FMS Farms SDM Case Report

Public version – July 2020

Cassava | Nigeria

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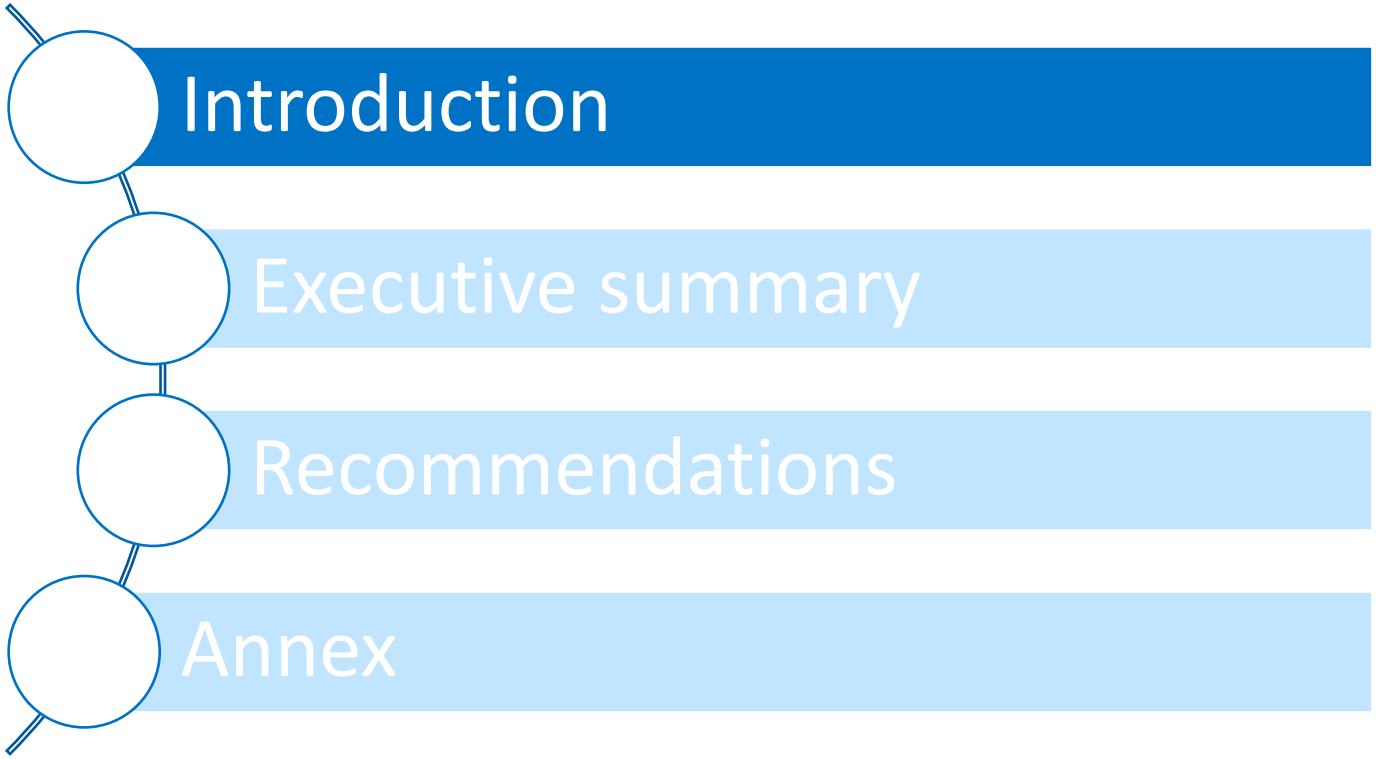

Introducing Service Delivery Models (SDM)

Importance of Service Delivery

Agriculture plays a key role in the wellbeing of people and planet. 70% of the rural poor rely on the sector for income and employment. Agriculture also contributes to climate change, which threatens the long-term viability of global food supply. To earn adequate livelihoods without contributing to environmental degradation, farmers need access to affordable high-quality goods, services and technologies.

Service Delivery Models (SDMs) are supply chain structures which provide farmers with services such as training, access to inputs, finance and information. SDMs can sustainably increase the performance of farms while providing a business opportunity for the service provider.

A solid understanding of the relation between impact on the farmer and impact on the service provider's business brings new strategies for operating and funding service delivery, making the model more sustainable, less dependent on external funding and more commercially viable.

About this study

To accelerate this process, IDH is leveraging its strength as a convener of key public-private partnerships to gain better insight into the effectiveness of SDMs. IDH developed a systematic, data-driven approach to understand and improve these models. The approach makes the business case for service delivery to investors, service providers, and farmers. By further prototyping efficiency improvements in service delivery, IDH aims to catalyze innovations in service delivery that positively impact people, planet, and profit.

Thanks

IDH would like to express its sincere thanks to FMS for their openness and willingness to partner through this study. By providing insight into their model and critical feedback on our approach, FMS is helping to pave the way for service delivery that is beneficial and sustainable for farmers and providers.

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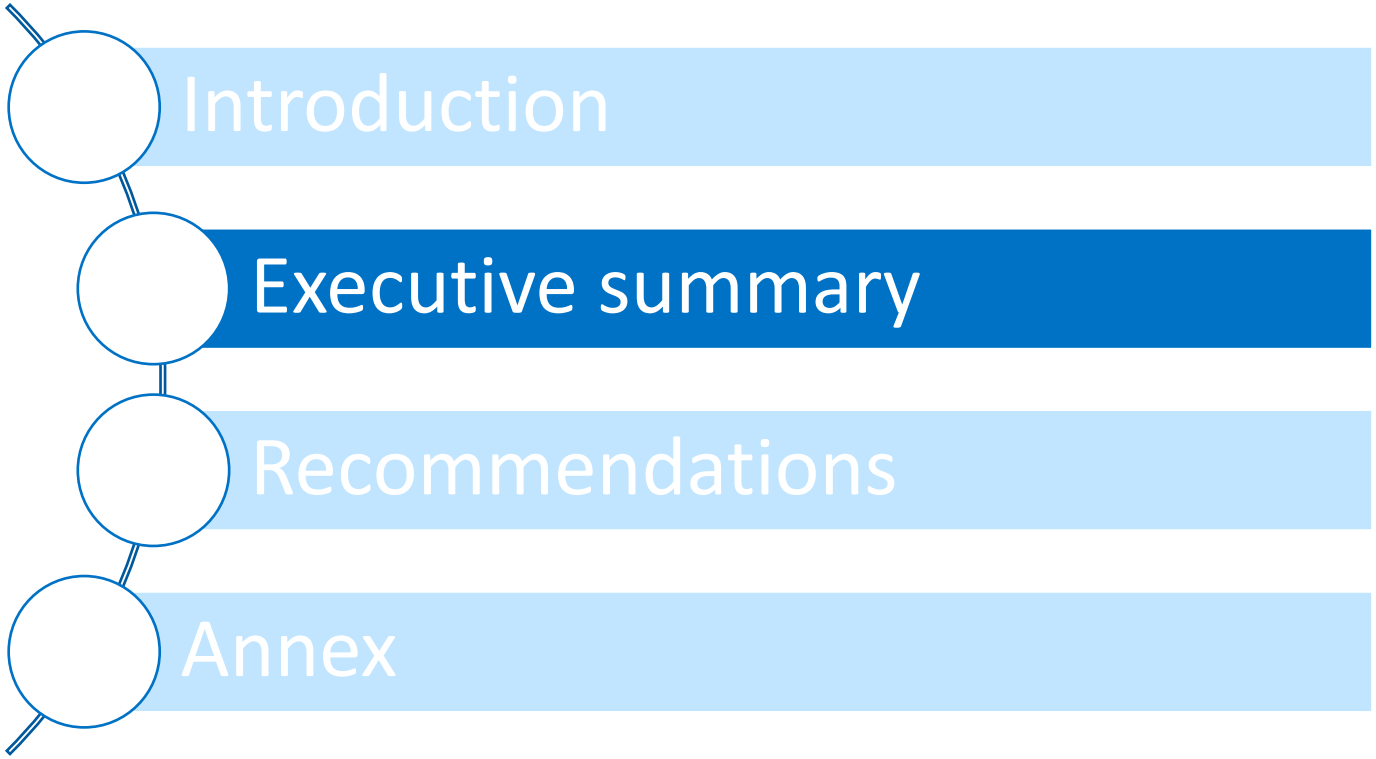


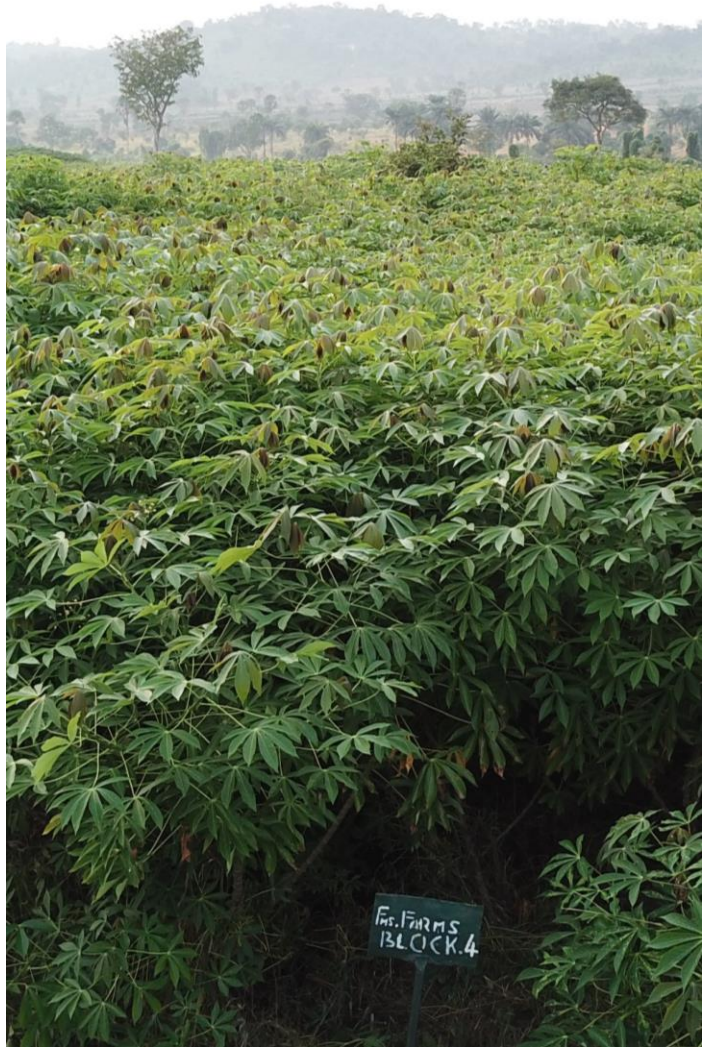
FMS seeks to supply their new cassava processing plant by sourcing from smallholder farmers

About FMS Farms

- FMS Farms, located in Ekiti state, was established to be an integrated agribusiness holding venture with a vision and specialized focus in broad areas of farming and processing including crop cultivation and animal husbandry.
- FMS Farms currently exists out of a vegetable farm, a cassava plantation farm with outgrower model and poultry farming. However, this SDM analysis only looks into FMS's cassava plantation business unit.

FMS objectives

- FMS Farms aims to process raw cassava tubers into starch and sell it to large domestic and international buyers. They seek to produce 15,000 MT of starch annually within the next 3-4 years, requiring a raw material supply of about 75,000 MT tubers.
- The current strategy is to source the tubers both from block farmers, who farm on land leased from FMS, and community farmers who have their own land. FMS has about 3,500Ha of land available to lease to block farmers, manage their own nucleus farm for stem multiplication, construct their processing factory. FMS has not yet implemented a service delivery model but is currently in the design/pilot phase.
- Establishing an efficient sourcing model is a pre-requisite before going ahead with investments in a processing plant as experience shows that many of the plants in Nigeria are operating below their maximum capacity due to lack of raw materials supply. However, as FMS has not yet fully implemented the SDM nor started sourcing, there is a lack of knowledge around the effectiveness of the sourcing model and loyalty of farmers. Limited availability of affordable capital forces FMS to strategically prioritize its capital investments and only gradually grow the number of farmers and sourcing volumes.
- For FMS to run an efficient, inclusive and sustainable cassava processing business it should strategically design its sourcing and service delivery model, while optimizing its working capital needs and attracting new sources of affordable finance.



Sources: 1) FMS Cassava business summary (2019), 2) FMS discussions

Operating in a favorable market, FMS is well positioned to grow an efficient and inclusive cassava sourcing and processing business

Summary of FMS SWOT based on context and strategy assessment (see annex)

Legend: Economic | Social | Environmental

	Helpful	Harmful
FMS	**Strengths** • Sourcing and service model design to optimizing processing plant utilization • Possession of 3,000 hectares of land to develop block farm • Block farm model ensures low operational cost and high degree of control over quality and security of supply • Processing facility is located on the block farm, minimizing post-harvest losses • Owns plot for high-quality stem multiplication • Paced and organic growth strategy that minimizes external finance dependency • Potential to leverage synergies of vegetable and poultry Business Units • Female leadership and gender intentional strategy	**Weaknesses** • No track-record on providing services to farmers • Very limited relationship with community farmers • No formal relationship with FI (for building processing factory or working capital) • Processing factory needs to be built in time for first harvest cycle • Block farm model requires large upfront capital investments • FMS has no/limited access to affordable financing (due to lack of proven commercial viability and impact)
Context	**Opportunities** • Large domestic and international market demand for industrial use of cassava derivatives • Potential to increase cassava tuber yields through comprehensive service package • Potential financing through Anchor Borrowers Program with the Bank of Nigeria • International buyers could pay higher margins and recude domestic buyer dependency • Block farming model could empower women, already heavily involved in cassava production, by providing them equal opportunities to own land • Irrigation services coupled with crop insurance could safeguard long-term productivity and farmer incomes • Crop rotation cassava with beans could effectively enhance soil fertility, reduce fertilizer costs and diversify farmer incomes	**Threats** • Highly-fragmented value chain with unstable supply • Rising and volatile tuber farm-gate prices and low, fixed factory-gate prices • Cassava SHFs lack inputs and markets • Poor infrastructure and perishable nature of crop hinders industrial processing of tubers • Strong competition for high quality cassava tubers supply in the same region • Dependency on single buyer of starch • Crop loss due to herdsmen driving their cattle through the block farm • Prevalence of high (junior) staff turnover • Increased prevalence of extreme climate events such as droughts

FMS should strategically design its sourcing and service delivery model, while growing gradually and attracting affordable finance

Reading guide

Strategically designing a block farming model allows FMS to control the supply of high-quality tubers to efficiently run their processing facility

- A signed contract between FMS and block farmers ensures loyalty and prevents side selling from block farmers
- With the processing plant located on the block farm, the cost and risks of transport can be partially reduced
- FMS controls the type of high-quality stems used on the block farms to ensure the level of starch and quantity of supply
- FMS setting up a phased cropping scheme within the block farm to maximize processing plant utilization

Developing a cost-effective inclusive and resilient Service Delivery Model designed for both block and community farmers

- Provision of services on credit to cash constrained farmers is critical in allowing them to invest in their farms
- Training, improved stems, inputs and mechanization significantly increase yields and quality of cassava
- In order to draw in farmers to work the lands of the block farm, the service package needs to be financially attractive
- A gender-intentional SDM allows FSM to become sustainable on the long-term

Optimizing the growth rate and sourcing mix needs will allow FMS to expand organically and sustainably

- An optimal mix of block and community farmers allows FMS to run a cost-effective and sustainable business
- Further improving the community farmer engagement is key in closing the annual tuber supply gap
- By growing gradually FMS can minimize the need for and cost of external financing

Securing new sources of capital to optimize the combination of debt and equity finance will allow FMS to sustainably grow its business

- A proven commercially viable business model with social impact can unlock commercial and impact finance
- Unlocking finance from the Anchor Borrowers Program will enable FMS to scale up faster

Legend

A signed contract between FMS and block farmers ensures loyalty and prevents side selling by block farmers

Pre-conditions for contracting

There is a need for exchange

- FMS supplies high-quality services
- FMS supplies prepared land
- Farmers provide labor

Farmers are convinced they will benefit

- FMS offers guaranteed offtake
- FMS offers attractive prices
- FMS service package leads to increased production
- FMS is a reliable partner

Engaged farmers who are committed to deliver on the contract

- Own personal farm and see block farm as additional income source
- Previously cultivated cassava

Contracting

The contract should include key elements that ensure a fair and transparent exchange

- ❑ Legally binding agreement of 1 year
- ❑ Transparent pricing structure
- ❑ Clear payment method and timing
- ❑ FMS as sole offtaker of produced cassava tubers
- ❑ Lease of 2ha land on block farm
- ❑ Provision of services & finance

Outcomes

Expected benefits for FMS

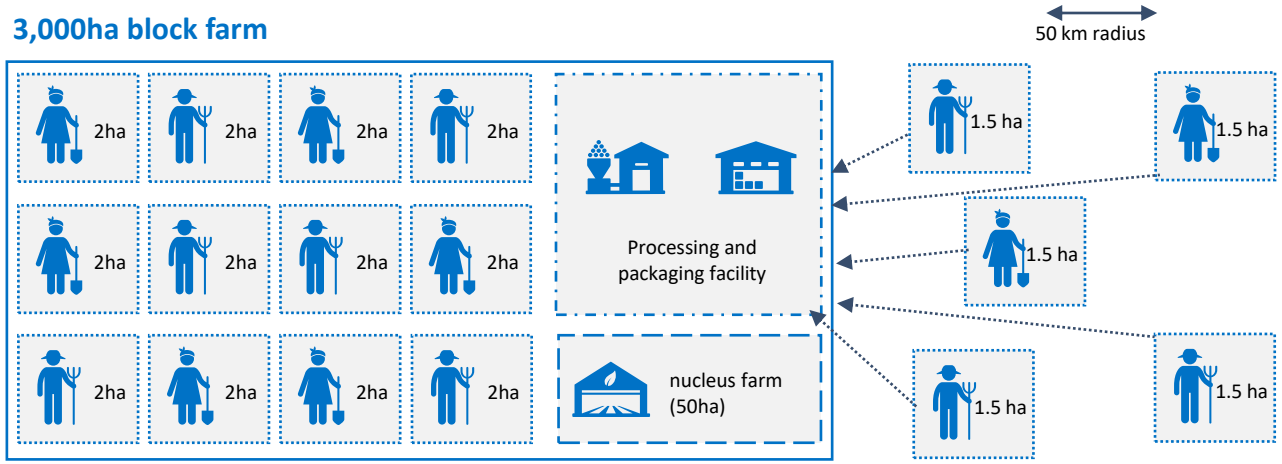
- Secured and predictable supply of high-quality cassava tubers
- High efficiency due to low post-harvest losses

Expected benefits for Farmers

- Increased livelihood through stable additional income source

Sources: 1) FMS Cassava business summary (2019), 2) http://www.fao.org/3/a-i8059e.pdf

With the processing plant located on the block farm, the cost and risks of transport can be partially reduced



FMS sourcing strategy to decrease risk of quality loss and costs

- To ensure full utilization of the processing factory FMS relies on a mixed supply of tubers from block and community farmers – with 65% set out to be sourced from block farmers.
- The total cost for sourcing from a block farmer is higher for FMS compared to sourcing from a community farmer. This is due to the higher cost for providing the service package and transportation, with this higher cost countered by the strong decrease in post-harvest losses and side-selling.
- Community farmers have 20% higher post-harvest losses due to the highly perishable nature of cassava tubers, bad state of infrastructure in Ekiti state and their distance of 50km to the processing factory.
- Additionally, community farmers in the FMS sourcing model need to hire a third party for the transport of their tubers resulting in high transport cost disincentivizing them into selling to FMS.
- On the contrary, tubers from block farmers can be processed within ten hours after harvest as FMS owns a processing factory on the block farm and has its own road network between farm and factory. Additionally, FMS owns tractors for the transport of harvested tubers to the factory. This greatly reduces the risk of post-harvest quality losses due to own management of transport planning.

FMS controls the type of high-quality stems used on the block farms to ensure the level of starch and quantity of supply

Comparison between three cassava varieties

	Local	TMS30572	TME419
Source	Unknown	IITA	MoA
Yield	9.5 MT/ha	25 MT/ha	25 MT/ha
Maturity period	15 months	12 months	12 months
Peak starch content	13%	24%	27%
Multiplication rate	10:1	5:1	5:1
Price	Free	Market price: 400 NGN FMS price : 350 NGN	Market price: 400 NGN FMS price : 350 NGN
Soil type	n/a	Sandy-loomy soil; survives wetter soils	Sandy-loomy soil
Performance	Disease-prone	Weed resistant Drought resistant Pest and disease resistant	Weed resistant Drought resistant Pest and disease resistant

Quality control through own stem multiplication

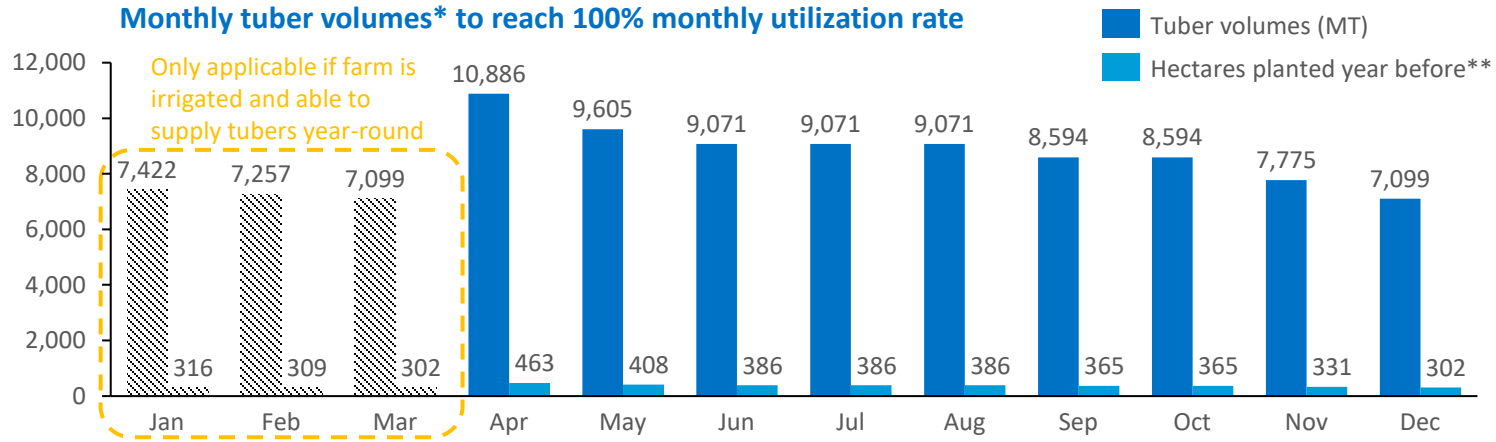
- FMS currently uses two improved varieties, TMS30572 and TME419, specifically tailored to local soils, and resistant against pests and diseases. This results in higher obtainable yield and starch level contents compared to local varieties.
- FMS owns a nucleus farm for stem multiplication. Stems are for own use and sold the block farmers on credit. Through in-house stem multiplication FMS can control:
  - Price charged to farmers, at around 75% of market price
  - Volumes produced through:
    - Multiplication rate: producing 5 new stems per 12-month period
    - Determining which volume is needed at which time, as stems can be stored for max 90 days.
  - Timing of stem supply in line with seasonal demand
  - Stem characteristics: in collaboration with research institutes FMS can continuously test and evaluate performance of current and future varieties. The best varieties can be selected, multiplied and brought to market.
  - Starch level: by optimizing the variety, timing of planting and harvest FMS can source tubers with high levels of starch content.
  - Yield level: by controlling timing of planting and harvesting FMS ensures steady supply of tubers.
- FMS can offer stems at below-market rates as the returns materialize in the form of higher yields, increased starch content and higher sourcing efficiency due to controlled timing of planting and harvesting

FMS setting up a phased cropping scheme within the block farm to maximize processing plant utilization

Cassava crop calendar: ideal timing of planting, harvesting and starch content

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ideal timing of planting	Rainy season affects tuber growth				Ideal climatic conditions for early stages of cassava growth cycle					Rainy season affects tuber growth		
Timing of harvest	Not recommended to harvest tubers older than 15 months (i.e., planted previous Sept latest)			Cassava planted between 12-15 months ago should be harvested to obtain optimal yield and starch content. After 15 months weeds, pests and decomposition severely affect yield and quality.								
Starch content (%)	22%	23%	24%	15%	17%	18%	18%	18%	19%	19%	21%	24%

Monthly tuber volumes* to reach 100% monthly utilization rate



*Obtained by dividing the monthly starch output capacity (1,668 MT/month) by the starch content of tuber harvested in that month (see upper table)
**Assuming these hectares are planted exactly 12 months before. In reality, the planting timeframe is shorter, necessitating FMS to plant the required hectares from Apr-Dec between Apri-Sep the previous year at around 376 hectares per month, or 3,391 hectares per year.

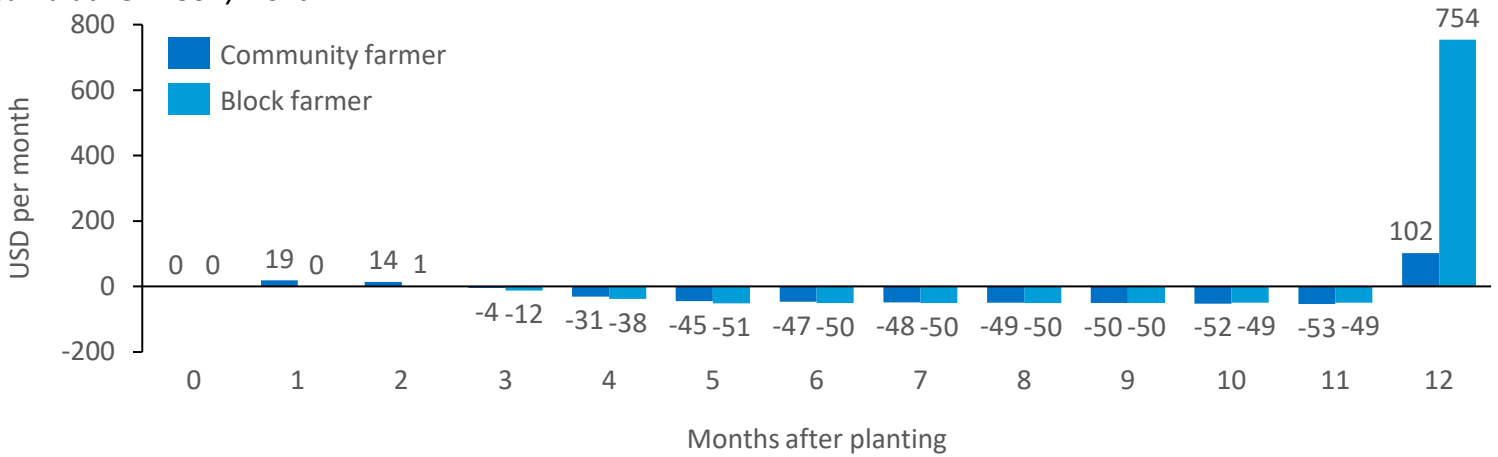
Improving the factory's utilization rate

- A steady supply of quality tubers throughout the year is critical in ensuring a high utilization rate of FMS' processing factory. This requires a balancing of:
  - Correct timing of planting of stems given seasonal variability in rainfall. Distributing the volumes harvested evenly across the months
  - Ensuring optimal starch content as influenced by the timing of harvest and time in ground
  - Ensuring optimal volumes of tubers harvested as determined by the time in ground
- Additional levers that can be used to improve the processing utilization rate are the sourcing mix (community versus block farm) and deciding whether to open or close the factory (balancing marginal costs and revenues)
- FMS uses 2 cassava varieties with a maturity period of between 12 and 15 months and encourages their block farmers to plant between April and August. This enables a harvest cycle that starts in April and ends in December.
- With limited control, community farmers follow their own cycle, planting in May and harvesting after 15 months from August till October.

Provision of services on credit to cash constrained farmers is critical in allowing them to invest in their farms

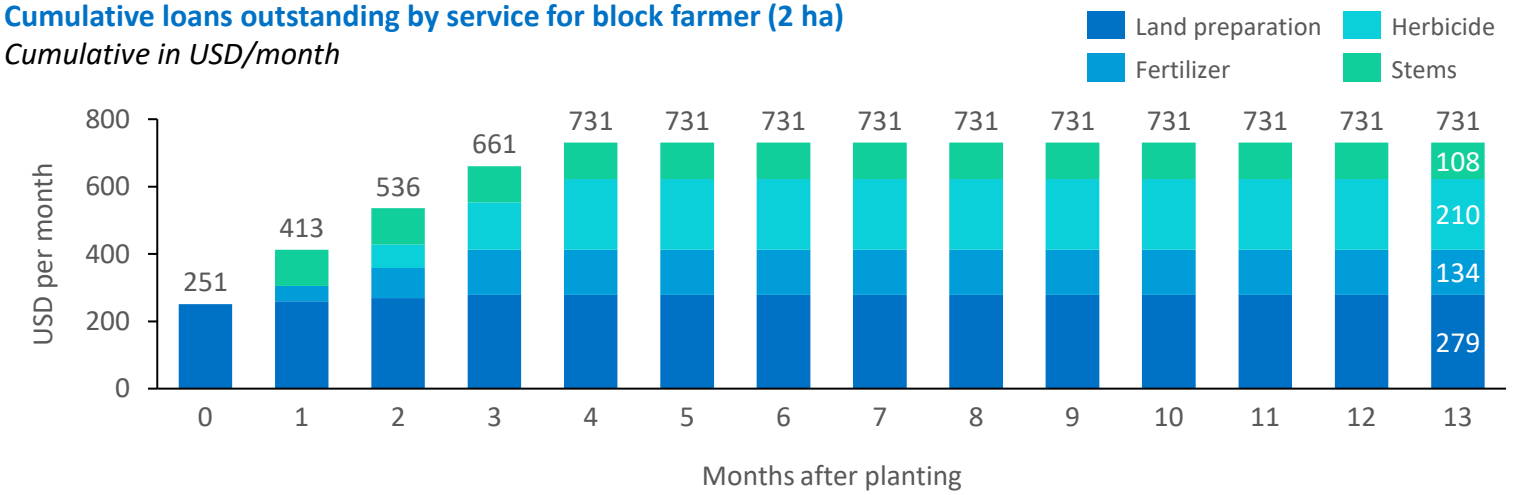
Comparing cash flows of community and block farmer

Cumulative in USD/month



Cumulative loans outstanding by service for block farmer (2 ha)

Cumulative in USD/month

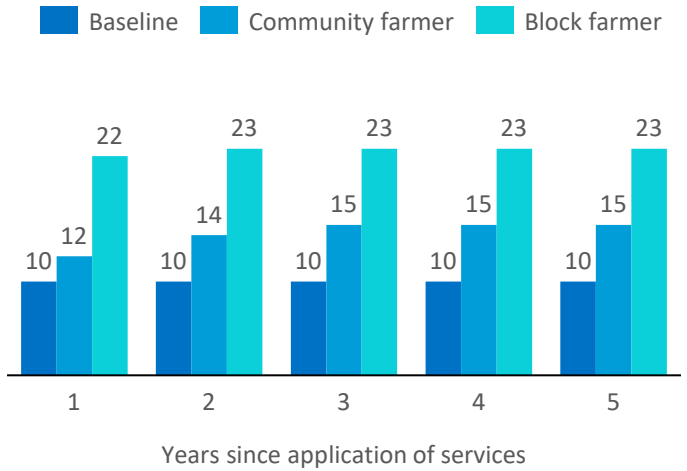


Expanding farm size through on-credit services

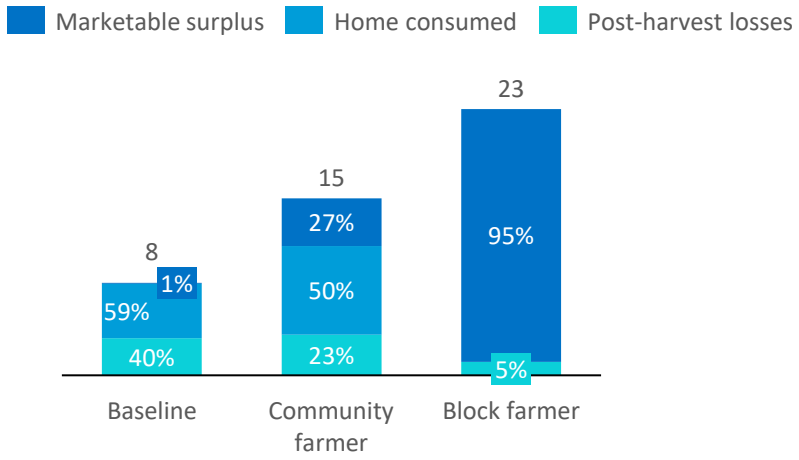
- Services on credit allow a block farmer to invest in high-quality inputs (stems, fertilizer, herbicides) while incurring low cash expenses, comparable to those of community farmers.
- At time of harvest, 12 months after planting, the outstanding loans and interests will be subtracted from the price received for the tubers, leaving block farmers with a considerable amount of net cash in hand.
- Farmers would otherwise never been able to make the $731 per hectare investment in land preparation, fertilizer, herbicides and stems.
- As a result, compared to community farmers, block farmers can cultivate a larger plot (2 instead 1.5 hectares), later expand their plots (up to 5 hectares) and obtain higher yields (23 versus 15 MT/ha), significantly improving their incomes.
- Still, the loans come at a cost. FMS charges block farmers with interests on their credit in line with the rates they can obtain. At market rate this would imply 25% per annum, versus 9% per annum when accessing the Anchor Borrowers Scheme.

Improved stems, inputs and mechanization increase yields and starch content. Proximity to factory reduces postharvest losses

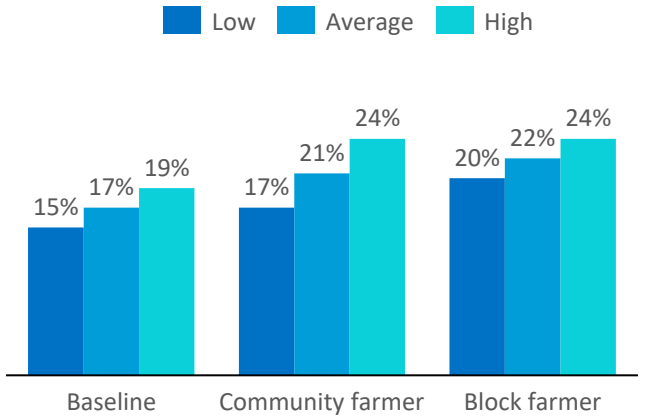
Change in yield per farmer segment



Change in yield per farmer segment



Starch content per farmer segment



Cassava yield

- Training on GAP and provision of improved stems increase community farmer yields to 15 MT per hectare. It takes them 3 years to fully adopt practices.
- Block farmers, receiving quality inputs and mechanization services, are expected to harvest up to 23 MT per hectare.

Marketable surplus

- A key driver of farmer profitability is reducing high post-harvest losses prevalent in Nigeria. Training community farmers on GAP reduced PHL to 23%, down from 40% of yield. Block farmers, located close to the processing factory incur only 5% PHL.
- While community farmers still consume most cassava themselves (65% as opposed to 98% baseline farmers), block farmers sell all their cassava to FMS.

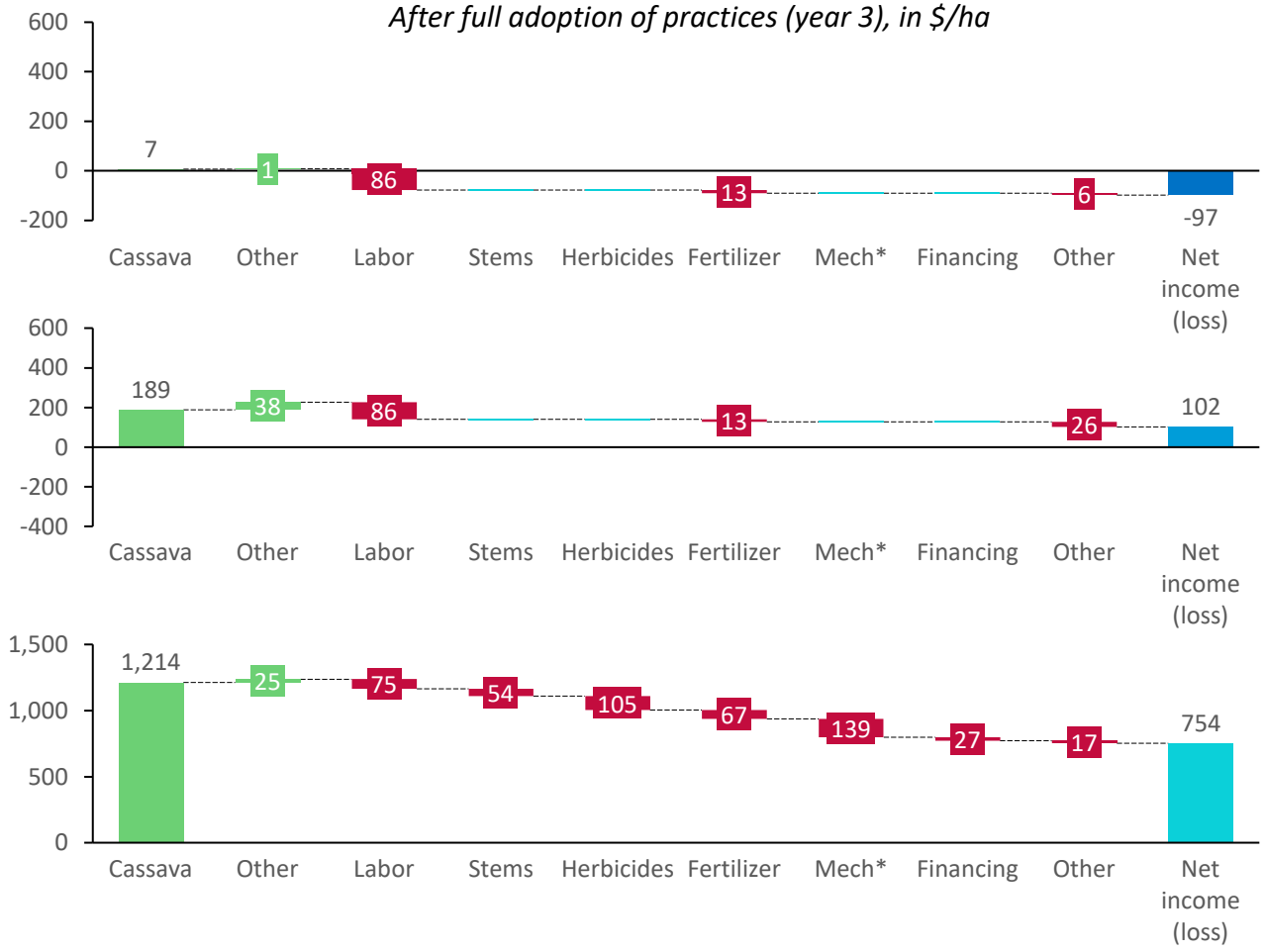
Starch content

- Improved varieties TMS30572 and TME419 yield cassava with an average starch content of 21% as opposed to 16% for local varieties.
- As the block farms are better managed and provided with improved varieties from the start (as opposed to community farmers), block farmers are expected to obtain, on average, slightly higher starch content.

By providing a clear business case, FMS can increase loyalty of community farmers and attract block farmers

Comparing net incomes of baseline, community and block farmers

After full adoption of practices (year 3), in $/ha



Baseline farmers

- An average farmer cultivates 1.5 hectare of cassava.
- With limited resources, farmers are unable to invest in quality inputs and rely mostly on family labour. Yields are low at around 9.5 MT/ha
- Correcting for post-harvest losses, a mere 3MT/ha of cassava remains, used mainly for home consumption (98%)

Community farmers

- By adopting GAP and planting improved stems, community farmers can increase yields and starch content, generating up to $190 per hectare in additional revenues.
- Farmers only incur and additional 21$/ha for transporting the cassava to the FMS factory. Training and stems are provided for free. In return farmers are expected to sell on average 40% of their produce to FMS.
- Still, with 65% of cassava consumed at home and considerable post-harvest losses (23%), farmers are making only a small profit.

Block farmers

- Block farmers earn substantially higher cassava revenues due to high yields of 23 MT/ha, only 5% post-harvest losses and selling 100% of produce to FMS.
- Compared to community farmers, block farmers' expenses are 318$/ha higher due to purchasing of improved stems, application of more and higher-quality inputs, accessing mechanized ploughing and weeding and incurring interest costs on outstanding loans.
- On top of a higher return, block farmers benefit from guaranteed offtake by FMS and are insured against crop damage due to climate extremes.

FMS benefits from implementing inclusive policies and services while lifting key barriers to women economic empowerment

Best practices

Set targets on the number of male and female farmers you are aiming to reach, and create a plan that will help you achieve your target, recognizing that this may require a tailored approach.

Develop and enforce human resources policies on sexual harassment, anti-discrimination, fair compensation, parental leave, fair recruitment and/or fair hiring, to support the development of a safe work environment.

Develop and protect safe reporting procedures for victims of violence (e.g., trusted advisors, emergency hotlines); ensure employees are trained to handle different potential cases.

Consider incentives that would encourage women to participate in block farming. For example, transport provision for women who may be very far from the block farm.

Recruit women in groups that are already self organized. Foster women's leadership-by encouraging the leaders of the women's groups to be lead farmers.

Include financial literacy in training (saving, budgeting, investment) to strengthen women's economic empowerment. Engender training methodology for new recruits.

Foster the use of mobile money transfer to women. This ensures autonomy, control of their income, and bolsters financial resilience.

Barriers to be lifted

Practical: accessing the block farms is a challenge to most women. The distance to the block farm is long (about 50km) and not every women can leave their domestic roles to farm so far off.

Cultural mobility: in some of the communities that FMS operates in, women are not culturally allowed to work for economic gain. Women are predominantly the primary caregivers in the home and the community therefore they have less time to participate in economic activities.

Economic: women's access and control of resources particularly income is comparatively lower than that of men.

Benefits to FMS

Adapting training to women's capacities, literacy rates, time schedules and location leads to **improved yields and quality of produce**[1].

Recruitment of women's is likely to foster **higher loyalty levels** and **increased bankability**[2].

Women's financial resilience is beneficial in household and community resilience and **fosters stable market and constant supply** chains[3,4].

Reduced risk of negative publicity around inclusiveness

Higher probability of attracting international buyers

1. Suri, T., Jack., W., (2016)., The long run pverty and gender impacts of mobile money; 2. IFC (2017)., Investing in women along agribusiness value chain; 3. Davies, M. Baars, M., (2017)., Link-up business case insights: Retrospective learnings from offering bank accounts to savings groups in Tanzania and Kenya; 4. Oxfam., (2016)., Women's Rights in the Cocoa Sector. Examples of emerging good practice

An optimal mix of block and community farmers allows FMS to run a cost-effective and sustainable business

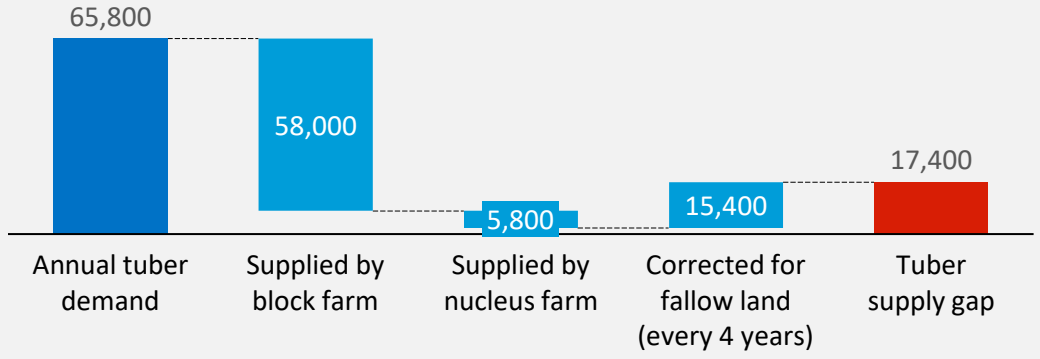
Adding community farmer supply to the sourcing mix

While sourcing from block farmers should be prioritized as it provides many benefits (see overview), adding outgrowers to the sourcing mix is both necessary and affordable.

- Necessary as FMS cannot supply the factory based on its own production, still having a tuber supply gap when lands are fully developed and assuming leaving it fallow once every four years.
- More affordable as it reduces upfront total loans outstanding at any given moment as sourcing from community farmers does not require extending 730 $ credit per hectare for a period of between 12 and 18 months – see graph and table to the right.

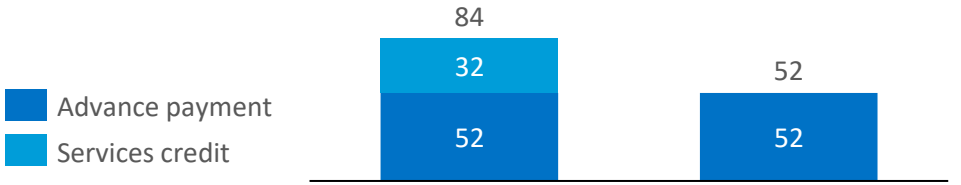
Tuber factory demand and potential supply from own lands

MT tubers per year assuming all available lands are cleared (>2023)



FMS credit outstanding per MT sourced

In USD, after harvest and before receiving payment from buyers



Indicators	Block farmer	Community farmer
Training cost	10$/farmer	10$/farmer
Service credit	731 $/ha	0$/ha
Months outstanding	12 – 18	0
Cost of finance	0% (carried over)	0%
Default costs	0%	0%
Sourcing per farmer	46 MT tuber	1.6 MT tuber
Distance	5km	50km

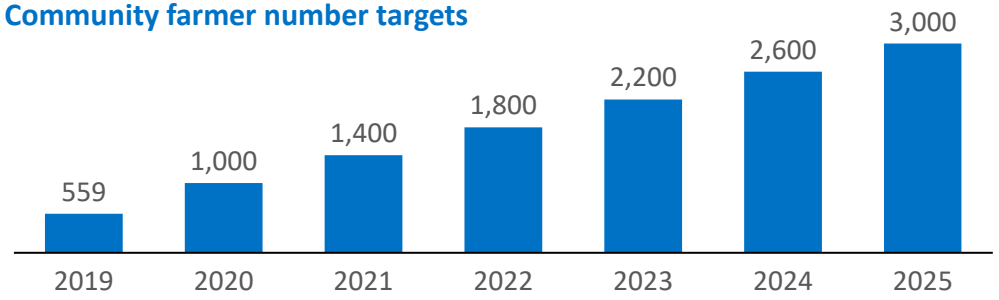
*Assumes full capacity of 15,000 MT starch output per year at 9 months operational and average starch content of tubers sourced at 19.5%
** Assumes a yield of 15 MT tubers/year, 23% post-harvest losses, 65% of production home-consumed and 40% sold to FMS versus other buyers

Further improving the community farmer engagement is key in closing the annual tuber supply gap

Increasing community farmer sourcing volumes

- Sourcing from the currently 3,000 planned community farmers would not suffice to meet the annual tuber demand of the processing factory. With on average 1.6 MT* tuber sourced per community farmer, the 3,000 farmers signed up by 2025 would bring in another 4,800 MT tubers, leaving the factory short by 12,600 MT per year.
- Various options can be explored to reduce this tuber supply gap – see below.

Community farmer number targets



Options to fill the tuber supply gap

Indicators	Increase tuber sourcing volume per farmer	Increase number of community farmers	Extend cassava cycles before leaving land fallow	Expand size of block farm
Impact	• Increasing from 1.6 to 3.9 MT tubers/farmer would close the 12,600 MT gap • Higher community farmer incomes	• Increasing community farmers from 3,000 to 7,600 all else equal would close the 12,600 MT gap • More farmers benefitting from FMS services	• Leaving land fallow once in every 6 years would close the gap by 2,200 MT tubers • Improved short and long-term soil health	• Developing an additional 380 hectares of block farm, yielding 46 MT/ha would close the gap
Key levers	• Pay higher prices compared to competition • Introduce volume-based incentive • Extend aggregation services to reduce PHL	• Adjust farmer number targets upward • Increase farmer outreach • Expand training capacity	• Plot by plot decision-making based on soil health • Close monitoring of soil health • Grow nitrogen fixing crops in between cassava cycles	• Make more land available for cassava block farming
Main constraints	• Team capacity • Setting expectations for future years (when paying high prices)	• Team capacity • Number of cassava farmers available close to the factory	• Actual depletion of soils • Ability to grow other crops between cycles	• Capital to clear and prepare the land

* Assumes a yield of 15 MT tubers/year, 23% post-harvest losses, 65% of production home-consumed and 40% sold to FMS versus other buyers

A proven commercially viable business model with social impact can unlock commercial and impact finance

Livelihood

Income increase – FMS supports 1,237 block farmers in increasing their livelihoods by 2025 and earn above the poverty line of 912 USD/HH/year. To reach the living income benchmark (2,646 USD/HH/year) block farmers would need to increase their land size to a minimum of 3.5ha. 3,000 community farmers also see an increase of 195% in their livelihood.

Income stability/security – A price guarantee in the contract between FMS and block farmers ensures the farmer's livelihood in periods of lower market prices.

Gender

Female farmers – FMS strongly supports female farmers to become block farmers (currently 40% are female). By assigning the contract to the block farmer itself, female farmers are given access to land and finance, circumventing the lack of statutory land rights and collateral.

Gender-intentional – Their approach also includes adjusting the training schedule to accommodate women's needs, employing female extension officers (1 out of 4) and collaborating with female lead farmers (3 out of 20).

Food security

Additional income – Providing farmers with the opportunity to rent an additional plot of land for cultivation, thus supporting farmers in obtaining an additional income source and enabling them to use 100% of their own farm for own consumption.

Climate resilience

Offsett crop loss risk – To offset the increasing prevalence to negative climate events and its associated risks to the farmers and FMS's business, FMS hires crop insurance to ensure a continuance of block farmers' livelihoods in case of droughts and floods.

Farmer resilience – The use of high-quality drought-resistant stems has reduced the impact of droughts on farmers' yields to 6.5% on average and contributes to securing the block farmer's livelihood.

Unlocking the Anchor Borrowers Program with the Central Bank of Nigeria will enable FMS' sustainable scale up approach

Anchor Borrowers Program (ABP)

The ABP, launched in 2015 by the Central Bank of Nigeria (CBN), to create an economic linkage between anchor companies involved in the processing (FMS) and smallholder farmers (block farmers) of certain commodities. Anchors sign agreements with farmers to whom they supply inputs in exchange for guaranteed sales of a proportion of the crop at a pre-agreed price, with the cost of inputs deducted from these sales.

Key details:

- Anchors have access to funding at 9 %, which is less than the going market rate of 25%.
- CBN guarantees half the value of any loan defaults.
- Farmers need to be organized in cooperatives.

Impact

Farm level

FMS borrows credit from the FI and carries both the credit and the interest rate over to the farmers.

→ The lower the interest rate, the lower the cost for the farmer, resulting in higher farmer net income.

→ From 2022 onward, when the block farm is fully operational, a total of $351,000 per year can be saved when charging 9% instead of 25% to all farmers (see graph below).

SDM level

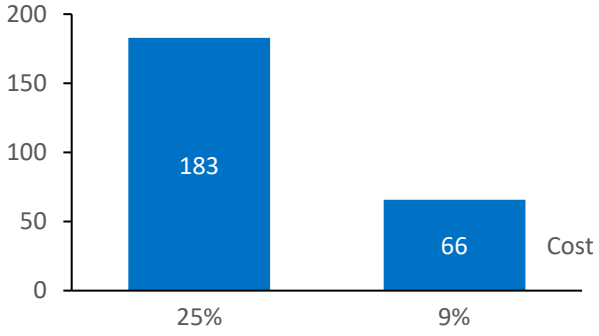
FMS also accesses credit from the FI for other purposes:

- OPEX: Working capital to acquire the produce from the farmer and pay the farmer timely
- CAPEX: Capital for investments such as land clearing the block farm to scale up the number of block farmers and to expand the nucleus farm for stem multiplication

→ The lower the interest rate, the faster the SDM can scale up and increase profitability.

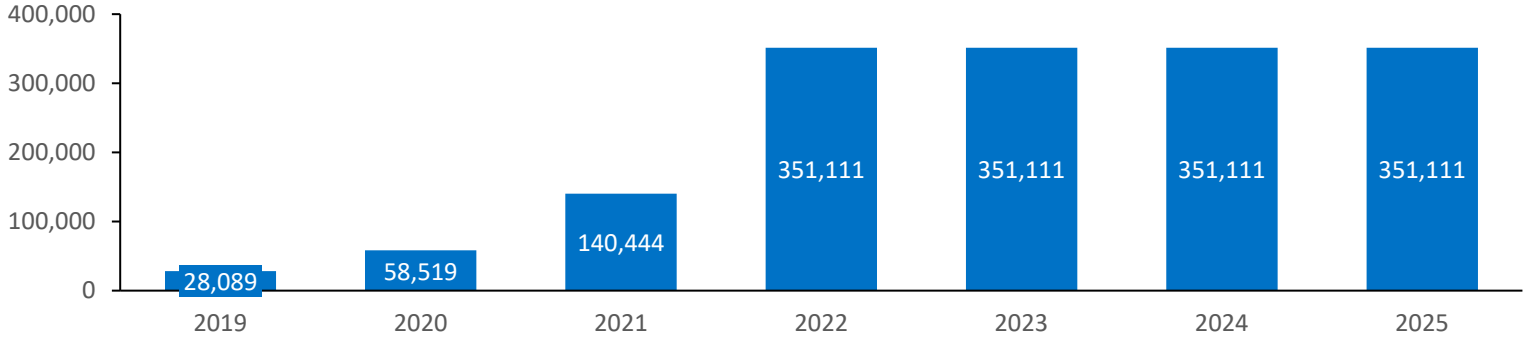
Annual cost of finance

In USD per hectare for different interest rates



Total annual value created at farm level

In '000 USD per year



Sources: CBN (2016) https://www.cbn.gov.ng/out/2017/dfd/anchor%20borrowers%20programme%20guidelines%20-dec%20202016.pdf

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Legend

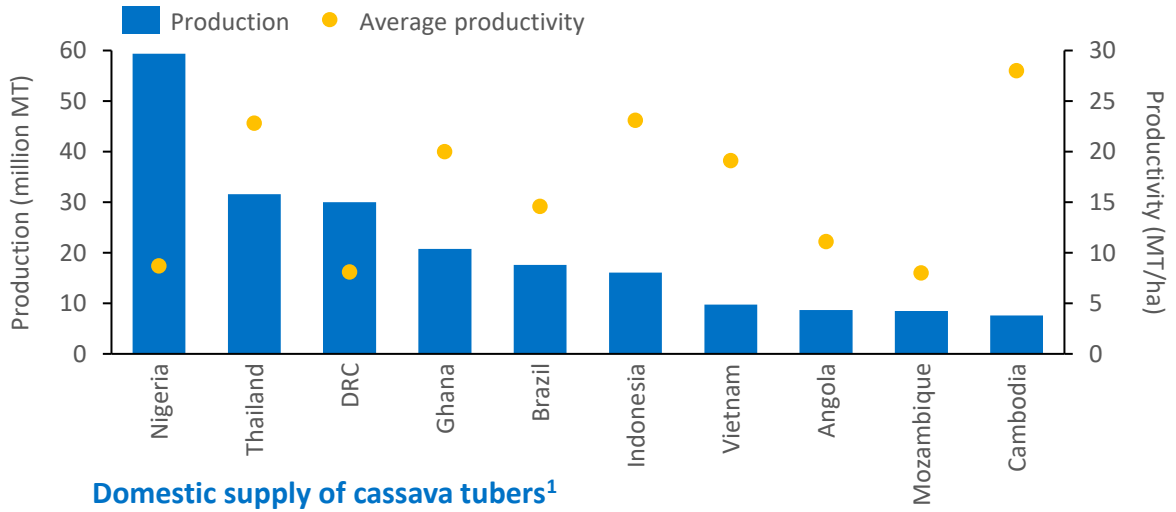
1. CONTEXT

Understanding the cassava value chain

Although productivity is low, Nigeria produces 21% of global cassava. Production and land area have stabilized since 2014.

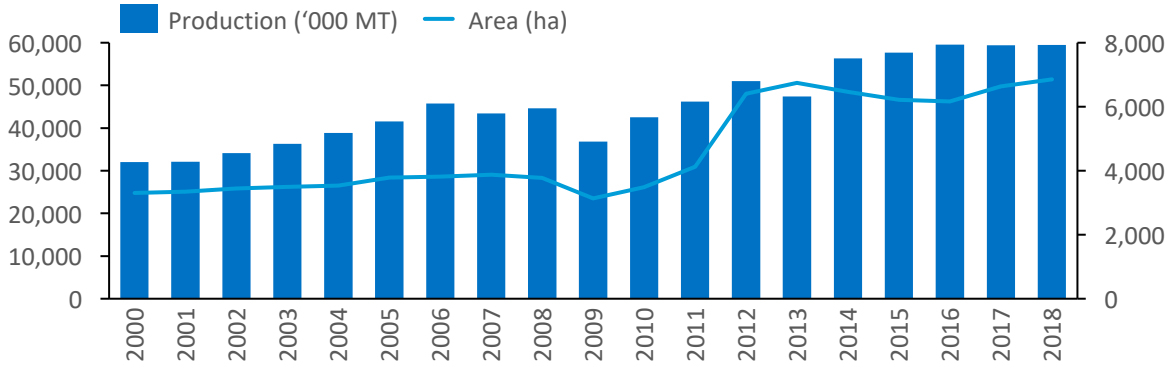
Top 10 cassava producing countries[1,2]

Production per million MT and productivity of MT per hectare in 2018



Domestic supply of cassava tubers[1]

Total cassava tuber supply per '000 MT



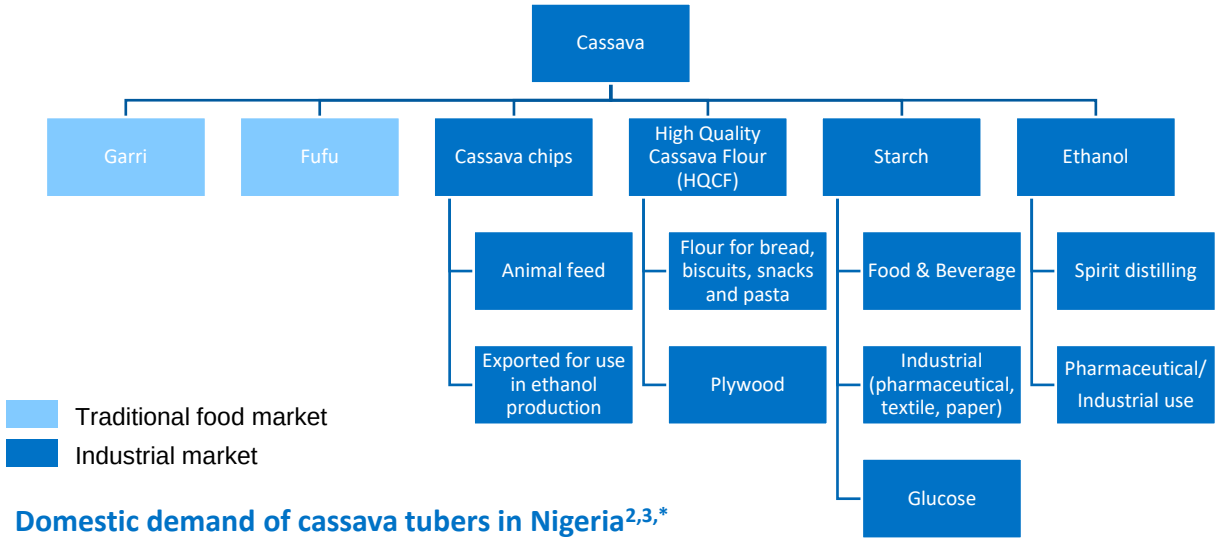
Large volumes, low productivity

- Nigeria produces 59 million MT of cassava annually (21% of global supply) on a cultivated area of about 6.8 million ha[1].
- Since the 90s cassava cultivation has grown enormously and in production volume terms is the most grown crop in Nigeria, primarily due to rapid population growth, large internal market demand, complemented by research to improved varieties of cassava and the governments' ATA program to reduce food imports in cassava and rice[5].
- However, productivity in Nigeria is very low compared Asian and Latin-American countries due to low application of fertilizer, poor planting material due to resistance at local level to adopt new varieties and a weak agricultural extension system. These issues also arise in the neighboring African countries, leading to similar results of low productivity[2,4].
- Although the cultivated area has been slightly increasing over the years, the lack of addressing the main issues in Nigeria's cassava value chain have led to a stabilization of domestic production[1].

Sources: **1)** FAO (2018). FAOSTAT database. 2) Dalberg (2015). Market Opportunities for Commercial Cassava in Ghana, Mozambique, and Nigeria. 3) FMS Cassava business summary (2019). 4) CAVA, Cassava: Adding Value for Africa (2013). 5) FAO Cassava development in Nigeria

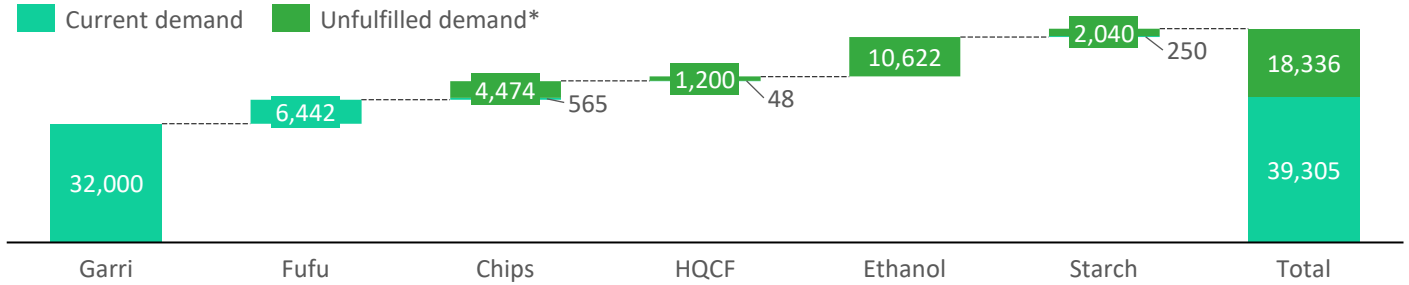
In contrast to other countries, in Nigeria cassava is mainly used for food consumption (90%) instead of industrial applications.

Cassava derivatives and their uses [2,3]



Domestic demand of cassava tubers in Nigeria[2,3,*]

*Annual domestic demand per '000 MT** in 2011*



* Demand estimations include growing markets and new markets due to substitution of other produce by cassava derivatives

** Demand for cassava tubers has been estimated by converting demand for derivatives into amount of cassava tubers using conversion ratios of (4.5:1), (5:1), (4:1), (3:1) and (6:1) for garri, starch, HQCF, chips and ethanol respectively

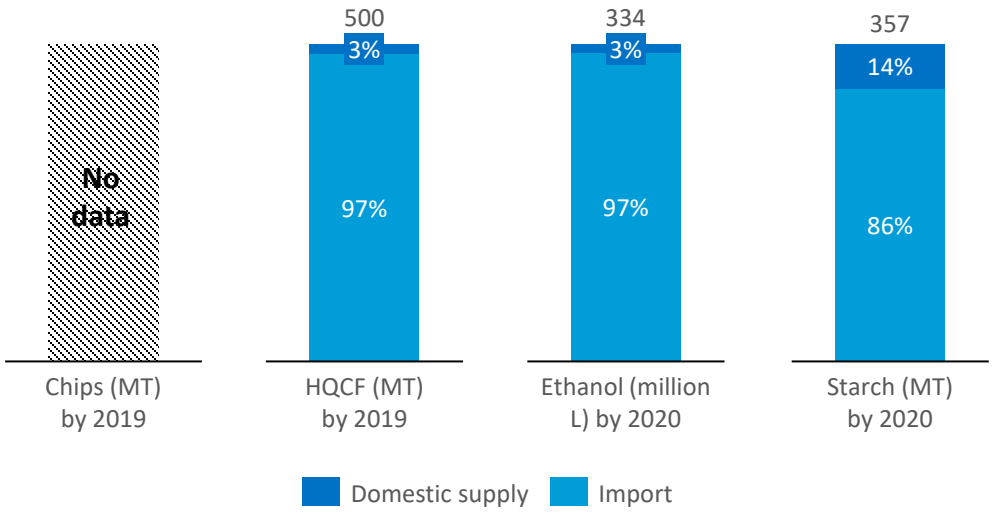
Sources: 1) FAO (2014). FAOSTAT database. 2) Dalberg (2015). Market Opportunities for Commercial Cassava in Ghana, Mozambique, and Nigeria. 3) CAVA, Cassava: Adding Value for Africa (2013). 4) IITA Cassava. 5) IDH and GrowAfrica (2015) Market opportunities for commercial cassava in Ghana, Mozambique, and Nigeria

Nigerian use of cassava and its derivatives

- Cassava being available all year round, drought-resistant and easily storable under the ground for months have made it a key crop for food security in Nigeria[4].
- Especially, cassava derivatives Garri and Fufu are traditionally part of Nigerian diets, being basic food sources of low-cost calories. It is estimated that 37% of the dietary energy of Nigerians comes from cassava[4].
- Other cassava derivatives have enormous potential for use in industrial processing. Given its versatility and high starch content, it can be transformed into four main product categories: 1) Chips for animal feed, 2) HQCF for the baking industry, 3) Starch for the food, beverage pharmaceutical and textile industries, and 4) Ethanol for the spirit distilling industry
- Research states that 90% of the cassava supply is used as traditional fresh food staple and 10% for commercial/industrial purposes. However, commercial supply appears to be even less than that. Amounting up to only 1-2% of the total supply of cassava tubers[2,3,5].
- In neighbouring African countries cassava is also mainly consumed in traditional markets and only between 1-6% in industrial markets. However, in Asian countries and Brazil the ratio is reversed with cassava feeding mainly into industrial markets[2,3,5].

Sourcing and processing inefficiencies and resulting low margins hinder domestic supply in meeting domestic demand

Domestic supply and import levels of cassava derivatives in Nigeria[4,5]
Annual domestic supply and import per '000 MT



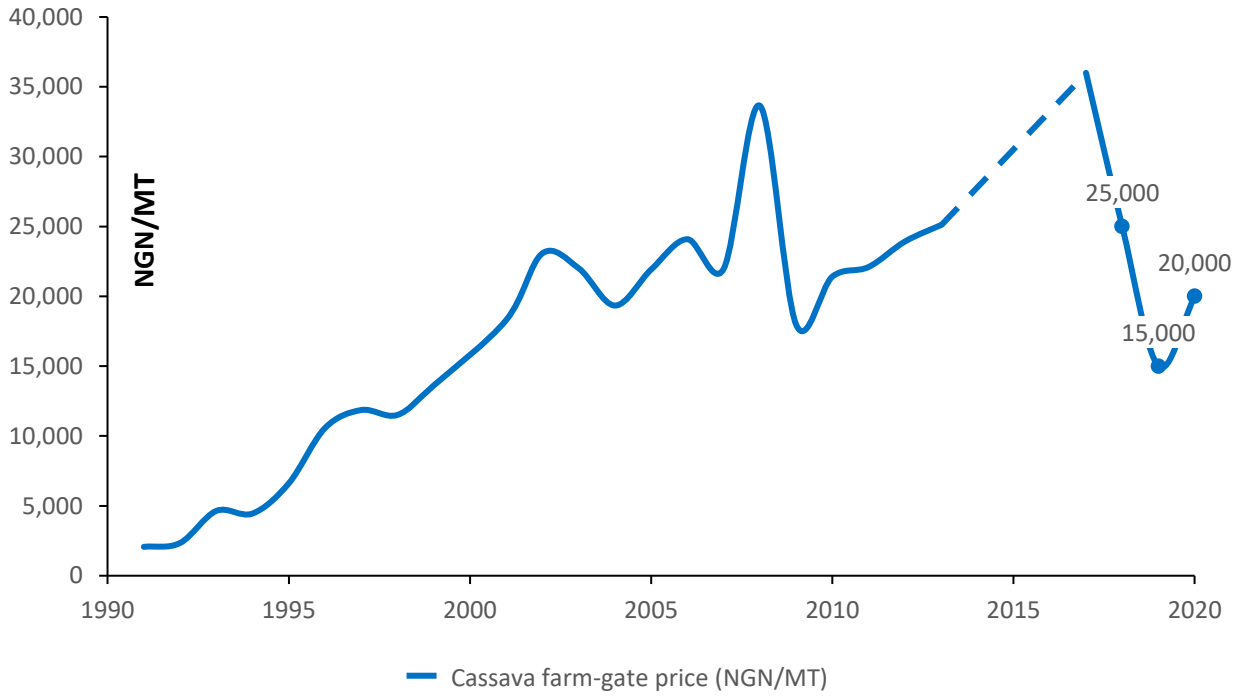
Sources: 1) FAO (2014). FAOSTAT database. 2) Dalberg (2015). Market Opportunities for Commercial Cassava in Ghana, Mozambique, and Nigeria. 3) FMS Cassava business summary (2019). 4) CAVA, Cassava: Adding Value for Africa (2013). 5) Guardian (2019) Tapping economic benefits of rising cassava starch industry in Nigeria. 6) Cassava, a 21st Century Staple Crop: How can Nigeria Harness Its Enormous Trade Potentials (2019)

Domestic demand for cassava derivatives

- Nigeria imports large quantities of cassava derivatives to address the large domestic demand and the supply deficit. This is due to:
  1. Insufficient processing capacity as the sector lacks investments,
  2. A less efficient way of sourcing and processing,
  3. Combined with higher farm-gate prices for tubers resulting into higher production costs compared to major derivatives producing countries, and
  4. The misalignment between domestic processors providing supply and the industry providing demand disincentivizing cassava cultivation[2,4].
  5. Policy inconsistencies as the government is yet to enforce or implement certain policies that would increase cassava production and usage at commercial level, i.e. the inclusion of 10% HQCF as flour substitute in bread and the blending of ethanol in petrol[6].
- National starch demand is around 350,000 MT annually, while current national production can only address 10-20% resulting into importing more that 80-90% of the starch needs.[3]

Cassava prices have been rising since the 90's. Seasonal and regional fluctuating prices encourage side-selling

Cassava farm-gate price (NGN/MT) 1991-2018[1,2]



Sources: 1) FAO (2014). FAOSTAT database. 2) Dalberg (2015). Market Opportunities for Commercial Cassava in Ghana, Mozambique, and Nigeria. 3) CAVA, Cassava: Adding Value for Africa (2013).

Cassava farm-gate prices fluctuate heavily

- Farm-gate cassava prices are very volatile within and between seasons[2].
- In Nigeria cassava is characterized by a cycle of glut (excess cassava) with depressed prices that regularly occurs every three to four years following a period of scarcity and high prices[2,3].
- Large seasonal and regional fluctuations in cassava supply enhance price volatility[2]. With the boom in industrial demand for high-quality cassava, there are now several large processors competing for the relatively limited high-quality cassava produce.
- Sudden changes in farm-gate prices make farmers more susceptible to side-selling at prevalent market prices, decreasing farmer loyalty. Farmers selling at open market prices will be able to increase an otherwise low net income.
- All processed produce, except Garri, are sold at constant prices eroding processor's margins when tuber prices increase[3].

Post-harvest challenges, unpredictable prices and land tenure issues are the main risk-factors impacting FMS' business

Risk level: Low | Average | High

Definition	Challenges related to cassava production and processing	Risk/cost to SDM
Environment	Cassava further depletes the soil. The region is very drought prone.	Droughts could significantly reduce the yields of FMS's farm, leading to insufficient cassava tuber supply for optimal utilization of the factory.
Infrastructure	Rapid post-harvest deterioration restricts storage of the fresh tuber. Lack of available transportation to the off-taker leads to direct physical loss of tubers. Post-harvest deterioration causes a further reduction in root quality	FMS must source from a larger number of farmers and travel long distances to get adequate supplies of cassava, driving up costs. If unable to secure enough fresh cassava, FMS may not be able to meet orders from off-takers.
Labor	Most labor is done manually by the family	
Inputs & Financing	Quality inputs are usually not available or affordable. Financing is not available	Low cassava yields would lead to insufficient cassava tuber supply for sustainable use of the processing factory.
Trading system	Difficult and uncertain market access leads to low willingness to invest in improving productivity The government is sufficiently encouraging the substitution of imported goods by domestically produced cassava derivatives through import tariffs.	Low cassava yields and uncertain or unsteady supply of cassava tubers would make FMS's processing factory unsustainable. Inconsistent domestic market demand due to cheaper imported goods could affect the sustainability of FMS.
Pricing & Competition	Farm-gate prices vary interannually due to periods of over- and undersupply. Due to its perishable nature, farmers need to sell their tubers fast to traders leading to low negotiation power.	Changing farm-gate prices negatively could affect famer loyalty to FMS as prices are determined at the beginning of the contract. It could also put pressure on FMS' margin if farm-gate prices rise uncontrollable and thereby affect the sustainability of FMS.
Institutional	Herdsmen roam around the region with their cattle, destroying crops. The institutional framework is insufficiently adapted to protect landowners.	Destruction of cassava tubers could lead to insufficient cassava tuber supply for sustainable use of the processing factory.
Land Tenure	Land is often held on a communal basis, inherited or rented; purchase of land is rare.	FMS will establish a block farm allowing farmers to cultivate a plot of land without having to own the land.
Social Norms	Traditional production is often seen as a 'woman's crop' due to its use as food, low risk and input requirements. Commercial production is dominated by men due to gender division of labor and control over resources.[1)]	Potential to miss the opportunity to make significant progress on improving women's financial and decision-making positions.

Sources: 1) Forsythe, et al. (2016). A crop of one's own? Women's experiences of cassava commercialization in Nigeria and Malawi. 2) Cassava peeling is the biggest challenge in cassava processing (Jimoh & Olukunle (2012)

A block farm contract could overcome disparities in women's lack of decision-making power and control over land and assets

Enabling environment

At the national level gender disparity in primary education is not significant, although enrolment is slightly in favor of men.

Access to land use, control and ownership is highly skewed to men. Women's lack of access control of asset reflects disempowerment.

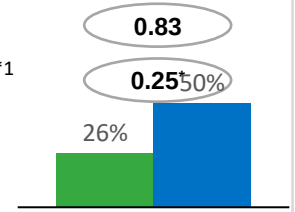
34% of women make household decisions either solely or jointly. The ability of women to make decisions solely or jointly reflects agency and empowerment.

Primary education enrollment *[1] — 0.83

Women's access to land use, control and ownership. *[1] — 0.25 (50%)

Use of bank account or money mobile service. *[2] — 26%

% of married women who participate in decision-making ***[3] — 34%



Legend: Women; Men; Gender ratio (Female/Male)[1]

Comparison of FMS to the national context

FMS is gender intentional and can be **gender transformative.** If it outlines a gender strategy, institutes gender intentional policies and a corresponding company organizational structure. It has a gender intentional service delivery approach that can be further sharpened.

At the national level, country labor force mostly comprises of men- implying less women participating in labor force.

At the national level women's leadership is quite low, this is also reflected in political spaces, company boards and women who own firms.

Women comprise 48% of labor force in agriculture at national level and 31% at FMS. **In cassava farming, women show a dominant role in cassava production in Nigeria, influencing about 62% of the whole agricultural labor in the south-western part, 71% in the south-eastern and 59% in the central zones**.*[4]

At the national level men earn more that women, lack of access to a source of income is demonstrative of disempowerment.

	Nigeria	FMS
How does FMS's ratio of female to male employees compare with the country labor force participation? * [1]	0.84	0.40
How does FMS's composition of leadership compare to the nationwide?*[1]	0.16***	0.66
How does FMS's proportion of female to male farmers compare with the country-wide farmer distribution? *[1]	48% / 52%	31% / 69%
How do the incomes earned by FMS's employees compare with the incomes earned by women and men in the country? *[1]	0.73	1.00

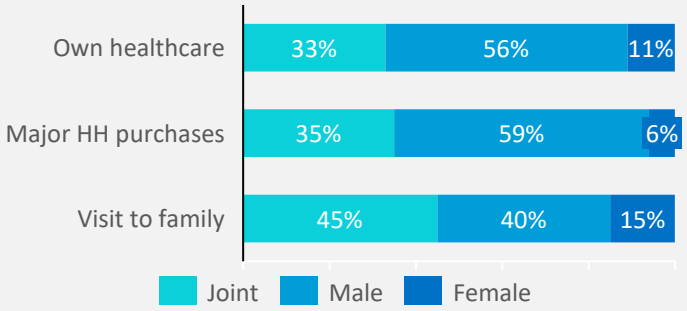
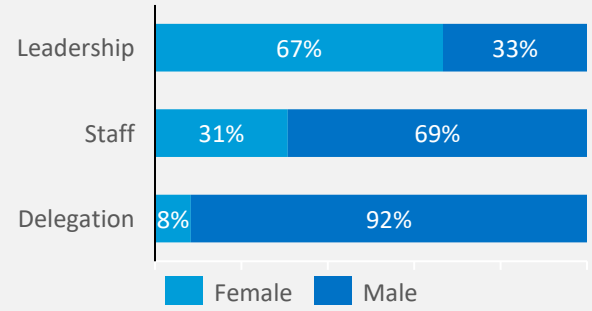
* Divide female indicator by male indicator to get ratio. A ratio of 1 indicates parity between the sexes; a ratio between 0 and 1 typically means a disparity in favor of males; whereas a ratio greater than 1 indicates a disparity in favor of females. http://reports.weforum.org/global-gender-gap-report-2020/dataexplorer/#economy=NGA ** Where 0= worst score and 1= to the best score; *** Where 0= worst score and 7 is the best score

Sources: **1)** World Economic Forum (2020): Global Gender Gap report; **2)** World Bank (2017): Global Findex; **3)** Demographic and Health Survey; 4) Osuji M.N. (et al)., (2017)., Cassava Value Chain mapping and Gender Role Analysis in Southeast Nigeria

Assessment of Gender-related risks and opportunities

Women perform a key role in the production of cassava but remain unrecognized

Gender Dynamics:

Category	Decision making	Decision making on Productive activities	Women in Leadership
Score	**Needs attention**	**Unable to assess**	**Needs attention**
Data	**Women's involvement in decisions[1]** 	**No farm-level data available**	**Women in leadership[2]** 

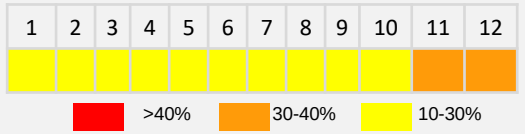
Category	Description of involvement	Detailed description of risk	Expected Impact
Involvement in household Activity	For elements of domestic work which are not traditionally associated with men – washing clothes, cleaning the house, cleaning the bathroom/toilet, and preparing food – participation of men is low[4].	• Disproportionate load of unpaid care work • Limited time to engage in productive/economic activities and in training on GAP (time poverty)	• Women's exclusion of effective participation in agricultural value chains • Lower Farm yields • Unsustainable agricultural value chains
Involvement in Farm Activity	In South West, women work 30% less hours per week on agricultural activities in the post-planting and post-harvesting season[3]. However, in the cassava value chain women are generally highly involved (60-80%), especially in weeding and in processing[5].	• Uneven agricultural value distribution-women focused on low-grade and poorly remunerated activities, i.e. peeling and cooking of cassava.	• Role of women invisible in agricultural value chains • Unequal distribution of value along the agricultural value chain

Sources: 1) DHS Nigeria (2018). 2) FMS data (2020). 3) LSMS Integrated Surveys on Agriculture Nigeria (2019). 4) Promundo UKaid Nigeria men and gender equality survey (2015). 5) Osuji M.N. (et al)., (2017)., Cassava Value Chain mapping and Gender Role Analysis in Southeast Nigeria

Assessment of Food Security-related risks and opportunities

Cassava can play a major role in regional food security both as food crop as cash crop

Farmer's overall Food Security status

Category	Cash-flow (Stability & Access)	Food Security (Access & Availability)	Assets (Stability)
Score	**High risk - needs attention**	**High risk - needs attention**	**Average risk**
Data	**CASH FLOW** 47% of households in South West are worried about not having enough food to eat because of lack of money[5]. 48% of households in South West are unable to eat healthy and nutritious foods because of lack of money[5]. While at national level it is 37% and 44% respectively.	**FOOD SECURITY** 31 % of households in South West expressed that they face food shortages in the last year – which is similar to the national level. The households in South West are most food insecure in November – December[5]. 	• **Ownership:** 76% of rural households own land[4] • **Farm size:** an average smallholder farm size is between 0.5-2ha [3] • **Cassava farm size:** 0.5-2 ha (~100% of total farm) • **Other crops:** Most farmers grow diversified crops, mainly maize, watermelon and cowpeas [3] • **Animals:** 65% of the farmers own livestock[4]

Category	Income (Access & Availability)	Market (Availability)	Health & Sanitation (Utilization)
Score	**High risk - needs attention**	**Limited risk – no action needed**	**High risk - needs attention**
Data	• **Cassava sold:** 2.5% of cassava is sold [3] • **Crop loss:** 40% of cassava production is lost due to post-harvest loss [3] • **Own consumption:** 97.5% is consumed by farmer [3] • **Price tuber:** Cassava sells for 15.000 NGN/MT [3] • **Price volatility:** High [3] • **Income from crop:** 85% of total income [3] • **Income from other crops:** 14% of total income [3] • **Income from non-agri activities:** 1% of total income [3] • **Living income benchmark:** 1,651 USD/HH/year • **Poverty line:** poverty line is 912 USD/HH/year • **Household size:** 5 people [4]	• **Per capita food production variability:** 11.5 thousand $ per capita [6] • **Global production**: Nigeria is global leader in production of cassava tubers • **Export vs Import:** Less than 1% of cassava is exported. To address local industrial demand, Nigeria imports on average 90% of all cassava derivatives. • **Local market:** 90% of processed cassava is sold in local markets, only 10% used for industry	• **District level nutrition status:** Malnutrition is prevalent, mostly for children [4] • **National average dietary energy supply adequacy:** 116% in 2016-2018. Combined with the prevalence of malnutrition indicates bad distribution of food supply in the region [6] • **Access to clean water:** Yes [4] • **Access to sanitation:** No [4]

Sources: 1) CAVA, Cassava: Adding Value for Africa (2013). 2) Dalberg (2015). 3) CrestAgro and Psaltry SDM analysis (2018). 4) DHS Nigeria (2018). 5) LSMS Integrated Surveys on Agriculture Nigeria (2019). 6) FAOSTAT (2020)

Assessment of Climate Resilience-related risks and opportunities

Although cassava is a climate resilient crop and grows on erosion-prone and infertile soils, increased frequency of droughts will test the resilience of cassava farmers and show the need for irrigation.

Farmer sensitivity and exposure to	Exposure	Sensitivity	Detailed description of risk	Expected impact
Changing temperatures	**High risk**	**High**	• The more extreme temperature will lead to more droughts and wildfires in the region[1,6]	• Water stress due to droughts will affect yield • Increased wildfires could damage the block farm and facilities
Changing rainfall patterns and soil conditions	**High risk**	**Average**	• Water risk due to droughts in the region are high[2] • Soil erosion is a general problem in Nigeria and leads to low soil fertility. Cassava contributes greatly to soil erosion[2]	• Water stress in the first three months after planting decreases tuber growth and yield • Low soil fertility causes yields to decrease
Frequent climate extremes	**High risk**	**High**	• Droughts in the region will become more frequent[1,6]	• Water stress due to droughts will affect yield

Farmer adaptive capacity			
Category	**Cash-flow**	**Assets**	**Access to services**
Adaptive capacity	**Unable to assess**	**Average risk**	**High risk – needs attention**
Data	**No farm-level data available**	• **Ownership:** 76% of rural households own land[4] • **Farm size:** an average smallholder farm size is between 0.5-2ha [3] • **Cassava farm size:** 0.5-2 ha (~100% of total farm) • **Other crops:** Most farmers grow diversified crops, mainly maize, watermelon and cowpeas [3] • **Animals:** 65% of the farmers own livestock[4]	• **Phone**: Most farmers own a phone (85 percent)[4] • **Bank account:** 40% has a bank account[4] • **Mobile money account:** Only 30% of farmers uses their phones for financial transactions [4] • **Loan:** Most farmers have no access to affordable loans, limiting farmers to adopt improved practices [4]

Sources: 1) Geofolio (2020). 2) Aqueduct Water Risk and Glasod (2020). 3) CrestAgro and Psaltry SDM analysis (2018). 4) DHS Nigeria (2018). 5) LSMS Integrated Surveys on Agriculture Nigeria (2019). 6) Think Hazard (2020)

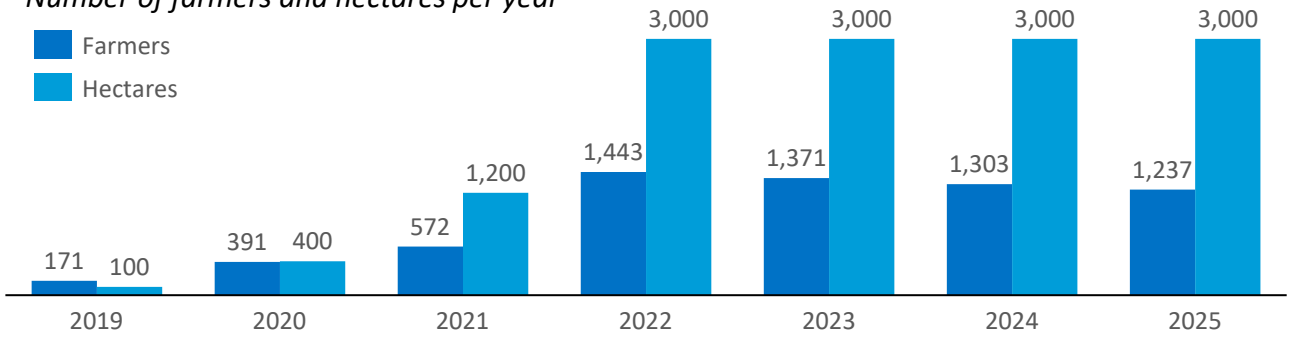
2. STRATEGY

Understanding the SDM's strategy and business model

Located in Ekiti state, FMS prioritizes gradual development of its block farm model over community farmer engagement

Scale of FMS block farm

Number of farmers and hectares per year



Startup

- FMS owns 3,000 hectares of land to be dedicated to their block farm operations.
- FMS is currently in the process of clearing all the land of the block farm and recruiting block farmers.
- Farmers are on average assigned to 2 hectare plots.

Gradual scale up

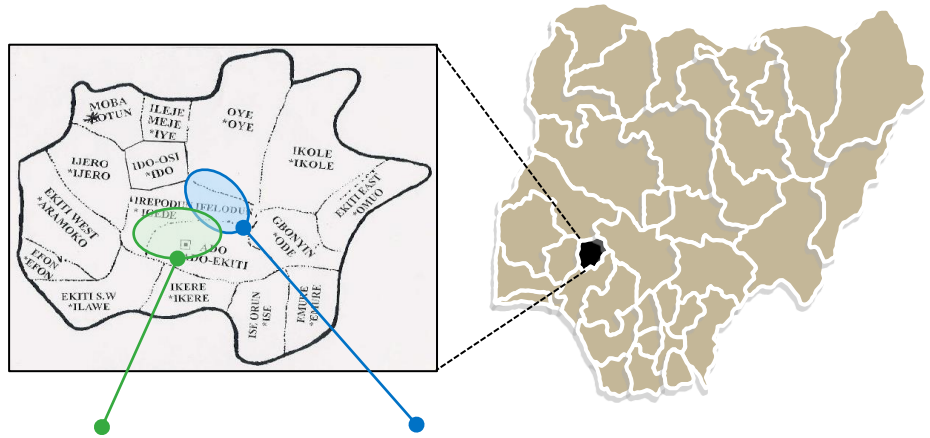
- FMS plans to gradually increase the number of block farmers on their land to ensure meeting 65% of capacity of the processing facility (requiring 45,000 MT tubers per year).
- A gradual and organic growth trajectory allows FMS to minimize external dependency and financing costs.

On-going production

- FMS will the strengthen relationships with existing block farmers and optimize tuber production and processing efficiency.
- Increased efforts are put into sourcing from community farmers (target of 22,500 MT tubers per year).

Location of operations

FMS is located in Ekiti state. One of Nigeria's key agricultural states with a positive future outlook for agriculture. Apart from its block farm there is potential to expand service and sourcing operations to established cassava farmers in the region.



3,000 ha block farm with processing factory, nucleus farm and target of around 1,500 farmers by 2022.

Scattered community farmers, Started outreach and training in 2019, the sourcing relationship is expected to begin in year 2022.

Sources: **1)** FMS Cassava business summary (2019), 2) https://yourfreetemplates.com/africa/

Farm services

Farm services

Access to finance

- FMS provides the farmers with access to finance by taking out a loan for FMS and distributing it amongst the farmers as a credit. This credit is used for planting material (stems), agro-inputs (fertilizer and herbicide) and mechanization services.
- FMS reclaims the credit from sales of cassava tubers.

Inputs

- FMS supports block farmers to access high-quality agro-inputs.
- The input bundle includes high-quality fertilizer, insecticides and herbicides and the volume is based on economy of production.
- Block farmers receive the inputs on credit from FMS.

Training

- FMS trains their own and Government Extension Officers to train the lead farmers, who in turn train block and community farmers.
- FMS provides training on GAP, environmental and social practices

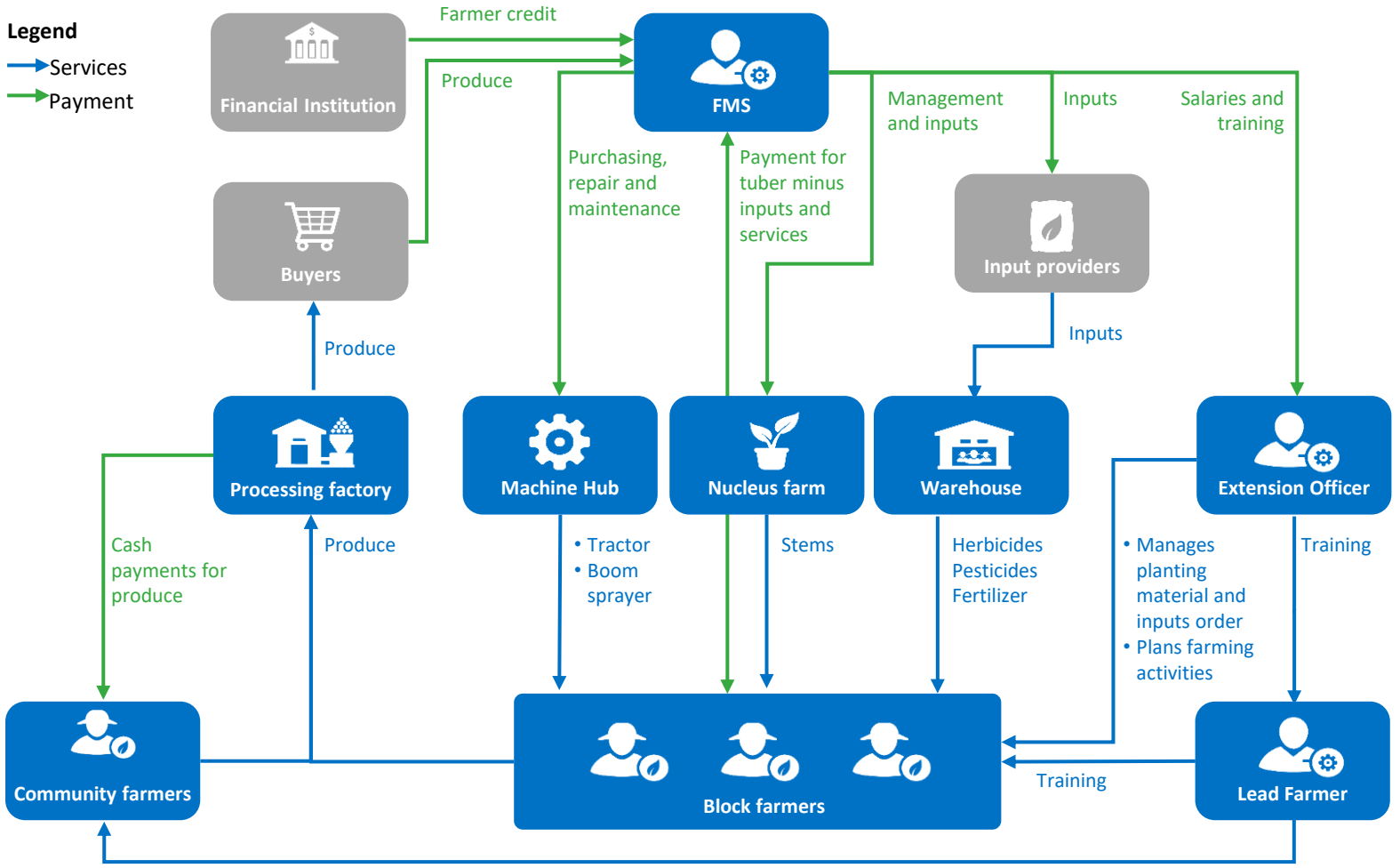
Planting material

- FMS supports all farmers to access high-quality cassava stems.
- FMS grows the stems on their own FMS farm
- Block farmers receive the planting material on credit from FMS.

Mechanization

- FMS provides mechanization services including tractors for land preparation, ploughing and weeding, and a boomer sprayer to block farmers.
- Block farmers receive these services on credit from FMS.

Key channels



Farmer segments

FMS is developing a dedicated supply chain to meet its starch processing needs by sourcing cassava with guaranteed offtake from farmers on its block farm. The size of the block farm will increase in line with sourcing needs to reach 65% capacity for the starch processing factory in four years. FMS will also give training to 3,000 community farmers (without sourcing commitments) as part of the SDM.



	Baseline	Block farmer	Community farmer
Description	• No relationship with FMS	• Signed contract with FMS • Farm is located on block farm land owned by FMS	• No signed contract with FMS, only service and sourcing relationship • Farm is located around the block farm of FMS and owned by farmer
Key characteristics	• Farm 1.5ha • Yield 9.5 MT/ha • Minimal input use • Intercropping with maize, cowpea and melon	• Farm 2 ha, increase to 5 ha for well-performing farmers • Yield optimized up to 25MT/ha • Optimized input use • No intercropping • No side selling	• Farm 1.5 ha • Possible yield up to 15MT/ha • Minimal input use • Intercropping with maize, cowpea and melon • Side selling is common
Services	• No service relationship	• Training • Planting material • Inputs • Mechanization • Collection & Transport • Access to finance	• Training

3. PERFORMANCE

Backing up main findings of business model analyses

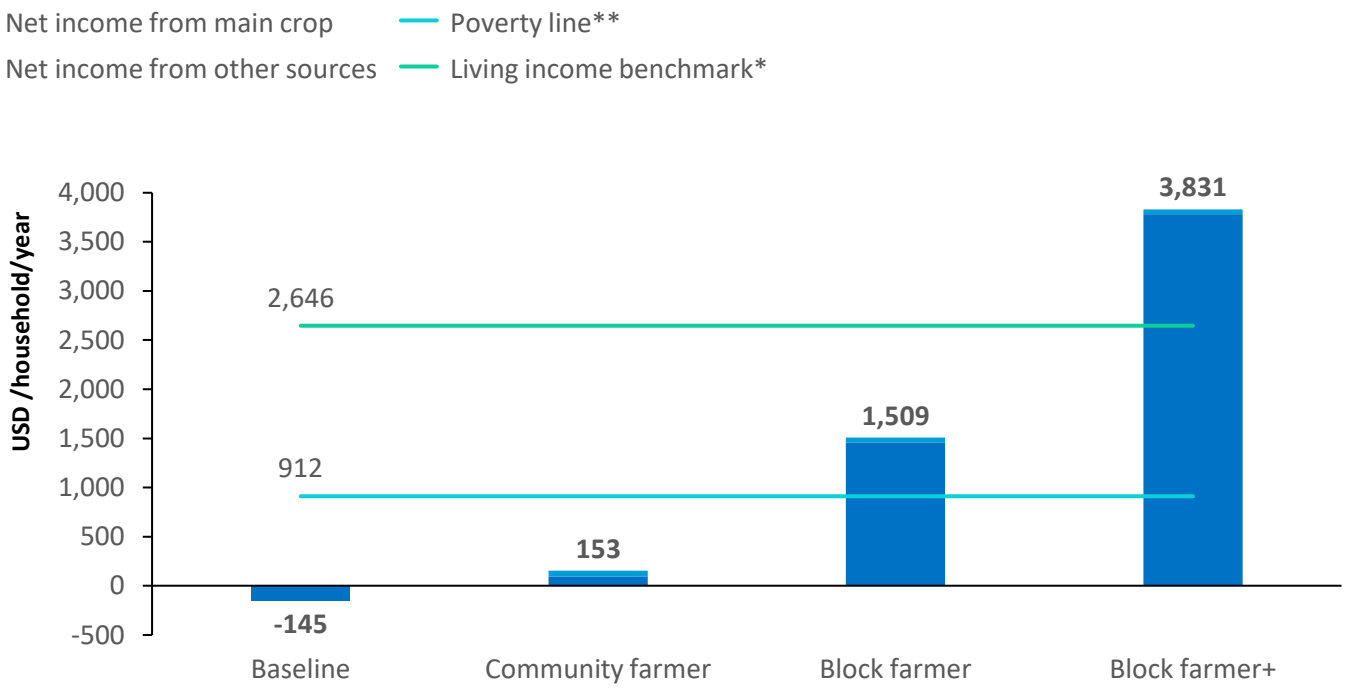
A block farming model best addresses tuber sourcing challenges

	Block farm *Land leased by farmer*	Organized outgrowers	Unorganized outgrowers	Open market
Commercial viability	+ Low cost/MT + High productivity potential + Control of planting, constant supply − High investment − High initial costs of land clearing	+ Low market price + High volume potential − Risk of side-selling − High risk of defaulted loans	+ High volume potential + Low engagement costs − Low cost/MT − Little control of production and side-selling	+ Ample supply − Very volatile prices − High and unpredictable cost of sourcing
Local impact	+ Provides women with equal opportunities − Limited to employment generation	+ Medium impact on livelihoods through comprehensive support	− Low impact potential due to short-term plans of sourcing (and offering support)	− Limited to increase in demand
Risks and vulnerabilities	− No risk-sharing with farmers	− ROI dependent on farmer loyalty − Risk of high costs from loan defaults	− ROI dependent on farmer loyalty	− Vulnerable to market price increases and competition
Feasibility	+ FMS owns 3,000 ha land − Limited by capital investments	+ Plenty nearby farmers − Inexperience with service provision	+ Plenty nearby farmers	
Priority of sourcing	HIGH	MEDIUM	MEDIUM	LOW

Farmer livelihoods

Comparing household income, living income benchmark and poverty line in year 5

Shown for each farmer segment, in USD/household/year



Land size per household (ha)	**1.50**	**1.50**	**2**	**2 ha with increase to 5 ha in year 3**

*Based on the National monthly living income benchmark for a standard family ranging between 70,250 and 100,590 NGN
** Based on the annual PPP poverty line of 353,356 NGN for a household of 5 persons
Sources: Worldbank PPP conversion factor (2018); Wageindicator – Living wage Nigeria (2019); Oanda converter

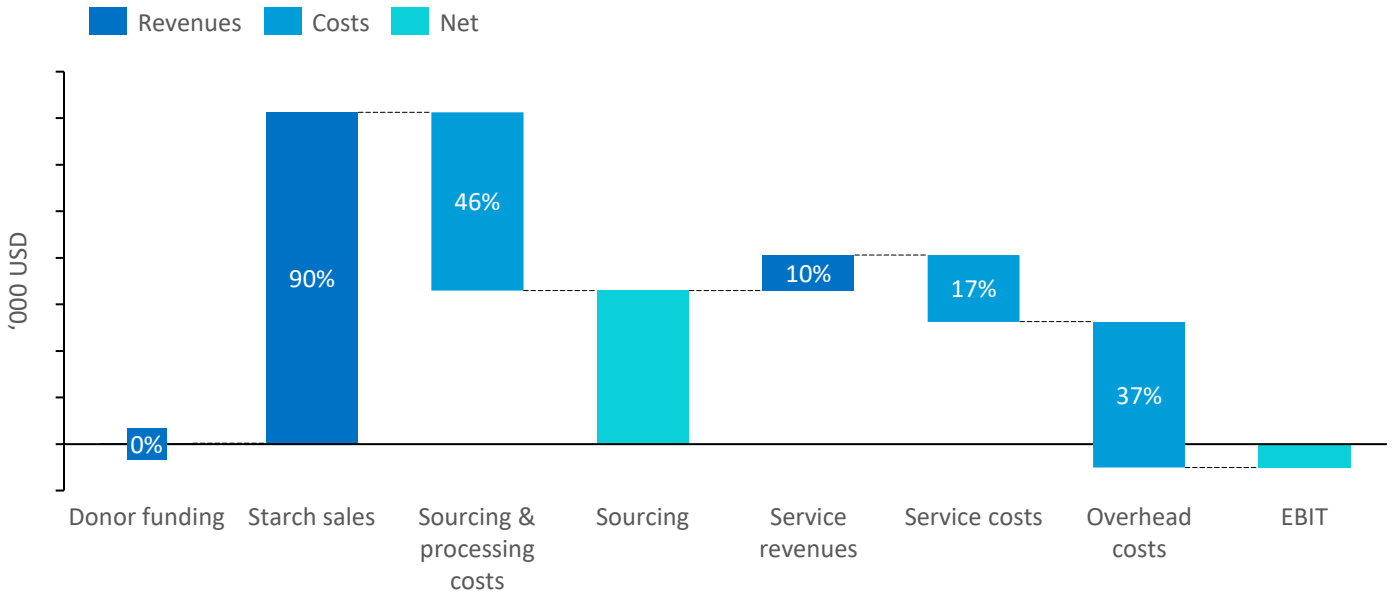
Impact on farmer incomes

- Given that a baseline farmer uses 98% of their total cassava production for own consumption, their net income from cultivating cassava is negative. Community farmers' their net income is similarly low although positive due to an own consumption rate of 65%. The baseline and community farmers' largest expenses are hired labor for weeding and harvesting, and their sporadic purchase of low-quality but expensive fertilizer.
- If FMS's envisioned service impacts will materialize, the SDM significantly boosts farmer incomes from cassava cultivation from **negative $145 to $1,509 in 5 years**. Key income drivers are discussed under the impact of services on farmer profitability and credit on farmer cash-flow.
- The access to an plot of land on the block farm provides block farmers with an additional revenue stream that will enable their households to **earn above the Worldbank poverty line of $912/HH/year.**
- Additionally, FMS encourages well-performing block farmers (Block farmers+) to expand their block farm plot to 5 ha. This increase in land allows the farmers to **more than double its net income and earn $3,905 by year 5.**
- **With the increase in land size to 5ha, the living income benchmark of $2,646** per household per year could be **reached by block farmers+** .

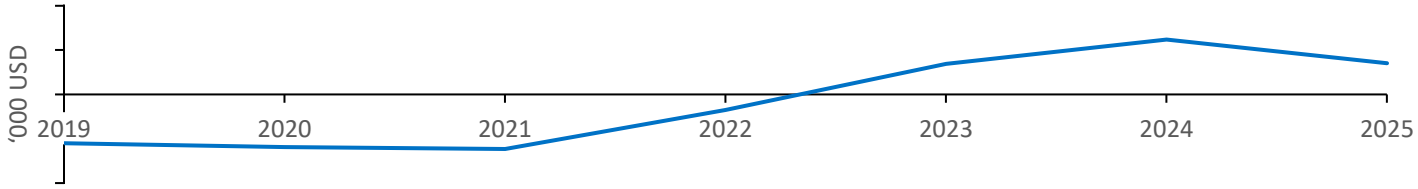
FMS profit and loss by activity

SDM profitability

Profit and loss in '000 USD, total 2019-25



Net income over time in '000 USD



Financial sustainability

- Net income remains negative until 2022 as large investments are made in the scaling up of the nucleus farm, the block farm and in the number of farmers sourcing from.
- Although FMS has large costs related to sourcing, these expenses are clearly outweighed by the revenues made from selling processed HQCS making this a profitable business from 2023 onwards.
- The main revenue shares are from selling processed HQCS and fertilizer, representing respectively 90% and 9% of total revenues.
- The largest expense for FMS comes from sourcing the high-quality tubers from block farmers and community farmers and operations of the processing factory (44% of total expenses). The second largest expenses comes from the from the land clearing costs and set-up and operation of the nucleus farm (captured in the overhead costs at 38%). Service costs make up only 18% of total expenses.

4. ASSUMPTIONS

Sources

Source	Link (if publicly available)
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