

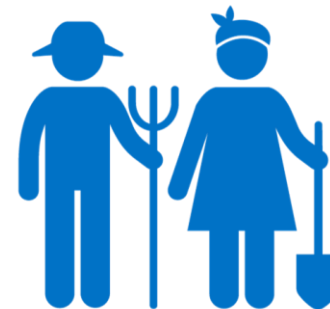
# SDM Case Report: Miro Forestry, Ghana

## Service Delivery Model Analysis

August 2019



Note that this SDM is in a design phase. The report explores possible ways of implementing the out-grower scheme, it is not a description of the actual or future model. Miro Forestry has used the results of this analysis to inform their potential outgrower strategy and business model, but cannot be held accountable to meeting any targets included in the report.



# Executive summary



Miro forestry owns and manages plantations in Ghana and Sierra Leone and uses the timber from these plantations as input to their veneer processing operations. In order to expand the sourcing base and to better engage with the local communities, Miro is also looking to establish a timber out-grower scheme in both countries. This study focuses on Ghana. The scheme is still in the design phase and no out-growers were part of it at the time of this study.

## **Miro has a positive business case for investing in the SDM and the out-grower scheme**

- The study reveals that the SDM can be profitable when commercial (veneer production) activities are taken into consideration. Over the period 2020 to 2031, Miro is projected to make cumulative net income of USD 2.99M (net of sourcing and production costs, excluding SDM costs) from veneer sales. However, operating the SDM will cost USD 1.84M for the same period resulting in a net profit of USD 1.15M from the out-grower scheme. Once the SDM is in steady state (2026 onwards), Miro can make a net profit of USD 3,082 per out-grower (over a 6-year period)
- The out-grower scheme provides the option to source good quality timber while reducing the need for capital (for acquiring plantation land) and reducing the need for hired labor (since out-growers invest family labor). The scheme can develop into an important sourcing channel for Miro and contribute to a significant portion of its veneer operations. However, given the high SDM costs which can only be recovered through commercial activities, it is vulnerable to factors such as loyalty of the out-growers, quality and quantity of timber they produce and the market price that Miro can command for its veneer.

## **Business case for out-growers depends on the availability of low-interest loans and has associated opportunity costs**

- An out-grower growing Gmelina and harvesting at 6-years can gain a net income of up to USD 2,221 or USD 370 per year. This could be financially attractive to out-growers as supplementary income since most of them have farms growing other crops with the average farm income in the Ashanti region being around USD 1,300 per year.
- The long cycle time between planting and harvest means that out-growers experience a negative cumulative cashflow of USD 1,337 during this period making it difficult for them to participate without access to credit. Providing loans at market rates (around 25% interest) makes a significant dent in their net income and hence makes the scheme significantly less attractive.
- Committing to the out-grower program means that this land cannot be used for any other crops. This has an associated opportunity cost, especially for farmers who have more experience growing other crops.

# IDH introduction

## 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 Miro Forestry for their openness and willingness to partner through this study. By providing insight into their model and critical feedback on our approach, Miro Forestry is helping to pave the way for service delivery that is beneficial and sustainable for farmers and providers.



# Reflection on SDM learning questions (1/3)

All numbers and results are based on projections

In this SDM study, a set of tailored learning questions were analyzed:

1. Who are the key actors in this SDM and what is the relationship between them?
  - Most of the services provided to out-growers could be **directly managed and delivered by Miro**. One of the reasons for this is that there are **no other similar timber out-grower schemes** in the Ashanti region of Ghana and hence out-growers do not have any access to expertise, materials and equipment outside of Miro.
  - Miro could work with several third parties such as fertilizer suppliers, tools suppliers, financial literacy trainers and transportation companies in order to effectively deliver the SDM services. In most of these cases, Miro would directly deals with the external party shielding out-growers from having to engage with them.
2. What are the costs to Miro for delivering the SDM? Can these costs be recovered?
  - Between 2020 and 2031, it is projected Miro would **incur costs of USD 2.74M** to implement the out-grower scheme. This includes both direct costs related to the provision of services as well as overhead costs related to managing the program. A certain portion of these costs would be recovered from the out-growers. These include direct costs such as those related to fertilizers, small tools and seedlings.
  - Additionally, the SDM has some revenues from the demo farms that are set up to train farmers.
  - Please refer to slide 38 for more details.
3. Is the SDM financially viable and what are the key factors influencing this?
  - **On its own, the SDM is loss making and not financially viable**. However, the out-growers scheme is profitable once the profits accruing from the production and sale of veneer is considered. Veneer profits from the out-grower scheme come into effect only from 2025 when the first set of trees planted in 2020 are ready for harvest.
  - **For each out-grower in the scheme in steady state, a profit could be made of USD 3,082** (over 6 years).
  - Please refer to slides 39 for more details.

# Reflection on SDM learning questions (2/3)

All numbers and results are based on projections

In this SDM study, a set of tailored learning questions were analyzed:

- 
4. How do the services contribute to out-grower income and cashflow?
- An out-grower who harvests at **year 6 makes a net income of USD 2,221 (USD 370 per year) and one who harvests at year 8 makes a net income of USD 2,778 (or USD 347 per year)**. This could be attractive supplemental income for the average farmer in the Ashanti region who earns about USD 1,300 per year.
  - Out-growers experience negative cash flows every year, from the first year. Over a **6-year period they have a cumulative negative cashflow of USD 1,337**. Significant positive cashflow is only seen at the end of year 6 when they harvest and sell their timber.
  - Additional details can be found on slides 32 and 33.
- 
5. What factors could improve or put at risk out-grower income?
- One of the biggest factor putting out-grower income and cashflow at **risk is the interest rates associated with agriculture loans in Ghana**. If we assume that out-growers take a loan of USD 457 at an interest rate of 25% per year to cover basic costs (fertilizer, seeds and small tools) this would **significantly reduce their income over 6-years to USD 1,534 ( 30% reduction)**.
  - However, while a loan of USD 457 helps address the year 1 costs for the out-grower, it does little to address his / her cashflow situation in subsequent years. **Due to the annual interest payments, out-growers now have a cumulative negative cashflow of USD 1,451 (even more than without a loan) by year 6**.
  - If we want out-growers to have no negative cashflows in any year, they would need to borrow USD 1,336. However, as a result of interest costs associated with this loan, out-growers will have a net income of only USD 216 (or USD 36 per year) at the end of the 6-year period.
  - Out-grower incomes can be improved by increasing farm size used for timber and with higher farm-gate prices. The out-grower income has an incremental sensitivities to both these parameters. For example, **increasing farm size by 100% increases their net income by 160%. Similarly, increasing the farm-gate price they receive by 29% results in a 54% increase in their net income**.
  - Additional details can be found on slides 32 and 33.
-



# Reflection on SDM learning questions (3/3)

All numbers and results are based on projections

In this SDM study, a set of tailored learning questions were analyzed:

6. What are some design options for access to finance, certification and diversification?
- It is clear from the analysis that most out-growers will need access to loans in order to grow timber. The interest rate on the loans have a big impact on attractiveness of the scheme whether they address out-grower's cashflow problems. Current market rates (around 25%) make the scheme unviable.
  - The loans could cover only first year costs (basic package), seedling and input costs for all years (all tools package) or all costs including labor and groundnut related costs (full package). However, the larger the package the bigger the impact of interest rates on the out-growers income.
  - Loans could be facilitated through a Micro-finance institution or a local bank but **in all cases Miro would be required to play a role**. The basic role Miro would need to play is to provide the following
    - **Valuation of an out-growers timber stock** which can be used by the MFI / bank to evaluate what amount of loans the out-grower is eligible for.
    - An **off-take contract** with out-grower which will act as an assurance that the out-grower will have enough income at harvest to repay the loan principal.
  - Additionally, Miro could also make arrangements with the MFI / bank for **payments for seedlings, inputs and tools to be disbursed directly to Miro. The repayment of the loan principal is also done directly by Miro to the bank** at the time of harvest and deducted from the payment made to out-growers for their timber.
  - In all these cases, it is assumed that the **out-growers would still be responsible for making annual interest payments**. Given the negative cashflow of farmers till harvest, this is likely to be **seen as a big risk by the MFI / bank**.
  - Additional details can be found on slides 29 and 30.
7. Can the number of out-growers benefiting from the services be scaled up?
- Current projections assumes a steady increase of outgrowers and hectares per year from 2021. It is assumed that 80% of the out-growers will choose to replant after the end of the first cycle. **So the total number of out-growers / hectares will grow at a faster rate from 2026 onwards.**
  - Scaling will result in proportional increase in costs related to staff and transport related to services such as onboarding, training, certification and monitoring & QC.
  - Main barriers would be finding out-growers that are interested in the scheme and have suitable land (with good road access, land titles). There are no major operational barriers from Miro since the scheme will still only be 8-9% of Miro's total sourcing operations.

# Reading guide

In this document we present the findings of our study. You can navigate through the document by clicking on the index.

In this document you will:

- ✓ Understand what SDMs are
- ✓ Get a complete overview of the flows of goods, money and services in your SDM
- ✓ Analyze in depth all the implications of the different services
- ✓ Have a clear understanding of the financial performance of the SDM
- ✓ Get insights on the farmer business case

## Contents

Overview of SDM stakeholders & objectives

Services, scale and organization of the SDM

Farm-level impact

Financial analysis overall SDM

Conclusions

Annex



# Overview of SDM stakeholders and objectives

This chapter provides a general introduction to the SDM partner and other relevant actors, as well as the SDM objectives and context.

In this section you will:

- ✓ Learn the basics about the SDM operator
- ✓ Understand the value chain in scope
- ✓ Get an overview of the stakeholders involved in the SDM
- ✓ Understand the objectives of this SDM

## Overview of SDM stakeholders & objectives

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# Context – Main SDM Stakeholders

## SDM Operator



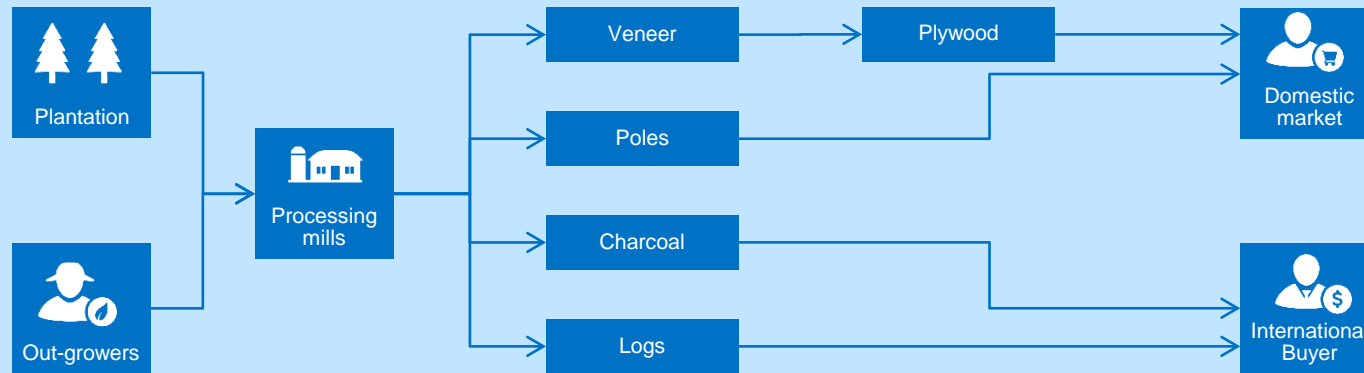
- Miro Forestry is a sustainable forestry and timber group with operations in Ghana and Sierra Leone.
- Miro manages approximately 13,000ha of sustainable plantations and are expanding at a rate of 3,000ha per annum.
- Miro plantations contain several different tree species including Gmelina, Eucalyptus, Teak and Acacias.
- Miro produces a variety of products (veneer, plywood, poles, charcoal) and aims to ensure they meet FSC environmental standards and provide social and economic benefit to local communities.
- Miro operates in the Ashanti district of Ghana. Within this district the company plants trees on set-aside forest reserves (Boumfoum, Awura and Chirimfa Forest reserves).
- Miro currently operates a veneer factory and charcoal kiln in the region. Plans are also underway to setup a plywood factory.

## Out-grower program in Ghana

- Miro intends to roll out a smallholder timber scheme in Ghana and Sierra Leone over the course of 2019 to 2021.
- The goals of this scheme is to provide Miro a long-term alternative sourcing base and engage the local communities in different ways. Over time, depending on the success of the scheme, it could potentially replace some of Miro's growth projections for its own plantations
- The timber grown by the smallholders will be bought by Miro mainly to produce veneer and potentially for poles and other products in the future.
- Farmers participating in the scheme will receive a bulk payout at the time of the clearfell harvest, which will be in 6 to 8 years from tree planting.
- Miro has built significant expertise through managing its own plantations in the Ashanti region and will use this knowledge to design a mutually beneficial out-grower program in Ghana.

Sources: Miro Forestry Annual Report 2018; Miro forestry smallholder scheme proposal 2019

# Context – Timber value chain in Ghana

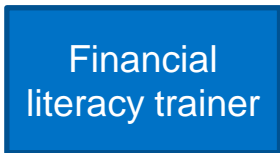


*Simplified view of Ghana timber value chain relevant to Miro forestry*

- Ghana had approximately 9.3m ha of forest in 2015, covering 39% of the country's land area. About 97% of this is natural forest while the remaining 3% are timber plantations.
- In 2014, Ghanaian timber plantations produced about 2.1 million cubic meters of roundwood.
- Export of raw logs from natural forests are banned and as a result a majority of the produce is processed domestically. The formal forestry sector consisted of around 200 timber processing mills in 2012.
- In 2012, 0.8 million cubic meter roundwood equivalent of timber products was exported. Timber is a key source of foreign exchange for Ghana with exports earnings of EUR 137.9m in 2010.
- Most exports go to the EU, African countries, China and India.
- The informal forestry sector in Ghana, consisting of mainly chain-saw milling, is nearly as big as the formal sector. The informal sector is a large driver of illegal logging.
- Smallholder timber farming in Ghana is still very nascent and does not account for a significant supply of timber.

Sources: FAOSTATS (2015); Ghana export promotion council (GEPC); NEPCon

# SDM Stakeholders and Entities Overview



	Legal status	Function <i>(Within this SDM)</i>	Revenue model <i>(Within this SDM)</i>	Incentive for Participation
	Private company	<ul style="list-style-type: none"> <li>SDM operator</li> <li>Provide services and off-take timber</li> </ul>	<ul style="list-style-type: none"> <li>Service payments deducted from harvest</li> <li>Veneer revenue from out-grower produced timber</li> </ul>	<ul style="list-style-type: none"> <li>Increased timber supply</li> <li>Improved community relations</li> </ul>
	'Stichting' under the Dutch law	<ul style="list-style-type: none"> <li>Funding for out-grower model</li> <li>Advices on SDM design</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>Increased farmer income through timber out-grower model in Ghana</li> </ul>
	Development bank	<ul style="list-style-type: none"> <li>Developmental funding to Miro</li> </ul>	<ul style="list-style-type: none"> <li>Interest rates on loan</li> </ul>	<ul style="list-style-type: none"> <li>Environmental and social return</li> </ul>
	NGO	<ul style="list-style-type: none"> <li>Train farmers on financial literacy</li> </ul>	<ul style="list-style-type: none"> <li>Payment covering training costs</li> </ul>	<ul style="list-style-type: none"> <li>Improved financial literacy of farmers</li> </ul>
	Private company	<ul style="list-style-type: none"> <li>Audit service for out-grower group to receive FSC certification</li> </ul>	<ul style="list-style-type: none"> <li>Payment for service</li> </ul>	<ul style="list-style-type: none"> <li>Payment</li> </ul>





# SDM Stakeholders and Entities Overview

Fertilizer provider

Small tools provider

Third party transportation

	Legal status	Function <i>(Within this SDM)</i>	Revenue model <i>(Within this SDM)</i>	Incentive for Participation
Fertilizer provider	Private company	<ul style="list-style-type: none"> <li>Sell bulk fertilizer to Miro</li> </ul>	<ul style="list-style-type: none"> <li>Payment for fertilizer</li> </ul>	<ul style="list-style-type: none"> <li>Commercial operations / revenues</li> </ul>
Small tools provider	Private company	<ul style="list-style-type: none"> <li>Sell bulk tools to Miro</li> </ul>	<ul style="list-style-type: none"> <li>Payment for tools</li> </ul>	<ul style="list-style-type: none"> <li>Commercial operations / revenues</li> </ul>
Third party transportation	Private company	<ul style="list-style-type: none"> <li>Transports logs from out-grower to veneer factory at harvest</li> </ul>	<ul style="list-style-type: none"> <li>Payment per load</li> </ul>	<ul style="list-style-type: none"> <li>Commercial operations / revenues</li> </ul>
	NGO	<ul style="list-style-type: none"> <li>Planting material R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>Payment for service</li> </ul>	<ul style="list-style-type: none"> <li>Expand and use forestry research</li> </ul>
	Public entity	<ul style="list-style-type: none"> <li>Planting material R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>Funded by government</li> </ul>	<ul style="list-style-type: none"> <li>Expand and use forestry research</li> </ul>



# SDM Structure: Services, scale and organization of the SDM

This section provides information about the services delivered to the farmers, the number of farmers in the SDM and the way they are organized.

In this section you will:

- ✓ Get an overview of the services provided
- ✓ Get a breakdown of the dynamics and flows per service, as well as the delivery method, costs and impact
- ✓ Get an overview of the SDM scale in terms of number of farmers

Overview of SDM stakeholders & objectives

## **Services, scale and organization of the SDM**

Farm-level impact

Financial analysis overall SDM

Conclusions

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# Farmer context

## Impact of the challenge on SDM farmers




0: very limited impact

5: high impact

### Farmer context

### Challenges

### Impact Measures taken by SDM operator

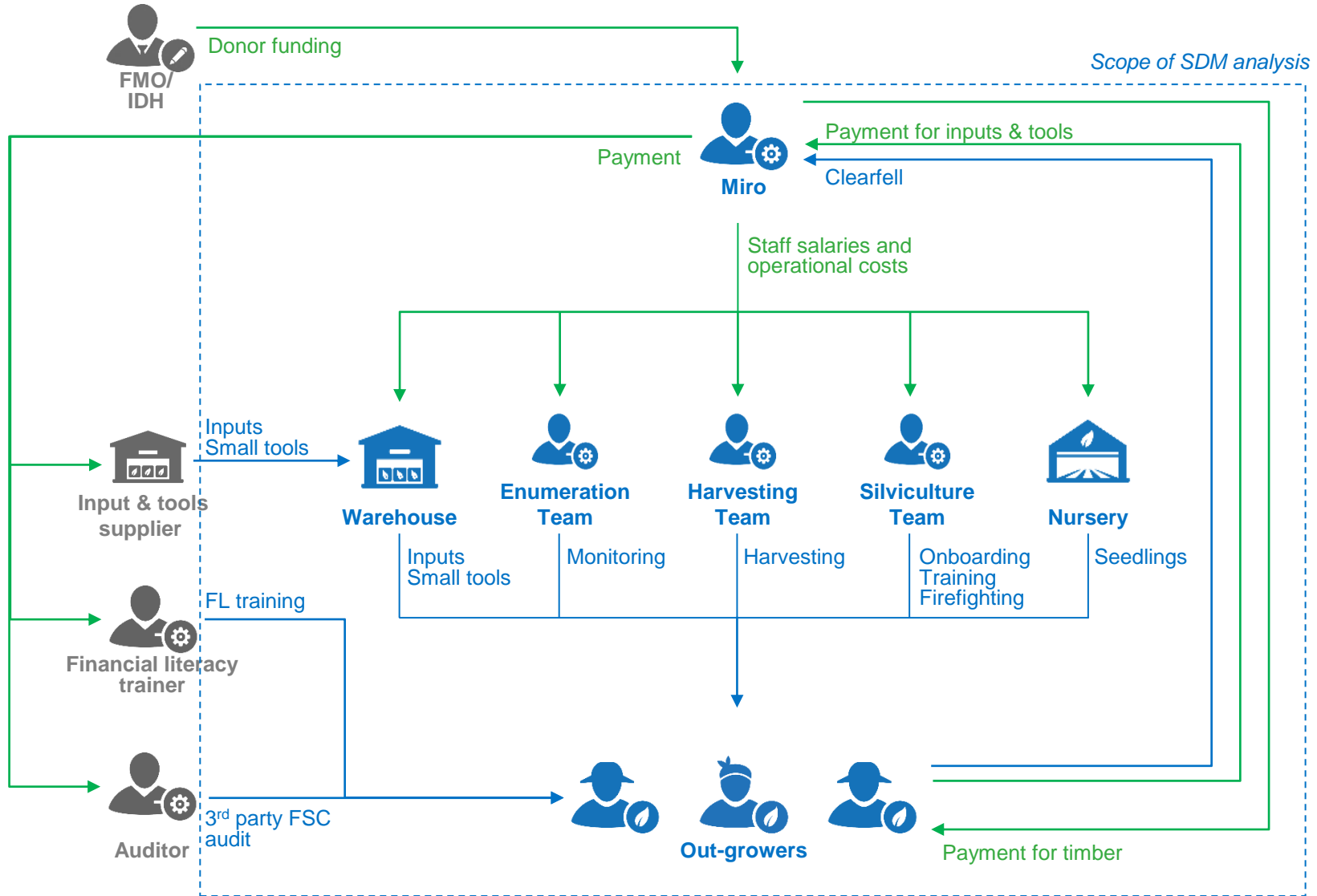
Farmer context	Challenges	Impact	Measures taken by SDM operator
 <p><b>Agronomic</b></p>	<ul style="list-style-type: none"> <li>85% of Ghana's population are smallholder farmers. Farmers in the Ashanti region grow cocoa as the main cash crop and commonly grow rice, maize, groundnuts, beans and vegetables as food crops.</li> <li>There are very few timber smallholders in Ghana, though some farmers also grow trees on their farms that can be sold when they have a need for extra cash.</li> <li>Most smallholder farmers do not have access to good quality timber seeds / seedlings or good quality fertilizers. Most timber grown by smallholder farmers also do not follow good silviculture practices which results in low yields and low quality of timber.</li> </ul>	<p>▼ 2</p>	<ul style="list-style-type: none"> <li>Miro will introduce an out-grower program that can work with farmers to grow timber on their land which will provide the farmers with an additional source of income.</li> <li>Miro will provide silviculture training as well as regularly monitor the farmers plots to ensure they can get optimal yields.</li> <li>Miro will also provide seedlings and fertilizers which will ensure farmers use good quality planting material and inputs.</li> </ul>
 <p><b>Economic</b></p>	<ul style="list-style-type: none"> <li>Most smallholder farmers in Ghana depend on a regular income from harvests for their livelihoods. Hence, a long-cycle crop such as timber will pose cash-flow challenges for the farmers.</li> <li>Less than 6% of farmers in Ghana receive any form of credit / loans since they cannot document their finances and show steady cashflow. Even when they do secure funding interest rates can be as high as 35% a year. This makes securing long-term financing for timber farmers a critical challenge.</li> <li>Most farmers have limited access to the organized timber sector and end up selling their trees in the unorganized sector resulting in lower prices.</li> </ul>	<p>▼ 4</p>	<ul style="list-style-type: none"> <li>Miro will primarily work with farmers who will use part of their land for timber and part of their land for other crops. This ensures that they are not dependent on timber for an annual income.</li> <li>Miro will train farmers on intercropping their timber farms with groundnuts (for one season), which provides additional income in the first year. Miro will also inspect farms and mark trees for first-thinnings which provides some income in the second year.</li> <li>Miro will explore facilitating access to finance for farmers to purchase inputs (fertilizers, seedlings and tools).</li> <li>Miro has setup a veneer factory in the region and will buy timber from the farmers at clearfell.</li> </ul>
 <p><b>Social &amp; Environmental</b></p>	<ul style="list-style-type: none"> <li>Ghana has lost over 10% of its forest cover in the last decade as a result of logging, unsustainable agriculture practices and mining.</li> <li>Forest fires, largely as a result of bush burning, is also a key driver of deforestation. Additionally, forest fires also pose a risk, especially in the dry seasons, to timber plantations and timber grown by smallholder farmers.</li> <li>Loss of forest cover is resulting in decreased biodiversity and a negative impact on water catchment areas.</li> </ul>	<p>▼ 5</p>	<ul style="list-style-type: none"> <li>Miro commits at least 10% of its land holding as managed conservation area with 35% of the areas critical to conserving water catchments which also extends to the out-growers.</li> <li>Out-growers will be trained on environmental awareness and be FSC certified.</li> <li>Out-growers will be trained on firefighting practices, build fire breaks around their farms and have access to firefighting services to reduce the risk of losses due to forest fires.</li> </ul>

Sources: GSMA Mobile-enabled Economic Identities for smallholder farmers in Ghana Report, 2019; AGRA Operational Plan 2018; Miro Annual Report 2017;

World resources institute 2018



# SDM Services and Revenue Flow Overview

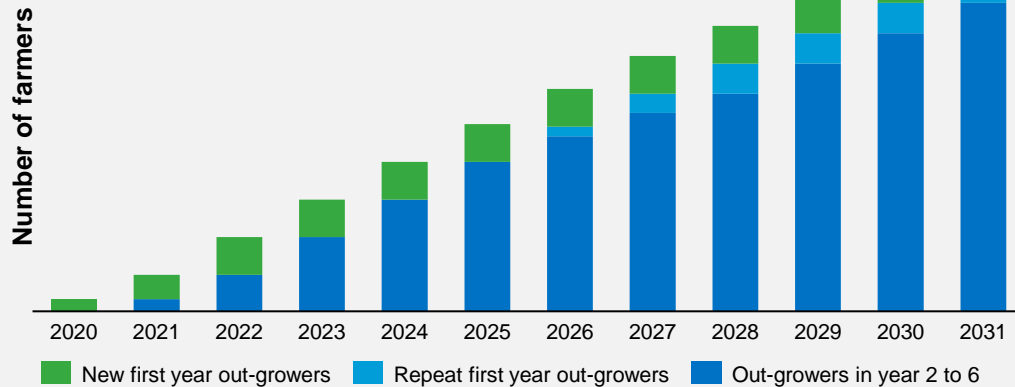


**Legend** ← Flow of goods and services

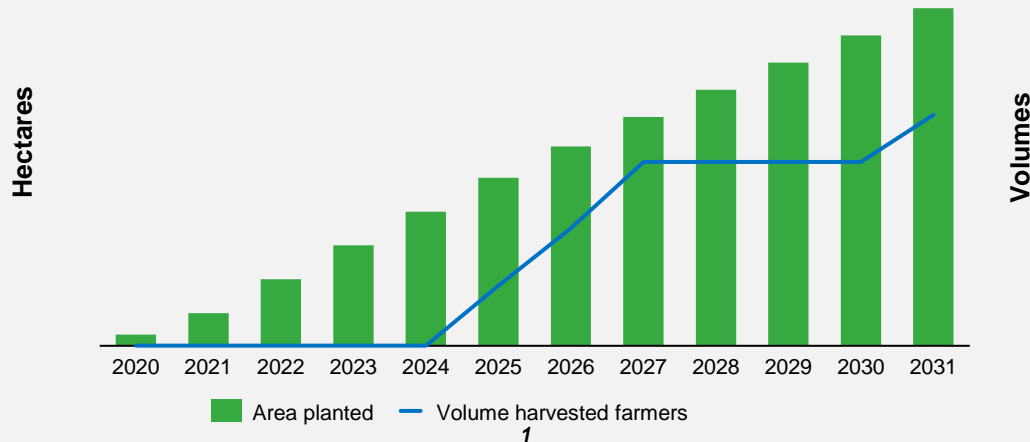
→ Financial / payment flows

# Scale of the SDM and duration in scope of this case study

**Farmers in the SDM**



**Area planted and timber harvested within the SDM**



## Out-growers in the SDM

The out-grower scheme (and the SDM) will be set up starting from 2020. This will initially start with one community in the vicinity of the Miro veneer factory with more communities added to the program each year. New out-growers are onboarded into the program starting in 2020.

The SDM will grow the number of outgrowers in a linear way. All SDM out-growers will plant Gmelina trees and harvest them after 6 years. Hence, while new out-growers are added each year, out-growers added in previous years continue to be part of the SDM and receive services.

In 2026 some (assumed to be 80%) of the out-growers that started in 2020 (and harvested in 2025) will re-plant Gmelina and hence add to the total number of farmers in year 1 of the cycle. This pattern will continue from 2026 onwards.

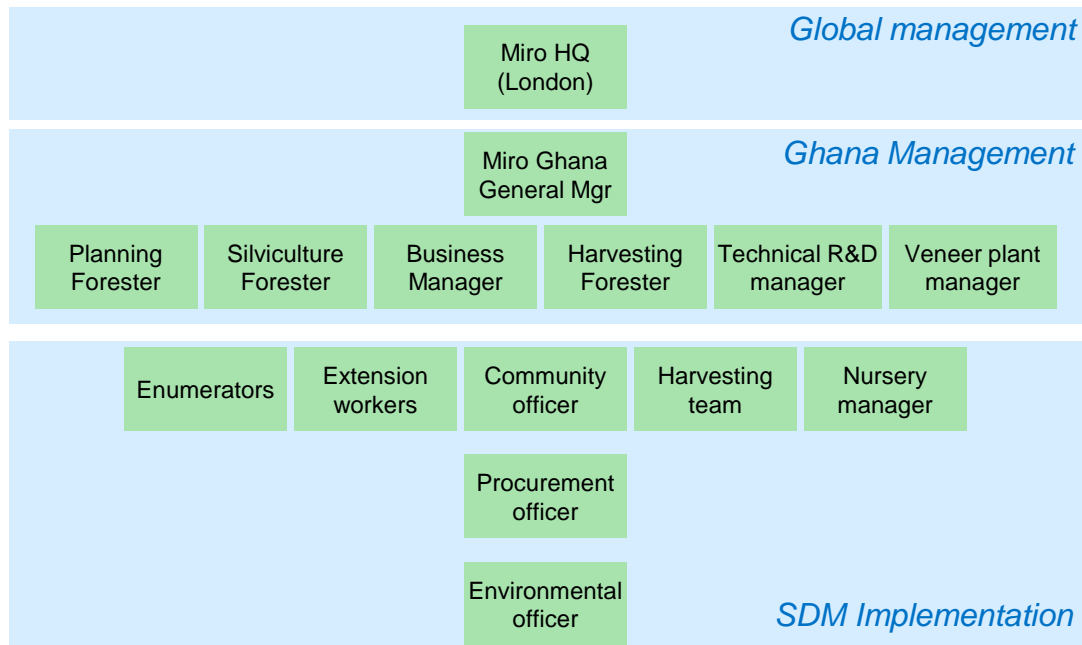
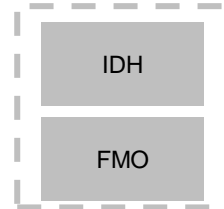
## Timber production

The total land area used by the SDM will grow in line with farmers numbers. By 2031 the SDM is projected to account for 8-9% of the total land area which Miro will source timber from in Ghana.

From 2025 onwards farms planted 6 years earlier will be ready for harvest. The stepped pattern of harvest volumes is explained by a similar pattern in number of first year farms 6 years earlier. From 2031 the harvest volumes increase since at this point some of the repeat farms from 2026 are ready for harvest as well.

# Organizational structure of Miro Forestry

Strategic advisors/  
donors



## Information on governance structure

Miro is organized into three levels: global management, Ghana management and implementation. The global management team consists of the CEO, CFO and the Compliance direct based out of London.

The operations in Ghana are led by the country general manager. To manage the SDM in the field, there are six main departments involved: Planning, Silviculture, Business, Harvesting, Technical R&D and the veneer plant. The heads of these departments manage the day to day operations of their teams in implementing the SDMs.

The Planning team covers the enumerators, who are involved in screening out growers' land during onboarding as well as various quality checks. The Silviculture team conducts onboarding sessions as well as trainings. The Business team provides initial liaison with the communities, procures the inputs/tools, and conducts the rapid environmental assessments. The Harvesting team takes care of all logistics, machinery and transport related to harvesting the logs from out growers the R&D team takes care of the nursery and the seedlings for out growers and the veneer plant processes the harvested logs. They are also supported by overall administration, accounting and other business functions.

Source: Miro Annual Report 2017

# Overview of Services



## Farmer Training

- Farmers receive training on GAP, financial literacy as well as certification. These are done through a combination of internal and external trainers.



## Farmer onboarding

- Miro will engage with communities located near the veneer factory, assess the suitability of the land for planting and register them in the Microforest system.



## Planting Services

- Miro will manage the nursery and distribute seedlings directly to farmers. Miro will provide 30 and 60 day survival checks.



## Certification

- All farmers will be FSC certified in year 5. Costs are covered by Miro and farmers do not receive a premium.



## Input Provision

- The main inputs covered are fertilizer and small tools, both of which are needed in year 1. Miro buys these in bulk and provides it to out-growers at cost-price.



## Firefighting

- Miro will have a firefighting team on-call to help out-growers during the 4-month fire season.



## Monitoring and Quality Control

- Miro will provide monitoring checks throughout the cycle, assessing the health and expected volume of the clearfell.



## Harvesting

- Miro will take on all harvesting services for the clearfell, including machinery and team.

# Farmer segmentation

This SDM model target different segments of farmers based on growing cycle because of farmer's financial needs



**Gmelina- 6 year**  
Segment 1



**Gmelina- 8 year**  
Segment 2

## Minimum criteria

Beneficiaries should meet the following minimum criteria in order to be eligible for service provision

### Minimum criteria

**Land available**

All famers must have at least 1 hectare of land

**Location**

All famers must be within 50km of the veneer factory

## Segments

Segments are distinct groups of SDM beneficiaries that differ on **farm characteristics** and/or **services received**

For each segment:

- the estimated **SDM impact at farm level** is shown on slide 32
- detailed farm agro- and economic **assumptions** to come to those calculations are shown on slide 69

### Characteristics

**Productivity**

155 m3/ha

208 m3/ha

**Harvest year**

6

8

**Farm size**

3.9 ha

3.9 ha

**% of land for timber**

50%

50%

**Groundnut seasons**

1

1

### Services

**Inputs**

Fertilizer, Seedlings, and Tools

Fertilizer, Seedlings, and Tools

**Training**

Access to GAP training from Miro and financial literacy from third party

**Certification**

FSC certification

FSC certification

**Firefighting**

Miro firefighting team

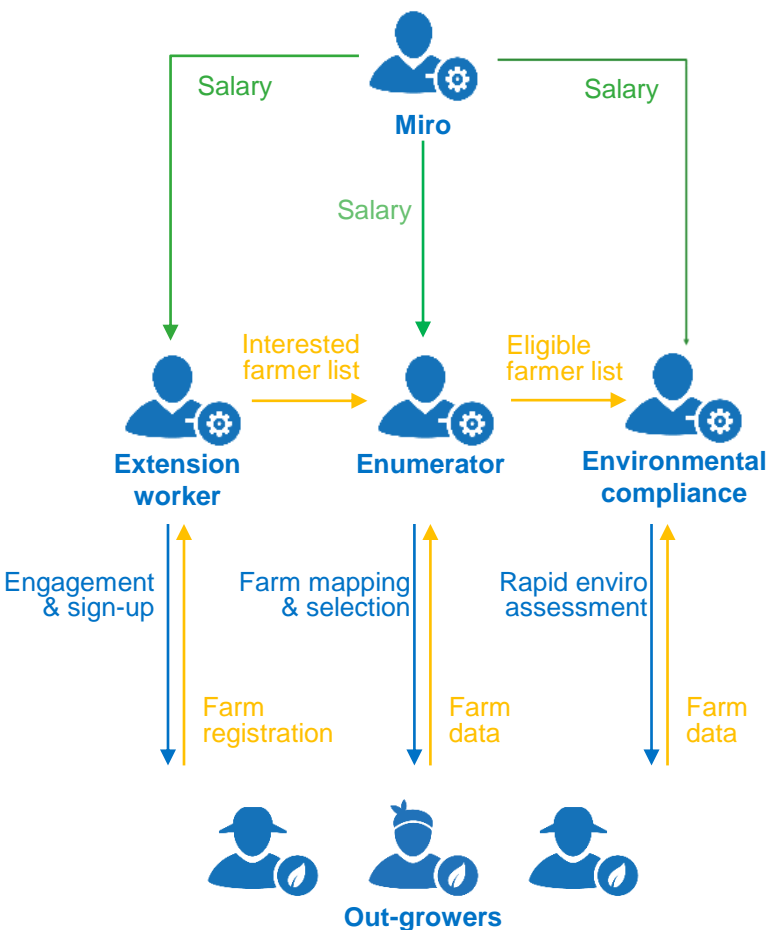
Miro firefighting team

**Harvesting**

Miro harvesting team

Miro harvesting team

# Detailed overview of Farmer onboarding



- Legend**
- ← Flow of goods and services
  - Financial / payment flows
  - Information

## Description / Methodology

- **Description:** Miro will sign up farmers by community. They will first do several engagement sessions with the selected community to explain the process, benefits and costs of being an out-grower. Interested out-growers will register and then be passed on to the enumeration team and environmental compliance team to assess suitability. In this process they will also be registered into Microforest by the enumeration team.
- **Method:** Miro will first identify communities that meet their minimum criteria, then the extension workers will put out a radio ad, organizing meetings every other week for 4 months. Once an out-grower has confirmed interest, the farm details will be passed to the enumeration team, who will visit the farm to assess its suitability. Once this has been confirmed, the environmental compliance team will conduct a rapid environmental assessment and the farmer will be registered.

## Marginal service costs for Miro

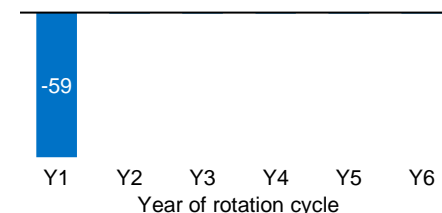
### Description

- Miro pays the salaries of extension workers, enumerators and compliance officers.
- Miro also incurs costs related to organizing community events.

### Drivers

- Staff salaries, travel and event related costs are the main cost drivers.

Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD

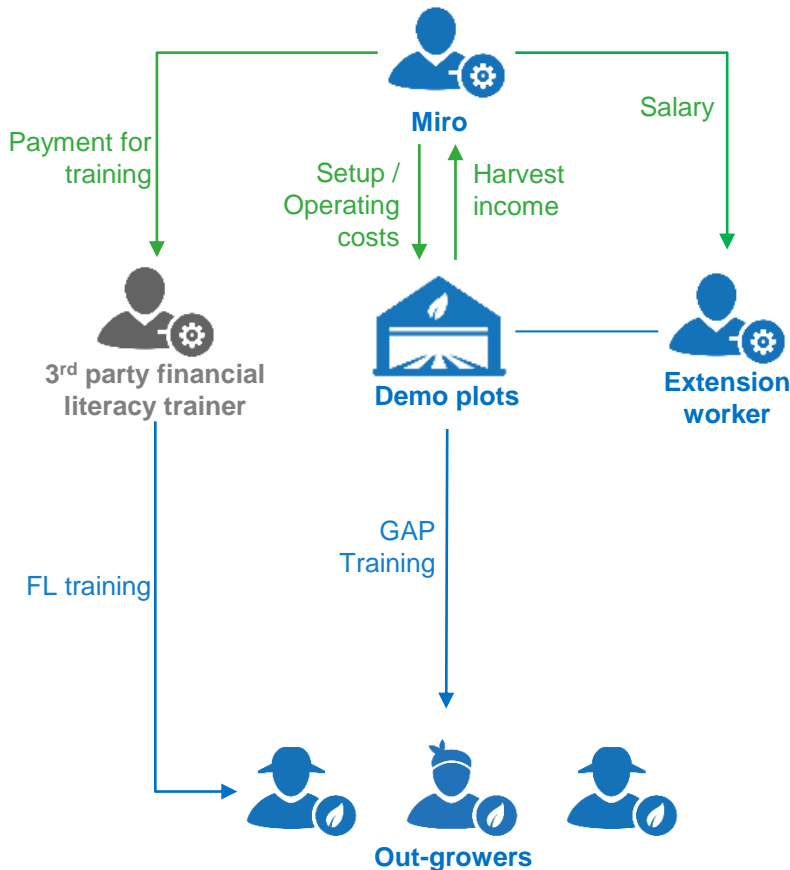


## Impact

- Local communities are engaged in building the out-grower scheme.
- Out-growers are carefully chosen to ensure they suit the program and stand to gain from becoming timber out-growers.
- Out-growers are provided with information on process, costs, benefits and risks up front and can make an informed decision to join the program.



# Detailed overview of Training



**Legend** ← Flow of goods and services  
→ Financial / payment flows

## Description / Methodology

- **Description:** There are two types of training, GAP training as well as financial literacy training. GAP training will cover marking/pitting, fertilizer, fire protection, pruning, FSC certification and groundnut intercropping. GAP trainings take place just before the activities are to be carried out on the field. Financial literacy training will be a one-day training covering basic financial concepts.
- **Method:** GAP trainings will be done primarily by Miro's extension officers, with support from the Foresters. Training are done in groups on demo plots or classrooms as well as individual trainings on the farm. Miro will set up a new demo plot each year for out-growers starting in that year. Out-growers receive booklets with illustrations and explanations of practices. Most trainings occur in year one, with some occurring every year as refreshers. The financial literacy training will be done by a third party, likely an NGO.

## Marginal service costs for Miro

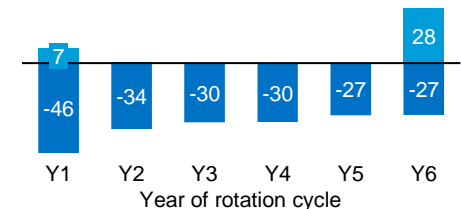
### Description

- Miro hires extension workers and sets up demo farms to provide training.
- Miro also pays for a third party to provide financial literacy training.

### Drivers

- Staff salaries and logistics are the main cost drivers.
- Groundnut harvest in year 1 and timber clearfell in year 6 from demo farms are the main revenue drivers.

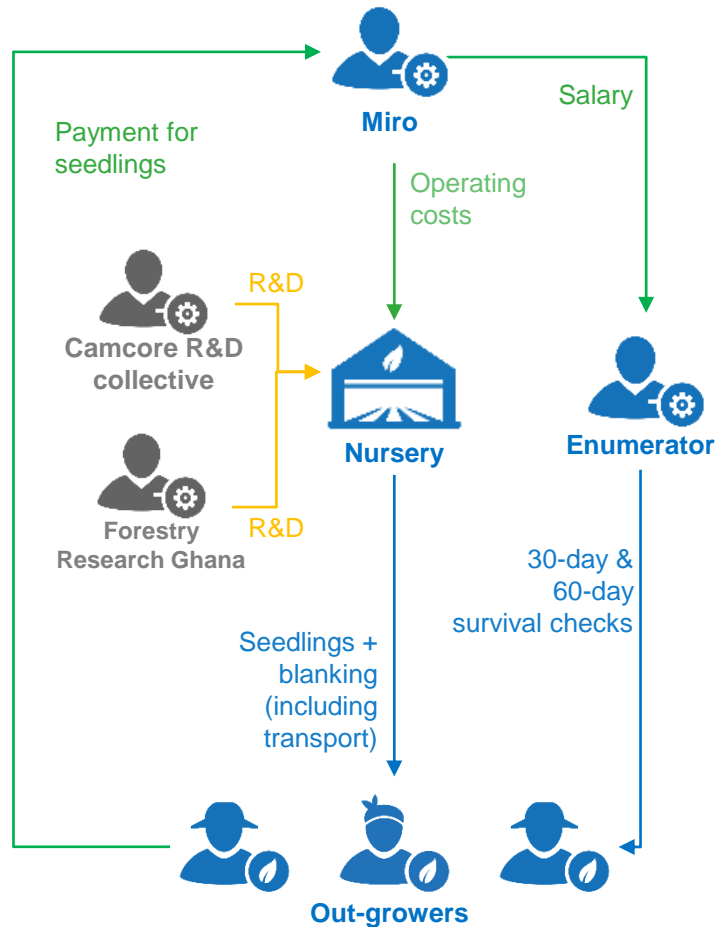
Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD



## Impact

- Improved seedling survival rates, especially during the first year.
- Lower risk of losses due to better fire management practices in place.
- Improved timber yields by following established silviculture practices.
- Additional income from groundnuts in year 1 without impacting tree crop.
- Better management of personal finance over the whole growing cycle.

# Detailed overview of Planting material and services



- Legend**
- ← Flow of goods and services
  - Financial / payment flows
  - Information

## Description / Methodology

- **Description:** Out-growers buy high quality Gmelina seedlings to cover initial planting and blanking that have been grown in the Miro nursery to FSC compliance standards. Miro enumerators will also perform a 30-day and 60-day survival check on the farms.
- **Method:** Miro will grow the out-grower seedlings in their existing nursery, continuing to use the R&D resources it is getting for its own seedlings to apply to out-grower seedlings. These seedlings will be transported to the individual farms with Miro's seedling truck. There will be a 30-day and 60-day survival check by the enumerators. Based on the survival rates, additional seedlings will be provided for blanking. The cost of seedlings for each out-grower is covered either by pre-financing from Miro or loans from micro-finance institution. These options are further discussed on slides 29 and 30.

## Marginal service costs for Miro

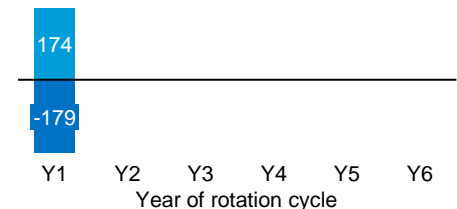
### Description

- Miro incurs upfront costs to grow seedlings in its nurseries.
- All costs and revenues are in year 1 (financing option 1).

### Drivers

- Cost of growing seedlings is the main cost. However, this is completely recovered from the out-growers.
- Miro incurs additional costs for a survival check, which is not recovered.

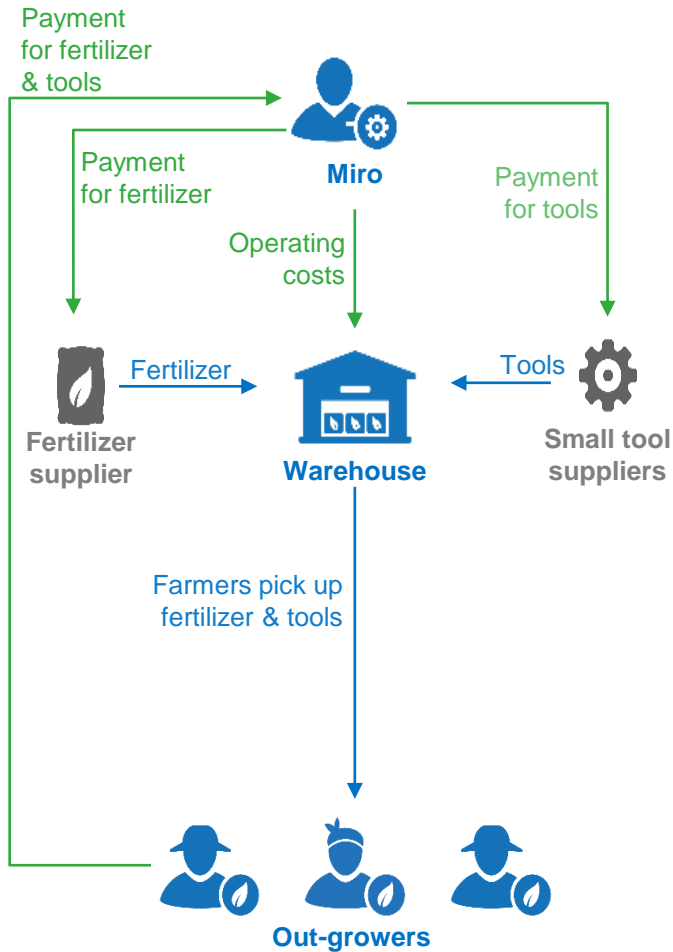
Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD



## Impact

- Out-growers receive high quality seedlings with higher survival rates and yields.
- Early survival checks by enumerators ensure tree density can be maintained.
- Seedlings meet FSC standards and enables certification of timber.

# Detailed overview of Inputs & tools provision



**Legend** ← Flow of goods and services  
→ Financial / payment flows

## Description / Methodology

- **Description:** Miro will purchase fertilizer and tools (handpick, pruning saw + extension pole, boots, gloves, fire knapsack, and fire beaters) in bulk and provide them to out-growers at cost. Most inputs are only needed once in the first year, except for the fire knapsack, which is every 3 years and maintenance twice a year.
- **Method:** Miro purchases fertilizer in bulk (including quantities needed for own plantation) and hence can negotiate favorable prices. Miro also purchases tools, PPE and firefighting equipment from different vendors – some of which needs to be imported as its not available in Ghana. The inputs and tools will be stored in Miro’s warehouses and provided to out-growers at cost. The cost of inputs and tools for each out-grower is covered either by pre-financing from Miro or loans from micro-finance institution. These options are further discussed on slides 29 and 30.

## Marginal service costs for Miro

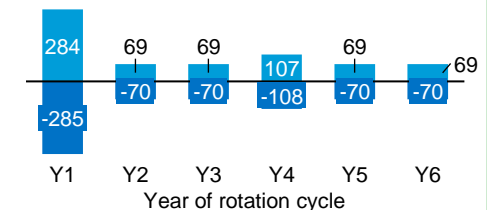
### Description

- Miro incurs upfront costs to procure and provide fertilizers and small tools.
- Revenues are in year of procurement (financing option 1).

### Drivers

- Cost of procuring is the main cost. However, this is completely recovered from the out-growers.
- Miro incurs small additional costs for its warehouse which are not recovered from out-growers.

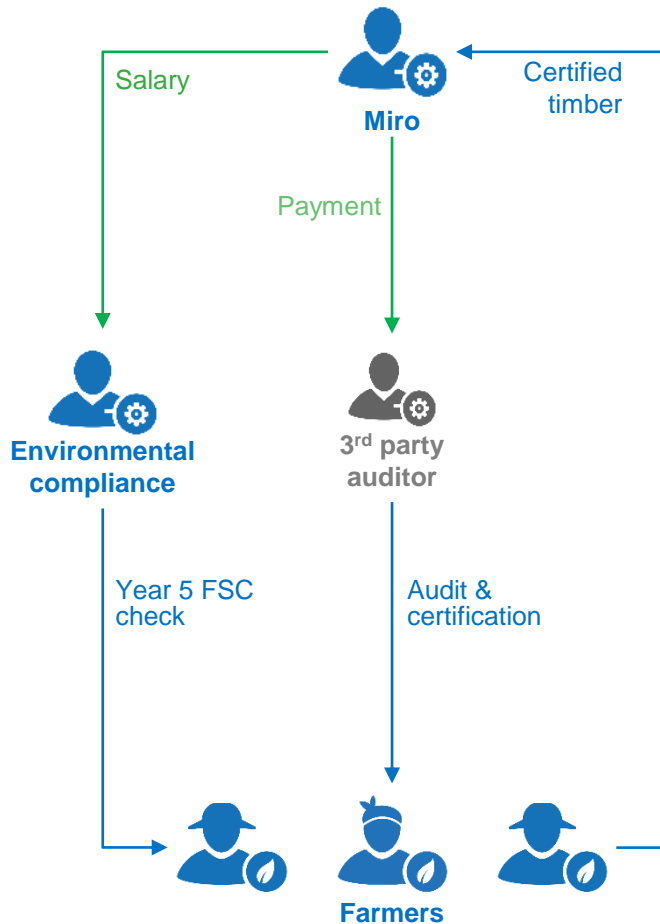
Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD



## Impact

- Higher timber yields as a result of using good quality fertilizers.
- Better working conditions on the farm due to use of the right tools and protective equipment.
- Reduce tree loss due to fires by having basic firefighting equipment on the farm.

# Detailed overview of FSC certification



**Legend** ← Flow of goods and services  
 → Financial / payment flows

## Description / Methodology

- **Description:** Miro will have already done the trainings required for certification in the GAP trainings and the materials needed for certification (boots and gloves) will have been provided in the input provision. Miro will pay for the third party auditor to come one year prior to clearfell to certify the farmers. Farmers will not receive a premium for FSC certification, as Miro is covering all costs, and any premium seen, will go to Miro.
- **Method:** Miro provides all training, inputs and audit needed to get farmers registered under group certification. In year 5 Miro will visit each farm and perform a check to ensure they meet FSC standards and have all the documentation needed during an audit. Miro then appoints a third party auditor to perform the FSC audit for the group certification scheme.

## Marginal service costs for Miro

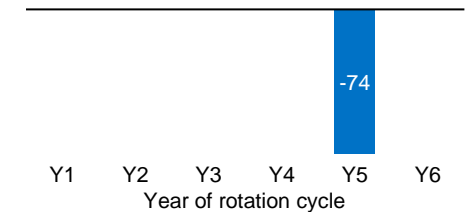
### Description

- Miro pays for a third party FSC audit in year 5.

### Drivers

- Cost of audits is the primary driver. These are not recovered from the out-growers.

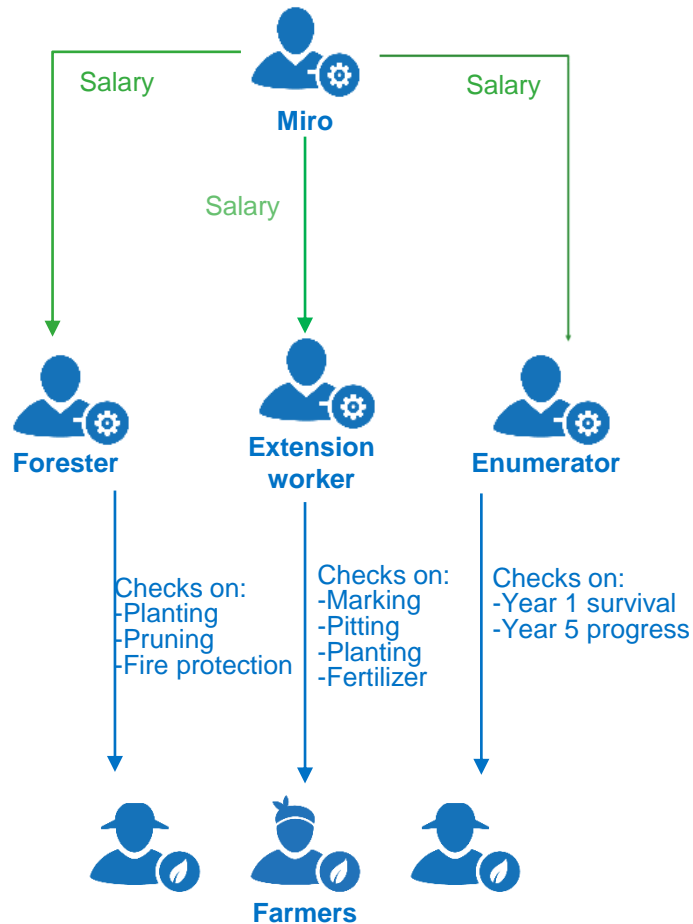
Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD



## Impact

- Timber is grown sustainably meeting FSC certification standards.
- Miro receives a reliable supply of FSC certified logs.
- Potential to receive a market premium for certified wood which can cover costs of certification and also pay a premium to out-growers in the future.

# Detailed overview of Monitoring & Quality Control



**Legend** ← Flow of goods and services  
→ Financial / payment flows

## Description / Methodology

- **Description:** Miro will have its staff conduct a number of checks on the farms. These checks are done by different Miro employees, depending on the specific needs of each check.
- **Method:** The schedule for a 6-year Gmelina out-grower is as below

	Y1	Y2	Y3	Y4	Y5	Y6
Marking / pitting	X					
Planting / fertilizer / groundnuts	X					
Corrective pruning	X					
Fire protection / pruning	X	X	X	X	X	X
1 <sup>st</sup> year survival count	X					
1 <sup>st</sup> thinning		X				

## Marginal service costs for Miro

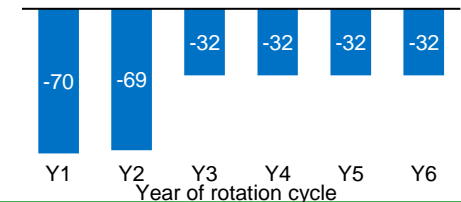
Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD

### Description

- Miro employs staff who perform multiple checks through the cycle.

### Drivers

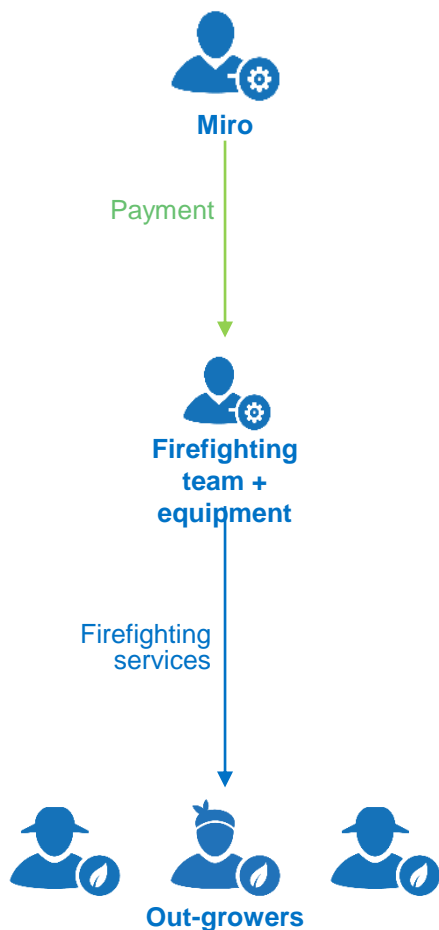
- Staff salaries and logistics are the main cost drivers.



## Impact

- Increase adoption of GAP and fire protection practices resulting in higher yields and lower losses to fires.
- Better forecasting on timber volumes for Miro's veneer plant.

# Detailed overview of Firefighting



**Legend**   ← Flow of goods and services  
 → Financial / payment flows

## Description / Methodology

- **Description:** Fire is one of the biggest risks that Miro faces, reaching 6% of their land in 2018. While farmers will be trained and provided with basic fire fighting tools, fires are inevitable, especially during the 4 dry months. Miro will thus provide fire fighting services for out-growers during the dry months.
- **Method:** Miro pays 4 of its extension workers to be a fire fighting team for the 4 months of dry season. They are on call should there be a fire and will take a truck and bakkiesakkie full of water to fight the fire.

## Marginal service costs for Miro

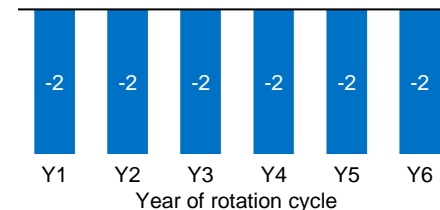
### Description

- Miro hires a team and provides them with fire fighting equipment. This team is shared with Miro's plantation operations.

### Drivers

- Staff and equipment costs are the main drivers. These are spread out across multiple out-growers.

Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD

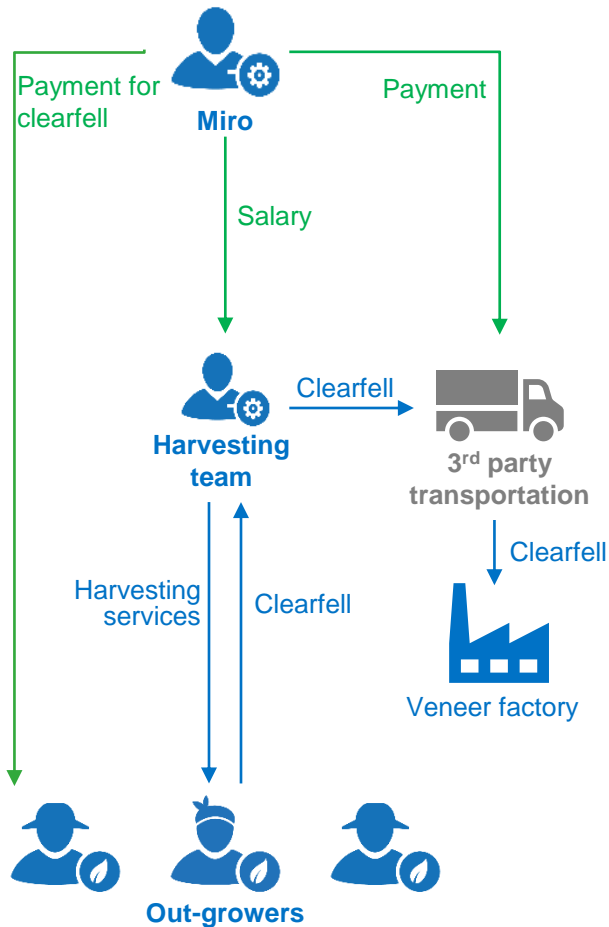


## Impact

- Out-growers have reduced the risk of tree loss.
- Miro minimizes potential of fires spreading from out-growers to Miro plantations.



# Detailed overview of Harvesting



**Legend** ← Flow of goods and services  
 → Financial / payment flows

## Description / Methodology

- **Description:** Miro bears all harvesting services and costs, which is built into the farm-gate price paid. This includes chainsaw operators, chainsaw supervisor, machine operators for the bell loader, tally clerks, log scalers, and chockers. It also covers applying for permits to clearfell as well as transport to the veneer factory.
- **Method:** Miro needs to first apply for permits to harvest from farms. The harvesting team will then transport all the machinery to the farms and harvest the trees. A third party transportation company is often used to pick up the logs and transport them to Miro's veneer factory. Miro does not directly charge out-growers for harvesting. However, the farm-gate price offered to out-growers account for this cost and are, as a result, lower than the market price for harvested logs.

## Marginal service costs for Miro

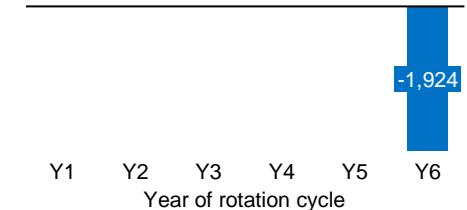
### Description

- Miro has a dedicated harvesting team with specialized equipment
- Miro hires a third party company to transport logs to the factory.

### Drivers

- Transport is the main cost driver, followed by equipment operations and staff salaries.
- There are no direct revenues but the cost of harvest are built in to the farm-gate price paid for timber from out-growers.

Marginal costs / revenues per out-grower in steady state (2026 onwards) in USD



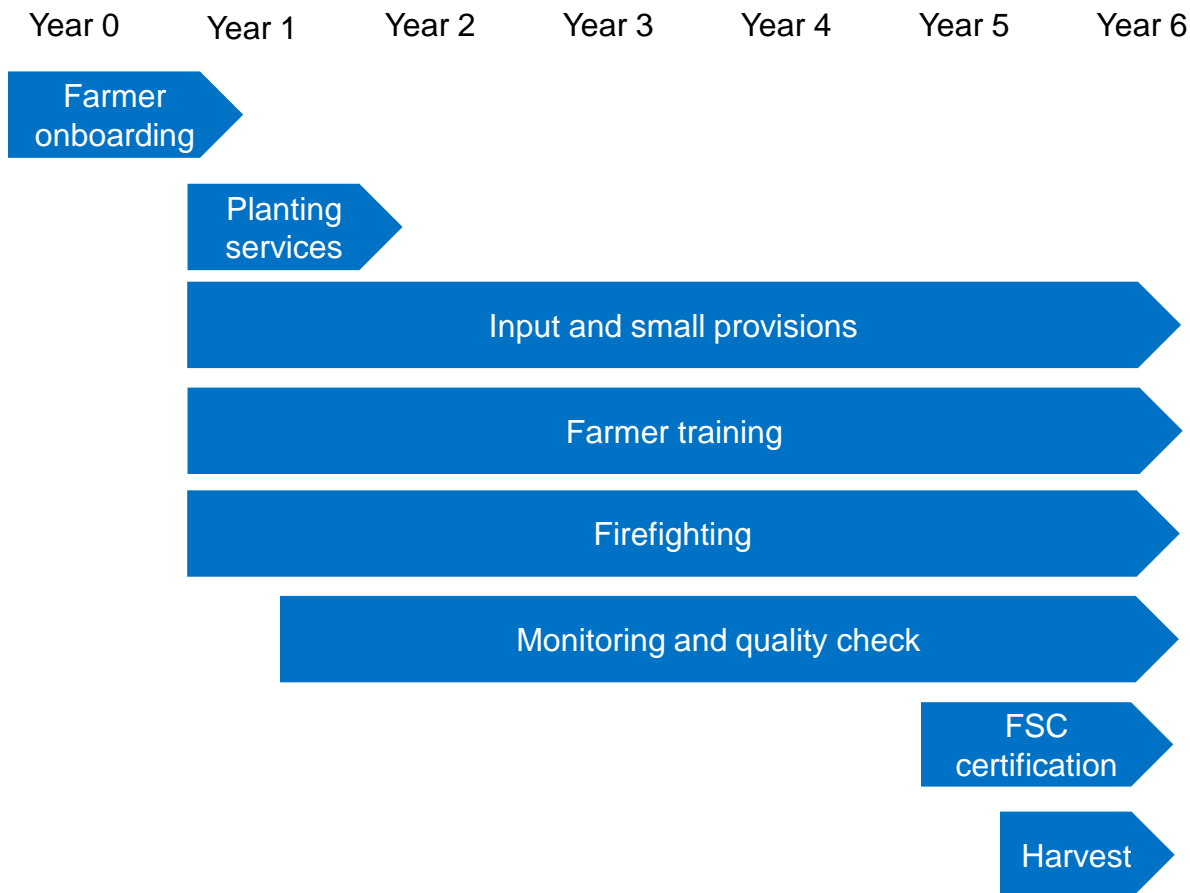
## Impact

- Quick, mechanized harvesting at time for clearfell.
- Miro gets all harvested trees from out-growers and can measure and cut them to size on the farm.
- Out-growers get access to efficient, mechanized harvesting of their farms.

# Sequence of services

## Program model

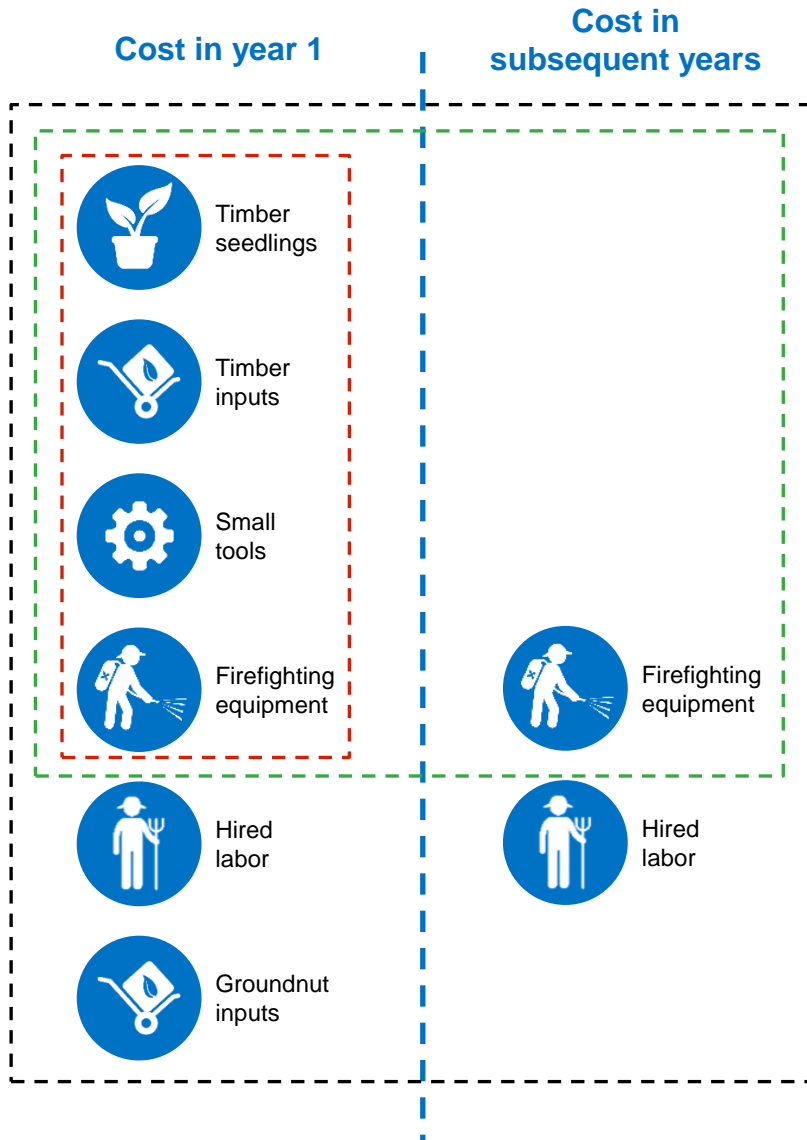
### Year of farmer entry into program



## Sequencing logic

- Farmer onboarding happens prior to the planting cycle.
- Once onboarded and confirmed, farmers receive planting services, inputs, training and access to firefighting services.
- Certain inputs and trainings are only in year 1, but others continue throughout the 6-year cycle.
- Firefighting will be provided throughout the cycle, during dry months.
- Monitoring and quality checks start just after planting and continues in all years till before harvest.
- Certification happens the year before harvest.
- Harvest is currently set at year 6, but could move to year 8.

# Detailed overview of Financing – design options



## Loans to cover costs

Out-growers incur significant costs in the first year, followed by periodic costs in subsequent years. Since most of the revenues only come at the time of clearfell harvest, out-growers will require upfront financing in the form of loans to cover these costs. Multiple loan packages can be designed depending on what costs are to be covered.

**Basic package** – This package would primarily cover upfront costs incurred to set up the out-grower’s farm. Costs covered include purchase of seedling, fertilizer, small tools and firefighting equipment.

**All tools package** – Out-growers also continue to incur costs for firefighting equipment beyond the first year. These are costs related to maintenance of their equipment as well as periodic costs related to buying new firefighting equipment every year. An all-tools package could cover everything in the basic package plus firefighting equipment costs for subsequent years.

**Full-package** – Even with the all-tools package, out-growers will experience negative cashflows as a result of having to pay for hired labor. A full-package could cover the costs related to labor in all years plus the costs incurred in year 1 related to groundnuts.

The next slide described two models in which financing could be achieved.

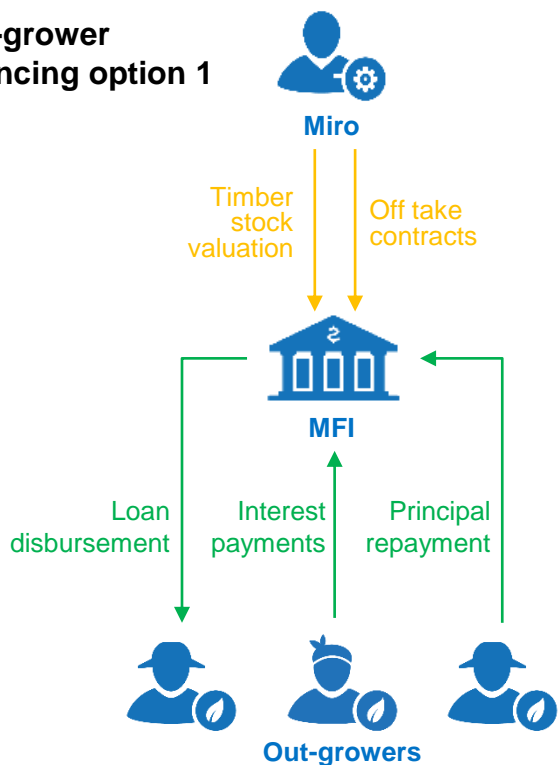


# Detailed overview of Financing – design options

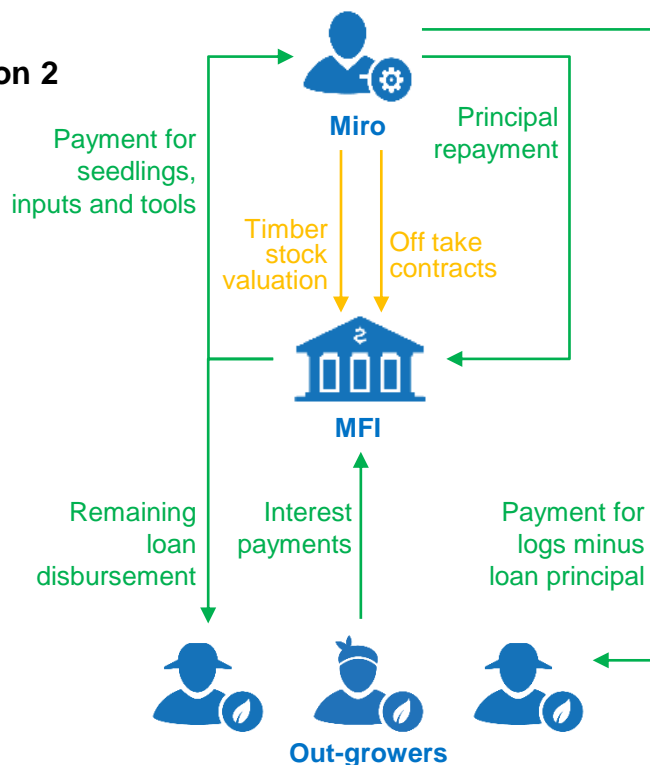
**Legend**

- ← Flow of goods and services
- Financial / payment flows
- Information

**Out-grower financing option 1**



**Out-grower financing option 2**



**Description:** Miro facilitates financing by partnering with a local micro-finance institution (MFI) or bank. Miro provide information such as valuation of timber stock and off take contracts it has with out-growers to the MFI in order to facilitate loan approval. The loans are disbursed directly into the accounts of out-growers who use it to cover all costs through the growing cycle. Out-growers are responsible for directly making annual interest payments as well as paying back the principal after harvest.

**Description:** As in the case of option 1, Miro facilitates financing from an MFI or bank. Payment for seedlings, inputs and tools go directly from the MFI to Miro, who then provides these to the out-growers. If the loan covers other costs (such as labor), this loan amount is disbursed into the out-grower’s account. Annual interest payments are made directly from the out-grower to the MFI. After the harvest, Miro pays back the loan principal to the MFI. The principal amount is then deducted from the payment made to out-growers for the timber.

*Note: This slide shows options that could be considered when designing a financing service. These do not currently exist and haven't been taken in to account in the SDM model in this report.*

# Farm-level impact

This chapter presents the analysis at farmer level.

In this section you will:

- ✓ Understand the P&L of the farmers in the SDM according to their segment
- ✓ Understand how relevant factors (e.g. market price, quality, input adoption, yield) impact the farmer business case

Overview of SDM stakeholders & objectives

Services, scale and organization of the SDM

**Farm-level impact**

Financial analysis overall SDM

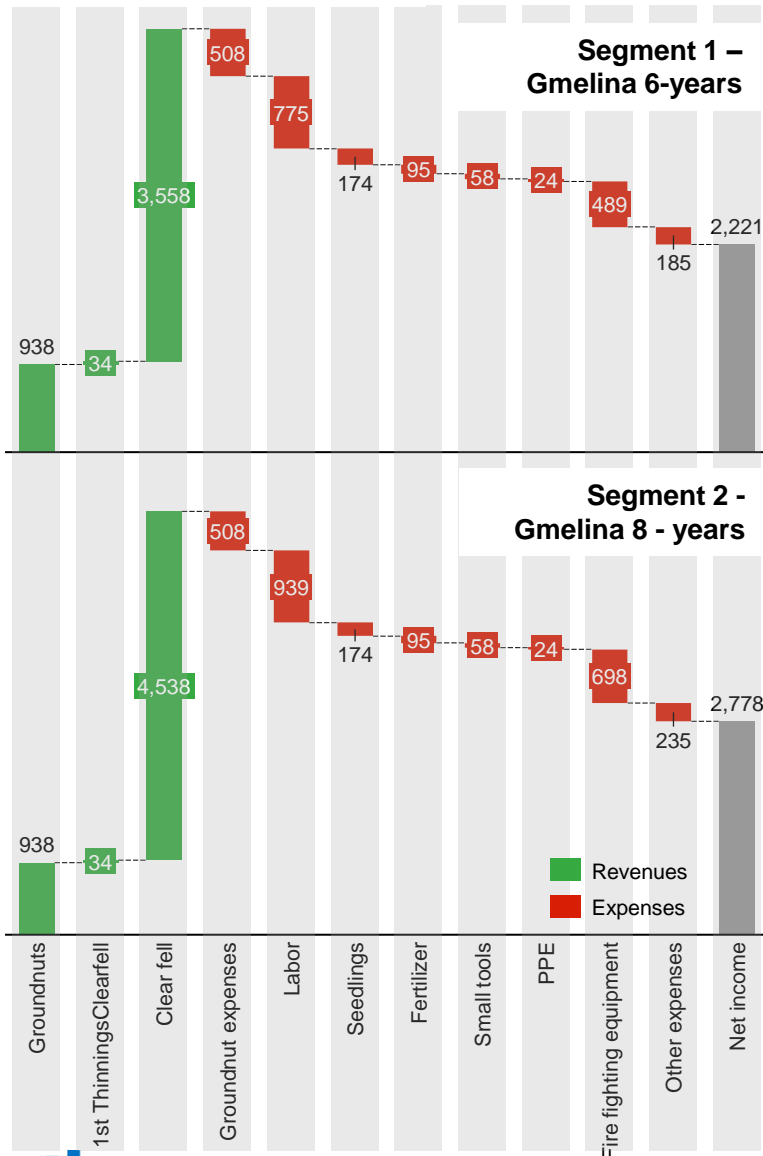
Conclusions

Annex



# Out-grower P&Ls without financing: overall impact

Out grower P&L (USD)



## Discussion

The graphs show the revenue and cost components that contribute to the out-grower's net income from one rotation of growing Gmelina. These graphs assume that the out-grower does not receive any pre-financing and hence has no interest related costs.

## Baseline

Given that the out-grower scheme is new and that there are no smallholder farmers in the region that currently grow Gmelina commercially, no baseline farmer has been considered.

## Segment 1 – Gmelina 6-years

A segment 1 out-grower harvests his or her Gmelina trees at 6 years. This provides revenues of USD 3,558 at harvest. The segment 1 out-grower also has revenues from groundnuts in year 1 and from 1<sup>st</sup> thinnings (sold as charcoal) in year 2. Total revenues over the 6-year period for a segment 1 out-grower is USD 4,530.

Main costs for segment 1 out-grower are hired labor followed by costs related to groundnuts (mainly seeds and fertilizers) and fire-fighting equipment purchase and maintenance. Net costs over the 6-year period are USD 2,308.

A segment 1 out-grower earns a net income of USD 2,221 over 6 years or USD 370 per year.

## Segment 2 – Gmelina 8-years

A segment 2 out-grower harvests his or her trees at 8 years. provides higher total timber volumes and revenues of USD 4,538. The segment 2 out-grower earns the same additional income from groundnuts and 1<sup>st</sup> thinnings as a segment 1 out-grower. Total revenues for a segment 2 out-grower over the 8-year period is USD 5,509.

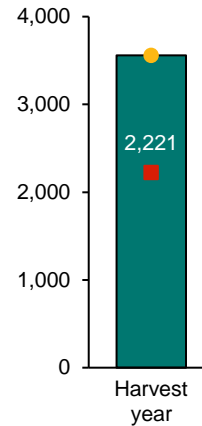
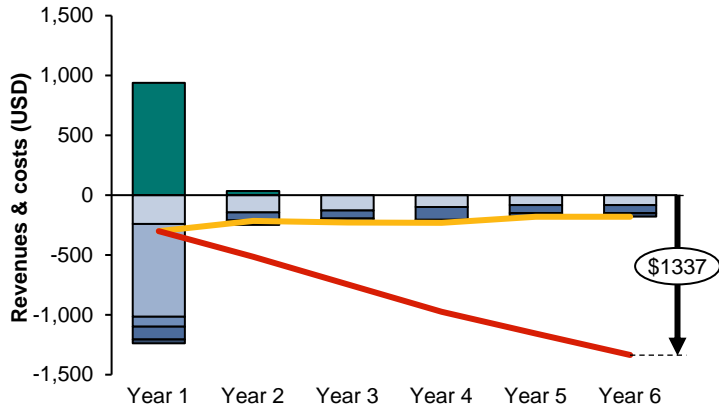
The biggest cost for a segment 2 out-grower is also hired labor at USD 939 for the 8-year period. The next biggest cost is fire fighting equipment at USD 698. Both these costs are higher for segment 2 out-growers since for each of the additional 2 years over segment 1 out-growers, labor need to be hired, fire beaters need to be bought and fire knapsacks require maintenance.

A segment 2 out-grower earns a net income of USD 2,778 over 8 years. This amounts to USD 347 per year which is lower than the per-year income for a Gmelina 6-year out-grower.

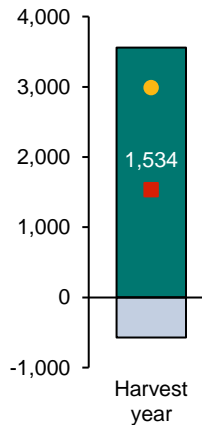
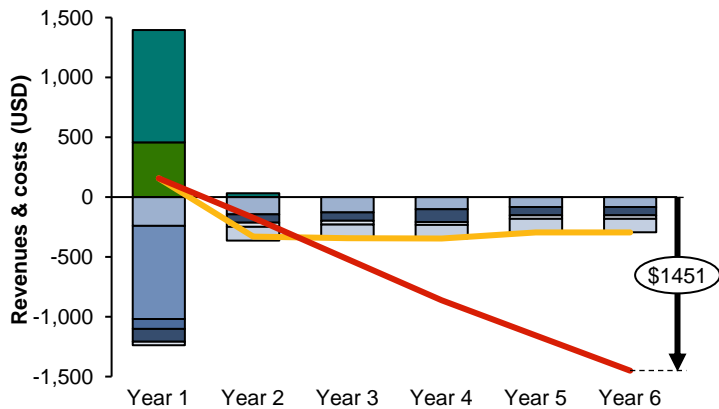
Note: Future cashflows have not been discounted

# Segment 1 (Gmelina 6-year) out-grower: cashflow

Segment 1 cashflow – without financing



Segment 1 cashflow – with financing



- Revenues
- Loan disbursement
- Labor
- Planting material & inputs
- Tools and PPE
- Fire fighting equipment
- Other expenses
- Loan repayment
- Annual cashflow
- Cumulative cashflow

## Discussion

When no financing is provided, the out-growers experience negative cashflows from the first year because the upfront costs in year 1 outweigh the revenues received from groundnuts. The net *negative* cashflow for the first year is USD 300 and the *negative* cashflow for each subsequent year ranges from USD 180 to USD 230. As a result, by year 6 segment 1 out-growers have incurred a cumulative net negative cashflow of USD 1,337. At the end of the 6-year cycle when the trees are harvested, out-growers receive revenues of USD 3,557 bringing their net cashflows over the period to a positive USD 2,221.

High first year costs could potentially be offset by loans from a bank or a micro-finance institution. However, this does not improve their overall cashflow situation over the 6-year period. Out-growers receiving a loan of USD 458 to cover cost of timber seedlings, fertilizers, small tools (in year 1) and PPE experience an even higher negative cumulative cashflow of USD 1,451 by year 6. The reason for this is an additional yearly cost of USD 114 from year 2 onwards towards paying interest (assumed 25%) on the loan. The interest payments also reduce net income that out-growers receive down to USD 1,534 over the whole period or USD 256 per year.

Increasing the loan principal to cover additional costs further increases interest payments and results in lower net income. For example, a loan of USD 1,336 will cover all costs (except interest payments) and will result in no negative cashflow in any year. However, the net income from the 6-year period will reduce to USD 216 or USD 36 per year.

A similar pattern is observed for the cashflows of a segment 2 out-grower. However, there are two more additional years of interest payments which further reduces net income of a segment 2 out-grower.

[Go to assumptions](#)



# Affordability: impact of interest rates and hired labor on out-grower income

Net income (USD/farm) at varying loan interest rates and percentage of hired labor on the farm

## Segment 1 - Gmelina 6-years

Loan interest rates

	0%	5%	10%	15%	20%	25%	30%	35%
0%	2,996.14	2,858.83	2,721.53	2,584.23	2,446.93	2,309.63	2,172.33	2,035.02
10%	2,885.40	2,748.09	2,610.79	2,473.49	2,336.19	2,198.89	2,061.59	1,924.28
20%	2,774.65	2,637.35	2,500.05	2,362.75	2,225.45	2,088.15	1,950.85	1,813.54
30%	2,663.91	2,526.61	2,389.31	2,252.01	2,114.71	1,977.41	1,840.11	1,702.80
40%	2,553.17	2,415.87	2,278.57	2,141.27	2,003.97	1,866.67	1,729.37	1,592.06
50%	2,442.43	2,305.13	2,167.83	2,030.53	1,893.23	1,755.93	1,618.62	1,481.32
60%	2,331.69	2,194.39	2,057.09	1,919.79	1,782.49	1,645.19	1,507.88	1,370.58
70%	2,220.95	2,083.65	1,946.35	1,809.05	1,671.75	1,534.45	1,397.14	1,259.84
80%	2,110.21	1,972.91	1,835.61	1,698.31	1,561.01	1,423.71	1,286.40	1,149.10
90%	1,999.47	1,862.17	1,724.87	1,587.57	1,450.27	1,312.97	1,175.66	1,038.36
100%	1,888.73	1,751.43	1,614.13	1,476.83	1,339.53	1,202.23	1,064.92	927.62

## Segment 2 - Gmelina 8-years

Loan interest rates

	0%	5%	10%	15%	20%	25%	30%	35%
0%	3,717.31	3,534.24	3,351.18	3,168.11	2,985.04	2,801.97	2,618.90	2,435.83
10%	3,583.20	3,400.13	3,217.06	3,033.99	2,850.92	2,667.85	2,484.78	2,301.72
20%	3,449.08	3,266.01	3,082.94	2,899.87	2,716.80	2,533.74	2,350.67	2,167.60
30%	3,314.96	3,131.89	2,948.83	2,765.76	2,582.69	2,399.62	2,216.55	2,033.48
40%	3,180.85	2,997.78	2,814.71	2,631.64	2,448.57	2,265.50	2,082.43	1,899.37
50%	3,046.73	2,863.66	2,680.59	2,497.52	2,314.45	2,131.39	1,948.32	1,765.25
60%	2,912.61	2,729.54	2,546.48	2,363.41	2,180.34	1,997.27	1,814.20	1,631.13
70%	2,778.50	2,595.43	2,412.36	2,229.29	2,046.22	1,863.15	1,680.08	1,497.01
80%	2,644.38	2,461.31	2,278.24	2,095.17	1,912.10	1,729.04	1,545.97	1,362.90
90%	2,510.26	2,327.19	2,144.13	1,961.06	1,777.99	1,594.92	1,411.85	1,228.78
100%	2,376.15	2,193.08	2,010.01	1,826.94	1,643.87	1,460.80	1,277.73	1,094.66

Indicates values currently assumed for other analysis in this report

### Discussion

All out-growers suitable for this SDM also have other farms to tend to and as a result will need to hire some external labor to manage their timber farm. It is currently estimated that they will hire 70% of the labor needed, with the remaining 30% coming from family labor.

All out-growers will also need loans (or pre-financing in some form) in order pay for upfront costs. For the purposes of this analysis, it is assumed that farmers receive a loan (or pre-financing) of USD 457, which will cover the costs of seedlings, fertilizer, small tools and the first year of fire fighting equipment.

### Out-grower impact

The interest rates have significant impact on the farmer. For example, keeping % hired labor constant at 70%, varying the interest rate from 0% to 35% reduces the farmers net income by USD 941 – a drop of 42%. If the amount of loan taken by farmers increases (to cover other upfront costs) then the impact of the interest rates on net income is also higher.

% hired labor also impacts farmer income, but to a slightly lesser extent. Keeping interest rates fixed at 25%, varying the % hired labor from 0% to 100% reduced farmer income by USD 1,107 – a drop of 48%.

### Changing the variables

A strong market actor would need to play a key role to facilitate and possibly guarantee loans (such as in financing option 2 earlier in this report) to lower interest rates. Bringing in impact investors (such as the FMO or IDH Farmfit fund) to provide capital or share the risk can also help reduce interest rates.

Out-growers could also reduce labor costs through labor sharing agreements with their neighbors. This arrangement is common in Ghana and Miro or the local communities could play a role in facilitating this.



# Improving income: impact of higher farm-gate prices and bigger farms on out-grower income

Net income (USD/farm) at varying farm sizes and farm-gate prices

## Segment 1 - Gmelina 6-years

		Total farm size (ha) →					
		1	2	4	6	8	10
Farm-gate prices (cedis / m <sup>3</sup> ) ↑	30	-667.85	-518.81	-145.53	193.11	571.75	887.42
	50	-452.47	-88.05	694.46	1,485.40	2,294.80	3,041.24
	70	-237.09	342.72	1,534.45	2,777.69	4,017.85	5,195.06
	90	-21.70	773.48	2,374.43	4,069.98	5,740.91	7,348.87
	110	193.68	1,204.24	3,214.42	5,362.27	7,463.96	9,502.69
	130	409.06	1,635.01	4,054.41	6,654.56	9,187.01	11,656.51
	150	624.44	2,065.77	4,894.40	7,946.85	10,910.06	13,810.32

## Segment 2 - Gmelina 8-years

		Total farm size (ha) →					
		1	2	4	6	8	10
Farm-gate prices (cedis / m <sup>3</sup> ) ↑	30	-964.29	-802.83	-387.93	-18.07	401.53	745.57
	50	-675.69	-225.63	737.61	1,713.53	2,710.33	3,631.57
	70	-387.09	351.57	1,863.15	3,445.13	5,019.13	6,517.57
	90	-98.49	928.77	2,988.69	5,176.73	7,327.93	9,403.57
	110	190.11	1,505.97	4,114.23	6,908.33	9,636.73	12,289.57
	130	478.71	2,083.17	5,239.77	8,639.93	11,945.53	15,175.57
	150	767.31	2,660.37	6,365.31	10,371.53	14,254.33	18,061.57

Indicates values currently assumed for other analysis in this report

### Discussion

All out-growers use a part of their farmland for timber and the remaining for other crops. It is currently assumed that the average total farm size is 4 ha and 50% of that – or 2 ha is used for timber. A change in total farm size, therefore, leads to a change in income from timber.

Out-growers are paid market-rate farm-gate prices, corrected for other factors such as the cost of harvesting and premiums, if any. A change in farm-gate price directly impacts out-grower income.

### Out-grower impact

Changing the total farm size has a non-linear impact on net income. For example, a 100% increase in total farm size from 4 ha to 8 ha increased net income by 160%. The reason for this is that some of the costs (such as small tools) do not increase linearly and better efficiencies of scale are realized.

Similarly, increasing the farm-gate price from 70 to 90 cedis / m<sup>3</sup> (a 29% increase) results in a 54% increase in net income.

### Changing the variables

If farmers can obtain better prices through premiums for class 4 logs or for FSC certified logs, or by optimizing costs of harvest, this can have a dis-proportionately larger impact on out-grower income.

While the average farm-size of potential out-growers was around 4 ha many of them had bigger land or plots in other regions which could be used for timber. If they find timber attractive enough, there are several out-growers who could expand their farms and benefit from larger economies of scale.

# Financial analysis overall SDM

This chapter presents the findings of the financial analysis of the whole SDM.

In this section you will:

- ✓ Understand the financial performance of the SDM
- ✓ Get an insight of the different sources and founders of the SDM
- ✓ Find an overview of the financing KPIs

Overview of SDM stakeholders & objectives

Services, scale and organization of the SDM

Farm-level impact










**Financial analysis overall SDM**

Conclusions

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# SDM costs and cost recovery from farmers

	Program overheads	HQ overheads Ghana overheads	Microforest system
	Farmer training	Fire Protection Env awareness	Financial literacy Demo plot
	Planting service	Planting material	Survival checks
	Input provision	Fertilizer Warehouse	Small tools
	Monitoring & QC	GAP FSC check	Survival count
	Farmer onboarding	Engagement Env assessment	Mapping
	FSC certification	Training	Third party audit
	Firefighting	Rapid response	
	Harvesting	Clearfell check	Clearfell harvest

## Discussion

One way to design the SDM is to charge for some services, and not others. A common way is to recover only the direct costs related to provision of seedlings, fertilizers and small tools. These costs are assumed to be recovered through payments from the out-grower (or from an MFI providing loans to the out-grower) soon after they are incurred.

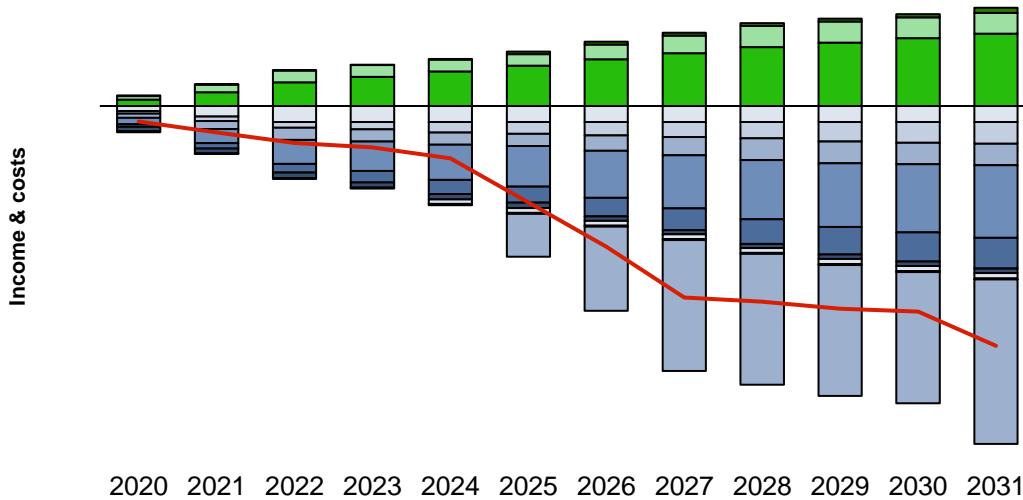
The remaining costs cannot easily be carried by the outgrowers. Ideally one or more value chain actors co-invest to carry to costs of services. In order for this SDM to be commercially viable, these costs need to be recovered through profits made from sales of veneer produced from logs sourced from SDM out-growers.

Recovered cost

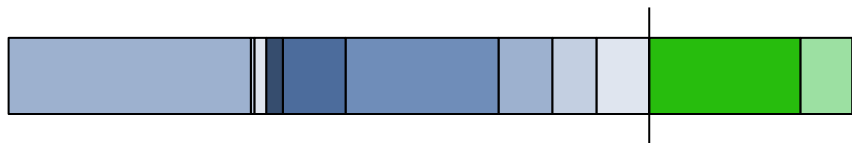
Costs not recovered

# SDM P&L: Costs and cost recovery

**P&L for operating the SDM**  
Excludes commercial profits from veneer



**Cumulative service costs and income from 2020 to 2031** - Excludes commercial profits from veneer



- Program overhead
- Monitoring & QC
- Firefighting
- Planting material
- Farmer training
- Farmer onboarding
- Harvesting
- Inputs & tools
- Input provision
- Certification
- Demo plot
- Net income

## Discussion

The SDM requires a significant investment in delivering services to the with only a small portion of these costs being directly recovered from farmers. The SDM is loss making with a negative net income every year starting from year 1.

## SDM costs

The SDM costs are proportional to the active out-growers in the SDM. Harvesting is by far the most expensive service followed by input provision, monitoring & QC and planting service. The costs increase sharply in 2025 along with an associated decrease in net income. This is mainly due to out-growers planting in 2020 having trees ready for harvest by then. Harvesting costs kick in at this point resulting in the sharp increase in costs. Harvesting is then required in every subsequent year as there will be some out-growers whose trees are ready for clearfell harvest.

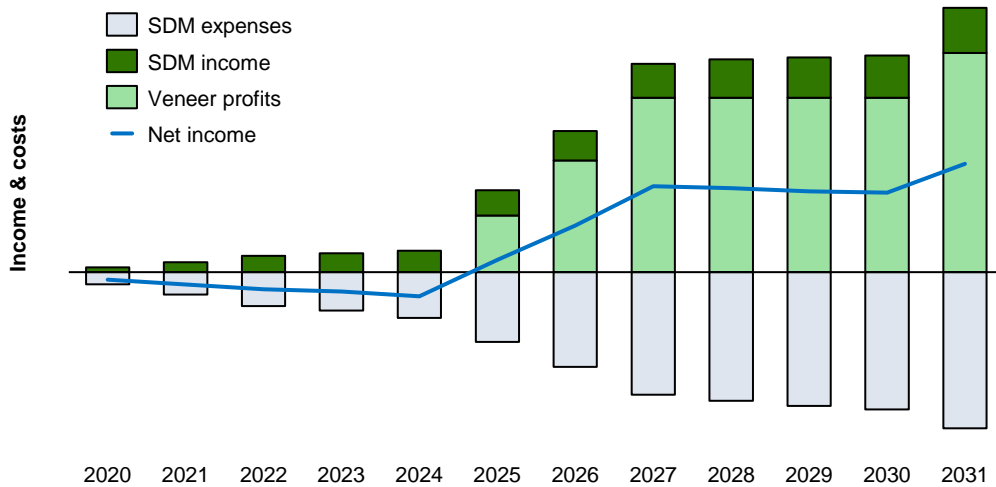
## SDM Income

There are three potential sources of income within this SDM. The biggest is the recovery of costs related to provision of inputs and small tools. The second source of income is recovery of costs associated with the provision of seedlings. This again covers only a part of the total costs incurred for the planting service as there are other cost components (such as survival checks) which are not recovered.

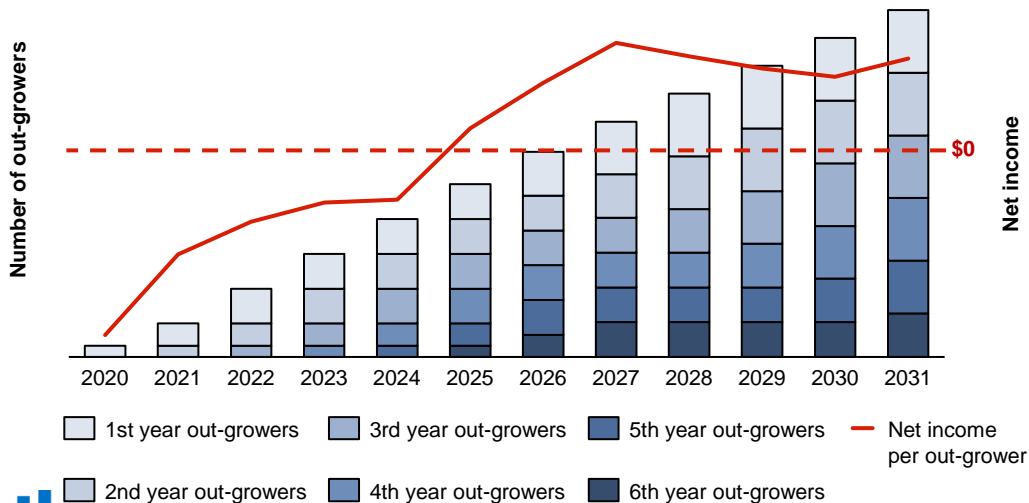
By setting up a new demo plot every year another revenue stream is added. The income is relatively small from 2020 to 2024 as it is mostly from first thinnings. From 2025 onwards one plot that is ready for clearfelling harvest will provide bigger income.

# SDM P&L: Net income from out-growers

SDM P&L including veneer income



Number of out-grower by year and net income per out-grower



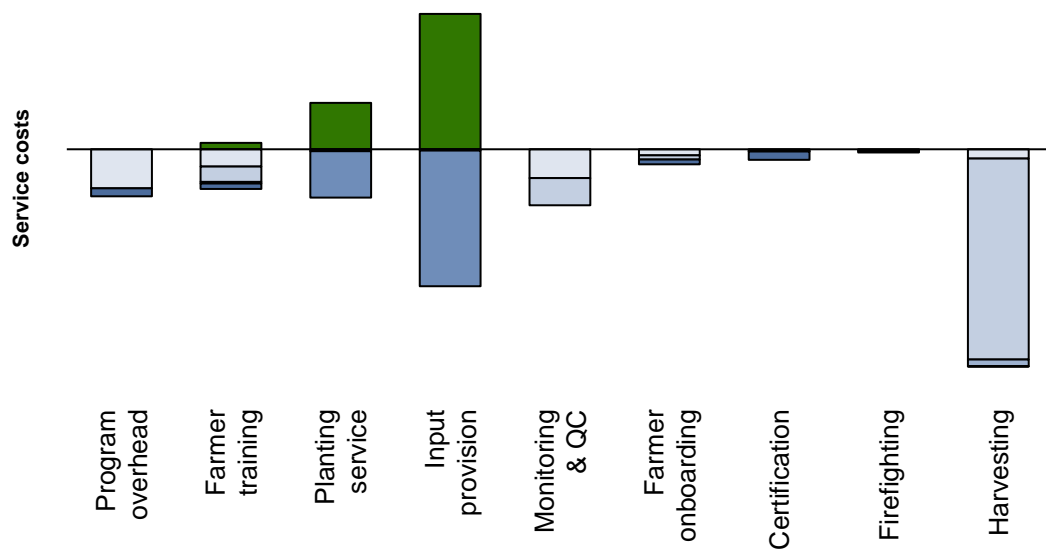
## Discussion

While harvest and many other cost components are not directly recovered from the out-growers, some of these costs are built into the farm-gate price. If we consider the profit accrued from the sales of veneer produced using logs from the out-growers the SDM shows positive net income from 2025 onward. The net income follows a positive trajectory between 2025 and 2027 which is due to increasing number of new out-growers in the scheme in earlier years who are now ready for harvest. Net income plateaus in 2027 once the number of new out-grower stabilizes. We see the net income rising again in 2031. While the number of new out-growers has remained stable, this increase is due to some out-growers who joined the SDM in 2020 (and harvesting in 2025) planting a second rotation, which is then harvested in 2031.

The graph below shows the number of active out-growers in the SDM, broken down by the year of the rotation in which they are. It also shows the net income to Miro per out-grower. This starts off as a big cost per out-grower in 2020 because at that point there are few out-growers in the SDM to distribute the fixed costs across. As the number of out-growers increases the costs get distributed across a bigger base resulting in lower per out-grower costs. From 2025 net income per out-grower is positive as a result of profits from veneer production and sales. It reaches a peak per out-grower in 2027 and remains relatively stable from that point on. It is to be noted that only net income from harvest of trees planted up to 2026 is considered here. The net income is projected to be positive and growing as we go beyond 2031 since the number of logs available for veneer production continues to grow.

# SDM P&L: Cumulative service costs and revenues

Cumulative costs and revenues per service between 2020 and 2031



Cumulative service costs between 2020 and 2031 by category



Staff
  Equipment
  Others
  Logistics
  Materials
  Revenues

## Discussion

The cumulative cost of harvesting for out-growers between 2020 and 2031 (which actually accounts only for trees planted between 2020 and 2026) is by far the biggest cost and the logistics for transporting the logs accounts for over 90% of this cost.

While services such as planting service and input provision incur high costs most of these costs are recovered from the out-growers.

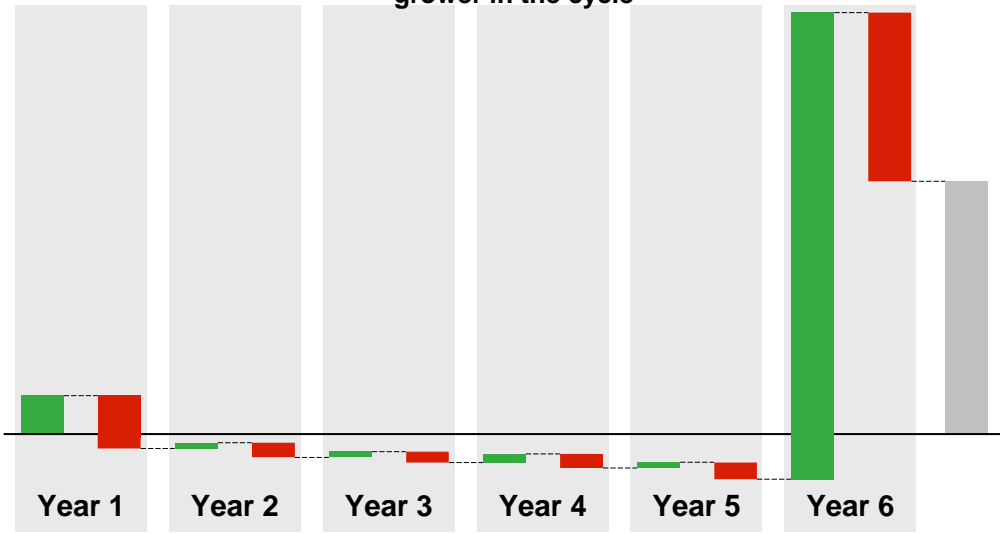
If we breakdown cumulative costs by category, logistics accounts for the single biggest bucket over the period. The biggest component of this category is the transport of harvested logs. Logistics costs also includes the costs related to staff travel to deliver the SDM services.

Material costs is the second biggest category, which accounts for costs such as provision of seedlings, fertilizers, small tools, training materials, etc. However, a large portion of these costs are recovered from the out-growers.

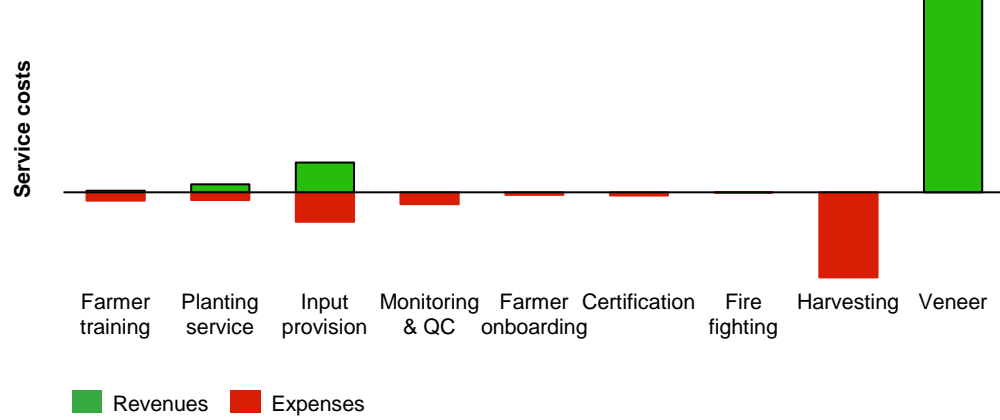
Staff costs is the third largest cost category between 2020 and 2031. The main components of this are salaries of program staff who are directly involved in delivering services to the out-growers.

# SDM P&L: Marginal service costs and revenues per out-grower

Costs and revenues per out-grower by year of out-grower in the cycle



Costs and revenues per out-grower by service over a full rotation (from 2026 onwards)



**Discussion**

Average annual costs impacted by a few different factors including

- The total number of active out-growers in any given year across which to distribute fixed costs
- The distribution of the active out-growers across the year of the cycle rotation they are in

The marginal costs, revenues and income on this slide shows the economics of an individual out-grower added to the scheme. An out-grower joining from 2025 onwards is considered as this is the point at which scheme reaches critical mass and the distribution of fixed costs to an individual out-grower remains relatively stable.

The marginal net income per out-grower over the 6-year period is USD 3,082 or USD 514 per year.

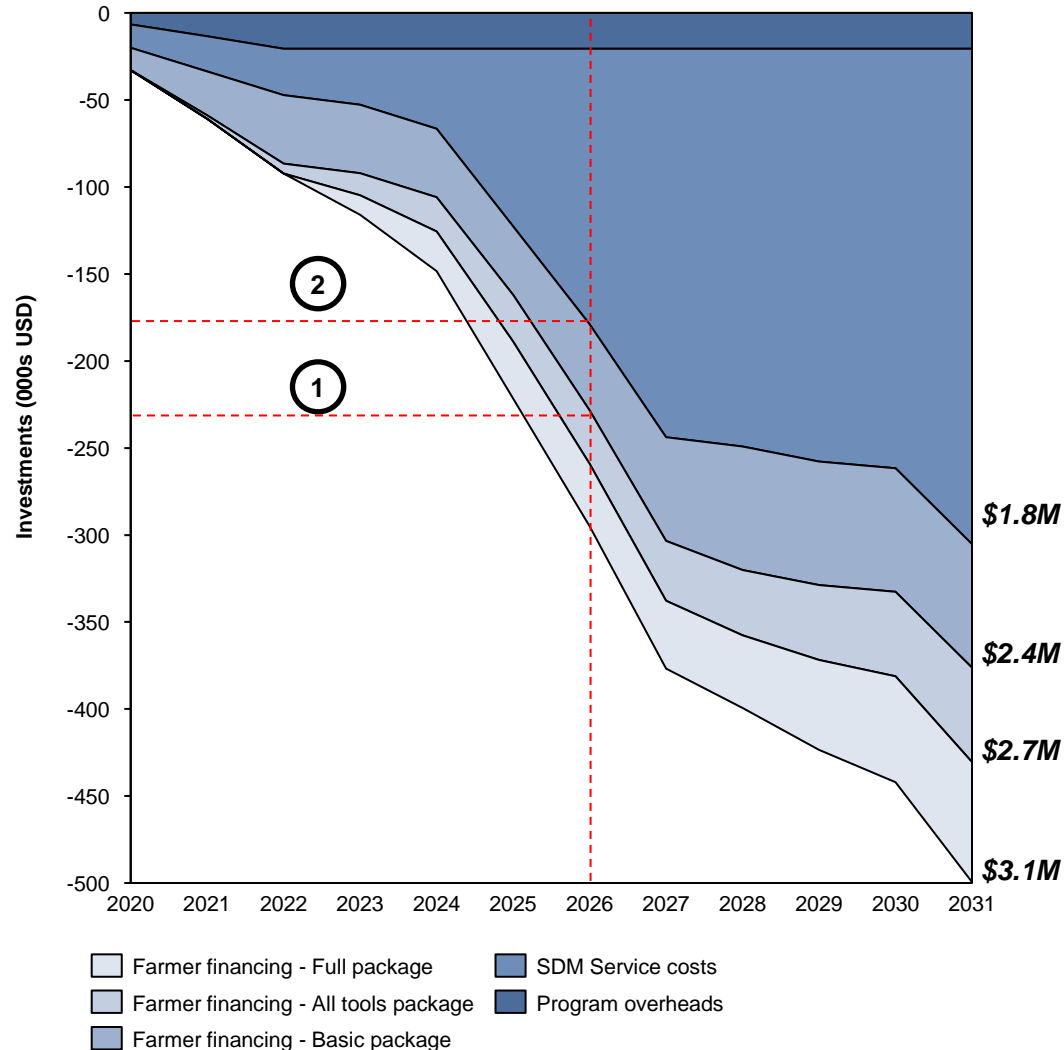
As can be seen from the top graph, costs and revenues are associated with out-growers in every year of the 6-year cycle. The biggest costs are associated with harvesting which takes place in year 6. The subsequent highest net costs of the SDM are monitoring & QC and training.

While services such as input provision and planting service incur high costs, most of these costs are recovered from farmers resulting in a low net cost per out-grower.

The SDM promises to be a commercially viable outgrower model. Above costs could be offset by revenues made from the processing and sales of veneer produced from the timber of a single 6-year Gmelina out-grower.

# Financing the out-grower scheme

Total investment needs including different farmer financing packages



## Discussion

Over the period from 2020 to 2031, under the current setup, a total investment of USD 1.8M is required to implement the SDM. However, out-growers make additional investments for seedlings, inputs, tools and labor. The total investment including the out-growers over the same period is USD 3.1M

The graph on this slide shows the total investments needed depending on the level (or package) of financial assistance provided to out-growers. It also shows the investments that would be needed till 2026, at which point the first farms are harvested and start providing veneer revenues.

- ① If out-growers are provided with the full financing package then an investment of USD 1.7M is needed before revenues can be generated from the out-grower scheme
- ② If out-growers are provided with the basic financing package then an investment of USD 1.5M is needed before revenues can be generated from the out-grower scheme

A strong value chain player could explore working with impact investors to raise funds for the out-grower scheme that includes enough capital to provide financing to out-growers. This could potentially help reduce the interest rates at which they receive credit.



# Conclusions

This chapter presents the findings and conclusions of the overall analysis, reflecting on the objectives described at the beginning of the analysis.

In this section you will:

- ✓ Get insights into additional learning questions on gender and environmental impact of the SDM
- ✓ Get insights of the overall SDM performance in relation to the initial objectives
- ✓ Find the key drivers for success identified and the lessons learned

Overview of SDM stakeholders & objectives

Services, scale and organization of the SDM

Farm-level impact

Financial analysis overall SDM

**Conclusions**

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# Conclusions: key drivers for success and key risks



## Key drivers of success

- **Ensure adequate training, monitoring and support for out-growers.** Most farmers in the region grow annual crops and hence growing timber is new to them. They need to be provided with training, monitoring and support services in order to ensure high quality output.
- **Financial literacy and good management is essential.** Given the pay-back period and the need for long-term loans with annual interest obligations, out-growers need to be given training and skills to manage their finances well.
- **Good tree stock and survival rates.** Out-growers do not have access to good quality seedlings, fertilizers and the right tools in the local market. These need to be provided to ensure good quality tree stock and high survival rates.
- **Access to affordable financing.** The prevailing interest rates (over 25%) for farm loans in Ghana makes the scheme unaffordable and unattractive. MFI's / banks have to step in to provide access loans at significantly lower rates.
- **Guaranteed off-take.** Out-growers do not have established local markets to sell timber at good enough prices. Guaranteed off-take contracts are essential for out-growers to invest and to access loans.



## Key risks

- **Early harvesting of trees.** Out-growers could be tempted to harvest their trees before the recommended 6- or 8-year period, especially given that they experience negative cashflows all through the growing cycle. Early harvest will result in sub-optimal yields and selling the trees to local traders who offer sub-optimal prices. This significantly reduces their income and results in losses for Miro.
- **Opportunity cost of timber.** Planting timber makes that land unavailable for other crops for 6 years. Out-growers may not think that a net income of USD 2,221 sufficiently covers this opportunity cost.
- **Availability and cost of hired labor.** Most out-growers hire labor (assumed to be 70%). Given the growth cycle, many out-growers are likely to need labor around the same time which could push up labor rates and impact out-grower costs and income.
- **Groundnuts offtake.** Out-growers incur significant costs in year one for groundnut seeds and fertilizers. Revenues are unpredictable since they sell the groundnuts on local markets where prices are volatile.
- **Out-grower farm locations.** Most potential out-growers have multiple plots of land. For timber, they intend to use plots that are currently not planted with other crops. These can be further away from their homes or in areas with limited infrastructure which makes them unsuitable for planting timber.



# Lessons learned during the study exercise



## Opportunities for improvement

- **Improve farm-gate prices through FSC premiums.** A 1% increase in farm-gate prices results in a 1.8% increase in out-grower income. Hence, if farmers can obtain a market premium for FSC certified this can have a significant impact on their net income.
- **Facilitate finance and guarantee loans.** One of the biggest challenge (and opportunity) in the out-grower scheme is access to affordable long-term finance. A strong value chain player could play a more active role in improving the credit risk of out-growers by helping them with land titles, providing buying commitments and underwriting or guaranteeing loans. Aggregating loans and dealing with MFIs / banks at a portfolio level can further optimize interest rates.
- **Design optimal loan products.** Designing a loan product that aligns with the out-grower's cost patterns can reduce both the loan principal and duration. This will help farmers with their cashflow needs while reducing the net interest burden.
- **Partner across sectors.** Other implementing partners that are active and work with farmers in the region should step in to develop the outgrower scheme. One potential option are cocoa traders who are very active in Ashanti. Many of them have set ambitious zero-carbon and re-forestation goals which could align well with this out-grower scheme.



## Key factors in replication of the model

- **Cost sharing with plantation.** Many of the services, such as seedling and input provision, harvesting and fire fighting can be delivered more efficiently when there is a larger plantation nearby. This needs to be closely evaluated if replicating the scheme in other countries / regions.
- **Land ownership, titles and regulatory environment.** Timber is suitable only for farmers who own their land and have clear land titles as the growing period is long. Even within the Ashanti region, only a few communities meet this requirement. If expanding to other communities, regions or countries, this needs to be taken into consideration.
- **Diversified income sources.** Timber has a long pay-back period with negative cashflows for at least 6 years. Out-growers will need to other sources of income in order to be able to sustain their livelihoods during this period and is a key consideration in replicating the model.



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# Annex

This chapter presents additional information that were used to carry out the analysis.

In this section you will:

- ✓ Get a general introduction to Service Delivery Models
- ✓ Get insights on other analysis (e.g. environmental lens, gender lens)
- ✓ List of KPIs used
- ✓ Glossary

Overview of SDM stakeholders & objectives

Services, scale and organization of the SDM

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# Annex I: SDM General Introduction & context

This section of the annex is standard for all cases and provides an introduction to the topic and the approach of this study.

In this section you will:

- ✓ Understand what SDM means
- ✓ Get a snapshot of the stakeholders and forces that shape an SDM
- ✓ Get an overview of our approach



# Service Delivery Models (SDMs)

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.

**Service providers** offer the services; they can be a trader, processor, farmer organization, NGO, public extension scheme, etc.

**Investors** tend to be (final) buyers of the product, looking to secure their supply and / or for reputational reasons are interested to invest in the farmer.



Processors, traders and other value chain players in agri-commodities are beginning to see service delivery as part of their business, rather than something the buyer requested or only as a way to create farmer loyalty.

This results in value chain players establishing a relationship with the farmer as a client, being interested to gain a better understanding of the structure of their existing SDMs, what services are being delivered, to which farmers, and the impact on their business.

Companies are also gaining a clearer understanding of how to fund such services and are exploring ways to make their model less dependent on external funding, i.e. commercially viable.

## Service delivery models and the stakeholders that shape them are evolving



Processors, traders and other value chain partners - see service delivery as part of their core business



Financial institutions, development banks and social investors – show an increased risk-taking appetite



Donors - focus on how to create the largest leverage and return on investment



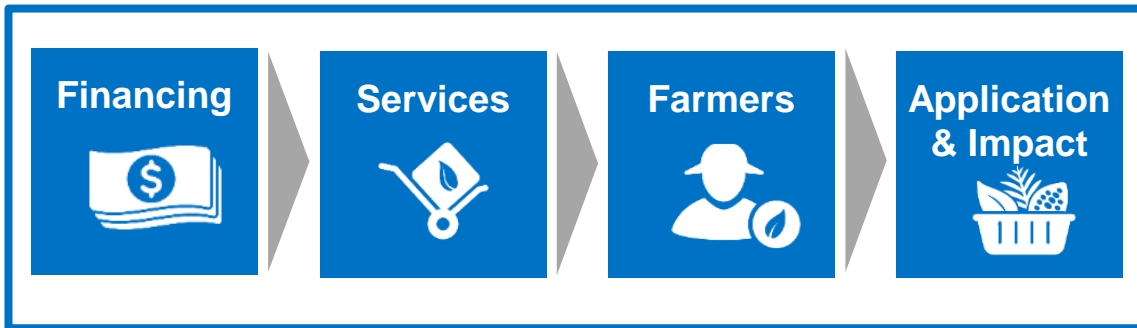
Innovative businesses emerge that develop solutions for optimizing service supply

# Levels of SDM Analysis



## SDM Structure

The analysis looks at the SDM from a holistic perspective, identifying the way the model is structured



Within this structure (financial) resources are invested

Those resources allow for a set of services to be delivered

These services are targeted at a (type of) farmer

The aim of these services is an impact at farm level



This impact translates into financial benefits so the structure (over time) becomes financially sustainable

This analysis in this case study is organized in the following way:

1. What is the **structure** of the SDM
2. What are the **services** provided
3. What is the impact of those services at **farm** level
4. What is the business case for the individual **entities** delivering the services
5. What is the **financial** impact of the SDM as a whole
6. What **conclusions** can we draw from our analysis



# Purpose of the SDM Analysis

An outcome of SDM analyses to date was the identification of those issues which the SDM operators found of critical importance, and where they encountered limited knowledge to be available. Examples are:

## Focus learning questions

- How to improve adoption and loyalty rates
- How to use farmer profiles to tailor make service packages
- How to drive down costs (for farmers and service operators)
- How to finance a SDM (types of finance, types of farmers) and timelines
- How to create a positive enabling environment for a service delivery model

IDH will stimulate dialogue with key partners on these topics, by targeting these questions in a broader range of SDMs and by facilitating webinars and knowledge sharing events.

## IDH aims to create:

### Action driven analysis

- Analyzing a broader range of SDMs with partners that are keen to improve their SDM
- Establishment of an Innovation Program & Fund to co-design and co-fund innovative solutions within SDMs
- Develop insights packaged for financial institutions, which facilitate partnerships with service providers

### A learning community

- Deeper analyses on key levers for optimizing performance of SDMs; e.g. farmer segmentation and adoption
- Convening key partners on pre-competitive topics in SDMs through learning events, webinars and knowledge sharing
- Forming strategic partnerships with knowledge partners that share the interest in driving performance of SDMs



# With the SDM analysis, IDH envisions to identify and create actionable improvement opportunities

## Individual SDM analysis:



Analyze SDM



Identify key success drivers



Identify enabling environment challenges



Identify opportunities for innovation



Evaluate funding needs

## To facilitate further learning and improvement, IDH aims to establish:

### Global knowledge hub

- Deeper analyses on key levers for optimizing performance of SDMs; farmer segmentation and adoption
- Benchmarking data and best practice for designing and implementing smallholder business models
- Organize learning community

### Enabling environment

- Convening key partners (at sector and national level) on pre-competitive topics in SDMs
- Forming strategic partnerships with knowledge partners that share the interest in driving performance of SDMs

### Blended finance

- Establishment of an Innovation Program & Fund to co-design and co-fund innovative solutions within SDMs
- Develop insights packaged for financial institutions, which facilitate partnerships with service providers

### Technical assistance

- Innovating and improving smallholder business models of private sector players
- Using private sector lessons to inspire public sector players and vice versa

# Annex II: Context

This section of the annex is standard provides a description of the context of the SDM

In this section you will:

- ✓ Get a comprehensive overview of the SDM structure
- ✓ Get insights on the development of the commodity sector and characteristics of the farmers in the region under study
- ✓ Get insights on the role of farmer organizations
- ✓ Understand the enabling environment in the region
- ✓ Get insights on the status of gender equity
- ✓ Get insights on the status of environmental resilience of farmers



# Context – farmers in the SDM region



## The Farm

- The average farm size in Ghana is 1.6ha, with 95% of farms less than 10ha, while 77% of farms in Ashanti are below 1.2ha. However, farmers interviewed in the area had between 0.8-238 hectares, with the average at around 3.9ha. This means that the farmers interested in growing trees tend to have larger land than the average farmer in the region.
- Interested farmers were willing to commit on average 50% of their total land to timber, so roughly 2ha/farmer.
- Farmers typically grew plantains and maize around Drobonso and maize, rice and yams around Jamestown/Dagomba. In addition, some farmers grew watermelon, beans, cassava, and cashews, but these were limited. Only one farmer grew groundnuts and one farmer grew teak trees.



## Farming dynamics

- While cooperatives previously existed in both communities, they are now basically defunct and no farmers interviewed were members of a cooperative. While they were open to the idea, they were not very enthusiastic about it.
- The two communities interviewed had very different land ownership set-ups. Drobonso, all farmers either owned the land themselves or their family owned the land, while in Jamestown/Dagomba, everyone rented land except for the chief.
- Those that rent land said that they would need permission from the land owner to grow timber, as they pay rent based on about 20% of annual produce on the land. They were generally very pessimistic about the ability to get approval from the land owner and worried that this would replace their food crops.



## Income

- A number of the farmers in the area had some of their land fallow, due largely to the financial requirements of maintaining the land.
- All of the farmers hired labor to support them with their current crops and would need to hire labor to support with any tree planting as well.
- Farmers are used to getting pre-financing for inputs and paying back at the end of the season, which is what they do for land rental as well. They expressed willingness to enter into such arrangements with Miro.
- Farmers have seen on a few occasions people coming to their farms to pay for trees, but it was not common

Sources: FAO website, CIA factbook, GSMA report, Africa Fertilizer, AGRA report, World Bank

# Opportunities and challenges in the enabling environment

**Impact of environment on SDM**  
 L (Limiting) = The environment hinders the implementation of the SDM  
 N (Neutral) = The environment does not influence the implementation of the SDM  
 E (Enabling) = The environment facilitates the implementation of the SDM

	Definition	Opportunities and challenges	Impact	Measures taken by SDM operator
Governance	<b>LAND OWNERSHIP</b>	Land is passed by patrilineage and rarely formalized, so most farmers are male and do not have documents to prove ownership. Some have to rent, making long-term crops difficult	L	<ul style="list-style-type: none"> <li>- Work with communities that own their land</li> <li>- Collaborate with local chief to confirm land usage for timber</li> </ul>
	<b>INFRASTRUCTURE</b>	Ghana has 70% electrification rates, but rural areas rely on biomass, resulting in deforestation. About 40% of the roads are paved, so many farms do not have road access, making it costly to get to	N	<ul style="list-style-type: none"> <li>- Select farm locations near the road</li> <li>- Farmers will provide own security to stop cutting for biomass</li> </ul>
Farm Inputs	<b>LABOR</b>	Most farmers have only 4 years of education, so need additional training. Labor costs are relatively low, but depending on the # of days can add up	N	<ul style="list-style-type: none"> <li>- Adapt trainings to the education levels</li> <li>- Adapt training to education level</li> </ul>
	<b>INPUTS &amp; FINANCING</b>	Government provides subsidies to fertilizer and seeds, but still a large cost for farmers. Financing costs are very high, up to 35%, and agriculture is not well financed, making it difficult to access formal loans	L	<ul style="list-style-type: none"> <li>- Purchase inputs in bulk</li> <li>- Provide upfront financing through clearfell deduction</li> </ul>
Crop	<b>TRADING SYSTEM</b>	There are a limited number of timber actors, meaning that there is limited market for farmers to sell their trees.	E	<ul style="list-style-type: none"> <li>- Provide harvesting services and ready market for out-growers</li> </ul>
	<b>PRICING &amp; COMPETITIVENESS</b>	Ghana's land and climate makes its timber competitive, as it has a fast growing cycle and limited threats. Timber products have high demand domestically, making it a clear market.	E	<ul style="list-style-type: none"> <li>- Pay farmers based on market rates</li> </ul>
Sustainability	<b>ENVIRONMENTAL RISKS</b>	Ghana has high rainfall, resulting in higher growth rates. Fires are a big risk for the timber, especially during dry season, requiring increased fire protection	N	<ul style="list-style-type: none"> <li>- Provide training on fire protection</li> <li>- Provide firefighting services</li> <li>- Allow for faster, 6 year cycles</li> </ul>
	<b>SOCIAL CONTEXT</b>	Females are less likely to own land due to the patrilineal nature of land ownership.	L	<ul style="list-style-type: none"> <li>- Actively identify female-headed households</li> </ul>

Sources: Doing Business 2018;




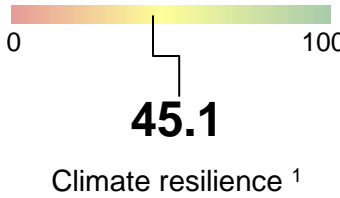



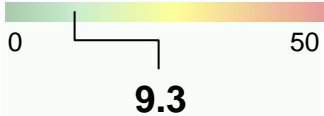
# The status of gender equity in Ghana and the SDM

Enabling environment	<p>Despite women in Ghana having almost equal access to education and general financial inclusion, they have less of a role in decision making and general access to land and financial services.</p>	<p>Primary education enrollment * 1 <b>0.96</b></p> <p>Women using a bank account or mobile money service* 2 <b>0.87</b></p> <p>% of married women who participate in decision-making ** 3 <b>35%</b></p>	<p>Legend</p> <p>Gender ratio (Female / Male)*</p>
		Ghana	SDM
Comparison of Miro to the national context	<p>Miro has significantly fewer female employees than the average in Ghana. Part of the reason may be that jobs at Miro require either a high level of training or are physically demanding. However, it was noted that women were being actively considered for jobs that were suitable.</p> <p>It is notable that none of the department heads in Ghana are women, though the head of the nursery as well as the head of environmental compliance are both women.</p> <p>As previously stated, landowners tend to be men and thus finding female landowners for the out-grower program, may prove to be difficult.</p>	<p>How does Miro's ratio of female to male employees compare with the country labor force participation? * 4 <b>0.95</b></p> <p>How does Miro's proportion of female to male headed households compare with the country-wide farmer distribution? *4 <b>0.31</b></p> <p>How do the incomes earned by Miro's employees compare with the incomes earned by women and men in the country? * 5 <b>0.69</b></p>	<p><b>0.20</b></p> <p><b>n/a</b></p> <p><b>n/a</b></p>

\*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. \*\*Own health care, major household purchases, and visits to family or relatives  
 Sources: 1) World Economic Forum (2016): Global Gender Gap report; 2) World Bank (2017): Global Index; 3) USAID (2016): Demographic and Health Survey; 4) World Bank data 2018; 5) UNDP 2018



# Environmental resilience of farmers in the SDM

	Indicator	Discussion	SDM Risks & opportunities
 <p><b>Climate resilience</b></p>	 <p>45.1 Climate resilience <sup>1</sup></p>	<p>Ghana is assessed to be lower middle in climate resilience, at 107 out of 181 countries and has remained consistent. While they have high vulnerability to climate change (47%), there is limited awareness of the risk and low ability to leverage innovation to convert them to adaptation actions (37%).</p>	<ul style="list-style-type: none"> <li>• Reforestation can help Ghana address its climate resilience, which is core to the SDM</li> <li>• SDM trainings provide environmental awareness training, helping the population learn about important adaptations that they can use beyond timber</li> </ul>
 <p><b>Soil</b></p>	<p><b>Moderate/high water erosion <sup>2</sup></b></p>	<p>The Ashanti region has moderate/high water-induced erosion, reducing the productive capacity of the soil.</p>	<ul style="list-style-type: none"> <li>• Miro's Rapid Environmental Assessments help to limit the impact of out growers on degrading riverbeds and other risk areas</li> <li>• Trees help to limit soil erosion, thus out growers will help the region reduce erosion</li> </ul>
 <p><b>Water</b></p>	<p><b>High risk <sup>3</sup></b></p>	<p>While most of Ghana has medium-high water risk, the Agogo area has high risk. There is a high risk of flood occurrence and access to water exist.</p>	<ul style="list-style-type: none"> <li>• The high level of rain results in faster growing seasons for trees, getting Miro and out growers to harvest faster</li> </ul>
 <p><b>Agro-ecosystem</b></p>	 <p>9.3 Human footprint <sup>4</sup></p>	<p>Ghana has a low to medium human footprint on the environment.</p>	<ul style="list-style-type: none"> <li>• Increased biodiversity through agroforestry is expected to lead to a reduced human footprint.</li> <li>• Following FSC regulations, high risk areas will be restored and protected</li> </ul>

1: ND-GAIN Country Index; summarizes a country's vulnerability and readiness to adapt to the negative impact of climate change  
 2: GLASOD; shows the severity of soil degradation in 4 categories: water, wind, physical and chemical deterioration  
 3: Aqueduct Water Risk; identifies areas with water-related risks, based on 12 subcategories such as drought severity, seasonal variability and ground water stress  
 4: WCS Human Footprint; measures the cumulative impact of direct pressures on nature from human activities. Scores 0-50, but national averages rarely exceed 25



# Annex III: Data

This section of the annex provides a description of KPIs used and data sources

In this section you will:

- ✓ Get an overview of data sources used to carry out the analysis
- ✓ Get an overview of key assumptions for farmer analytics





# Key assumptions for services



## Farmer onboarding

Number of communities engaged each year	2 for the first 6 years, from year 7 onward 1 per year
Number and cost of radio announcements per community	2, 500 Ghana cedi for 2 day announcement
Number of meetings per community	8
Duration of engagement	0.5 days
Costs of engagement	500 Ghana cedi
Farm mapping	2 enumerators, 0.5 days per farm
Percentage of farms mapped suitable for timber	60%
Rapid environmental assessment	Environmental compliance officer + Assistant, Year 1, 0.25 days per farm
Continuous farmer groups engagement	0.5 days per month per community

# Key assumptions for services

## Training



Days of training per farmer annually

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
Marking / pitting	1(GT)							
Planting / fertilizer / groundnuts	1(GT)							
Fire protection	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)
Fire protection	0.25(IT)	0.25(IT)	0.25(IT)	0.25(IT)	0.25(IT)	0.25(IT)	0.25(IT)	0.25(IT)
Pruning	1(GT)	1(GT)	1(GT)	1(GT)				
Thinning		1(GT)						
Environmental awareness	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)
Financial literacy	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)	1(GT)
<b>Total</b>	<b>6.25</b>	<b>5.25</b>	<b>4.25</b>	<b>4.25</b>	<b>4.25</b>	<b>3.25</b>	<b>3.25</b>	<b>3.25</b>

Farmers per training Miro group trainings: max. 10, Financial literacy group training: max. 40

Method of payment for training (free of charge, upfront by farmer, on credit) free

Training to be certified (yes/no) no

Method of training (individual, groups, lead farmers) Individual training (IT) and Group training (GT)

Location of training Individual training – on farm  
GAP group training – on demo plot  
Other group trainings – at community



# Key assumptions for services



## Seedlings (Nurseries)

Cost per seedling	0.34 Ghana cedi
Number of nurseries	1
Number of survival checks	2 (30 and 60 days)
Nursery production capacity	Sufficient for SDM Included in cost per seedling
Nursery management	
Method of seedlings delivery	Truck



## Inputs

Total cost of fertilizer (per ha) incurred by service provider	350 Ghana cedi
Percentage paid by farmer for fertilizer (per ha)	100%
Total cost of small tools incurred by service provider (over 6 year period)	3,091 Ghana cedi
Percentage paid by farmer for small tools	100%
Method of payment for inputs by farmers (free of charge, upfront by farmer, on credit)	Free of Charge
Method of transport	Pick-up by farmer

## Finance



Average annual amount of credit farmers receive	Dependent on cycle year (see slide 33)
Average time in months until a loan is repaid	Dependent on cycle year (see slide 33)
Percentage of total loans (sum of in cash and on credit loans) that are not being repaid	n/a
Interest rate charged	To farmer: 25%
Cost of SDM operator of providing financing services	Financing scenario 2: 5% on redeemable expenses



# Key assumptions for services

## Quality control



Days of quality control per farmer annually

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
Marking / pitting	0.25 (EX)							
Planting / fertilizer / groundnuts	0.25 (EX)							
Planting / fertilizer / groundnuts (20% of new farms)	0.25 (JF)							
Corrective pruning	0.25 (JF)							
Fire protection / pruning / 1 <sup>st</sup> thinning	0.5 (JF)	0.5 (JF)	0.5 (JF)	0.5 (JF)	0.5 (JF)	0.5 (JF)	0.5 (JF)	0.5 (JF)
1 <sup>st</sup> year survival count	0.25 (EN)							
1 <sup>st</sup> thinning		3 (M&TT)						
1 <sup>st</sup> thinning		0.25 (ET)						
<b>Total</b>	<b>1.75</b>	<b>3.75</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>

Type of controller    Extension worker (EX),  
Junior forester (JF),  
Marking and Thinning's team (M&TT) (hired),  
Enumerator team (ET) (4 enumerators per team)

Method of payment for quality control (free  
of charge, upfront by farmer, on credit)    free



# Key assumptions for services



## Harvest

Preparation for clearfell	Clearfell check (year 5, Enumerator team, 0.25 days per famer)\ Group harvest permit application (office staff, 4 days per year)																		
Number of farms harvested per day	2																		
Harvesting team	<table border="1"> <thead> <tr> <th>Type of Miro staff</th> <th>#</th> </tr> </thead> <tbody> <tr> <td>Chain saw operator in forest</td> <td>6</td> </tr> <tr> <td>Chain saw operator at road side</td> <td>12</td> </tr> <tr> <td>Supervisor</td> <td>1</td> </tr> <tr> <td>Machine operator</td> <td>1</td> </tr> <tr> <td>Tally clerk</td> <td>2</td> </tr> <tr> <td>Log scaler</td> <td>2</td> </tr> <tr> <td>Chocker</td> <td>3.5</td> </tr> <tr> <td><b>Total</b></td> <td><b>27.5</b></td> </tr> </tbody> </table>	Type of Miro staff	#	Chain saw operator in forest	6	Chain saw operator at road side	12	Supervisor	1	Machine operator	1	Tally clerk	2	Log scaler	2	Chocker	3.5	<b>Total</b>	<b>27.5</b>
Type of Miro staff	#																		
Chain saw operator in forest	6																		
Chain saw operator at road side	12																		
Supervisor	1																		
Machine operator	1																		
Tally clerk	2																		
Log scaler	2																		
Chocker	3.5																		
<b>Total</b>	<b>27.5</b>																		
Method of payment for harvesting	Harvesting cost subtracted from farm gate price for clearfell																		
Harvesting machinery	Chainsaws, bell loader																		
Method of Transportation	Hired transport (team and truck)																		
Cost of transportation	42.48 Ghana cedi per m3 per 50 km																		



# Service KPIs

## FSC certification



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FSC training	0.5 days in Year 5, by Extension worker, individually on farm
Costs of 3 <sup>rd</sup> party audit, annually	5000 USD
Timing of FSC certification	Year 5

## Fire fighting



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Number of people in fire fighting team	4
Number of month per years on stand-by	4
Equipment	1 bakkie sakkie (1 time purchase in year 1) 4 knap sacks (maintenance 2 time a year, replacement after 3 years) 4 fire beaters (replaced each year)



# Key assumptions for farmer analytics

	Gmelina 6	Gmelina 8
Starting farm size (ha)	3.9	
Timber farm size (ha)	1.46	
Tree density (trees/ha)	1,207	
Groundnut seasons	1	1
Thinning year	2	2
Cleafell year	6	8
Timber - first thinnings (m3/ha)	1.0	1.0
Timber - clearfell biomass (m3/ha)	18.3	17.7
Timber- clearfell class 1-3 (m3/ha)	144.0	172.6
Timber- clearfell class 4 (m3/ha)	11.23	35.40
Groundnut production (bags/acre)	25	
Groundnut discount rate	80%	80%
Man-days (day/cycle)	249	302
Hired labor	70%	70%

Sources: Expert interviews and extrapolations based on measurements from Miro's plantations



# Annex IV: Glossary

This section of the annex includes an overview of the standard glossary terms used in the SDM analysis







# Standard glossary (2/2)

Acronym	Meaning
<b>Learning Questions</b>	Those questions that drive the analysis of the SDM; the key things IDH or the case partner wants to know out of this specific case
<b>Loyalty</b>	The percentage of total farm production volume sold by the farmer to the buyer in the SDM
<b>NGO</b>	Non-governmental organization
<b>P&amp;L Analysis</b>	A profit and loss statement summarizing the main revenues, costs and costs incurred during a specific period of time during SDM operations
<b>Remote data collection</b>	The iterative process of collecting readily available SDM data from the SDM Operators, both before and after the field trip
<b>ROI</b>	Return on Investment
<b>SDM Database</b>	Collection of aggregated data from all case studies, with the aim to identify broader lessons long-term trends
<b>SDM Snapshot</b>	Overview of SDM objectives, Theory of Change, entities and services
<b>Segment (Farmer-)</b>	A group of farmers that is a sub-set of the total population within an SDM, sharing certain characteristics
<b>Sensitivity Analysis</b>	Analysis to determine how different values of an independent variable impact a particular dependent variable under a given set of assumptions
<b>Service Delivery Model (SDM)</b>	Supply chain structure which provides services such as training, access to inputs and information to farmers in order to increase their performance and sustainability
<b>Service Provider (SP)</b>	Organization that delivers one or more services (e.g. training, inputs, access to finance) to the farmer
<b>Services</b>	List of services to be delivered to farmers in order to attain SDM objectives (e.g. Certification, crop diversification, training)
<b>Theory of Change</b>	Overview of the process of change of the SDM towards achieving the desired outcomes
<b>Tool</b>	An Excel-based tool used to model an SDM's economic sustainability (P&Ls) for the farmer, service provider, and investor.



