SDM: Case Report Alluvial

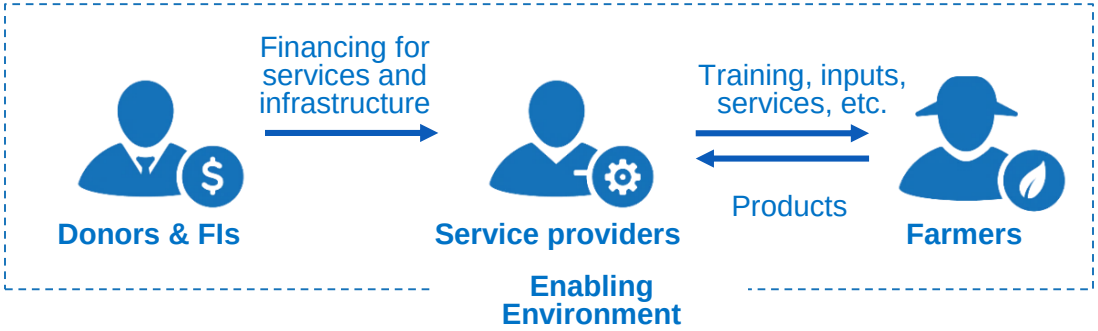
Service Delivery Model assessment: short version

March 2020

Location: Nigeria
Commodity: Rice
Services: Farmer training, input provision, planting materials, mechanization, access to finance, access to insurance

What are SDMs and why are we interested in analyzing them?

Service Delivery Models (SDMs) are supply chain structures, which provide services such as training, access to inputs and finance to farmers, to improve their performance, and ultimately their profitability and livelihoods.



By analyzing SDMs, we aim to support **efficient, cost-effective and economically sustainable SDMs at scale** through:

- Key drivers for success of SDMs benchmarking
- Innovation opportunities to support
- Cross-sector learning, learning community
- Convening at sector and national level

Analyzing SDMs brings a range of benefits

Farmers and farmer organizations

- **Better services** improve productivity, product quality, quality of life and social and environmental outcomes
- **Better outcomes**: improved productivity, income and resilience

SDM operator

- **Understand** your model's business case
- Gain insights to **improve** service delivery
- Develop **cost-effective** SDMs based on insights
- Identify opportunities for **innovation** and **access to finance**
- **Learn** from other public and private SDM operators operating across sectors/geographies
- **Communicate** stories of impact and success at farmer level

Investors/FIs

- **Common language** to make better informed investment decisions
- Insights to achieve optimal **impact, efficiency and sustainability** with investments and partnerships in SDMs

The Alluvial SDM and objectives

General SDM information:

Location:	Nigeria
Timing in analysis scope:	2019-2028
Scale (start of analysis):	2,000 farmers
Scale (end of analysis):	22,065 farmers (scaling scenario)
Funding:	Servide provider, co-funded by IDH
SDM Archetype*:	National

- Alluvial Agriculture seeks to provide end-to-end agricultural solutions to smallholder farmers growing staple crops across Nigeria.
- Alluvial's approach is centered on a community block farming model. Alluvial leases land through a community leasing agreement and in turn leases land to smallholders on the block farm. This approach enables Alluvial to deliver services more efficiently and effectively, optimize farm management and oversight, as well as leverage economies of scale.
- Alluvial works through an integrated network of value chain partners to enable farmer access to services including tractors, inputs, finance, markets and other support services such as insurance.
- Alluvial is in the process of launching operations on a 10,000 hectare block farm for rice. From 2021, Alluvial plans to significantly scale-up its agricultural operations with more block farms across Nigeria and expansion of its SDM to more farmers and crops.

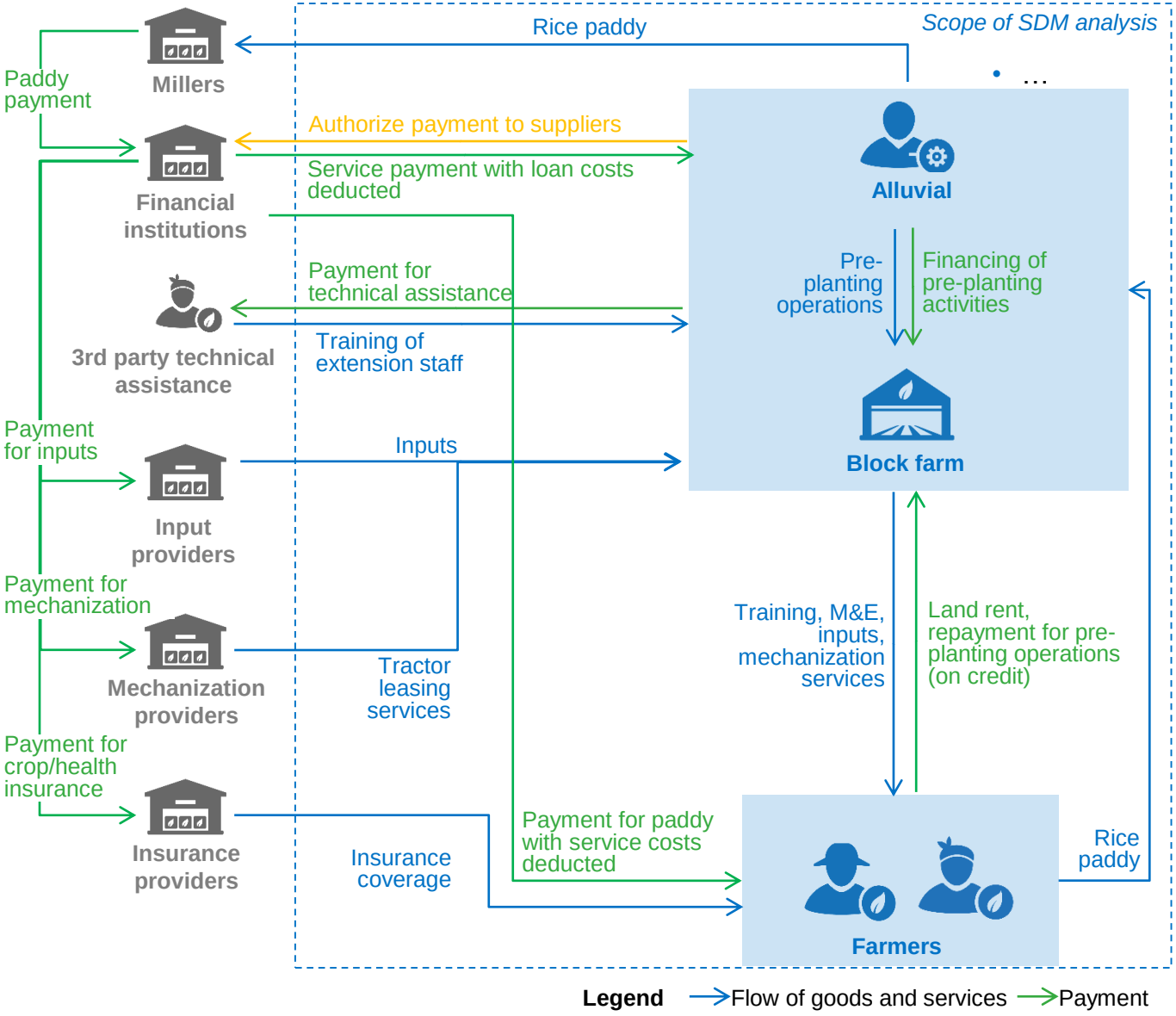
* For more info on SDM archetypes, see the IDH Smallholder Engagement Report

SDM objectives:

1. **Contribute to food security in the rice farming sub-sector in Nigeria through a market-driven service delivery model**
2. **Sustainable intensification** through land consolidation and scaled rice production
3. **De-risked operations** which enable investors and financial institutions to invest in the rice sector
4. **Improved farmer livelihoods and resilience** by creating a strong farmer business case

SDM rationale:

SDM and structure and enabling environment



Enabling environment

Farmers are impacted by several factors within their enabling environment. Most important are:

Inputs and financing

- Low affordability and quality of seeds, fertilizer and agrochemicals constrain productivity.
- Access to finance through the Anchor Borrowers Scheme is hindered by delays in disbursements.

Trading system

- Rice prices fluctuate based on the level of imports which is further amplified by policy inconsistency.
- However, the current ban on rice importation from neighbouring countries has resulted in price surges.

Socio-environmental issues

- Flooding of paddy fields due to poor land topography and climate change results in massive crop losses.
- Most smallholder farmers are well below the median household income

Overview of Services*

Farmer training

- Alluvial contracts a 3rd party agency to develop and deliver a training program for Alluvial extension officers. After the first year, staff receive annual refresher training.
- Extension officers conduct trainings for block farmers (1 officer/100 farmers). Extension officers also train and supervise lead farmers who provide training to groups of 20 farmers.

Input provision

- Alluvial engages a network of input providers who provide affordable, quality inputs.
- Alluvial facilitates farmers' access to inputs on credit by authorizing the bank to provide loans to block farmers for input purchases.
- Farmers pay on credit via their bank accounts.
- Loan repayment to the bank occurs through automatic deductions from rice revenues.

Planting materials

- Alluvial engages a network of seed providers who provide affordable, quality seeds.
- Alluvial facilitates farmers' access to seeds on credit by authorizing the bank to provide loans to block farmers for seed purchases.
- Farmers pay on credit via bank accounts.
- Loan repayment to the bank occurs through automatic deductions from rice revenues at the end of the season.

Pre-planting operations

- Before commencing operations on the block faarm, Alluvial negotiates a community land leasing agreement and registers and organizes farmers to be part of the block farm.
- Alluvial uses its own, and leases, tractors for pre-planting (land clearing, preparation). Block farmers pay land rent and repay costs over a 10-year period plus a margin. Loan repayment occurs through deductions from rice revenues.

Mechanization services

- Alluvial has agreements with the equipment provider John Deere and distributor Tata Nigeria for leasing mechanization equipment.
- Alluvial facilitates mechanization access by authorizing the bank to provide loans to block farmers to cover costs of equipment and fuel.
- Farmers pay on credit via their bank accounts. Loan repayment to the bank occurs through automatic deductions from rice revenues at the end of the season.

Access to finance

- Alluvial facilitates farmers' access to inputs on credit by authorizing the bank to provide loans to block farmers. Loan repayment to the bank occurs through deductions from rice revenues.

Access to insurance

- Alluvial facilitates access to insurance by authorizing the bank to provide loans for crop and health insurance. Loan repayment occurs through deductions from rice revenues.

Farmers are segmented in this SDM:

The SDM is targeted at **block farmers ("Segment 1") who farm rice on the block farm.** These farmers are provided with plots of 5 ha. The land is cleared and landscaped by Alluvial before being leased to farmers.

During the season, block farmers receive all services provided by Alluvial which includes training and access to inputs, planting materials, finance and mechanization.

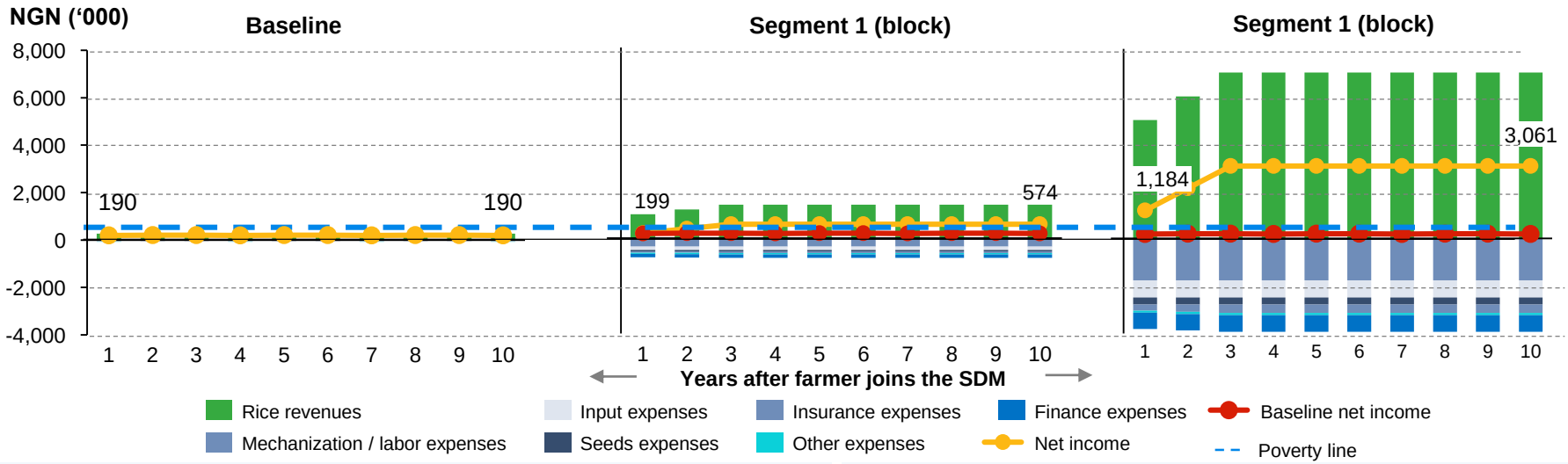
Segment 1 "block" farmers are compared to baseline farmers in this analysis who have 1 ha, a 2.7 MT/ha yield, and do not receive SDM services.

**All services are modelled as though they hit Alluvial's P&L but this is only the case with training and pre-planting operations. This is done in order to highlight the facilitation role that Alluvial plays in brokering the partnerships and arrangements with different service providers that make service delivery possible.*

Overall SDM impact: Farmer P&L

1 NGN = 0.00246 USD

Annual net income for average farmer per segment



Economic sustainability at farm level

- On a per hectare basis, the SDM enables block farmers to increase their net income by an annual average of 164% compared to the baseline. Block farmers increase their net income by 189% between Y1 and Y10 of the SDM due to a 40% increase in revenues driven by higher yields (from 5 to 7 MT/ha/season) as a result of mechanization, especially transplanting.
- If Segment 1 farmers were not using mechanized transplanting, the yield increase would be smaller (from 4 to 5 MT/ha/season) but Segment 1 farmers would still achieve a 42% net income increase by Y10 of the SDM compared to the baseline (to 296,836 NGN/year) by Y10.
- However, Segment 1 farmers on the block farm are given access to larger land sizes of 5 ha. Thus, Segment 1 farmer net income increases fivefold to 3,061,078 NGN/year—over 1500% higher than the baseline by Y10.
- With the PPP-adjusted poverty line per person at 292,475 NGN/year, Segment 1 farmers are under both the 1 ha and 5 ha scenarios above the poverty line. Under the 5 ha scenario, Segment 1 farmer net income exceeds the PPP-adjusted poverty line for a farming household of 7 (2,047,328 NGN/year) which suggests that scaling farm size is key to support the needs of farming households.

Main revenue drivers

- **Yield:** while yield stays stagnant at 2.7 MT/ha/season under the baseline scenario, the SDM enables Segment 1 farmers to increase their yields to 5 MT/ha/season (without transplanting) or 7 MT/ha/season (with transplanting) for a Segment 1 farmer

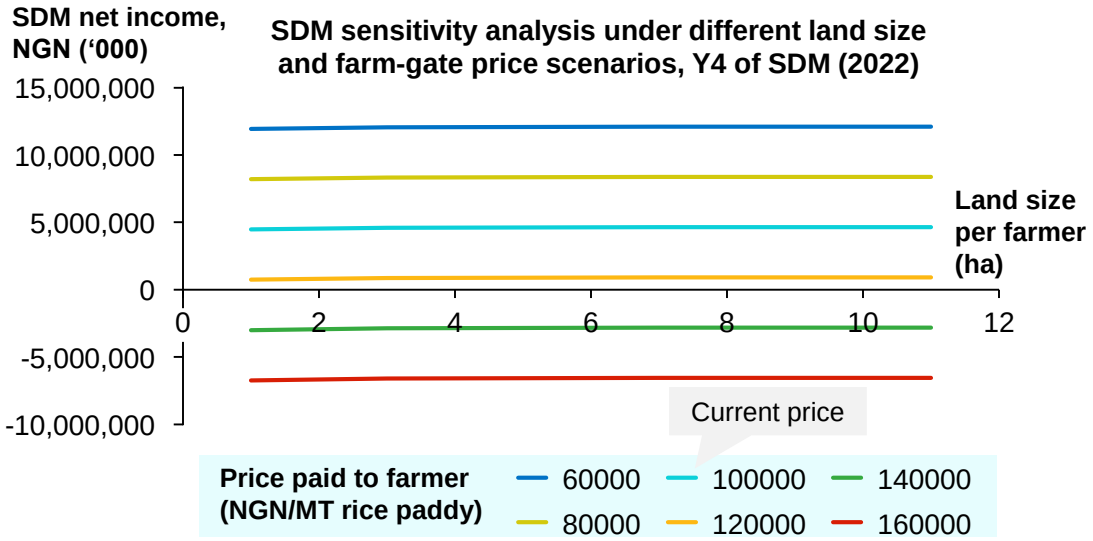
Main cost drivers

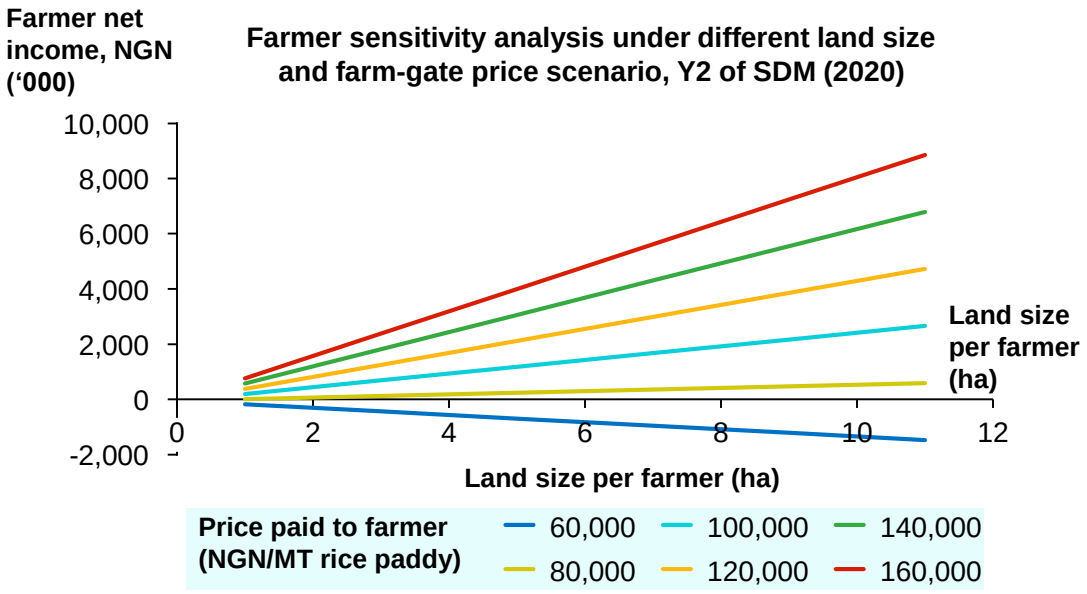
- **Mechanization:** is by far the higher cost driver for Segment 1 farmers. The combined cost of all the mechanized activities of land preparation, ploughing, harrowing, spraying, harvesting, fertilizer application and transplanting is 1,765,000 NGN/year. However, mechanization enables farmers to drastically improve their efficiency and yields.
- **Finance:** the second highest cost in the SDM is finance costs. Farmers pay an annual 30% interest rate on the loan obtained which covers all their farming costs. Despite being a significant cost, this is the critical enabler for farmers to be able to access key services.

1. Uses World Bank international poverty line of 1.90 USD/day, adjusted for PPP conversion factor 2018 (private consumption) of 154.4 NGN/USD, and the average exchange rate of 361.2 NGN/USD. No other household income sources nor income needed for dependents are considered.

Go to assumptions

The farmer impact differential based on land size supports Alluvial's rationale of pursuing depth of impact per farmer over reach





SDM level

- It makes little difference to Alluvial's net income whether farmers are allocated 1 or 5 ha on the block farm. The main efficiency gain made by Alluvial of sourcing from fewer farmers is savings on **staff costs.** However, the net income impact is negligible.
- There is a significant difference to overall net income depending on the **farm-gate price charged for rice paddy.** Prices above 120,000 NGN/MT (330 USD/MT) enables the SDM to breakeven.
- What is not shown in the figures but is significant for the SDM is the **difference in risk** between the scenarios**.** Investing in fewer farmers helps to **de-risk operations** by making farmers more profitable and resilient, and thus bankable to Alluvial/investors.

Farmer level

- The impact of changing land size at the farmer level is significant. In the current scenario, an average SDM farmer with 5 ha receiving 100,000 NGN/MT (275 USD/MT) for rice paddy results in **annual net income of 1,183,578 NGN/year (3,255 USD/year).**
- If land size decreased to 1 ha, **farmer net income would decrease by almost 500% to under 200,000 NGN/year (550 USD/year).** Any drop in prices would hit farmer net income further, with prices below 80,000 NGN/MT (220 USD/year) for rice paddy resulting in farmers making a loss.
- The range at which the biggest average percentage increases in farmer net income happens is the increase from 1 to 3 ha per farmer (232%) and to a lesser extent 3-5 ha per farmer (70%). Increases beyond 5 ha per farmer are significant but not as high.
- Although Alluvial could scale its farmer outreach considerably by allocating fewer hectarage per farmer, pursuing **depth over reach allows Alluvial to have more considerable impact on a per farmer basis, albeit to fewer farmers in absolute terms.**

A farmer sensitivity analysis on price and yields suggests SDM farmers are highly resilient

Farmer sensitivity analysis under different yield and farm-gate price scenarios, Y1 of farming on the block farm (2020)

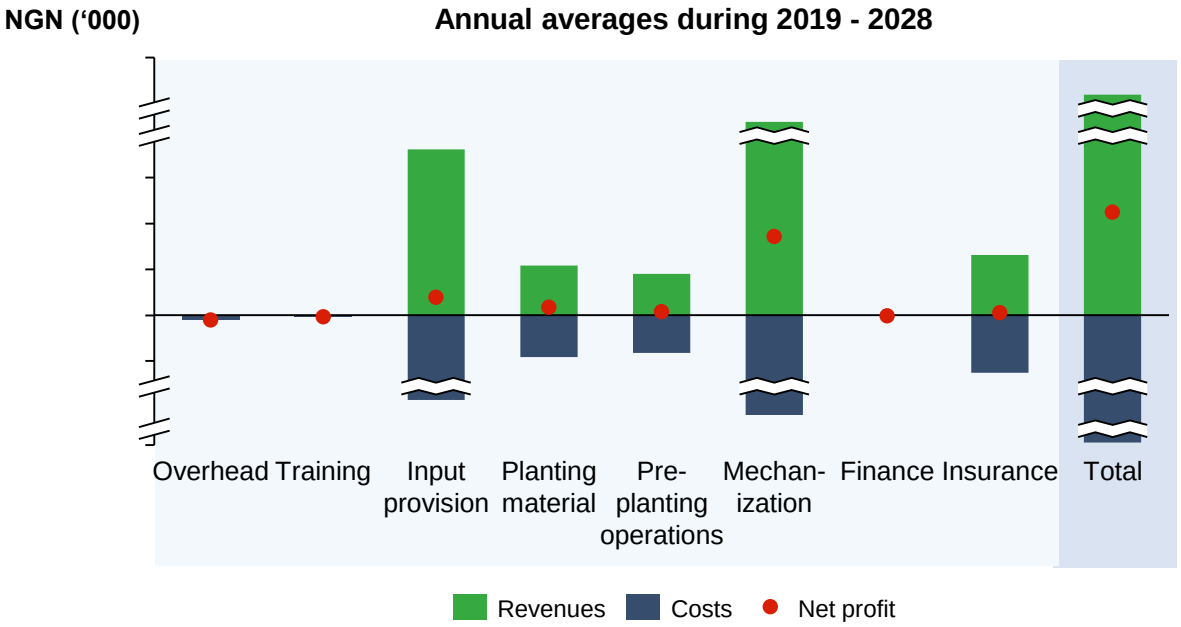
Price (NGN/MT rice paddy) ↓ / Farmer yield (MT/ha/season) →	1	2	3	4	5	6	7	8	9	10
60,000	(2,946,922)	(2,383,672)	(1,820,422)	(1,257,172)	(693,922)	(130,672)	432,578	995,828	1,559,078	2,122,328
80,000	(2,759,172)	(2,008,172)	(1,257,172)	(506,172)	244,828	995,828	1,746,828	2,497,828	3,248,828	3,999,828
100,000	(2,571,422)	(1,632,672)	(693,922)	244,828	1,183,578	2,122,328	3,061,078	3,999,828	4,938,578	5,877,328
120,000	(2,383,672)	(1,257,172)	(130,672)	995,828	2,122,328	3,248,828	4,375,328	5,501,828	6,628,328	7,754,828
140,000	(2,195,922)	(881,672)	432,578	1,746,828	3,061,078	4,375,328	5,689,578	7,003,828	8,318,078	9,632,328
160,000	(2,008,172)	(506,172)	995,828	2,497,828	3,999,828	5,501,828	7,003,828	8,505,828	10,007,828	11,509,828

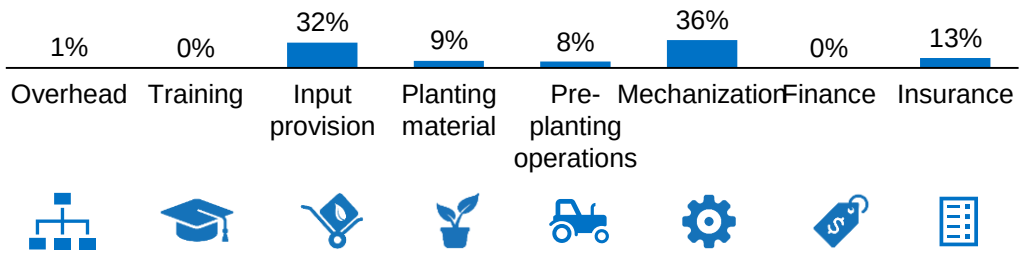
Current scenario

Farmer resilience

- In the most vulnerable year for the farmer (Y1 of farming on the block farm), it is **important that SDM training and adoption has a swift effect** as farmers who retain baseline performance (yield of 2.7 MT/ha/season) would make a loss (net income of -693,922 NGN/year).
- SDM farmers who **benefit from the full package of SDM services, including mechanized transplanting, are highly resilient.** Expected yields of 7 MT/ha/season means that even with a price decline of 40% to 60,000 NGN/MT, net income remains positive.
- The risk of **financing pre-planting operations on the block farm** for Alluvial is therefore relatively low. If market demand can be secured at trading prices above 115,000 NGN/MT (see previous slide), Alluvial can trade at a profit while paying farm-gate prices that result in positive returns for farmers.
- A key part of risk mitigation for productivity drops is the **area yield insurance** which ensures that farmers are insured with a minimum price for their harvest.

Overview of service profitability





Service profitability

Profitable services

- **Mechanization:** both accounts for the highest percentage of SDM costs while also being the most profitable service. Alluvial makes losses on some mechanization activities but these are offset by high margins from others—especially the very high margin on transplanting.
- **Input provision:** similarly, input provision is high in terms of both SDM costs and profitability. Input purchase costs are recovered through a margin charged by Alluvial on the sales price. Profitability stays constant as farmers take the same input package each year.
- **Pre-planting operations:** are responsible for the largest single-year service net loss in Y1. However, over the next 7 years as farmers repay the land clearing investment, the service returns annual average net profits from Y2.

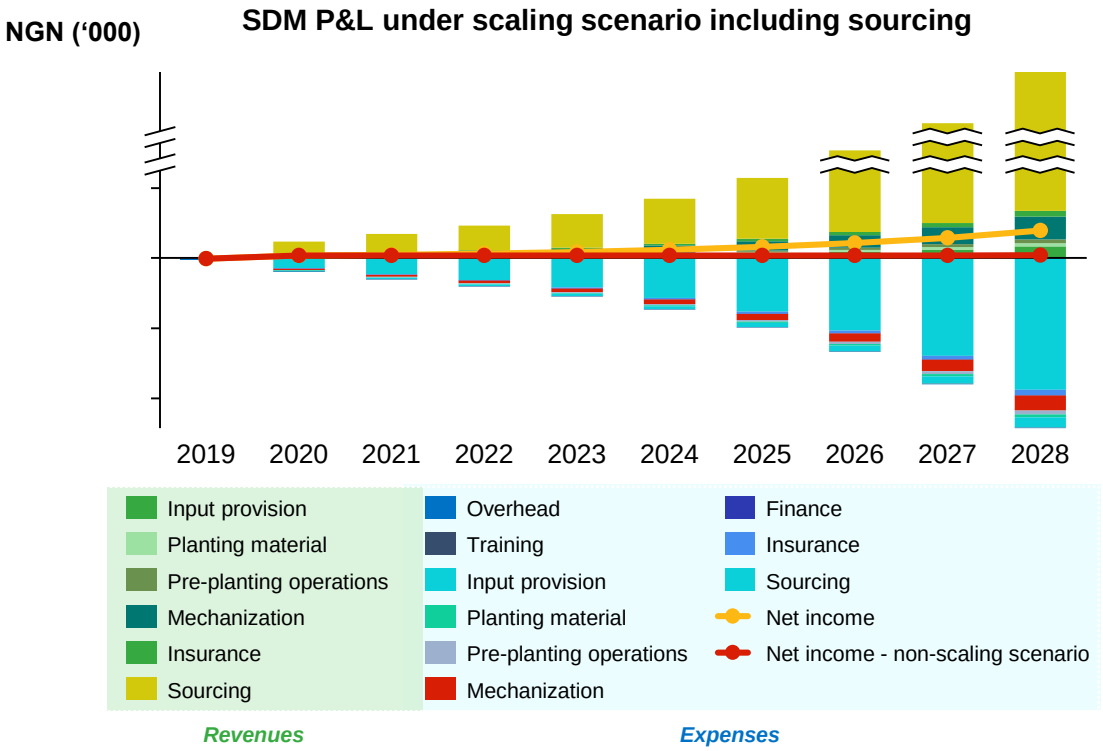
Loss-making services

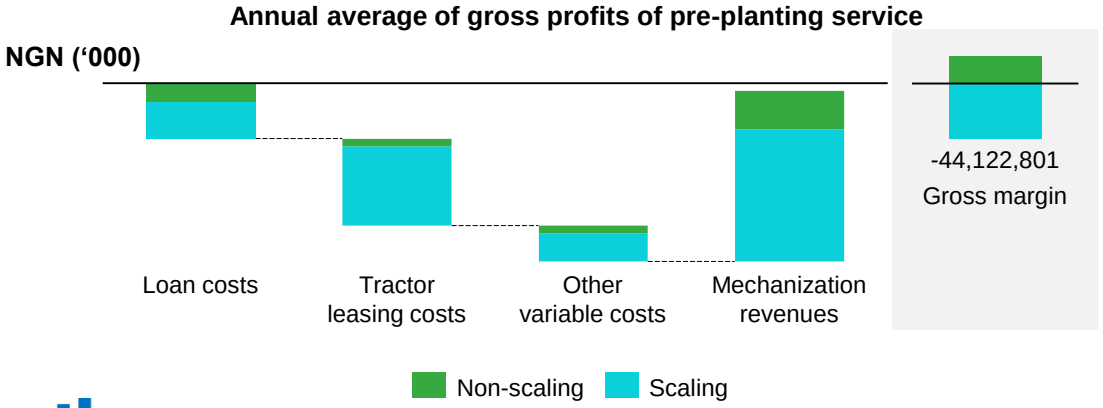
- **Overhead:** has no revenue drivers with staff salaries as the biggest. Overall, the service results in annual average losses. However, relative to total expenses, this is very marginal at less than 1% of SDM costs.
- **Training and finance:** are both cost centers in the SDM but are <1% of total SDM costs thus do not dent high overall SDM profits.

Discussion

- The SDM business case is **highly viable.** Despite Alluvial's dependency on the relatively high margins charged for mechanization and inputs, as it facilitates bank loans and logistics for these services, block farmers have few alternative options.
- Alluvial **takes no risk in the SDM** as the bank absorbs all defaults. Alluvial does not depend on sourcing income to cover the costs of the SDM which also reduces its exposure to agricultural shocks that result in reduced sourcing volumes and thus income.

Viability of the SDM at scale





SDM scaling scenario

- Alluvial's goal of driving a highly profitable model alongside contributing to food security through the rice farming sub-sector in Nigeria requires scalability beyond a 10,000 ha block farm. As a result, **viability of the SDM at scale is key.**
- If the block farm is scaled from 10,000 to 110,000 ha over the SDM with a 30% annual increase in cumulative land area (with proportional increases in the number of farmers), **profitability on the block farm increases by an annual average of 331%.** By 2028, profitability is almost ten times higher than the non-scaling scenario.
- On a service basis (excluding sourcing), the **biggest profitability increase in both absolute and relative terms is for mechanization services** during the season. This increase is driven by tractor leasing to an increasing pool of farmers for which Alluvial charges a margin.
- This is partially offset by a **profitability decrease in the pre-planting service under the scaling scenario** which results in average annual losses over the SDM. In the long-term, Alluvial can recover investments with a margin because of interest charged to farmers; but only over 10 years up to 2038.
- **The main challenge in the scaling scenario is very high capital needs for Alluvial.** Annual loan needs are high and driven by the sharper increases in land expansion from 2026 onwards when over 20,000 ha is added to the block farm per year.
- As Alluvial takes a loan upfront for pre-planting operations each time the block farm is scaled and is only repaid gradually by farmers over the following 10 years, on a cumulative basis, in the peak year (2028), **Alluvial's outstanding loans are over 10.1 billion NGN.**
- The viability of scaling thus depends on the ability of Alluvial to **attract significant investment** and willingness to shoulder increasing risk**.** Loan needs could be reduced if Alluvial re-invest profits from the previous years into scaling operations.

SDM outcomes and main learning questions

These are not an official assessment of SDM success or failure by IDH or NewForesight, but an indication based only on the analysis done in this forward-looking study, and on assumptions provided by the case owner(s). Actual assessment of success of the SDM should be conducted during and after the SDM is conducted using measured results

	Objectives	Results
1	**Contribute to food security in the rice farming sub-sector in Nigeria through market-driven service delivery**	• Alluvial **has developed an innovative business model to provide end-to-end mechanized solutions for rice farmers across the supply chain** based on a block farm model which enables farmers to lease larger land plots from Alluvial and receive mechanized services and skills to become entrepreneurial farmers. • **Alluvial's SDM is highly profitable.** Margins on SDM services bring high annual average profits. Alluvial also helps to connect farmers to markets through offtaking rice paddy and selling it to millers with a profit. • **The business case of scaling SDM and sourcing operations by tenfold suggests SDM viability at scale.** Alongside sourcing, mechanization during the season is a key long-term revenue driver in this scaling scenario plus other service revenues. If Alluvial increases its sourcing volumes as projected, to 15% of Nigeria's rice production, this is in line with Alluvial's vision of contributing to food security in Nigeria.
2	**Sustainable intensification through land consolidation and scaled rice production**	• **Alluvial's community land leasing arrangement is a key part of enabling scaled rice production**. Alluvial accesses comminty land for the block farm and in turn leases plots of lands on the block farm to farmers which enables them to access additional land and increase their land size (from 1 to 5 ha). • **A key driver of Alluvial's ability to reach scaled rice production is mechanization**. This is an enabling mechanism for: (1) Driving up Alluvial's sourcing offtake: due to mechanized operations, especially pre-planting (clearing, landscaping,) which optimizes land management and enables a 2-season crop cycle; and (2) increasing farmer productivity: due to mechanized transplanting which drives a 40% yield increase.
3	**De-risked operations which enable investors to invest in the rice sector**	• **The block farm is viable in terms of its unit economics and has potential for de-risked operations at scale.** This depends on the ability of Alluvial to attract significant investment and shoulder increasing risk; especially for external financing of the loan for pre-planting operations which Alluvial is repaid for gradually. • **Key financing risks** are the ability to secure sufficient land for expansion suitable for rice production, the high CAPEX business model, and the ability to offtake the high sourcing capacity. • **Risks are lowered by close performance monitoring of farmers** which ensures best practice adoption, reduces the risk of farmer defaults, and enables professional, efficient operations and economies of scale.
4	**Improved farmer livelihoods and resilience** by **creating a strong business case**	• Alluvial's block farming model enables an **increase in farm size per farmer to enable sustainable livelihoods** through an innovative community land leasing arrangement**.** By increasing the land size from 1 to 5 ha, Segment 1 (SDM) farmer net income increases fivefold over the SDM.

Key insights

Key drivers of success

- **Block farming model using community leasing arrangement:** enables Alluvial to access and lease one contiguous block of land. This makes it possible for Alluvial to efficiently clear and develop the land, and then ensure the farm is professionally run.
  Partnerships with key suppliers: Alluvial relies heavily on third party suppliers, especially for mechanization. As the SDM expands, scaling its network of partnerships and securing availability of quality equipment is essential.
- **Pre-planting operations:** Financing this on behalf of farmers who lack upfront capital means Alluvial facilitates SDM farmers to have 2 rice seasons/year by optimizing land and water management

Key factors in replication

- **Farm size per farmer:** A key step in farmer professionalism is increased farm size. The farmer Alluvial targets manages his or her farm as a professional agribusiness which is profitable, sustainable, and linked to markets.
- **Full mechanized service model:** Mechanization enables scaling through cost efficiency and increased production.
- **Scale (starting at 10.000 ha):** Alluvial uses the SDM to create demand for its mechanized services. This improves the business case and enables services to be provided that do not create revenue such as training.

Key risks

- **Finding suitable farmers:** The model heavily relies on entrepreneurial farmers able to manage 5 ha of land.
- **Land access and protection:** Land acquisition is an intensive negotiation process with local communities. Alluvial risks not being able to secure access to land for both political (goodwill of local communities) and geographic (no sizeable land available with access to water for a rice block farm) reasons.
- **Lack of working capital:** Activities such as harvesting need to happen within a narrow time window for a successful crop cycle. If Alluvial (e.g. due to late payouts from a bank) has no working capital to either perform mechanization or buy the rice paddy, it would miss out on a very large part of its revenues.
- **Scaling too quickly:** As most farm activities are mechanized, the Alluvial model is very capital intensive. If Alluvial scales too quickly before the model has proof of concept, it could run on false assumptions with potential irreversible financial consequences.

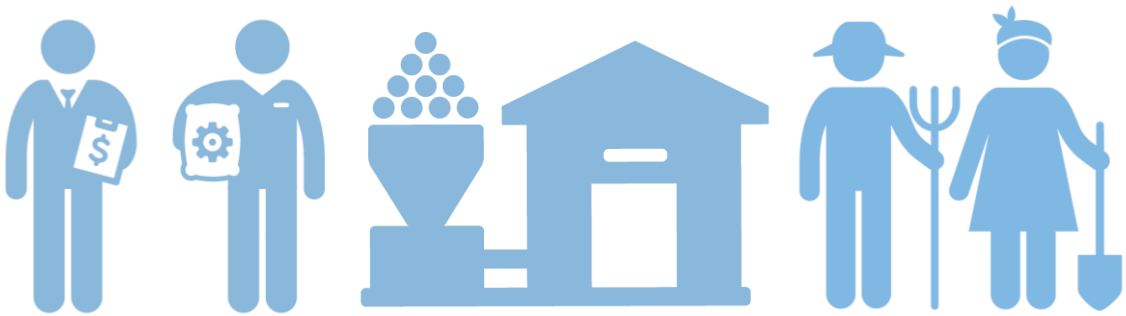
Opportunities for improvement

- **Farm professionalization training:** Finding effective block farmers is essential for the business model. Alluvial staff could be trained by an agency that specializes in farmer professionalism to create a farmer assessment framework.
- **Sophisticated M&E system:** As the business model depends on scale, monitoring and evaluation will be critical to assess company and farmer performance.
- **Acquiring cleared land:** The largest costs for Alluvial are land clearing costs. If Alluvial is able to find cleared land for rice farming, it would increase its profitability.
- **Special financial constructions.** Funds such as the IDH Farmfit fund could provide tailored financial products. This would significantly reduce risk.
- **Investment in a milling facility:** After successful scaling, Alluvial could start milling its own paddy to increase margins.

Dayo Ogundijo
Program Officer
+234 (0)80 3424 9301
ogundijo@idhtrade.org

Jesse Arnon
Senior Consultant
+31 (0)30 234 8218
jesse.arnon@newforesight.com

Jennifer Morton
Consultant
+31 (0)30 234 8218
jennifer.morton@newforesight.com



For more information and insights on SDM's, see the IDH Smallholder Engagement Report