Manual yields 7 tonnes / ha.; Partial mech. yields 10 tonnes / ha.; Full mech. yields 20 tonnes / ha.
Sale Price	Agridrive + Laterite	Assumes cassava is sold unprocessed at a rate of ₦ 45k per tonne; which is an average of the high (₦ 70k) and low (₦ 20k) prices seen in 2021
Costs		
Mechanization	Agridrive 2021 prices	Assumes partial mechanization includes 2 ploughs only. Full mech includes everything
Machine Transport	Agridrive	Assumes transport distance of 70-80km, which averages ₦150k total; assumes smallholders are clustering in groups of 15 households in order to afford the transport cost, resulting in a cost of ₦ 10k per household
Additional Labor	Agridrive + Laterite	Assumes a daily rate of ₦ 2,000 per day per laborer. Assumes a fully manual farm requires 60 days per hectare; 40 days for partial mechanization; 20 days for full mechanization
Cassava Stems	Agridrive	₦ 800 Naira per bundle x 70 bundles per hectare = ₦ 56k
Fertilizer & Herbicides	Agridrive	Fertilizer: 4 bags fertilizer per hectare @ 12,500 per bag x 4 = 50,000; Herbicide: 3,000 per liter and use 4 liters per hectare = 12,000
Land Leasing	Legacy Cooperative	25,000 per hectare per year; this is the rate Legacy Cooperative is paying for its 400 hectare plot.
Transport of Harvest	Agridrive	10,000 per hectare for haulage
Security	Agridrive	Assumes 1 security guard gets 35,000 per month; Require 2 months for fully mech or partial mech

Yields with Mechanization

What is driving the higher yields from mechanized farming?

Cassava yields in Nigeria are low compared to the rest of the world, despite being the #1 producer of cassava

National average of yield in Nigeria is **12 tons per hectare**[1] (including both manual and mechanized farmers)

For comparison, in India, the national average yield is **36 tons per hectare**[1] – or **3X higher**

- Under optimal conditions, cassava yields can reach **80 tons per hectare**[1]

From Agridrive's experience:

→ **Manual farmers** in the South West yield **5 – 7 tons per hectare**

→ **Partially mechanized farms** (land preparation only) yield **~12 tons per hectare**

→ **Fully mechanized farms** can yield from **20 – 30 tons per hectare**

Mechanization leads to improvements in yield in two main ways

1. **Better timing**
The timing of farming tasks is vital for increasing yield, particularly land preparation, planting, and weeding. With mechanization, these tasks can be started and completed within a day, instead of over weeks. This prevents situations where only a portion of the plot is prepared, weeded, planted, or harvested.

2. **More precision**
With mechanization everything is more precise. The ability to plant is straight rows, the spacing of the rows, the spacing of the seedlings, the depth of the tilling, the distribution of the harrowing.

Photo: Encyclopedia Britannica www.britannica.com/plant/cassava

[1] IAEA. (2018). Cassava Production Guidelines for Food Security and Adaptation to Climate Change in Asia and Africa. https://www-pub.iaea.org/MTCD/Publications/PDF/TE1840_web.pdf

Overview: Agridrive Limited

Operations in South West Nigeria

Agridrive's customer base in the South West includes primarily **cassava** and **maize** farmers

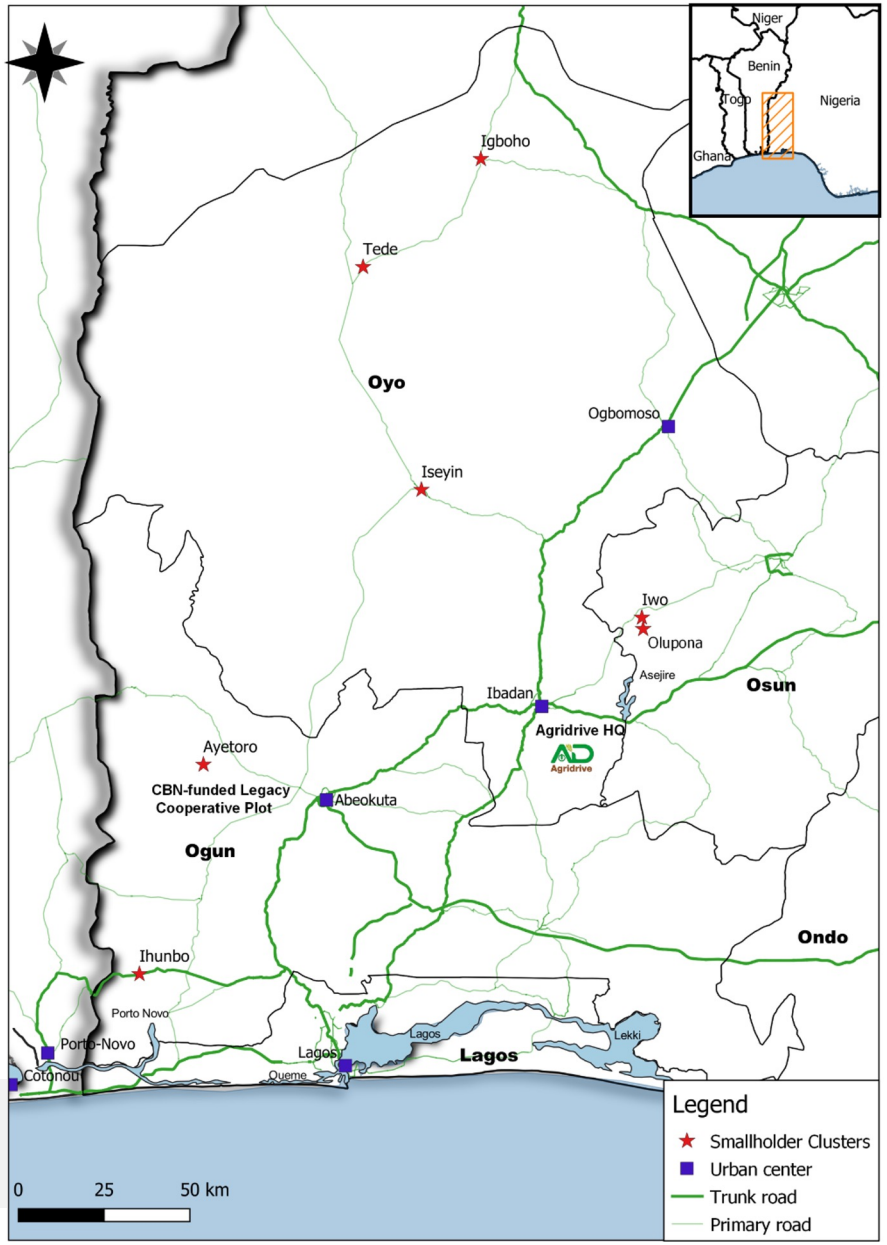
There are three distinct groups of customers

1. **Large-scale producers and corporations** who outsource mechanization to Agridrive – e.g., Dufil Noodles (50+ hectares each)

2. **Smallholder cooperatives** who have purchased one contiguous plot – e.g., 400 ha. Legacy Cooperative plot under Central Bank of Nigeria project

3. **Individual small and medium producers** mechanizing their home plot; usually clustered into groups (0.1 – 20 hectares per farm). These individual small and medium farmers are often clustered nearby to big Agridrive clients plots as that makes the economics worth it for Agridrive.

The map on the right shows the locations of some of Agridrive's smallholder farmer clusters in the **Ogun, Oyo,** and **Osun**



Overview: Services, Prices, and Machinery

Fleet of tractors and operators provide mechanization on fee-for-service basis

Agridrive's owns 35 John Deere 75hp tractors

- Each tractor is worth ₦ 22M or $55k USD
- 20 of these tractors are in SW, rest in the North
- All other implements attach to the tractors:
  - → Baldan ploughs (₦ 6M or $15k each)
  - → Baldan harrows (₦ 3M or $8k each)
  - → Planti-Center Cassava Planter
  - → Planti-Center Cassava Harvester
  - → Boom sprayers (₦ 6M or $15k each)
- Agridrive also uses drones for crop disease and irrigation monitoring

Services & Prices

- Individual farmers are free to pick and choose services
- In addition to the prices per hectare (shown below), farmers must pay for the transport of the machines, which averages ₦ 150k for a 70-80km trip (not included in prices below)

	Prices per hectare for 2021	
Land clearing[1]	₦ 185 – 265k	$450 - 650
Ploughing (per time)	₦ 24k	$58
Harrowing (per time)	₦ 20k	$49
Ridging	₦ 24k	$58
Cassava or maize planting & fertilizer application	₦ 24k	$58
Herbicide application using boom sprayer	₦ 16k	$39
Weeding using a cultivator with boom sprayer	₦ 15k	$37
Cassava Harvesting (uprooting only)	₦ 20k	$49

[1] Land clearing takes place before land preparation (ploughing & harrowing). Clearing involves removing trees, stumps, and rocks to make the land farmable. Depending on the intensity of clearing required Agridrive charges more or less.