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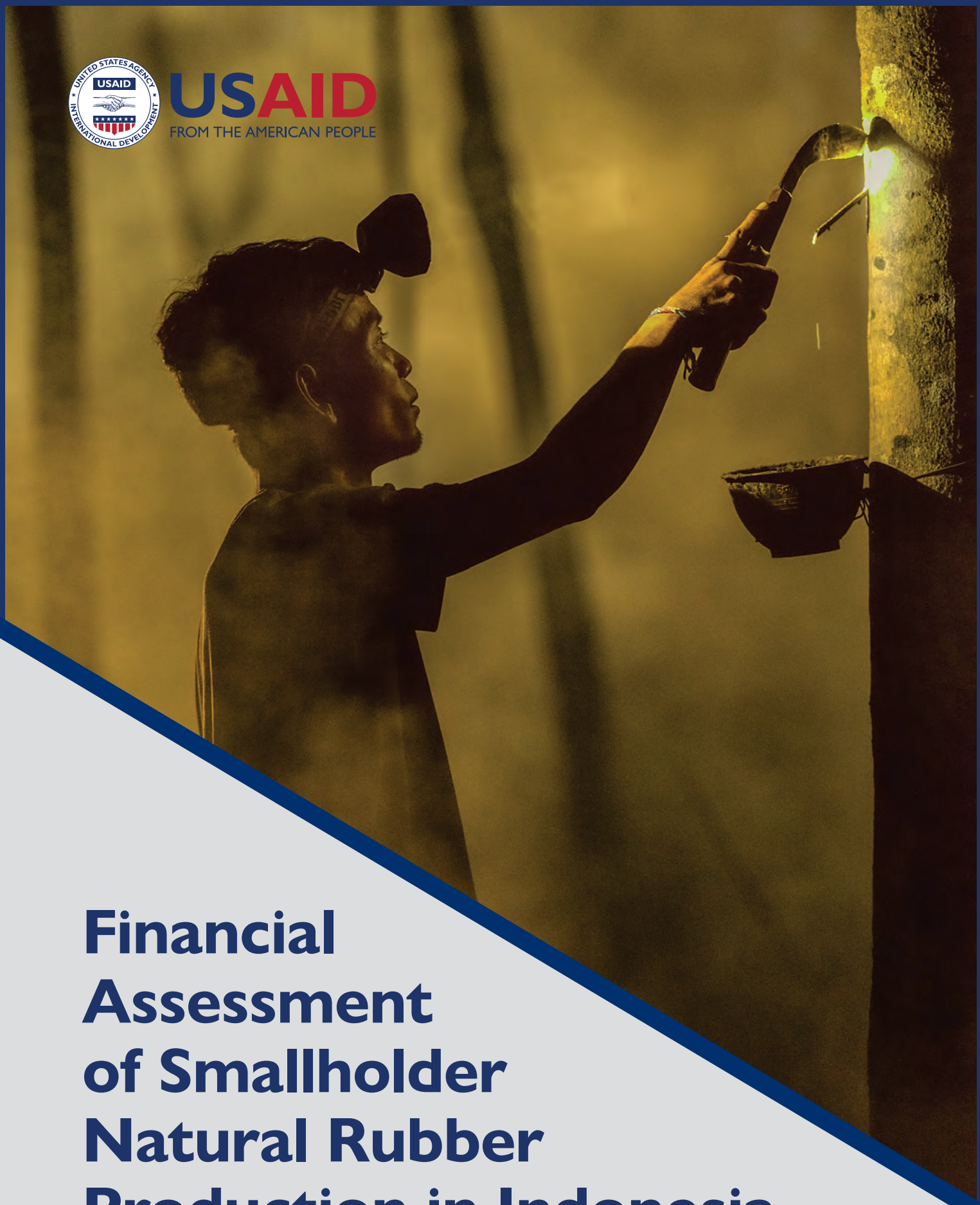

Financial Assessment of Smallholder Natural Rubber Production in Indonesia

July 2020

USAID GREEN INVEST ASIA

FINANCIAL ASSESSMENT OF SMALLHOLDER NATURAL RUBBER PRODUCTION IN INDONESIA

June 2020

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Photo Credit: Cover photo by Bugphai, Man tapping rubber tree at night.

zasabe/Freepik: Rubber tree (hevea brasiliensis) produces latex. by using knife cut at the outer

ABOUT THIS REPORT

This report was written by Mekong Strategic Partners (www.mekongstrategic.com), as part of the USAID Green Invest Asia team, with HeveaConnect, Financial Access and the Netherlands Development Organization, SNV

USAID GREEN INVEST ASIA

USAID Green Invest Asia is a sustainable investment platform in Southeast Asia mobilizing $400 million to invest in the region's sustainable, low-carbon agriculture, and forestry companies. The platform links investors and financial institutions with a pipeline of investments, and de-risks lending through improving clients' environmental risk management. USAID Green Invest Asia works with lenders to support the growth of their green lending portfolios, while lowering their overall transaction costs. The head office is based in Bangkok, Thailand, with representatives working in the initial target countries, Cambodia, Indonesia, the Philippines, and Viet Nam.

HEVEA CONNECT

HeveaConnect is a digital trading and data platform for the natural rubber supply chain. We are at the forefront of using technology to transform rubber trading and tracing process. This digital transformation provides a simple and secure solution for trading while enabling deeper analysis of the supply chain to uncover environmental, social and financial risks. HeveaConnect plays a vital role in enabling sustainable developments in each segment of the supply chain by adapting and utilising technological advancements. We envision a future where consumers are empowered to make smarter decisions through insights on their supply chain.

HeveaPro is HeveaConnect's sustainable natural rubber standard to support rubber processing factories in meeting the recommended practices for quality, safety, social responsibility and security aspects of their operations.

SNV

SNV is a not-for-profit international development organisation that makes a lasting difference in the lives of people living in poverty by helping them raise incomes and access basic services in three sectors: WASH, Agriculture and Energy.

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Financial Access is a financial services firm, focused exclusively on frontier and emerging markets. Financial Access provides consulting, financial advisory and financing services to diverse clients including (impact) investors, PE firms, banks, specialised non-bank or microfinance institutions, international donor organisations and NGOs, development finance institutions and private companies.

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ACRONYMS

BPD.....Regional development banks
BPR.....Rural banks
EAA.....Equivalent Annuity Approach
EBITDA...Earnings Before Interest, Taxes, Depreciation, and Amortization
FOB.....Free on Board
FSP.....Financial service providers
FSC.....Forest Stewardship Council
GAP.....Good Agriculture Practice
GOLS.....Global Organic Latex Standard
GPSNR....Global Platform for Sustainable Natural Rubber
IRR.....Internal Rate of Return
IRRI.....Indonesia Rubber Research Institute
ISPO.....Indonesian Sustainable Palm Oil certification
ITRC.....International Tripartite Rubber Council
IRSG.....International Rubber Study Group
KUR.....Kredit Usaha Rakyat government credit facility
LTV.....Loan-to-value ratio
MFI.....Microfinance Institution
MoEF.....Ministry of Environment and Forestry, Indonesia
MSME.....Micro, small and medium-sized enterprises
SME.....Small and medium-sized enterprises
SOE.....State-owned enterprises
SNR-i.....Sustainable Natural Rubber Initiative
SNV.....SNV Netherlands Development Organization
TLFF.....Tropical Landscape Finance Facility
UPPB.....Processing and Marketing Units
$.....US Dollars

EXECUTIVE SUMMARY

Ninety percent of the world's natural rubber comes from Southeast Asia and provides an important income for millions of smallholders. In Indonesia, more than 80 percent of natural rubber raw material is sourced through smallholders cultivating less than 2 hectares (ha) of land. However, the conjunction of low yields and record low international prices is causing smallholders in Indonesia to cut down their rubber trees and convert to other land uses such as palm oil production, leading to some major negative consequences including clearing of jungle rubber and rubber smallholdings of valuable biodiversity, and a decrease in economic output diversity.

Smallholders rubber plantations represent a threat and an opportunity for carbon stock and biodiversity in Indonesia.

A threat because poor agriculture and forestry practices lead to overuse of pesticides and fertilizers, water and river pollution and deforestation; and an opportunity because smallholder rubber plots hold a much higher biodiversity and carbon stock than their most common alternative: palm oil monoculture. Smallholders' rubber plots and jungle rubber, as opposed to large, monoculture commercial estates, demonstrate higher animal diversity, especially for birds and bats. Regarding foraging and nesting sites, smallholder rubber agroforests ("jungle rubber") may be able to come closer to mimicking the diversity found in natural forest ecosystems. With a structure and biodiversity similar to that of a secondary forest, jungle rubber is considered a complex agroforestry system. Subsequently the carbon stock is estimated to be between 30 percent and 100 percent higher than rubber monoculture and 55 percent to 130 percent higher than oil palm monoculture.

Replanting high-quality rubber trees and improving planting and tapping practices have potential to increase yields and smallholders' incomes as well as maintain existing rubber plantations and jungle rubber plots. However, long-term financing for replanting is rarely available for Indonesian smallholders, leading to an aging tree population and declining rubber yield.

The main objective of this study is to gather and analyze financial data of smallholder rubber farms to assess whether it is possible to create a financial mechanism to provide smallholders loans to replant rubber trees and, if so, what the features of the financial product should be.

The study is based on desk review, government data, and field data collected in September-October 2019 from 250 smallholders, stakeholders and value chain actors in Jambi, South Sumatra, and West Kalimantan.

Based on findings, a proof-of concept proposal describing how to channel funding from local financial institutions to smallholders for rubber replanting loans was drafted to engage with diverse funding sources.

With approximately 2.25 million smallholders cultivating land for rubber throughout Indonesia, the commodity has become a key driver for income and job creation.

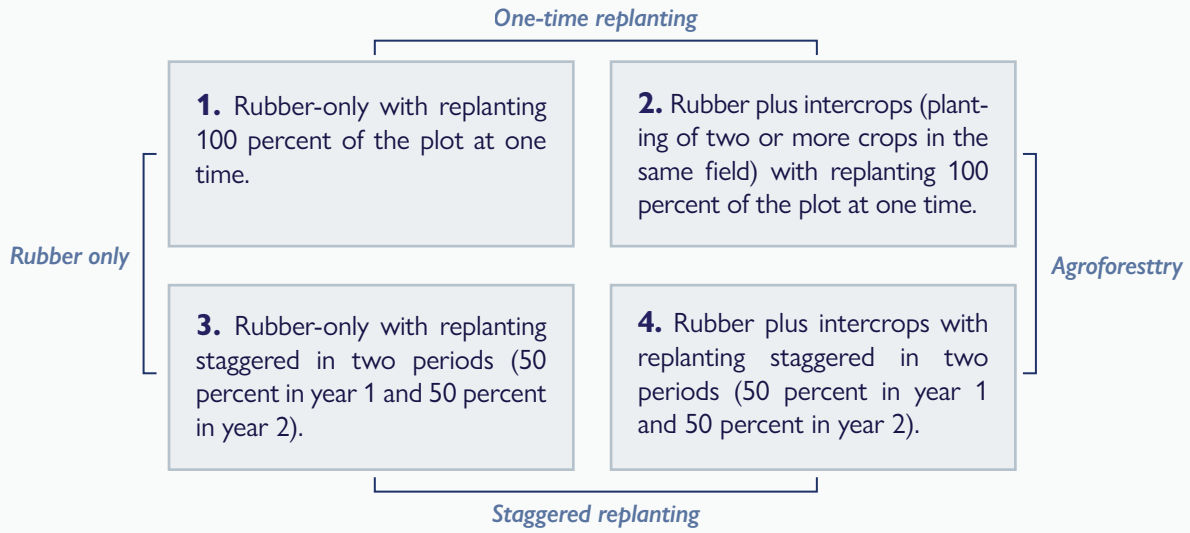
However, smallholders' yield for rubber in Indonesia is among the lowest in the region. This is due to low-quality clones, limited knowledge of Good Agriculture Practice (GAP) and optimal tapping practices, and aging trees (often older than 25 years old, the maximum economic lifespan for rubber trees).

The Government of Indonesia has defined short, medium and long-term national strategies for the development of the natural rubber sector. This study is aligned with the government long-term strategy to support plant rejuvenation.

The study developed an Excel-based model to analyze cash flows of replanting and intercropping models. Using industry and field survey data, the model projects smallholder monthly costs of replanting, maintenance and harvesting, as well as yields, while estimating rubber prices to calculate net incomes for farmers over a rubber tree's economic lifespan.

The models forecast the impact of different loan structures, amounts and terms to assess the economic viability of providing long-term replanting loans for rubber smallholders in Indonesia. The financial return to replanting is gauged by its internal rate of return (IRR[1]) calculated on an annual basis over 25 years.

The model uses a matrix of two production models with two variants each:



Financing analysis results

Replanting timing ONE TIME REPLANTING	Scenario 1	Scenario 2
	Monoculture 100%	Agroforestry 100%
2 hectares of rubber are replanted in year 1	Maximum cash shortfall in year 5 of $7,600.	Maximum cash shortfall in year 1 of $4,000.

Replanting timing STAGGERED	Scenario 3	Scenario 4
	Monoculture 50-50	Agroforestry 50-50
1 hectare of rubber is replanted in year 1 the other hectare is replanted in year 2.	Maximum cash shortfall in year 6 of $6,450	Maximum cash shortfall in year 3 of $3,370.
The 2nd hectare remains productive as a 20-year-old monoculture rubber plantation.		

Only scenarios 3 and 4, i.e. the agroforestry models, produced an IRR greater than 30 percent p.a. in a neutral context. **Only scenario 4 – Agroforestry model/ staggered replanting – is a viable option for a commercial rate loan with a total repayment of $7,855 over seven years.**

1. The IRR approach used in this study is adapted to fit an informal individual enterprise. It does not include financial costs of a possible loan and it does not deduct the equivalent of the smallholder salary. This IRR is therefore not directly comparable with the IRR of a stock on the stock exchange, for instance.

Currently, commercial financial institutions in Indonesia do not provide loans with these characteristics (long tenor, grace period, appropriate repayment schedule and interest rate below 15 percent p.a.) from their own funds. Moreover, the past five years, all banks decreased the size of their loan portfolios in rubber due to declining natural rubber prices. Banks do, however, channel funds from government-subsidized programs.

The Government of Indonesia has created three subsidized credit programs lending to the agriculture sector: (1) Kredit Usaha Rakyat (KUR) (People's Business Credit), (2) Partnership and community development program - Program Kemitraan dan Bina Lingkungan (BUMN) and (3) Revolving Fund Management Agency for MSME - Lembaga Pengelola Dana Bergulir Koperasi Usaha Mikro Kecil dan Menengah; and one program for the forestry sector.

The Special KUR for agriculture has most of the features required for a replanting loan, but uptake by smallholders has been limited to-date.

From a smallholder's perspective, the Special KUR, rather than commercial loans, will serve as a baseline for comparing the cost of the loan product (with an interest rate at 7 percent in 2019 and announced to be reduced at 6 percent p.a. in 2020). A commercial loan product would be more than twice as expensive and would need to target market subsegments that the KUR is not reaching and/or with faster and less bureaucratic delivery processes.

Demand for replanting is different for each region. Despite low rubber prices and low yield, only 7 percent of farmers grow other crops besides rubber. Up to 10 percent of farmers said they will switch to another crop in the future because of low rubber prices and 20 percent of farmers have replanted part of their plot in the last decade. Over half of these farmers (10 percent) replanted 20 percent less and virtually all farmers planted less than 60 percent of their land.

Demand for replanting is strongest in Jambi, where 40 percent of farmers are willing to undertake replanting. Replanting demand is lowest in West Kalimantan. Taking a conservative estimate that only half of Jambi farmers who expressed interest in replanting (40 percent expressed interest) would actually replant with an alternative loan product from KUR, the potential market for financing to replant would range from 100,000 to 125,000 ha and over $400 million.

The potential market for replanting finance is estimated at $500 million for Jambi and Sumatra.

In South Sumatra the situation is quite different. Even though this region has over twice the number of smallholders in Jambi, only 20 percent want to replant. Again, taking a conservative estimate, the market size would be equivalent to 13,000 smallholders or $100 million. In West Kalimantan the situation is less attractive, with just 1 percent of farmers willing to replant and none is interested in taking a loan to finance replanting.

The findings of the study led to a concept note to engage with investors about the creation of a facility combining a financing mechanism to channel blended finance to smallholders through local financial institutions with technical assistance to improve smallholders' yield and income.

A shortened version of this report can be accessed at *https://greeninvestasia.com/research/*.
For more information, please contact *info@greeninvestasia.com*.

INTRODUCTION

Ninety percent of the world's natural rubber comes from Southeast Asia and provides an important income for several million smallholders. In Indonesia, more than 80 percent of natural rubber raw material is sourced through smallholders cultivating less than 2 hectares (ha) of land with an average yield of approximately 1 ton per hectare per year. However, the conjunction of low yields and record low international prices is causing smallholders in Indonesia to cut down their rubber trees and convert to other land uses such as palm oil production. This is leading to major negative consequences including clearing of jungle rubber and rubber smallholdings of valuable biodiversity[2], and a major decrease in economic output and output diversity for Indonesia.

Replanting high-quality rubber trees and improving planting and tapping practices have potential to increase yields and smallholders' incomes, as well as maintain existing rubber plantations, jungle rubber plots. However long-term appropriate financing for replanting is rarely available for Indonesian smallholders, leading to an aging tree population and declining rubber yield.

Expected benefits

Enabling finance for rubber tree replanting and technical assistance for sustainable production by smallholders is expected to lead to positive impacts at several levels:

- Biodiversity and carbon stock conservation through maintaining jungle rubber and rubber smallholdings. Smallholders' rubber plots and jungle rubber , as opposed to large, monoculture commercial estates, demonstrate higher animal diversity, especially for birds and bats. Regarding foraging and nesting sites, smallholder rubber agroforests ("jungle rubber") may be able to come closer to mimicking the diversity found in natural forest ecosystems. Subsequently the carbon stock estimated to be between 30 percent and 100 percent higher than rubber monocultures.

- More international funding in blended finance instruments for sustainable rubber production by smallholders.

- Social benefits for smallholders through more diversified income.

- Better quality data and increased traceability of sustainable natural rubber.

- Support for international tire producers (approximately 70 percent of worldwide rubber consumption) to meet their commitments to source sustainable rubber with no deforestation, no child labor, and compliant with international environmental and social standards.

Jimbophoto/Freepik: Para rubber tree, latex rubber plantation and tree rubber

Challenges

- It is estimated that an average smallholder with 1.5 ha of rubber will earn 57 percent less than the Indonesian minimum wage (Halcyon, 2018).

- Indonesia's average rubber yield is 60 percent lower than Malaysia's and 37 percent lower than Viet Nam's. Low yield is due to low-quality seedlings, aging trees, and suboptimal collection practices.

- On average, although processors pay around 80 to 85 percent of Free on Board (FOB - shipment term used to indicate whether the seller or the buyer is liable for goods that are damaged or destroyed during shipping) for raw material, less than 50 percent of payment, often as little as 30 percent, goes to the actual producer (USAID, 2007).

- A complex and multi-layered value chain hampers traceability for sustainable natural rubber.

Objectives of the study

Despite the importance of rubber production and the key role of smallholders in producing rubber for Indonesia, there is limited data on rubber smallholders' farming models, revenues, profits, value chain structures, and other business information. Without this data, it is difficult to assess the business case for providing long-term financing for replanting new rubber trees.
The study objectives included:

(i) Quantify the need for finance in replanting rubber trees on smallholder plantations.
(ii) Identify obstacles hindering financing and assess financial viability of replanting (with and without inter cropping models).
(iii) Review the role of agents and intermediaries in the value chain.
(iv) Assess possible models for new financing mechanisms.

The study was conducted in 2019–2020 with a field survey in two provinces of Sumatra and one province of Kalimantan to interview smallholders, staff at processing factories, and other value chain actors.

Based on findings, a proof-of-concept financing proposal was drafted to structure and channel diverse funding sources (blending finance funds and donor funds, funds from commercial and domestic banks and that of international tire producers) through local financial institutions to smallholders for rubber replanting loans.

1. NATURAL RUBBER MARKET OVERVIEW

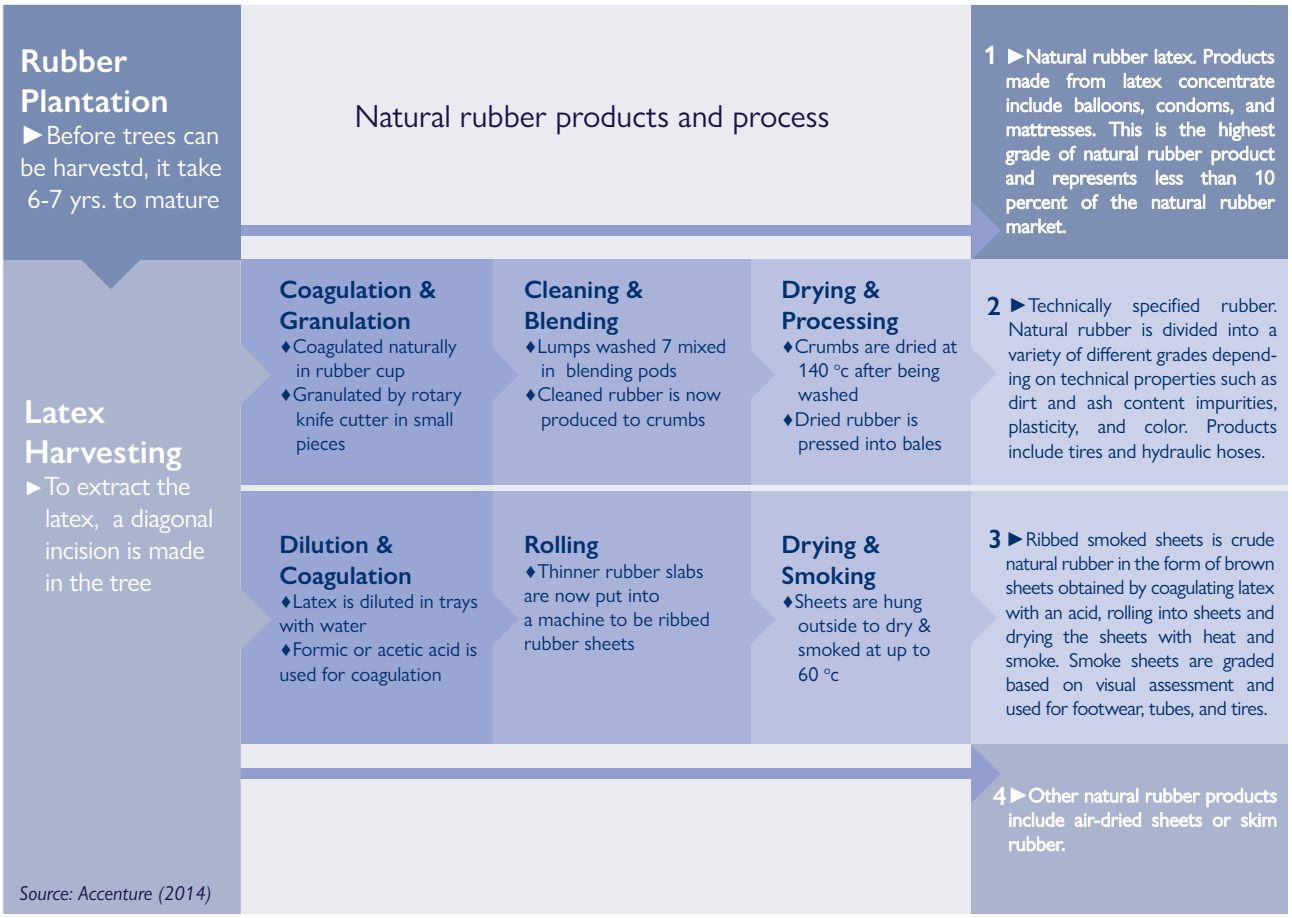
Rubber products

Natural rubber properties and production

Natural rubber's characteristics of elasticity, heat resistance, resilience, toughness, and water resistance make it a valued commodity used in a wide range of products. It is produced from latex tapped from rubber trees (Hevea brasiliensis). Tapping is the process of making an incision in the bark of a rubber tree and collecting the latex in a cup. Rubber trees can be tapped from the fifth or seventh year after planting for the next 20 to 25 years.[2]

Natural rubber is categorized into the following four grades depending on the processing method used to obtain the final product:

FIGURE 1: NATURAL RUBBER PRODUCTION PROCESS AND MAIN GRADES



Synthetic rubber offers better resistance and consistent quality but has a higher environmental impact.

Natural rubber can be combined or used interchangeably with synthetic rubber depending on the quality needed for the end product. The International Rubber Study Group (IRSG) estimates total world consumption of rubber in 2016 was 27.55 million tons, of which natural rubber made up slightly less than half (46 percent). Synthetic rubber is an artificially produced polymer synthesized from petroleum and is linked to a different cost structure and market fundamentals.

2. Aidenvironment, 2017

Advantages of synthetic rubber are good oil and temperature resistance, and ability to produce a consistent quality product. Synthetic rubber has many industrial applications, especially in the automotive industry for tires, hoses, belts, flooring, doors, and windows. However, natural rubber is more environmentally friendly than synthetic rubber as it is a renewable resource produced from rubber trees that absorb carbon dioxide. This study focuses on natural rubber.

Global consumption, production, and price outlook

Rubber markets are concentrated in the Asia Pacific region.

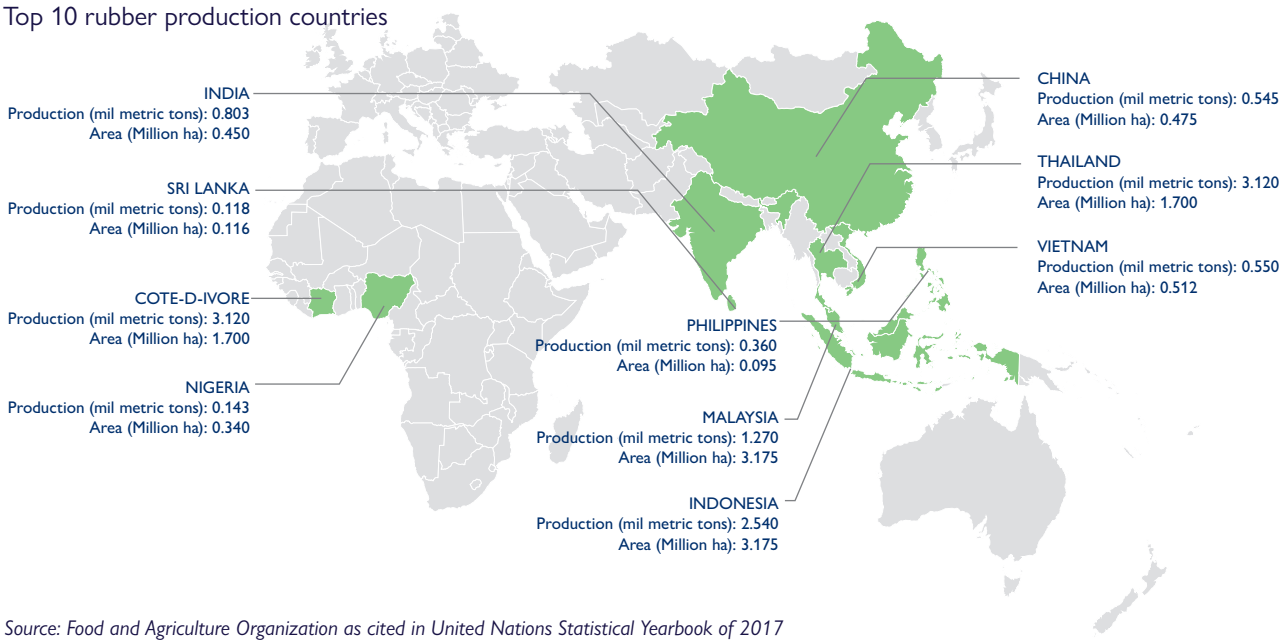
Rubber trees only grow in certain tropical climates, therefore, rubber markets are concentrated in the Asia Pacific. With a global trade totaling $14.4 billion in 2018, market pressures on suppliers in the Asia Pacific region are strong. Global production of natural rubber reached 13.5 million tons in 2017. This was an increase of more than 7 percent from the previous year and followed by a 6.6 percent increase in 2018, far above the 10-year average growth rate of 3 percent.

Although the volume of trade has increased steadily in recent years, the value of trade has fluctuated significantly due to volatility in the commodity price. Growth in trade volume is largely driven by an increase in the land area planted with rubber trees. From 2010–2012, about 500 thousand ha of land were converted to rubber plantations, increasing total cultivation area by about 4 percent per year. However, only 126 thousand ha were planted in 2016; due to falling prices, planting is projected to steadily decrease to less than 40 thousand ha in 2026.

China is the largest importer of natural rubber, making up one-quarter of total demand. China's demand for natural rubber is more than double the world's second-largest importer, the United States. North America makes up just 15 percent of world imports compared to 60 percent for Asia and 21 percent for Europe. The largest increase in demand since 2014 was in Russia (22 percent) and India (9 percent).

In 2016, Thailand was the largest producer country, producing 23 percent of world supply, closely followed by Indonesia (19 percent) and Malaysia (10 percent). The next seven producers generated another 18 percent of global supply. The top ten global producers account for well over two-thirds of the market.

FIGURE 2: TOP TEN RUBBER PRODUCTION COUNTRIES



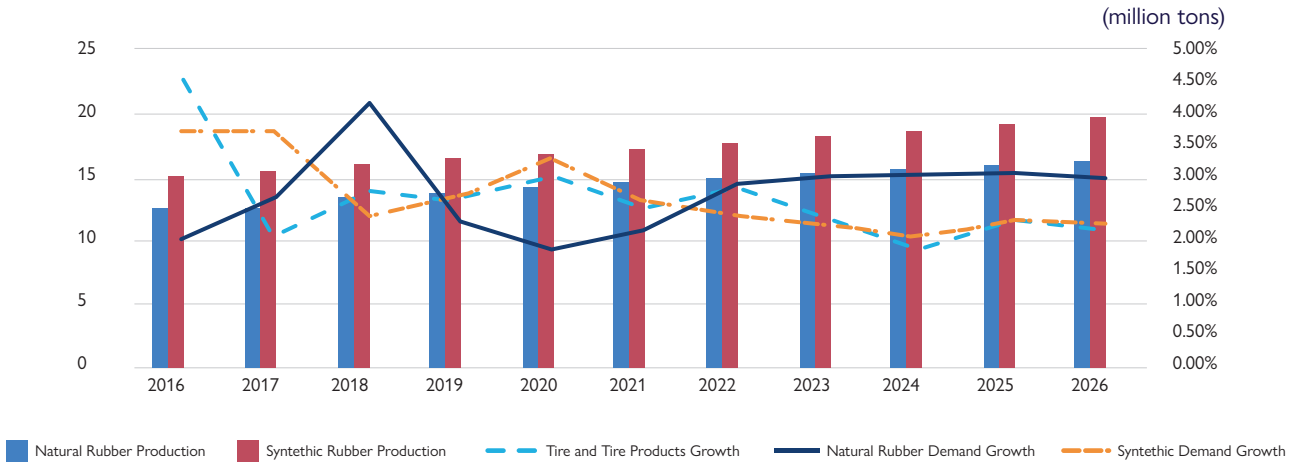
Source: Food and Agriculture Organization as cited in United Nations Statistical Yearbook of 2017

Worldwide, smallholders manage about 80 percent of the total area under production, although their lower yields, compared to large commercial plantations, means they supply relatively less rubber per hectare.

The total area of land cultivation for rubber trees is only one factor determining supply. Another key determinant is yield. Rubber trees only have a 25-year productive lifespan, with steeply declining yields after that. Replanting should ideally occur on about 4 percent of plantations annually to ensure stable output.

Yet between 2010 and 2017 replanting was only undertaken on an estimated 1.3 percent of total rubber cultivation area. This rate is expected to increase to 1.7 percent between 2018 and 2026, but still falls short of the 4 percent required to maintain rubber yields. The decrease in yields per hectare is, to an extent, offset by the increase in total plantation area despite the fact that the growth rate for new areas is slowing down.

FIGURE 3: PROJECTED RUBBER PRODUCTION AND GROWTH



As capacity for synthetic rubber production increases, the growth rate of natural rubber decreases.

In 2017, IRSG released the World Rubber Industry Outlook: Review and Prospects to 2026[3]. The outlook projects that global rubber consumption will grow at around 2.5–2.7 percent annually, from 2019. This is much lower than the historical average growth rate of 3.6 percent between 1961 and 2013. Improved production capacity for synthetic rubber has and will continue to push down the growth of demand for natural rubber, which is projected to fluctuate between 2–3.3 percent until 2026 and will make up 45 percent of total rubber demand in that year as seen in Table 1.

TABLE 1: PROJECTION OF WORLD DEMAND FOR RUBBER

(Million tons)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Rubber Demand	27.55	28.43	29.37	30.10	30.86	31.59	32.43	33.29	34.14	35.06	36.00
Growth (percent)	2.90	3.20	3.30	2.50	2.50	2.40	2.70	2.60	2.60	2.70	2.70
Natural Rubber Demand	12.59	13.03	13.34	13.70	14.15	14.53	14.87	15.20	15.51	15.87	16.23
Growth (percent)	3.70	3.50	2.40	2.70	3.30	2.70	2.30	2.20	2.00	2.40	2.20

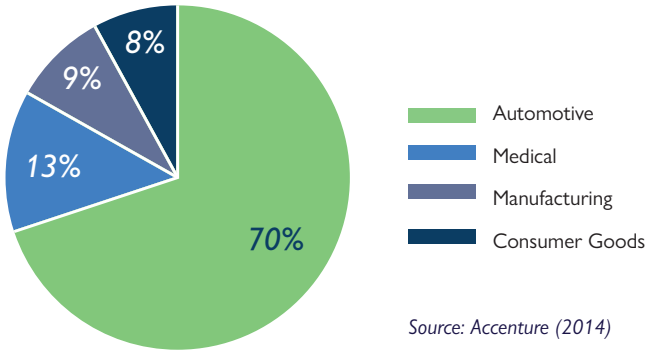
Source: IRSG 2017

3. IRSG, 2017

Rubber is used widely for industrial applications (from engine belts and insulators to gaskets and seals) but tire production accounts for the largest portion of market share.

The automotive industry is responsible for 70 percent of global demand in 2013 (Figure 4). The tire industry is heavily concentrated, with Bridgestone, Michelin, Goodyear, and Continental accounting for three-quarters of global tire demand.

FIGURE 4: MAIN RUBBER APPLICATIONS



Source: Accenture (2014)

Prices have fallen considerably between 2013 and 2017 but are expected to rebound in the coming years with China as a price mover.

Rubber is a homogeneous commodity traded on commodity exchanges including the Tokyo Commodity Exchange, Singapore Commodity Exchange, and Malaysian Rubber Exchange. Prices on different exchanges are highly correlated, but when converted to dollars, commodity prices are not always equal. Rubber prices have decreased in recent years, falling from $2.79/kg in 2013 to $1.58/kg in 2017. The price is expected to rise to $2.02/kg in 2025 and reach $2.40/kg in 2030 (Statista, 2019).

China has significant influence on the price of natural rubber because it is the largest importer of rubber globally. China has taken significant steps to increase its domestic production capacity and that of its neighbors, Myanmar, the Lao People's Democratic Republic, and Cambodia. This recent shift toward local rubber production has contributed to the continuing fall of rubber prices on the global commodity market.

The increase in productivity in main producer countries (Thailand, Indonesia and Malaysia) as well as the recent surge of production in China, Myanmar, Lao People's Democratic Republic, and Cambodia have led to an oversaturated market resulting in a further price decrease on the global commodity market. A final determinant of the natural rubber price is that of its closest, though not perfect, substitute, synthetic rubber.

As synthetic rubber is produced using crude oil, oil price affects the volatility of the natural rubber price. In commodity markets, Accenture (2014) showed a price correlation between natural rubber, currencies, crude palm oil, and crude oil due to buyers sourcing from multiple commodities to manage portfolio risks.

Some natural rubber producers such as Indonesia and Malaysia are also exposed to the palm oil market; there is a cross-correlation risk in relation with future price movement[4].

4. According to A.F.S Budiman (2002) changes in relative exchange rates can affect rubber prices both directly and indirectly. The direct effect stems from the fact that natural rubber is normally purchased from one country in a given currency for use or resale in another country with a different currency. The indirect effect comes from arbitrage activity and speculative demand, which can be either commodity speculative or foreign exchange speculative.

Indonesia, natural rubber market

Smallholder farmers account for 83 percent of national production.

In 2017, the Government of Indonesia recorded around 3.7 million ha of natural rubber area. Total production was estimated at 3.6 million tons. For the last ten years, production grew at 2.84 percent per year. Five provinces contribute 66.5 percent of national production: South Sumatra, North Sumatra, Jambi, Riau, and West Kalimantan.

In Indonesia, smallholder farmers account for 83 percent of national production as of 2018, managing a total of 3.1 million ha with productivity slightly below 1 ton/ha. State and private commercial plantations demonstrate higher productivity, at 1.4 ton/ha and 1.5 ton/ha respectively. With approximately 2.25 million smallholders cultivating land for rubber throughout Indonesia, natural rubber has become a key driver for income and job creation.

According to the Indonesia Rubber Association[5], large (state and private) plantations occupy only 15 percent of the national productive area. Similar to the downward trend observed for smallholder plantations, there was little overall increase in state or private rubber plantation areas from 2012 to 2018.

State and private plantations are divided primarily between North Sumatra, South Sumatra, Riau, and West Kalimantan. They employ around 249 thousand workers bringing the number of people active in cultivation of natural rubber in Indonesia to approximately 2.5 million people.

FIGURE 5: YEARLY AVERAGE INCREASE IN PRODUCTIVE RUBBER AREAS BETWEEN 2012 AND 2018

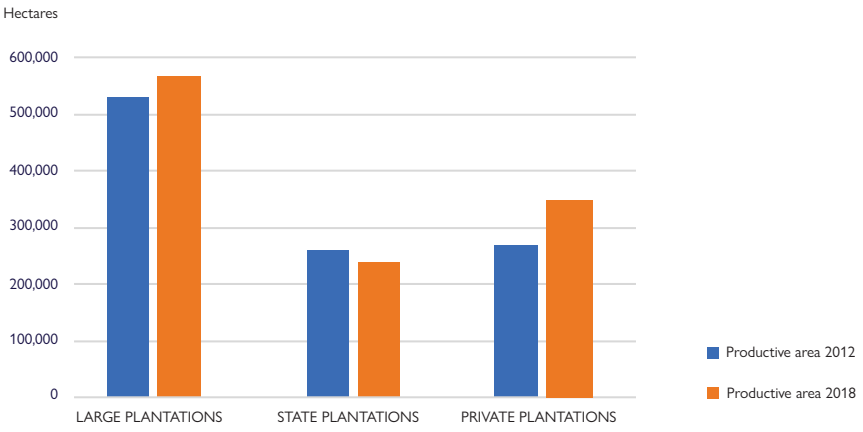
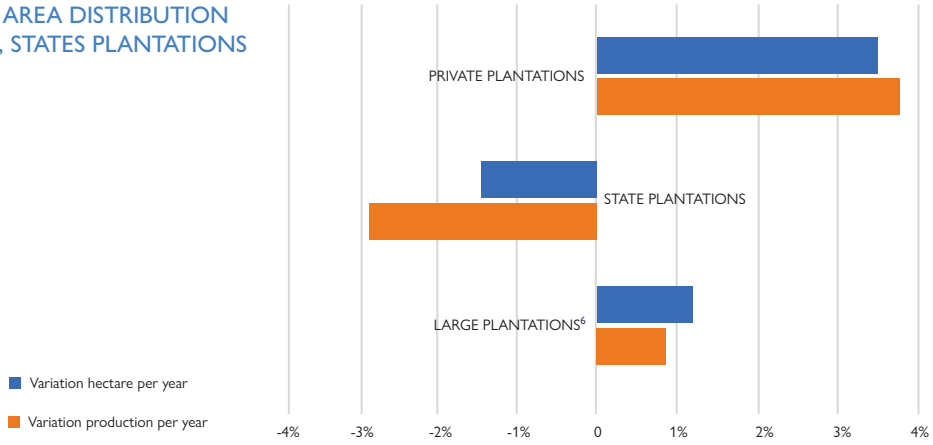


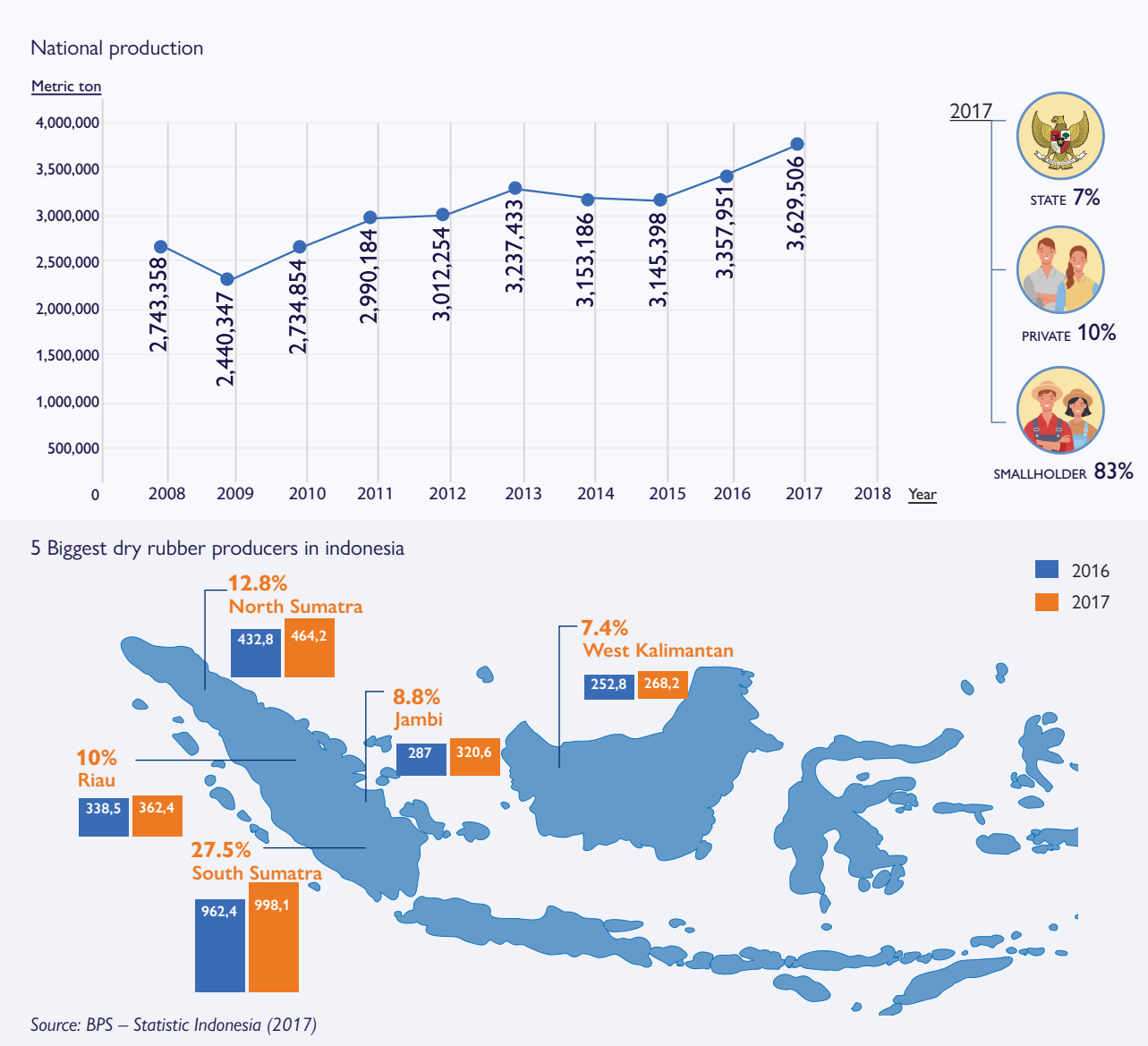
FIGURE 6: RUBBER PRODUCTIVE AREA DISTRIBUTION BETWEEN LARGE PLANTATIONS, STATES PLANTATIONS AND PRIVATE PLANTATIONS



5. Gabungan Perusahaan Karet Indonesia/GAPKINDO, 2019

6. Large plantations are larger than 25 ha and require a government license.

FIGURE 7: INDONESIA'S NATURAL RUBBER PRODUCTION PROFILE IN 2017



Source: BPS – Statistic Indonesia (2017)

Indonesia is the world's second-largest producer, but lacks downstream capacity for domestic rubber manufacturing. Although Indonesia is the second-largest producer of natural rubber worldwide, its downstream rubber industry is not well developed. The country is dependent on imported processed rubber products due to lack of domestic processing facilities and a well-developed rubber products manufacturing industry. Indonesia exports about 85 percent of its rubber production. However, in recent years the relative rate of exports to production declined slightly due to an increase in domestic consumption. About half of the natural rubber processed domestically is used by the tire manufacturing industry, followed by the manufacture of rubber gloves, rubber threads, footwear, retread tires, medical gloves, and other tools.

The United States is the most important export market for Indonesia's natural rubber, buying between 20 and 25 percent of the country's total exports over the past six years, except in 2017 when exports to the United States dropped below 20 percent and China became the main export destination. The United States also imports half of its natural rubber from Indonesia, with Thailand being a distant second. The total trade in natural rubber between Indonesia and the United States was worth $1.1 billion in 2018. However, imports by the United States have dropped almost 18 percent in value since 2014, driven by the decrease in the rubber price.

2. CHALLENGES FOR INDONESIA'S SMALLHOLDERS

Low productivity and low quality

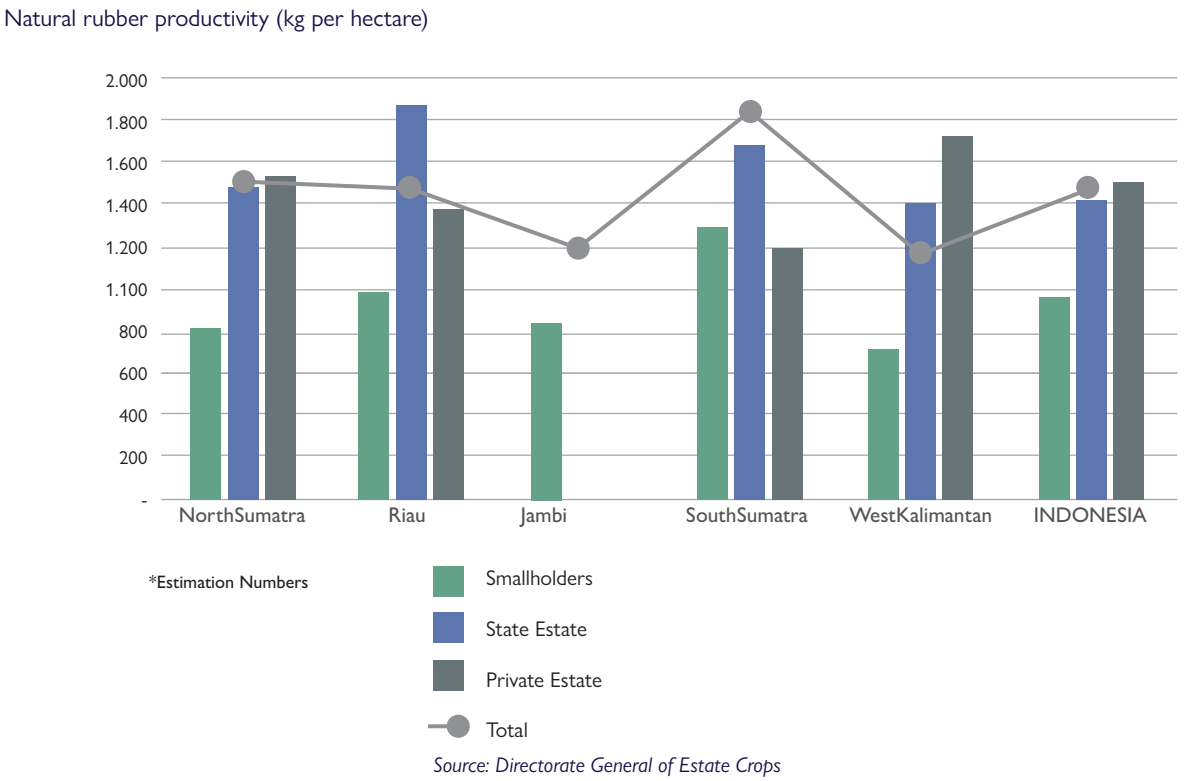
Two main problems faced by natural rubber smallholders are low productivity and low quality of crumb rubber[7], making it difficult to compete in the global market (USAID, 2007).

Low productivity stems from poor application of Good Agriculture Practices (GAP) and a high number of old, abandoned trees. The productivity of Indonesia's rubber trees is very low compared to neighboring producer countries. Indonesia's national natural rubber productivity is only 1.04 ton of rubber per ha. Smallholders - who manage 83 percent of the planted area - produced only 0.994 ton/ha in 2017. Thailand produces 1.8 ton per ha per year whereas Vietnam and Malaysia's productivity stands at 1.72 ton/ha and 1.51 ton/ha respectively.

Around 60 percent of smallholder rubber cultivation in Indonesia is in rubber agroforests, or jungle rubber, where rubber trees are grown alongside fruit trees and timber crops. Here the number of rubber trees varies from 200 to 700 trees per hectare compared to intensive plantations containing 400 to 500 trees per ha.

South Sumatra province is Indonesia's largest and most productive area. Its natural rubber area is almost 23 percent of the total national productive area and smallholders' plantations take up 98.5 percent of this area. The productivity of smallholder plantations in South Sumatra is the highest among smallholder areas in Indonesia, producing 1.3 ton/ha.

FIGURE 8: INDONESIA,NATURAL RUBBER PRODUCTIVITY IN 2017



Source: Directorate General of Estate Crops

7. Rubber technical specification for high-end industrial raw material.

Good Agriculture Practices require high working capital expenditures.

USAID (2007) highlighted two components of GAP not being applied by farmers, the use of high-quality planting materials (good clones) and a proper tapping process. The quality of budwood nurseries is critical to get good clonal plants. Smallholders obtain planting material from local state nurseries. Some produce clones themselves using local seedlings. Very few local nurseries have a license from the Indonesia Rubber Research Institute (IRRI) as this is not mandatory, despite the fact that many nurseries use seeds from clonal trees which are passed off as good clonal plants. A licensing fee must be paid to IRRI by registered producers and this results in a significant price difference of Indonesian Rupiah 500 to 1,000 ($0.3 to $0.6) per plant between planting material produced by unlicensed and licensed nurseries.

Poor tapping also lowers productivity and is the main cause of low yields, superseding the use of good planting material. Tapping practices in most smallholdings create bark damage as the cut is too deep, exposing the cambium to cancerous growth. Other bad tapping practices are tapping too early or using the wrong panel. Poor tapping processes decrease the productive life of trees by up to 50 percent.

SNV Netherlands Development Organization's assessment in Musi Banyuasin District, South Sumatra, showed that poor application of GAP is caused by lack of farmer awareness.

There was limited government support for natural rubber plantation programs to build capacity of rubber farmers. Government agriculture extension officers (petugas penyuluh lapangan/PPL) mostly provided training and advice on food crops and not natural rubber.

Recently, some civil society organizations have started providing GAP knowledge to farmers, specifically for perennial crops such as oil palm, coffee, cocoa, and rubber. SNV, for example, introduced Better Management Practice training modules for natural rubber agroforestry to smallholders in Indonesia in 2016. The training modules are expected to improve productivity, quality, and sustainability of smallholder rubber plantations. Some agriculture extension officers in South Sumatra are using the modules to support their work.

However, implementing GAP requires working capital, which is highly dependent on the rubber price. Karyudi (2016) created a purchasing power parity index for rubber (rubber to rice as staple food) from 2011–2016. Around 1 kg of raw rubber was equal to 4 kg of rice in March 2011, but five years later 1 kg of rice was equal to 4 kg of raw rubber. Consequently, there is less capital available to improve fields, buy fertilizer, or hire workers for weeding and tapping. According to Alamsyah (2006), farmers are more likely to seek loans from local agents (pengepul lokal) to raise capital which can further lower their incomes, leading to a negative debt cycle.

Due to low productivity and low income, many smallholders have converted their rubber trees to other crops such as oil palm in Sumatra and Kalimantan and sugar cane in Java (Karyudi, 2016). Research by Hidayah et.al (2016) from the Bogor Institute of Agriculture in two villages, Lubuk Kembang Bunga and Air Hitam in the Pelalawan District of Riau, showed that, on average, smallholders now grow rubber on only 0.34 ha, with another 2.17 ha devoted to oil palm. In other research, Daulay (2003) noted that 66 percent of natural rubber plantations in Batu Tunggal village of Labuhan Batu, North Sumatra, had also been converted to oil palm. Other smallholders who do not have the capacity to switch commodities look for jobs outside the farm, e.g., construction.

BOX 1: FARMERS' DECISION FACTORS FOR CHOOSING OIL PALM OVER NATURAL RUBBER

Schwarze et al. (2015) identified several factors that influence smallholders' choices to cultivate oil palm instead of rubber. Price is not the only factor for smallholders.

Cultivating oil palm is less labor intensive and generally farmers do not need to hire external labor. This is the major reason for growing oil palm instead of rubber. Although gross returns of rubber are higher than for palm oil, the lower labor requirement of oil palm makes it more profitable for smallholders.

Palm oil farmers receive more support from the government and supply chain actors.

Contract farming arrangements for palm oil enables farmers to get loans/ credits and extension services from companies.

The longer startup time for new rubber trees compared to oil palm is another factor as farmers receive income earlier than when planting oil palm.

Majority of rubber trees planted in 1978–1991 are now past maturity.

Most rubber trees in Indonesia were planted from 1978–1991[8] with several government schemes[9]. Given the 25-year lifespan of a rubber tree, almost all rubber trees planted under these schemes have passed their peak production and now experience steeply declining yields.

There is no formal data available on rubber tree aging in Indonesia. However, the Ministry of Agriculture estimates around 600 to 700 thousand ha of natural rubber plantations need rejuvenation. The government plans to rejuvenate only around 50,000 ha over nine years as part of its long-term strategy of natural rubber development (see Section 3).

8. Interview on 14 June 2019 with Irmiati Rachmi, Director, Ministry of Agriculture.

9. Perkebunan Inti Rakyat (PIR), Smallholder Rubber Development Project (SRDP), Sector Crop Development Project (SCDP), Tree Crop Smallholder Development Project (TCSDP) and Tree Crop Sector Development Project (TCSSP) funded by international donors, World Bank and Asian Development Bank

Inefficient pricing methodology

Rubber raw material produced by smallholders mainly takes the form of slab and lump. The quality requirements of rubber raw material are listed in the Indonesian National Standard of SNI 06-2047-2002, but very few rubber estates and smallholders actually meet these requirements.

Alamsyah (2006) and USAID (2007) indicated that the price-setting mechanism at farmer level also contributes to low quality as farmers are usually paid by the collector based on weight, regardless of the dry rubber content and quality. Thus, farmers often soak their product in water, using non-recommended coagulants (sulfuric acid as well as alum and kaolin) to retain a higher water content and increase weight to the detriment of quality.

The local rubber price set by rubber processing factories in Indonesia is based on one of the international exchange prices of TSR 20 (Technically Specified Rubber) for dry rubber content of 100 percent (Hartati, 2018). The price is then converted into Indonesian Rupiah and the operational cost of the rubber factory is deducted (average IDR 2,500–3,500 per kg). Finally, the price is reduced in line with the dry rubber content; for a dry rubber content of 50 percent, the price is halved. It is important to note that this price is paid to collectors or other intermediaries. The price the smallholder receives is lower and is not dependent on the dry rubber content. Intermediaries are directly affected by costs associated with producing low quality rubber, but these costs are not passed onto the smallholders.

Given this price-setting mechanism, better post-harvesting processes are only implemented by farmers if they receive a higher price and if they have direct access to a rubber processing factory. Meeting these two conditions, SNV (2018) showed that farmers in two villages Mendis, Peninggalan, and Pangkalan Bulian, South Sumatra, were able to sell rubber to the factory (PT. Djambi Waras) at an average price of IDR 9,000–10,000 ($0.58- $0.65)[10] per kg, above the auction market price of IDR 6,000–8,000 ($0.39- $0.52)[10] per kg in September 2018.

Placebo365/istock Photos: A freshly harvested crop of rubber sap

10. These exchange rates are as of May 15 2020.

3. GOVERNMENT NATURAL RUBBER DEVELOPMENT STRATEGIES

The Government of Indonesia has defined short, medium and long-term national strategies for the development of the natural rubber sector.

Three short-term strategies focus on export control, upstream chain production, and farmers' bargaining power.

Export control

Export control is implemented in line with the International Tripartite Rubber Council (ITRC) agreement to control natural rubber supplies in the world market. The council was formed on December 12, 2001, by Thailand, Indonesia, and Malaysia to achieve a higher natural rubber price and support producers, while maintaining the balance of natural rubber supply and demand. Addressing low world rubber prices, ITRC implements export quota restrictions for all three members. At the end of 2018, ITRC agreed to reduce exports by 240,000 tons for the period of April–July 2019 in the framework of the 6th Agreed Export Tonnage Scheme. According to the agreement, Indonesia shall reduce exports by 98,160 tons whereas Malaysia and Thailand agreed to reduce exports by 15,600 tons and 126,240 tons respectively. The export quota is applied to exporters and intended to improve the global price. It is still unclear how this is done and the consequences for smallholders. Given that more than 80 percent of production comes from smallholders, they may experience an improvement of rubber prices.

Improved production facilities

To address farmers' need for improved production facilities and to encourage good agricultural practices, the government continues to subsidize production facilities at the farmer level including agriculture tools, seedlings, fertilizer, as well as post-harvesting/processing facilities (smoked rubber slabs and cup lump). This is part of an annual state budget program, referring to the technical guidelines for development of rubber crops (Pedoman Teknis Pengembangan Tanaman Karet) and compiled by the Directorate General of Estate Crop of the Ministry of Agriculture.

Establishment of processing and marketing units

The government promotes the establishment and capacity development of rubber materials processing and marketing units, Unit Pengolahan dan Pemasaran Bahan Olah Karet (UPPB). This new legal entity was established by Regulation of the Minister of Agriculture number 38/Permentan/OT.140/8/2008 with guidelines for the processing and marketing of rubber processing material.

The guidelines also regulate technical processing procedures of natural rubber from tapping, recommended sealing materials, quality standards (dry rubber content) as well as cooperation between farmer groups or UPPBs with traders and processing plants, including profit margins at UPPBs and processing plant levels.

BOX 2: RUBBER PROCESSING MATERIALS PROCESSING AND MARKETING UNITS

Rubber Processing Materials Marketing and Processing Units- UPPB

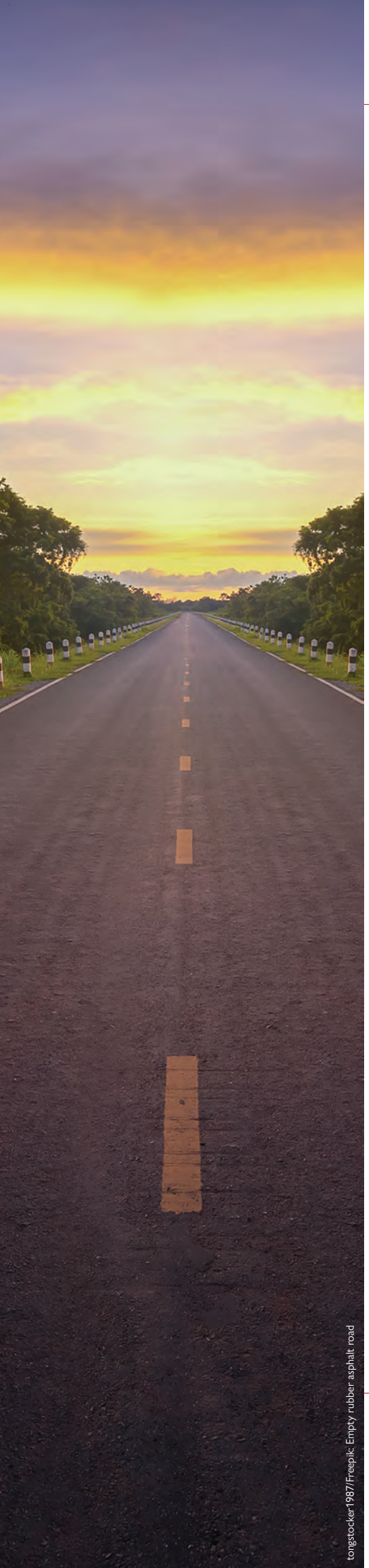
A Rubber Processing Materials Marketing and Processing Unit (UPPB) is a group of farmers that has a combined garden area of at least 100 ha and a total production of at least 800 kg of dry rubber every three days. As the UPPB is a legal entity, it must have formal Articles of Association and a board including a chairperson, secretary, and treasurer. UPPBs are voluntary organizations and their officers are responsible to their members.

UPPBs must be registered with the Agriculture or Estate Crops Office at the district/city level where they receive a UPPB registration letter (Surat Tanda Registrasi UPPB/STR-UPPB). The registered UPPB must submit activity reports every six months to the office that outlines production, quality, prices, and buyers. Registration can be revoked if the UPPB does not maintain minimal quality, environmental standards or fails to submit reports.

The main value of the UPPB to farmers is the technical and business development activities. Technical activities include the development of tapping skills, equipment usage, and the introduction of quality standards. Business development activities include support in the provision of manufacturing materials, production facilities, marketing, transportation, and raising capital. To carry out these functions, the UPPB is equipped with simple processing equipment such as hand grinding machines, drying barracks, sealing materials, and preservatives. Furthermore, each UPPB has technical personnel tasked with providing services and mentoring farmers in processing and marketing activities. The Ministry of Agriculture governs the procurement of production facilities and technical personnel.

The rubber trading price should be based on FOB price which is valid at the time of transaction with a dry rubber level of 100 percent. The rubber price should be at least 75 percent of FOB price including UPPB's cost of using equipment and materials, and the price at the processing plant level is at least 85 percent of FOB price. A team of planters, representatives of merchant associations, factory, and government associations establish prices at the farmer level. The UPPB conveys the rubber sales price to farmers daily.

Source: Regulation of the Minister of Agriculture number 38/Permentan/OT.140/8/2008 concerning guidelines for processing and marketing of rubber processing material.



tongstocker1987/Freepik: Empty rubber asphalt road

Mid-term objective is to increase domestic natural rubber consumption.

Siswa (2019) reported that the Ministry of Public Works and Housing is using rubber asphalt in road preservation work totaling 65 km in nine provinces in 2019. This will boost the demand for pre-processed rubber (Bokar) by at least 2,500 tons to produce 17,900 tons of rubber asphalt. The government has allocated IDR 8,500–10,000/kg ($0.55 to $0.65) to purchase rubber processing material directly from farmers in Jambi, South Sumatra, and Lampung. The government purchase price is higher than the current price of IDR 6,500–7,500/kg ($0.42-$0.49) due to the low global natural rubber price. As Indonesia has around 540,000 km of national, province, and district roads, local consumption of natural rubber is expected to grow significantly if rubber is included in road maintenance.

Long-term focus is on plant rejuvenation.

For the long-term strategy, the government is planning to improve productivity by rejuvenating rubber plantations and conducting international trade diplomacy with other rubber-producing countries to ensure price stabilization.

The government is targeting approximately 700,000 ha for rejuvenation, over a 9-year period from 2019–2027 (see Appendix 2). Two regulations have been launched to address these objectives.

►Regulation of the Minister of Agriculture number 132/Permentan/OT.140/12/2013 concerning good natural rubber cultivation guidelines to ensure the application of Good Agriculture Practice by smallholder farmers.

►Regulation of the Ministry of Agriculture number 16/Permentan/SR.230/4/2018 for a credit facility, KUR (Kredit Usaha Rakyat, People's Loan for Business[11]) for the agriculture, farming and fishery sectors. The regulation was followed up by the Coordinating Ministry of Economics issuing the technical implementation guidelines of Special KUR (Pedoman Pelaksanaan Teknis KUR Khusus) in April 2018. A more detailed discussion of KUR is presented in Section 8.

11. Kredit Usaha Rakyat/KUR (People's Loan for Business) is the most relevant initiative by the government to improve micro, small and medium-sized enterprise (MSME) financing. This government-guaranteed and subsidized loan facility is provided by state-owned banks and selected non-banking financial institutions.

4. VALUE CHAIN ANALYSIS

This section reviews different rubber value chain structures. Each model uses different broker arrangements and intermediaries with different impacts on pricing, transparency, accessibility, and efficiency. Understanding the value chain is a crucial step to reach out to smallholders, understand the price structure and incentives and increase overall sustainability and traceability.

Traditional value chains

The traditional natural rubber value chain is generally linear, starting from the farmer and moving to village or district dealers before arriving at crumb rubber factories. Along the value chain, the price increase of raw material is incremental before it reaches the factory gate. There are also multichannel value chain models with different channels through which natural rubber moves from farmers to factories.

In these models, farmers who work on plantations or own plots of land and village-level collectors consolidate raw material. The price of raw material is higher before reaching the factory gate with commissions paid to village collectors, intermediaries, and brokers.

FIGURE 9: TRADITIONAL LINEAR MODEL VALUE CHAIN[12]

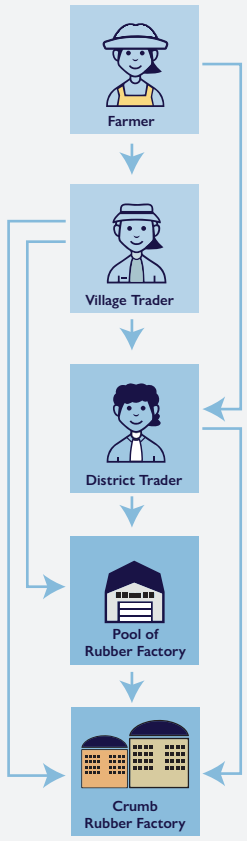
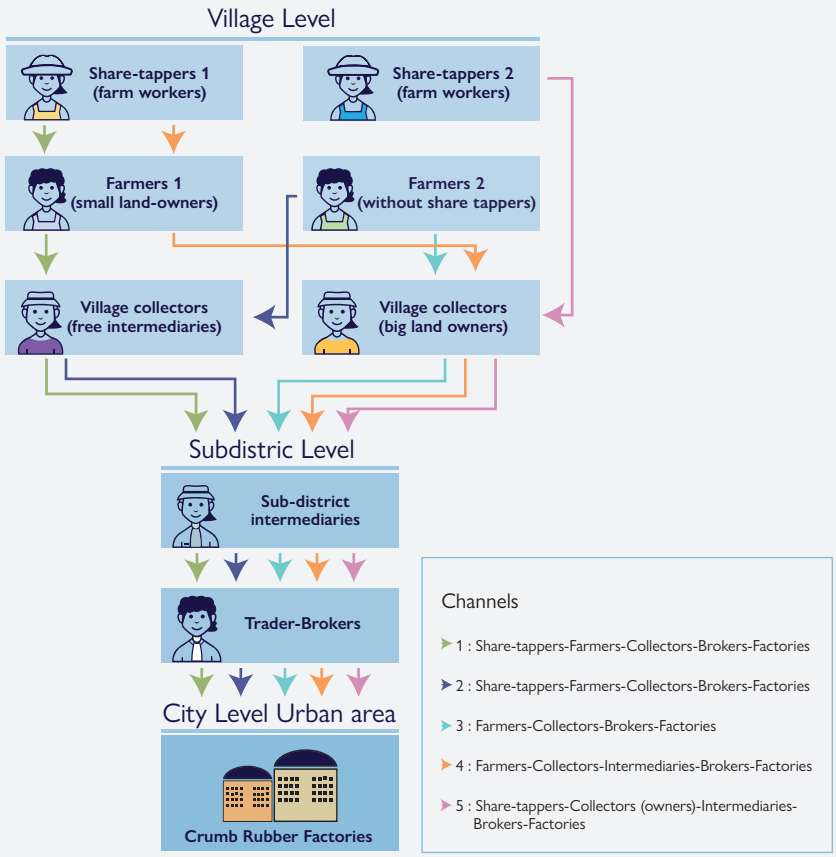


FIGURE 10: TRADITIONAL MULTICHANNEL MODEL VALUE CHAIN



These traditional marketing systems are not efficient due to poor yields and quality, low level of adoption of processing technology by smallholders and; lack of smallholder participation in farmer groups.

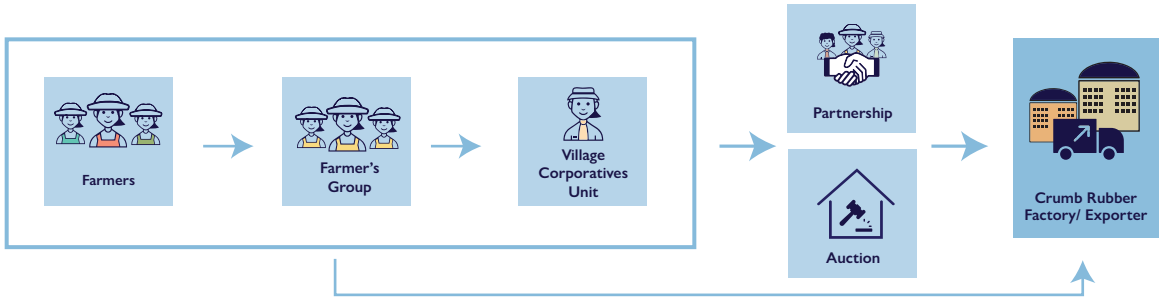
12. Rubber factories 'pool' rubber from smallholders together and an auction is organized by village traders and district traders to bid on collected rubber.

Organized marketing systems

To improve the quality and yield of raw rubber material, the government implemented the Clean Raw Rubber Material national movement[13].

The movement is directed through the Processing and Marketing Units (UPPB) where newly formed or existing rubber farmer groups are placed under local UPPBs. This enables the direct involvement, cooperation, and capacity-building of farmers in the production, processing, and marketing of clean and good quality raw material.

FIGURE 11: ORGANIZED VALUE CHAIN WITH FARMER COOPERATIVES



By 2017, 147 UPPBs had been established in South Sumatra, 32 in Jambi and 100 in South Kalimantan (none in West Kalimantan) with government support playing a key role in accelerating the program. Organized marketing systems have changed the perspective and behavior of smallholders in processing and marketing raw rubber material. The quality and yield of raw material have improved, and are clean without contaminants, relatively uniform in size, and use the recommended coagulant so that dry rubber content can be increased. Dry rubber content is the key factor to determine the price received by smallholders.

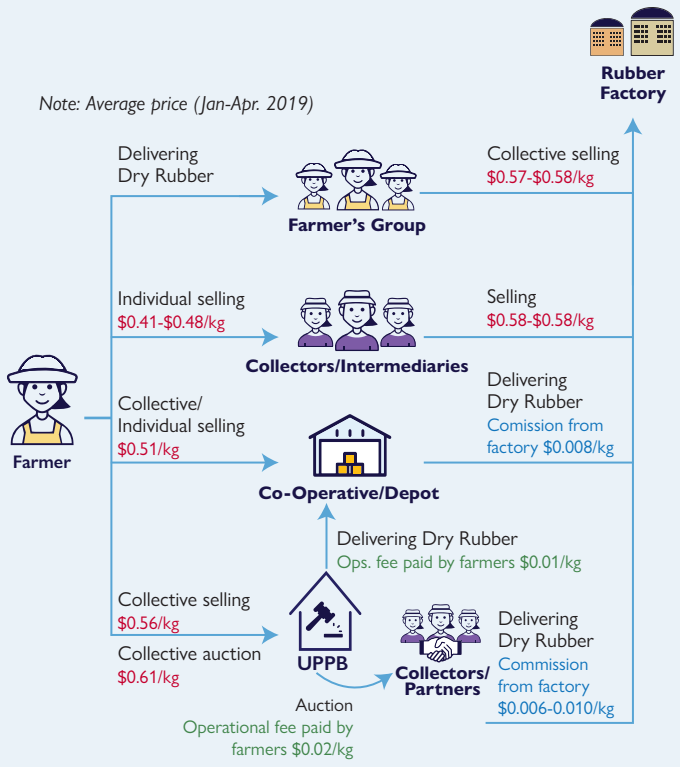
Other organized marketing systems have been implemented in some districts in South Sumatra since the 1980s through farmer groups or cooperatives integrated with the Smallholders Rubber Development Project (SRDP).

With government support, SRDP has regained momentum in the last ten years to improve the condition of raw material produced by smallholders.

Organized marketing systems have also improved smallholders' bargaining position. From a study of six UPPBs and village cooperatives in South Sumatra, the price received by smallholders through organized marketing systems was 75–89 percent Free on Board (FOB). In traditional marketing systems, smallholders only received about 58 percent FOB because the dry rubber content of raw material is lower.

13. This movement is based on the Ministry of Agriculture Act No. 38/Permentan/OT.140/8/2008 Guidelines for processing and marketing of raw rubber material (Ministry of Agriculture, 2008) and the Ministry of Trading Act No. 53/M-DAG/PER/10/2009 Quality control of commodity export material of standard Indonesian rubber traded based on SNI no. 06-2047-2002 on raw rubber material (Ministry of Trading, 2009) and Law No.18 of 2004 on Plantations.

BOX 3: FOUR TYPES OF NATURAL RUBBER VALUE CHAINS IN MUSI BANYUASIN, SOUTH SUMATRA



SOURCE: SNV, 2019

Farmer's Group — Farmers collect dry rubber in the Farmer's` Group, which then collectively sells to a rubber factory.

Collectors — Farmers individually sell dry rubber to small collectors/intermediaries. Then, the small collectors/intermediaries sell it to big collectors, who then sell it to a rubber factory.

Coorporative/ Depo — Farmers sell dry rubber to depots/purchasing agents of a rubber factory on a commission basis. Depots can be owned and managed by farmer cooperatives or farmer groups. Operational costs, e.g. transportation and loading, are borne by the factory.

UPPB — UPPB is community-owned rubber processing and marketing house. It collects dry rubber from farmers, and auctions or sells directly to a depot by referring to the current rubber price (SICOM-Singapore Natural Rubber Exchange or TOCOM-Tokyo Commodities Exchange)

Collectors/ Partners — Auction bidders of UPPB are collectors, who may act individually or as proxy of a rubber factory. As a proxy, a collector will get commission from the purchase.

A study in the Musi Banyuasin region of South Sumatra by SNV illustrated several methods of selling rubber to crumb rubber factories through an organized marketing system. It was evident that farmers get the best price for their raw material by selling through farmer groups to factories, followed by collective or individuals selling through cooperatives/depots and UPPBs. Farmers get the lowest share of price if they sell through collectors to factories.

The organized marketing system and auction method benefits smallholders by increasing the quality and yield of raw material produced, increasing smallholders' bargaining power, and enabling a higher farm gate price which is determined transparently with auction prices as a reference. Unfortunately, the growth of organized marketing systems still faces some constraints. The major obstacles are lack of farmers' commitment to UPPBs; low awareness to maintain quality of raw material; and lack of transparency between UPPB board members and farmer groups.

5. SUSTAINABILITY FRAMEWORKS AND CERTIFICATIONS

This section summarizes four sustainability initiatives and certification programs targeting the natural rubber industry. These initiatives and programs are voluntary and require financial investment from producers or traders who seek certification to sell a premium-priced product to consumers.

1. Sustainable Natural Rubber Initiative (SNR-i): A voluntary verification initiative for sustainable natural rubber.
2. Fair Rubber Association: Fair trade premium for sustainably sourced natural rubber.
3. Forest Stewardship Council (FSC): Forest management certification for sustainable natural rubber plantations.
4. Global Organic Latex Standards (GOLS): Certification standards for organic latex.

Sustainable Natural Rubber Initiative

The International Rubber Study Group launched its Sustainable Natural Rubber Initiative (SNR-i) at the 2014 World Rubber Summit in Singapore. SNR-i is a voluntary and collaborative initiative designed to improve the sustainability and transparency of the rubber value chain.

Five value chain criteria were defined for a voluntary verification system, from which indicators were then developed. Organizations that may participate in this initiative on a self-certification basis include small and large growers, corporate plantations, processors, traders, and downstream users.

TABLE 2: FIVE VALUE CHAIN CRITERIA OF THE SUSTAINABLE NATURAL RUBBER INITIATIVE

Support improvement of productivity	Optimize planting and diversification of recommended clones. Optimize planting density per ha and replacement of dead plants after initial planting. Optimize use of natural fertilizers, biological pest and disease control methods, and minimize chemical use.
Enhance natural rubber quality	Commitment to natural rubber standard quality policy or ISO 9001 certification. Compliance with testing and grading both visually throughout production process and laboratory testing according to corporate quality control procedure.
Support forest sustainability	Compliance with relevant local legal requirements of rubber tree plantations only established on suitable land, with protected areas and species habitats respected. Protection and conservation of protected areas with buffer zones established and maintained.
Water management (targeting corporate plantations, processors, traders, and downstream users)	Compliance with relevant local legal requirements and local customary water use rights. Treatment of industrial wastewater in full compliance with all relevant legal requirements.
Respect human and labor rights	No evidence of child labor and minimum age of workers is respected. No forced or bonded labor. Freedom of association and right to collective bargaining is respected.

As of July 2018, 53 organizations, including leading global tire makers, have completed the self-declaration process. Among these 53 self-declared registrants, 58 percent are processors, 19 percent are downstream tire processors, 10 percent are traders, 12 percent are plantation owners and 1 percent are cooperatives.

Fair Rubber Association

The Fair Rubber Association applies the concept of fair trade for products made from natural rubber to achieve a more equitable distribution of value addition in the rubber supply chain. This is done by consumers paying a higher price, a "fair trade premium", and having this premium reaching the smallholders and plantation workers. The goal of the Fair Rubber Association is to improve the working and living conditions of primary producers with this premium. The association also strives to promote environmentally friendly production of natural rubber.

Smallholders and plantation workers receive a fair trade premium, paid by the importer or seller of a rubber product, who then pass this extra cost on to consumers. The fair trade premium entails $0.50/kg dry rubber content and passed on to primary producers without any deductions via the Fair Rubber Association.

Rubber Association

For plantations, the premium is paid separately from the commercial price, i.e. the extra payment is used exclusively to help improve workers' work and living conditions even when plantations are selling at a loss. In the case of smallholders, the premium is paid along with the commercial price, i.e. they receive a 'fair' overall compensation for their product. Supplier partners may decide to use fair trade payments to partially or completely finance projects such providing families safe water supplies.

For Fair Trade members and companies to use the Fair Trade logo and provide a fair trade premium, they need to adopt the Fair Rubber standards and undergo a third-party audit. The standards address social and environmental criteria, Fair Trade standards, and other general requirements.

Forest Stewardship Council and forest management standards

Forest Stewardship Council (FSC) forest management certification confirms that forests are managed in a way that preserves natural ecosystems and benefits the lives of local people and workers, all while ensuring sustainable economic viability. To meet social criteria, certificate holders must respect Indigenous Peoples' land rights and enhance forest workers' rights. The certification also requires forest managers to protect areas of high conservation value with significant concentrations of plant or animal species; rare, threatened, or endangered ecosystems; or areas of rare or outstanding biological, ecological, or social value.

Certification is achieved by passing an assessment carried out by an FSC-accredited certification body. Following a brief pre-assessment to reveal any potential areas of non-conformity that could prevent certification, the evaluation process consists of an in-depth assessment of forest management processes and their environmental, social, and economic impact against FSC principles and criteria. FSC forest management certification is valid for five years, subject to annual checks that FSC requirements are continuously met.

Global Organic Latex Standard

The Global Organic Latex Standard (GOLS) outlines requirements for latex products made from organic raw materials and non-organic origins. The standard establishes criteria for natural rubber from certified organic plantations (United States Department of Agriculture National Organic Program or European Union). To achieve GOLS certification, a product must contain more than 95 percent of certified organic raw material. The GOLS defines permissible limits for harmful substances, emission test requirements, and polymer and filler percentages.

Rubber plantations, processing units, and final retailers can be certified according to GOLS. By using transaction certificates at every sale of a product in the supply chain, traceability from the plantation to the final retailer is ensured. Manufacturers' approval to produce organic products under the GOLS logo must follow mandatory social and environmental regulations.

Comparison of sustainability frameworks

Comparison of costs

The table below presents the premiums paid and the audit costs of three sustainability frameworks. The cost of certification per plot of land can be estimated using these costs and the average production/yield per hectare.

TABLE 3: COST COMPARISON PER CERTIFICATION

	Forest Stewardship Council	Fair Rubber Association	Global Organic Latex Standard
Premiums	$0.04–$0.015/kg latex	0.55 cents/kg dry rubber content	$0.057–$0.11 /kg latex
Audit cost	$0.005–$0.025/kg latex	Approx. $4,500 for a small operation	Approx. $2,000 for one latex centrifugal unit

The premium for FSC-certified latex is dependent on the baseline price and how much farmers are earning in the market for their rubber before getting FSC-certified. It is also dependent on geographical context (countries), supply chain structure (intermediaries/brokers), and final current price paid to farmers. The audit cost refers to the direct costs of the audit (not costs associated with implementation of standards), and depends on the size of the plantation and if it is an industrial organization or a smallholder structure.

Unlike FSC, where certification costs are absorbed by the supplier, the cost of certification for Fair Rubber is absorbed by the Fair Rubber Association. However, the Fair Rubber Association only accepts additional suppliers if there is a buyer. There is no shortage of suppliers, but finding buyer companies willing to apply to the scheme is more difficult. The Fair Rubber Association has about a dozen members, mostly small companies, which cooperate with five primary rubber suppliers. For GOLS, certification is charged either on latex centrifugal units (to clean and process latex) or plantations. For plantation certification, fees are dependent on location, distribution networks, farmer group sizes, and land area.

Comparison against Global Platform for Sustainable Natural Rubber principles

All four sustainability frameworks have strengths and weaknesses when compared with the 12 principles of the Global Platform for Sustainable Natural Rubber (GPSNR)[14], presented in the table below. The key highlight of this analysis is that equity or equal value distribution across the supply chain is not addressed by any of the four frameworks and remains a crucial gap when addressing the issue of sustainability in the natural rubber industry.

TABLE 4: SUMMARY OF STANDARDS SCOPE

GPSNR[14] 12 Principles	Global Organic Latex Standard	Fair Rubber Association	Natural Rubber Initiative	Forest Stewardship Council	Heava Pro[15]
Forest sustainability	☐	■	■	■	☐
Water management	■	■	■	■	■
Land rights Free, Prior and Informed Consent	☐	■	■	■	☐
Labor rights	■	■	■	■	■
Human rights	☐	☐	■	■	■
Equity	☐	☐	☐	☐	☐
Traceability	■	☐	☐	☐	■
Transparent reporting	■	■	■	■	☐
Anti-corruption	☐	☐	☐	■	■
Grievance mechanism	☐	■	☐	■	■
Auditing protocols	■	☐	■	■	☐
Training and education	☐	■	■	☐	■

■ STRONG: 1 Principle covering three points or more

■ MEDIUM: 1 Principle covering two points

■ WEAK: 1 Principle covering 1-point, vague description

☐ Not Covered

14. GPSNR is an international, multi-stakeholder, voluntary membership organization, with a mission to lead improvements in the socioeconomic and environmental performance of the natural rubber value chain. GPSNR was initiated by the World Business Council for Sustainable Development Tire Industry Project in November 2017. Members include producers, processors and traders, tire makers and other rubber makers/buyers, car makers, other downstream users, financial institutions, and civil society organizations.

15. Hevea Pro is Halcyon Rubber – World's leading rubber franchise – an environmental and social standard used throughout Halcyon Rubber value chain. https://www.halcyonagri.com/what-we-do/our-products/hevea-pro/

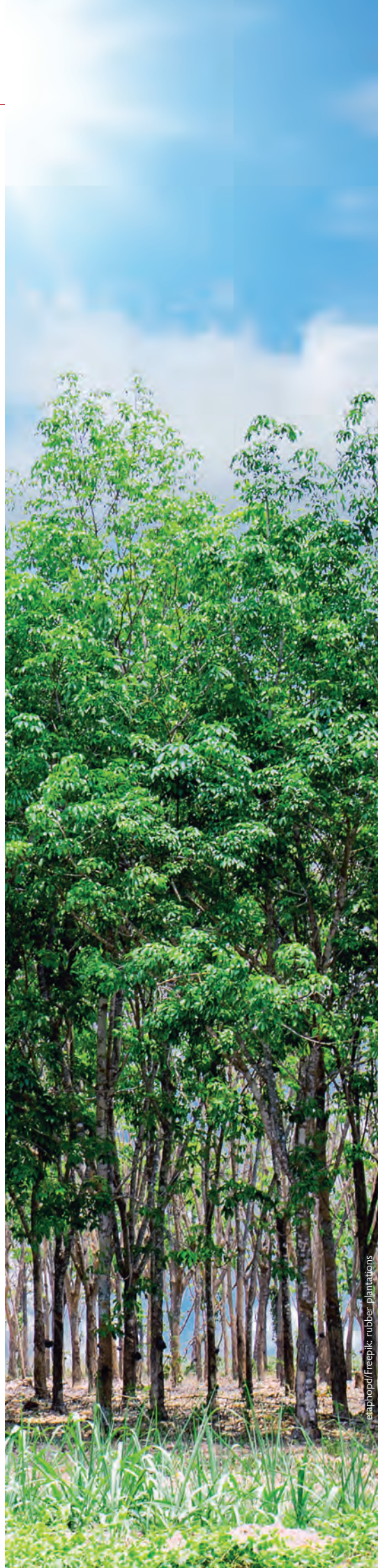
Low uptake of certification schemes in Indonesia

There is widespread lack of adoption of standards, certification schemes, and sustainable initiatives in Indonesia. There are no FSC-certified natural rubber plantations in Indonesia at present. FSC principles and criteria are more stringent than local legislation. While several Indonesian companies have committed to SNR-i, there has been no uptake of certification for organic latex and Fair Trade rubber.

Lack of consumer demand for certification, low natural rubber market prices, low rubber yield, and the high cost of certification contribute to the low uptake of certification schemes. For example, although the premium for FSC-certified rubber is higher than the cost of certification, plantation owners would struggle to break even due to lack of demand for certified sustainable natural rubber, especially large-scale plantations.

Current global demand for certified sustainable or organic natural rubber is low. Despite having made commitments to using sustainable rubber, no major tire companies have committed to paying a premium for sustainable natural rubber. Some big brands such as Patagonia, IKEA, and Under Armour are among a handful of companies committing to purchase certified natural rubber.

With the formation of the GPSNR in 2018, there has been a renewed push for sustainable natural rubber. However, there is little indication in the market whether certification schemes or best practices and guidelines are the best way forward, given the relatively poor uptake of certification schemes for other commodities (palm oil, cocoa, and coffee) in Indonesia.



©hapopd/Freepik: rubber plantations

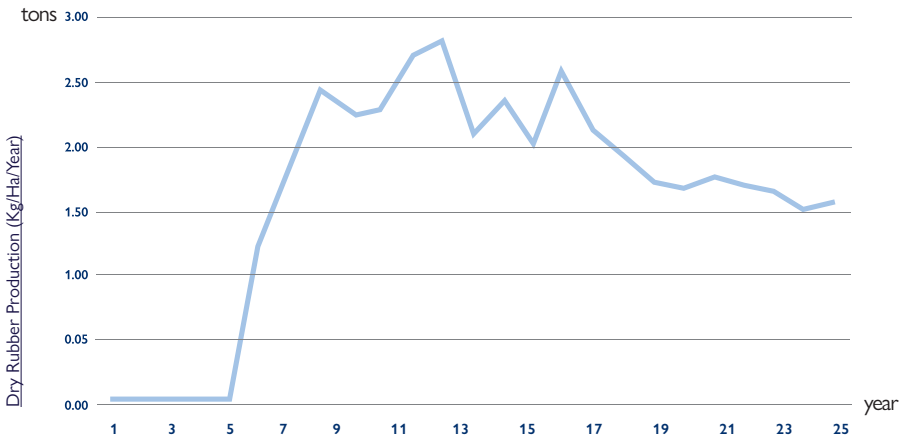
6. SMALLHOLDER RUBBER PRODUCTION IN INDONESIA

This section analyzes the yields of aging rubber trees per region, reviews rubber farming incomes/expenses patterns, agronomic and post-harvesting practices, and rubber pricing. Data was collected through a field survey with over 250 smallholders in September and October 2019 in Jambi, one province in South Sumatra and one province in West Kalimantan[16]. Given the very large population of smallholders cultivating rubber, a sample size of 250 individuals can not claim to be representative. It provides however insights in trends and patterns in the different regions.

An analysis of the environmental, social, and governance risks and challenges for smallholder farmers is also outlined, including the impact of conversion of smallholder rubber farms to plantations on carbon stock and biodiversity.

Rubber trees grow mainly in tropical lowlands at altitudes below 400 meters. The production requires year-round high rainfall of approximately 1,500–2,000 mm/year. The trees need deep soils of at least 40 cm, require relatively stable temperatures at 25–30°C and a continuous moisture level of 75–80 percent throughout the year. Dry periods that last longer than two to three months or temperatures below 18° C do not affect vegetative growth, but reduce production and quality of latex (Verheye, W. 2010 and Wijaya, T. 2008).

FIGURE 12: OPTIMAL PRODUCTION PATTERN OF PB260 CLONE (TONS PER YEAR)



SOURCE:https://www.scribd.com/doc/123599444/Pengenalan-klon

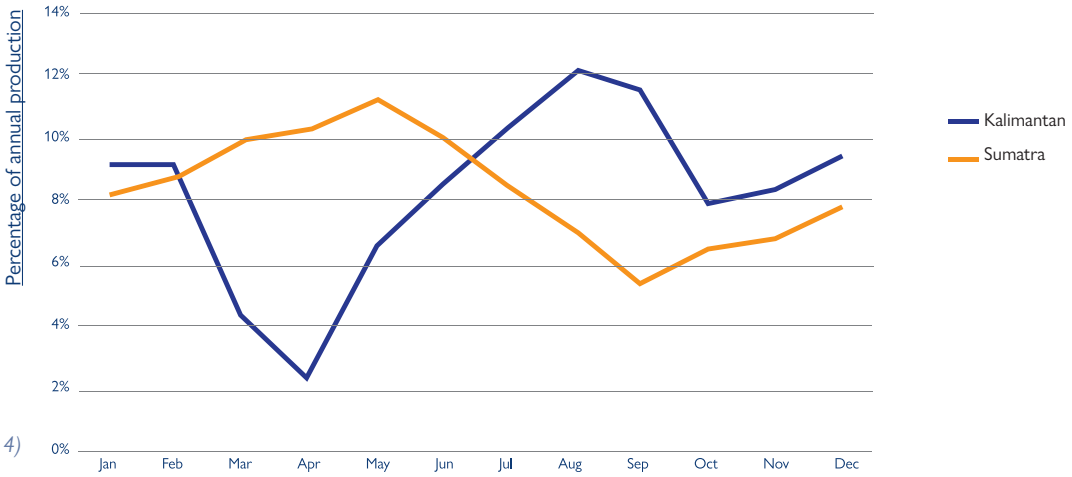
With the optimal PB260 clone variety currently promoted by the Indonesian government and rubber processors, yields are already quite substantial in the sixth year – the first year of production – at around 1.2 tons per hectare. The latex harvests then quickly increase to reach 2.4 tons in the seventh year where it remains for about eight more years. In the 15th year, production increases due to the fully recovered initial tapping panel (also called renewable bark). From the 18th year, the yield will start declining to about 1.7 tons.

Optimal yields are often achieved by plantations, but not by smallholders. The latter usually achieve only 80 percent of the stated yield. In the 24th year, the yield is approximately 1.5 tons and soon after it becomes uneconomical for a smallholder producer to sustain the farm, as costs of maintenance and harvesting stand at around $400 per hectare and outweigh the revenues generated.

16. Farmers were selected and accessed through rubber processors and cooperatives. See Appendix 5 for more details.

In addition, there are also important short-term factors in rubber production, as seen by the small but significant seasonality shown within a given year in Figure 13.

FIGURE 13: SEASONALITY OF LATEX PRODUCTION OF PB260 RUBBER CLONE



SOURCE:
Siregar T. H. S. (2014)

Although rubber trees produce latex year round, the quantity produced significantly improves when rainfall is high in the evening and absent in the morning. Increased suitable rainfall improves the stem flow of the trees, meaning that the coagulated latex can be collected more easily and quickly. In addition, large differences in smallholders' tapping patterns during the rainy and dry seasons – in terms of the number of tapping days and length of tapping on those days – can lead to lower yields during the rainy season (Siregar T. H. S. 2014). In Kalimantan, yields of PB260 are more than two-thirds lower than the annual average in April, the start of the dry season (Siregar T. H. S. 2014). Yields are highest in August at the start of the wet season and up to 46 percent above the yearly average. Seasonal fluctuations are smaller on the island of Sumatra, where Jambi and South Sumatra are located. Here yields are highest in May and lowest in September.

Trends for long-term and short-term yields are important factors when designing an appropriate replanting loan product.

There are significant differences in farm sizes and tree ages among the three regions studied (Jambi, South Sumatra and West Kalimantan). In the survey, around 80 percent of farmers' rubber plantations are two hectares or less and the average land holding is just below two hectares. This general trend mirrors that of Indonesia (Table 5).

TABLE 5: INDONESIAN SMALLHOLDERS, PRODUCTION AND PRODUCTION AREAS PER REGION

Smallholders (2017)	Area (ha)				Annual production (ton)	Number of smallholders
	Immature	Productive	Damaged (unproductive)	Total		
Jambi	55,090	306,602	18,238	379,930	262,546	214,168
South Sumatra	94,586	686,692	14,900	796,178	908,445	466,492
West Kalimantan	57,148	287,962	7,654	352,764	215,741	264,328
Indonesia	398,284	2,653,080	64,340	3,115,704	2,638,071	2,253,496

The average size of farms in the survey sample was lower than 2 hectares in Jambi and West Kalimantan and 2 to 3 hectares in South Sumatra with the largest farms in Sumatra and Jambi covering approximately 8 ha.

Planting in West Kalimantan was regular over the years, increasing from the 1960's until 2010 approximately before declining. Jambi and South Sumatra followed a very different planting approach with barely any planting until the 1990's in Jambi and until 2000 in South Sumatra followed by strong planting peaks during the period 1995-2005 in Jambi and 2005-2015 in South Sumatra.

FIGURE 14: FARMLAND AREA IN THE SURVEY SAMPLE

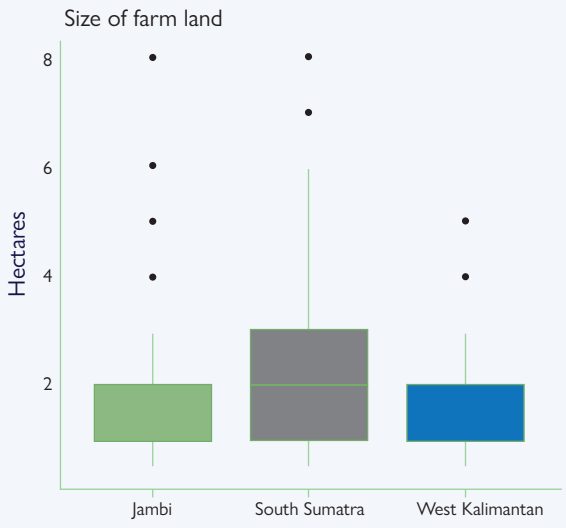
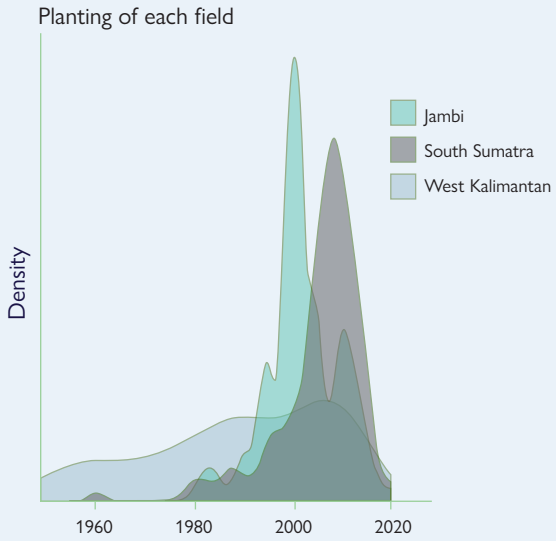
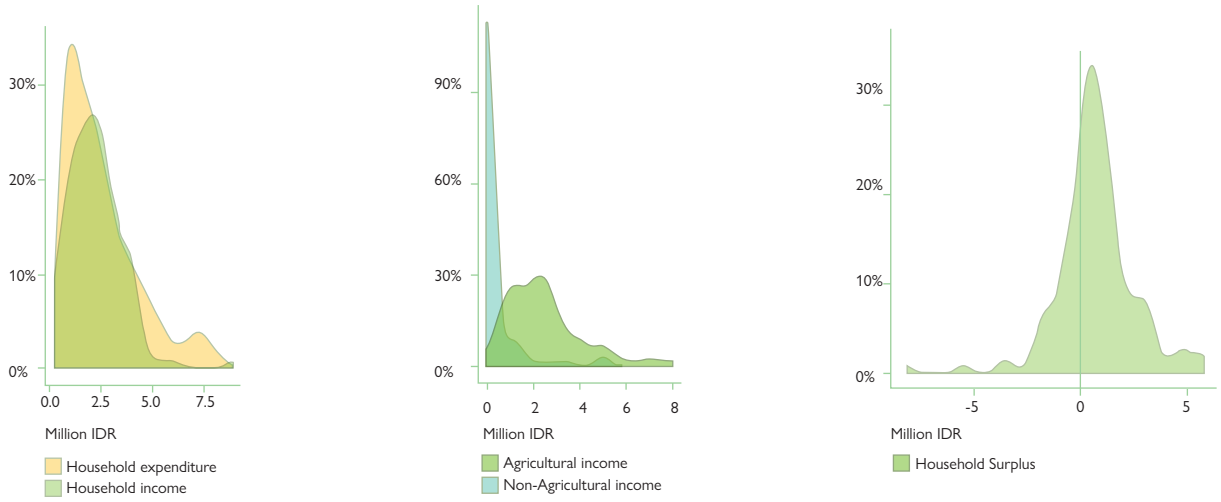


FIGURE 15: PLANTING DISTRIBUTION OVER TIME PER REGION



Description of rubber smallholders' incomes and expenses patterns

FIGURE 16: HOUSEHOLDS, INCOME IN SURVEY SAMPLE (density plots)



The largest group of smallholders report a monthly income around IDR 2.5 million ($162) while the largest group of expenses is around IDR 1 million ($65). Agricultural incomes are for most smallholders between IDR 1 million and IDR 3 million ($65-$194) while non-agricultural income is most often below IDR 0.5 million ($32). For most smallholders' households the net result is slightly above 0, indicating a small saving capacity.

Planting varieties

Using the right clone makes a tremendous difference in a rubber tree's lifetime yields. The productivity of rubber clonal and seedling-derived plants is almost three times lower than for certified clones.

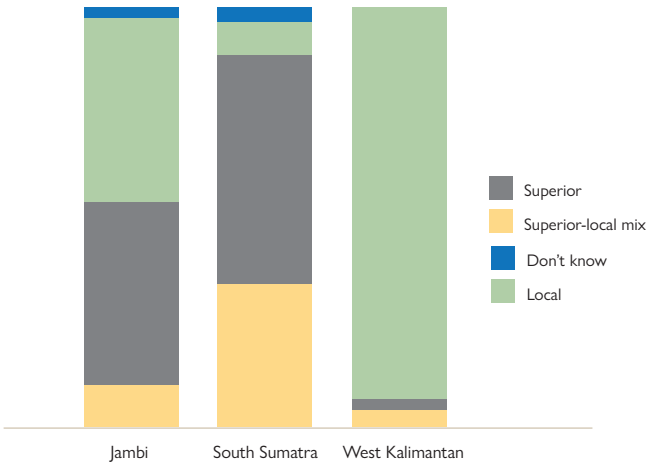
Across the regions, just 5 percent of farmers received their seedlings through a government program. Certified clones can be bought at the Sembawa Research Station or certified rubber nurseries established by the government but, in both provinces, certified nurseries are only located in provincial and district capital cities resulting in limited access to high-yielding planting materials for remote smallholders.

In Jambi and South Sumatra, superior clones are more common, especially in areas where government-supported smallholder rubber projects were established. Most farmers who grow superior clones use the PB260 variety. In West Kalimantan, however, local, lower quality, clones are the norm. During the last planting cycle, most farmers in Jambi (80 percent) and South Sumatra (70 percent) bought their clones at a nursery. Farmers usually buy rubber planting materials from local nurseries, which is cheaper but not certified.

In West Kalimantan, over 95 percent of farmers created their own seedlings, either using their own trees or using rubber trees in nearby forests.

Spacing of trees is also an important factor to ensure maximum productivity, as it determines sunlight absorption and availability of organic materials in the soil. Ideal planting space for smallholder rubber plantations is about five by three meters. Thus, for one hectare of land, about 600 to 660 plants can be grown.

FIGURE 17: TYPES OF RUBBER CLONES PLANTED BY REGIONS



Company-owned plantations usually plant rubber seedlings at a wider distance such as seven by three meters on relatively flat land. The plantings' holes are made on a straight line, following the east-west direction for seven meters and north-south direction for three meters, which leads to 476 trees/ha. Examples have also been noted of Company-owned plantations with a denser planting pattern of six by three meters, i.e. more than 550 trees per hectare. Meanwhile, spacing applied to undulating or hilly land is eight by 2.5 meters and provides space for about 500 trees/ha (Abidin, 2016).

In Jambi and South Sumatra, most farmers' interviewed planted with a four by five meter spacing. A survey conducted by Syarifa et al. (2012) in nine districts in South Sumatra recorded that the common planting distances adopted by farmers were 5 m x3 m, 4 m x 4 m and 4 m x 3 m. In West Kalimantan three-quarters of farmers do not have regular spacing between their trees.

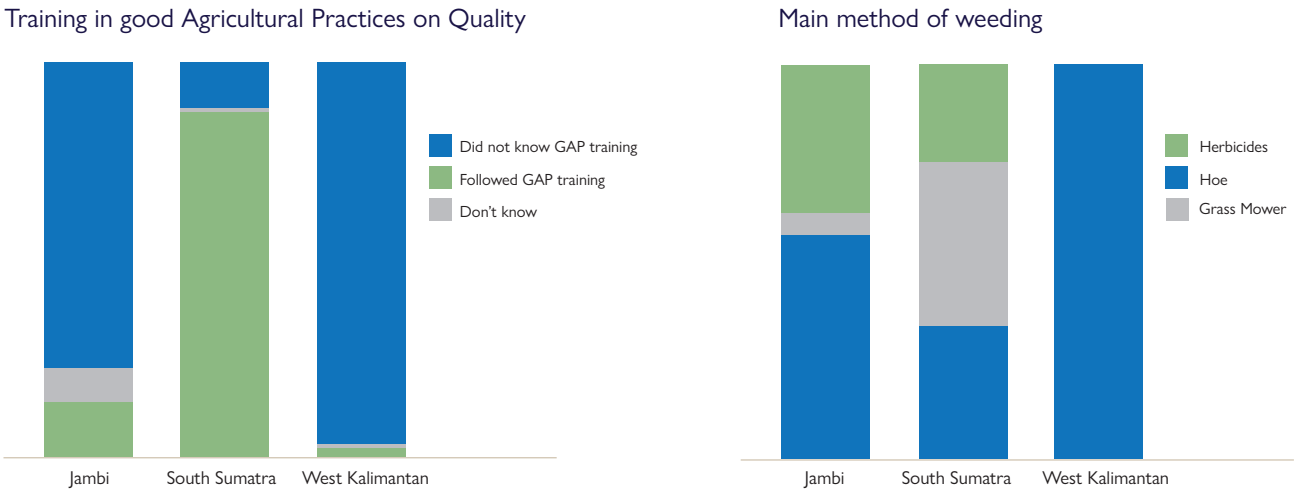
Land preparation is also an important factor for sustainability of production, especially for replanting projects, as good land preparation can lead to lower rubber infection rates (by clearing old logs and lumps containing termites and potentially white root disease). The cost of land preparation and field protection is among the most expensive investments, besides the purchase costs of high yielding clones.

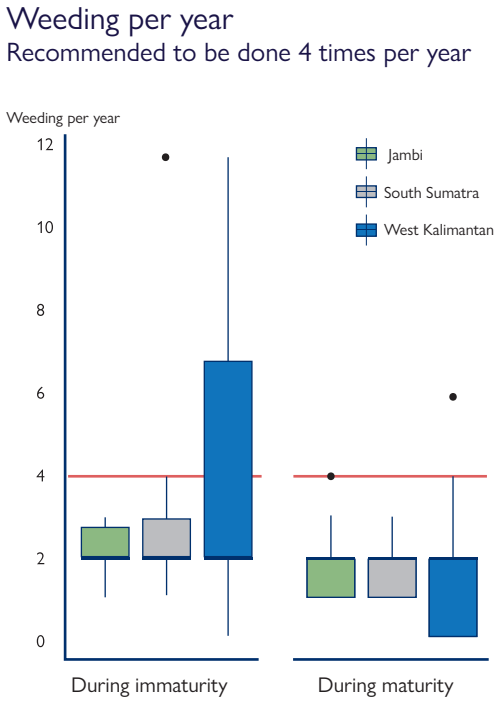
Maintenance

A plantation's productivity can be much improved when trees and soils are properly maintained. Activities during the immature period, prior to the tapping (mature period) include disbudding (removing fake buds that have grown), replacing missing trees during the first year after planting, pruning (with PB260 clones, pruning is not necessary), fertilization, and weed control. The main maintenance activity during tapping is weed control, at least four times per year according to best practices (SNV, 2018).

Figure 18 highlights strong differences in the application of GAP among regions, with South Sumatra demonstrating higher knowledge and application of GAP.

FIGURE 18: APPLICATION OF GOOD AGRICULTURAL PRACTICES IN SUMATRA AND KALIMANTAN





Despite farmers having been trained in GAP, fertilizer use is suboptimal and too little weeding is carried out. The optimal time to apply fertilizer is determined by the timing of weeding, as fertilizer should be applied after weeding to allow for maximum absorption of nutrients by the rubber plant. The best timing to apply fertilizer is in the beginning of the wet season or end of the dry season (SNV, 2018).[17] Best practices for fertilizer application and fertilizer composition depend on soil and tree age, plant nutrient status, agronomic practice, disease incidence, slopes and rainfall patterns. Smallholders' lack of knowledge in this area leads to inappropriate and overuse of fertilizers.

FIGURE 19: FERTILIZER APPLICATIONS PER YEAR

Diseases are a major threat to rubber trees with 80 to 90 percent of farmers experiencing tree diseases in 2019 in West Kalimantan and South Sumatra, respectively, and 60 percent in Jambi. The most common diseases are jamur upas (pink disease) and jamur akar putih (white root rot). The white root rot forms a high risk for the trees. When this disease attacks trees, the trees should be cut down, leaving not even the stem in the ground, to minimize infection of other trees. A new rubber leaf fall disease (Pestalotiopsis species) is spreading in Sumatra and Kalimantan. This disease causes leaf fall more than twice a year and reduces annual yield by up to 40 percent. The treatment for this disease is expensive and is often not implemented by smallholders.

17. Sembawa Rubber Research Institute recommends the application of a combination of four types of fertilizer, urea, SP 36, KCL and kieserit with specific composition based on the age of the trees (Janudiato et.al., 2013).

Harvesting and post harvesting

Proper tapping system can lead to more than 30 percent increase in yield.

The bark is the most important part of the rubber tree as it contains a network of interconnected vessels through which the latex flows (Verheye, 2010). Survey results indicated farmers in South Sumatra have the best tapping direction technique, with 94 percent following best practices, cutting from top left to bottom right. The remainder mostly cuts in both directions, i.e. a V-shape. In Kalimantan just over half of farmers cut in the opposite direction, and just 4 percent in the right direction. Most worryingly, 20 percent of farmers in Kalimantan do not have any standard cutting procedure. Farmers in Jambi are almost evenly split in three groups: those who apply the best cutting practice, those who apply it in reverse, and those who cut in a V-shape.

Those who do not follow the recommended cutting technique have 30 percent lower yields on average, with the V-shape having the lowest performance. Yet, even those who use the right cutting direction do not necessarily use the right tapping process, as anecdotal evidence suggests many farmers cut too deep and damage the cambium. Other important factors determining rubber yield, such as the time of tapping, are well-known by farmers in Jambi and West Kalimantan, who almost all say that the optimal time for tapping is in the early morning. Farmers in South Sumatra, however, are almost evenly split between those who think early morning tapping is best and those who think late afternoon tapping is optimal. The general recommendation for farmers is to tap every three days in the first two years of tapping , and every two days afterward. Farmers tend to tap their trees more frequently when the rubber price is relatively high.

Optimal harvesting techniques, land preparation, maintenance, and fertilizer management lead to a very significant income increase for farmers (through higher yields and lower tree mortality) and, therefore, a higher capacity to repay loans for replanting. Technical assistance to use GAP is crucial in enabling farmers to finance replanting sustainably.

Latex quality standards

Farmers are often unaware of quality standards set by processors and the price they can receive from different off-takers. A long and untransparent value chain is a major obstacle to improving latex quality and price per ton for smallholders.

Cleaning latex is a major expense for rubber processors due to electricity costs associated with centrifugal cleaning. They prefer receiving clean latex which they do not have to clean before processing.

However, to increase the weight of latex delivered, farmers often mix in contaminants such as tree bark, sand, stone, soil, leaves, sacks, or vulcanized rubber (SNV, 2018). When asked, 88 percent of farmers claim to provide high-quality, uncontaminated rubber. This number is a high overestimate of the percentage of farmers who actually provide high-quality rubber, as farmers are rarely aware of processors' quality standards and the price they receive from their off-taker is rarely dependent on the quality provided.

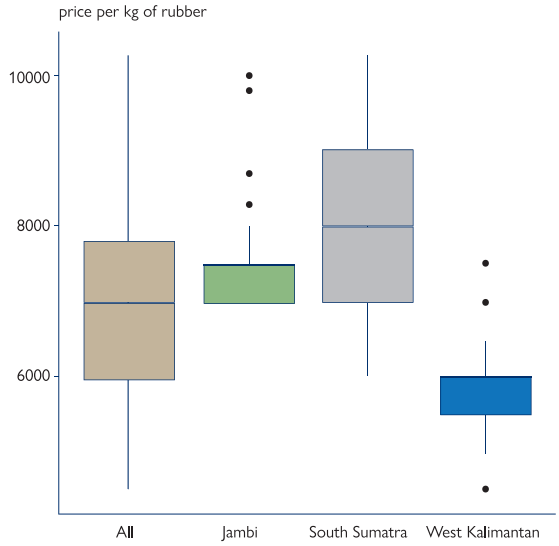
Tree damaged by improper tapping process in West Kalimantan (Photo credit: SNV)

Farmers in West Kalimantan store rubber in water

Appearance of rubber slabs in West Kalimantan

It is recommended to store coagulated latex (slabs) in a clean and dry place before sale, as dry rubber content increases with storage (SNV, 2018). Most farmers (83 percent) in Jambi store their rubber and, of these, two-thirds store it in a dry place. In South Sumatra only 15 percent of farmers store their rubber, half of those in a dry place and half store on their farm. In Kalimantan, just under half of farmers store their rubber, but 89 percent do so by soaking it in water. Soaking increases the rubber's weight and farmers' revenues as the price they are paid is usually independent of the quality. However, it lowers the quality and also harms water quality due to the presence of chemical coagulants.

FIGURE 20: PRICE PER KG OF COAGULATED RUBBER



Marketing and pricing

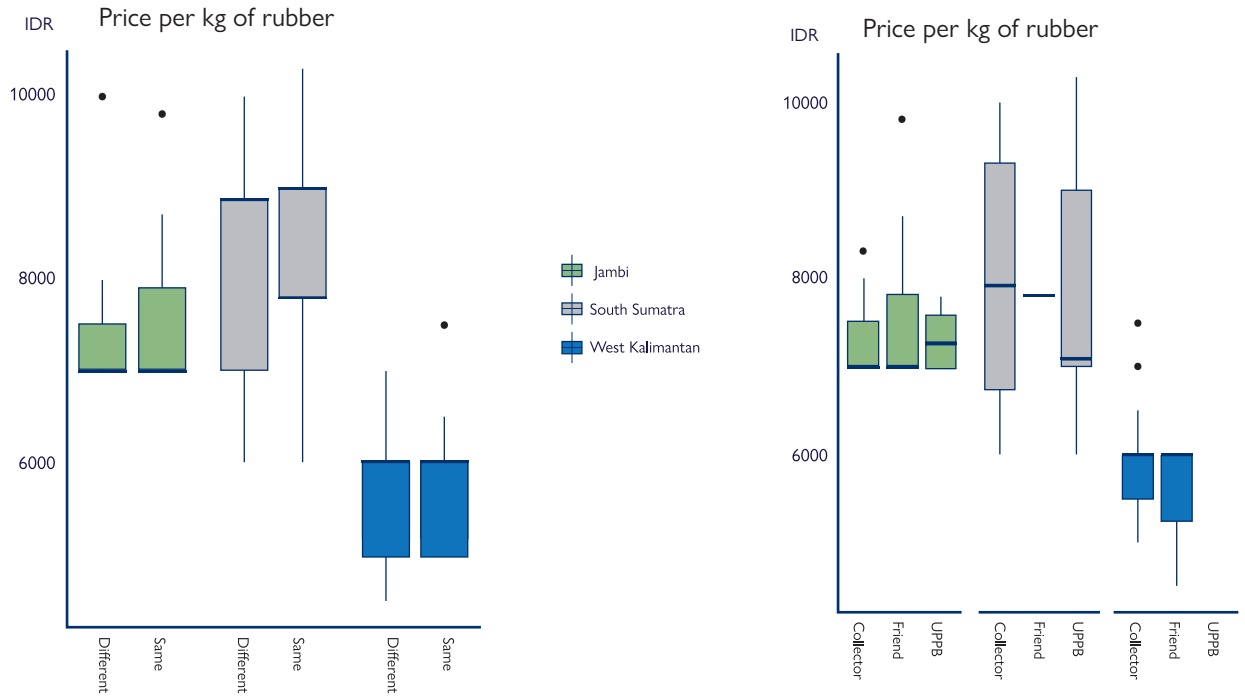
Farmers received the lowest rubber price in West Kalimantan, at just IDR 6,000 ($0.39) per kg. The price in South Sumatra is the highest at IDR 8,000 ($.52), compared to Jambi's IDR 7,000 ($0.45)[18]. South Sumatra had the highest price variation overall, Jambi had little price variation below the median price and Kalimantan little variation above the median price.

Prices vary significantly between regions but are consistent between different off-takers within each region.About half of all farmers across the three regions usually sell their rubber to the same buyer/off-taker. Of these farmers, 60 percent say that they sell to the same buyer because s/he offers higher prices. This is confirmed by the data, as those who sell to the same off-taker receive higher prices. However, the dynamics between the three regions are quite distinct (Figure 21). In Jambi those who sell to the same off-taker have higher average prices.

In South Sumatra both the median and average prices in stable off-taker–farmer relationships are higher, meaning there is a clear advantage to having an established relationship with an off-taker. Finally, in West Kalimantan, the median price is the same for farmers who sell to the same off-taker and farmers who don't, but there is much less variation below the median price for farmers who have stable off-taker relationships. This minimal variation of low prices makes stable off-taker relationships more attractive.

18. Average price for the last six months.

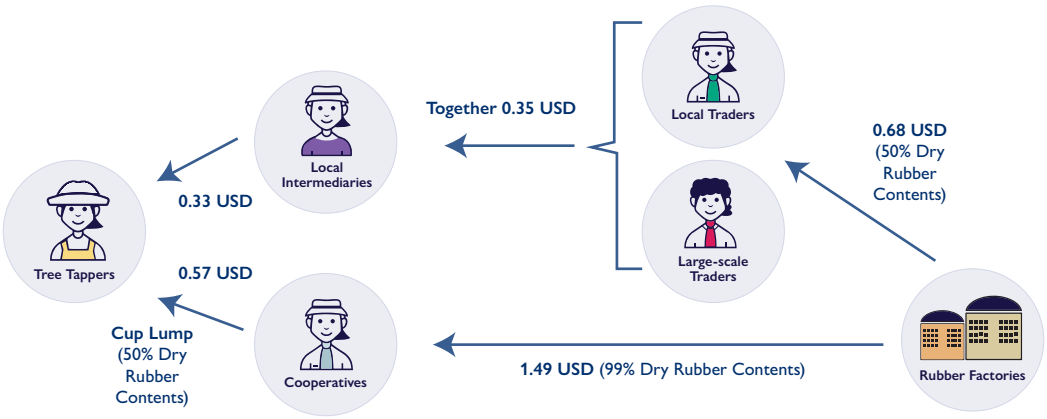
FIGURE 21: PRICE COMPARISON PER KG OF RUBBER BETWEEN FARMERS WHO SELL TO THE SAME OFF-TAKER AND FARMERS WHO SELL TO DIFFERENT OFF-TAKERS



More than 80 percent of farmers in West Kalimantan and Jambi rely on collectors for price information, effectively allowing collectors to set the price at village level. The situation is different in South Sumatra, where two-thirds of farmers receive information through cooperatives or UPPBs, and the remainder receive information from collectors. Figure 22 shows a breakdown of pricing in the value chain (Hevea Connect, 2020). At the factory, the trader will only get about $0.68 per kg. If the tapper joins a cooperative, the price received is higher, since the cooperative supplies directly to the factory. Most farmers in Jambi get paid on the same day as they deliver. In South Sumatra about half get paid the same day, the other half must wait one day whereas in West Kalimantan three-quarters of farmers must wait one day for payment. The maximum waiting time across the survey sample was just seven days.

Figure 22 compares the price received by tree tappers using cooperatives to sell their product compared to local traders.

FIGURE 22: ESTIMATES OF PRICING DISTRIBUTION ALONG THE RUBBER VALUE CHAIN



Source: Halcyon Agri

7. ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) RISKS AND CHALLENGES

In Indonesia, smallholder farmers as opposed to large, monoculture commercial estates largely drive the production of rubber in small-scale multicrop plantations. Smallholder plantation production shows lower social and environmental impact and higher biodiversity than large-scale monoculture operations. However, poor crop and operational management practices may result in low productivity and can lead to negative social and environmental impacts including onsite pollution, deforestation, loss of biodiversity, health problems, lower standards of living, and less ability to enhance livelihoods.

There are growing sustainability challenges in the natural rubber sector that will require a strong and unified response from stakeholders. The following table is an analysis of environmental, social, and governance risks and challenges for smallholder farmers in the rubber sector, based on the Global Reporting Initiative standards. Potential factors for mitigation are also outlined[19].

TABLE 6: ANALYSIS OF ENVIRONMENTAL, SOCIAL, AND GOVERNANCE RISKS AND CHALLENGES FOR SMALLHOLDER FARMERS IN THE RUBBER SECTOR

	Risks and challenges	Mitigation strategies	Key performance indicators
ENVIRONMENTAL IMPACTS	• Land degradation (land clearing using fire). • Unabated carbon emissions. • Increased global warming. • Species and biodiversity loss. • (Ground) water contamination. • Air and land pollution.	• Energy conservation and adoption of renewable energy. • Increased energy efficiency of processing facilities. • Biodiversity conservation and landscape management. • Waste reduction, recycling and pollution abatement. • Zero deforestation and 'No Deforestation, No Peat and No Exploitation' commitments.	• % CO2 emissions reduction. • Number of ha land cleared. • Number of ha land with high conservation value and high carbon stock. • % of waste recycled. • % of water recycled.
SOCIAL IMPACTS	• Risk of child and forced labor. • Aging farmers and limited interest of children to take over business. • Lack of access to GAP (poor tapping practices, inability to control weeds and pests). • Lack of access to input resources for rubber trees. • Poor storage and handling practices of tapped rubber. • Lack of expertise in other trades and crop management. • Poor health and safety practices.	• Training on GAP. • Training on storage and processing of raw material. • Training on health and safety practices. • Implementation of monitoring mechanism against child and forced labor.	• Number of cases reported on child and forced labor. • Occupational injury frequency rate. • Number of trainings on GAP. • Number of trainings on storage and processing of raw material. • Number of farmers supported with better inputs. • Number of trainings on health and safety practices.

19. The statistical information used in this section is from the Rubberway application run by Hevea Connect together with Michelin. This is a qualitative risk-based assessment tool used in over eight factories in Jambi, South Sumatra, to map the supply chain from the factory gate to the dealers and then to smallholder farmers. Hevea Connect has been running this program for 2-3 years and has qualitative data from about 1,200 farmers.

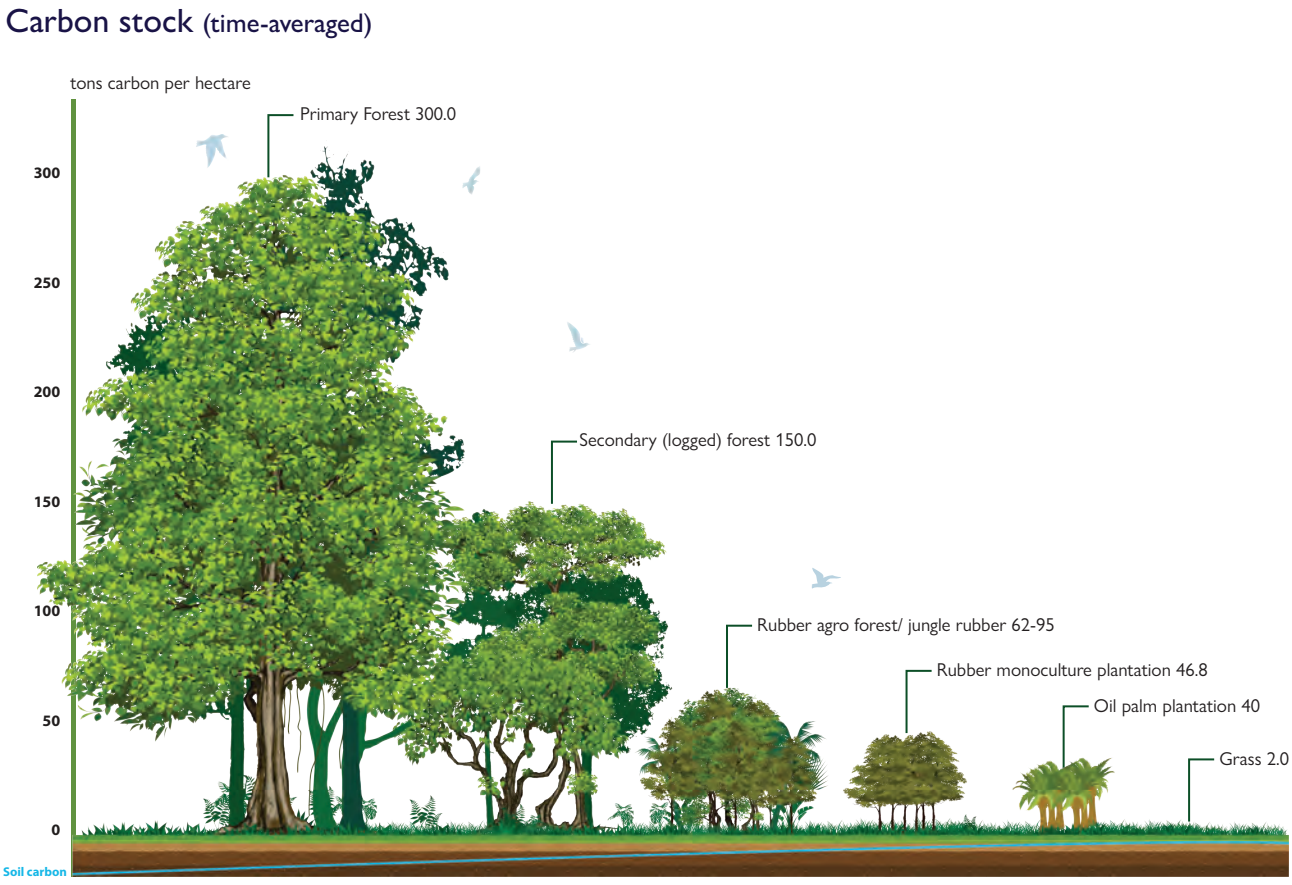
	Risks and challenges	Mitigation strategies	Key performance indicators
GOVERNANCE IMPACTS	• Poor demarcation and zoning of land areas. • Lack of sustainability certification and commitment of stakeholders towards sustainable natural rubber. • Lack of capital investment and seed funding to enable replanting efforts, provide fertilizers and cascade knowledge on GAP.	• Promote transparency and traceability of raw material in the industry. • Increase knowledge sharing among smallholder farmers. • Promote innovative models of funding. • Improve working conditions of farmers. • Land titles.	• Number of programs, tools and frameworks available to promote transparency and traceability throughout the sector. • Number of financial sector engagements to build innovative financial methods.

Biodiversity and carbon stock

Conversion of natural forests to rubber, oil palm, and other agricultural commodities has significant negative impacts on carbon stocks and biodiversity. Such land use changes result in lower carbon stocks, increased rates of carbon emissions to the atmosphere, and depleted biodiversity.

Aboveground, time-averaged carbon stocks for rubber plantations average about 46.8 tons C/ha, while oil palm plantations average about 31, and rubber agroforests about 62.1, compared to primary forest with about 300 tons C/ha (Swallow et. al. 2007; Figure 23).

FIGURE 23: ABOVE GROUND TIME-AVERAGED CARBON STOCKS OF DIFFERENT LAND USE SYSTEMS IN INDONESIA



Source: Swallow, B, M. van Noordwijk, S. Dewi, D. Murdiyarso, D. White, J. Gockowski, G. Hyman, S. Budidarsono, V. Robiglio, V. Meadu, A. Ekadinata, F. Agus, K. Hairiah, P.N. Mbile, D.J. Sonwa, S. Weise. 2007. Opportunities for Avoided Deforestation with Sustainable Benefits. An Interim Report by the ASB Partnership for the Tropical Forest Margins. ASB Partnership for the Tropical Forest Margins, Nairobi, Kenya.

Guillaume et al. (2018) studied the impacts of Sumatra rainforest conversion to tree plantations of increasing management intensity on carbon stocks and reported that the conversion of rainforest to jungle rubber, rubber, and oil palm monocultures lost 116 ton C/ha, 159 ton C/ha, and 174 ton C/ha, respectively.

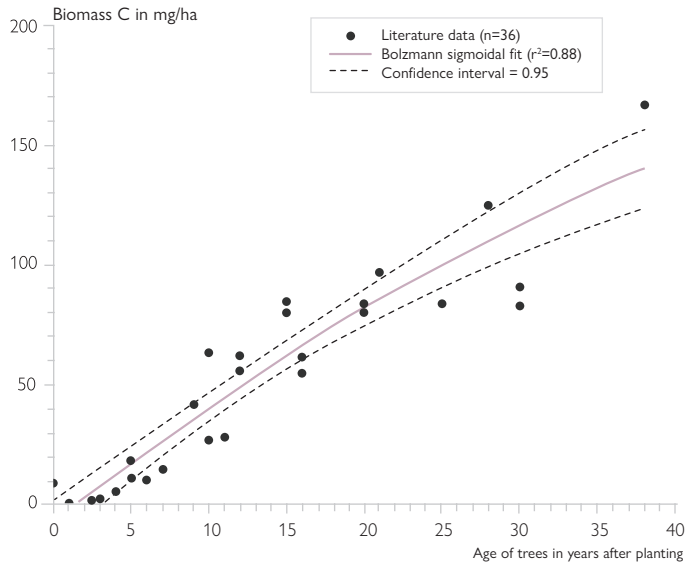
One study by The World Agroforestry Centre involving industrial rubber plantations in Sumatra showed that conversion of forest into estate crop plantations changed biodiversity from complex to simple composition (Tata, 2011), with the loss of forest cover significantly decreasing vegetation and bird richness. Similar conditions were also reported by Rahayu and Pambudi (2017) from a study of rubber monoculture plantations in Central Java, which accounted for only four species of vegetation. The high diversity of forest vegetation supports higher animal diversity, especially for birds and bats regarding foraging and nesting sites. Smallholder rubber agroforests ("jungle rubber") may be able to come closer to mimicking the diversity found in natural forest ecosystems.

In a study conducted in West Kalimantan, plant diversity inside traditional smallholder rubber agroforestry plots (RAS1 plots) was found to be relatively high and vegetation succession was close to that of natural secondary forest (Ihalainen, 2007).

Hauser et. al (2015) conducted a meta-analysis of carbon sequestration in rubber plantations using 38 data sets on biomass accumulation in rubber from around the world to calculate a single graph (Figure 23), indicating that 25-year-old plantations store approximately 100 tons of carbon per hectare.

Rubber agroforestry systems are likely to contain similar or higher carbon stocks than monoculture plantations. Wiryono et al. (2016) estimated carbon stock in trees was about 95.2 ton carbon per hectare in rubber agroforestry systems in southwest Sumatra.

FIGURE 24: ABOVEGROUND BIOMASS CARBON IN RUBBER PLANTATIONS



Source: Hauser et. al 2015

Oil palm's high profitability is also contributing to recent trends of smallholder farmers converting their rubber and jungle rubber plots to this alternative crop, with associated negative environmental impacts in terms of carbon stock and biodiversity losses. Dewi et.al. (2009) estimated average carbon stocks of oil palm plantations in two estates in Sumatra and Kalimantan at 38.8 tons carbon per hectare and 39.2 tons carbon per hectare respectively, with a 25-year planting cycle.

8. MODELING ECONOMIC VIABILITY OF LOANS FOR REPLANTING RUBBER TREES

In this section, two different business cases and associated loan products for financing rubber replanting for smallholders are modeled. The models forecast the impact of different loan structures, amounts and terms, and assessing the economic viability of providing long-term replanting loans for rubber smallholders in Indonesia.

An extensive Excel-based model was developed to analyze cash flows of replanting and intercropping models. Using industry data and data collected during the field survey, the model projects smallholder monthly costs of replanting, maintenance and harvesting; yields and estimated rubber prices to calculate net incomes for farmers over the rubber tree economic lifespan. Household finances and intercrop net incomes are also included to ensure that cash flows of the entire household can be modeled, rather than just those of the farm.

FIGURE 25: SCREENSHOT EXAMPLE OF FINANCIAL MODEL

Financial Access

Smallholder Rubber Replanting Model

Loan

Loan per hectare	-	
Repayment schedule	Annuity	
Grace period	12	months
Repayment period	6	years
Yearly interest rate during grace period	15%	
Yearly interest rate after grace period	15%	

Replanting

Sell rubberwood	No
Price per m3	150,000
Type of clone	PB260
Price assumption	Neutral

Household

Monthly outside income	500,000

Specify monthly household costs or household composition

Monthly household costs	
Adults	
Children (0-6)	2
Children (6-12)	1
Children (12-18)	1
	-

Disubursement Schedule

Disubursement date 1	January-20
Replanting percentage 1	50%
Disubursement date 2	January-21
Replanting percentage 2	50%
Disubursement date 3	January-22
Replanting percentage 3	0%
Disubursement date 4	January-23
Replanting percentage 4	0%

Alternative Crops

Corn	No
Soy	No
Rice	No
Sorghum	No
Banana	Yes
Pineapple	No
Pepper	Yes
Cardamom	No
Turmeric	Yes
Carcuma	No
Iles-iles	No
Timber	20%

Critical data points used for modeling

Key input variables included:

- Estimated yield over time (with or without application of GAP) and depending on the region.
- Rubber price forecasts.
- Inputs and maintenance costs.
- Impact of selling rubber wood on viability when replanting.
- Household expenses.
- Costs for external labor. This includes costs of tappers, day labor and other laborers hired for preparing and maintaining land. It does not include labor costs of the farmer and his/her household as this is considered as the profit or outcome of the rubber plantation.
- Financial costs. Evaluating the viability of taking a loan for replanting rubber trees is the final objective of the model. Financial costs are therefore not included in the return analysis, but will be integrated when concluding whether taking a loan for replanting makes sense financially and, if so, at which interest rates.

The model uses a matrix of two production models *(rubber-only vs. agroforestry system)* **with two variants each** *(one-time replanting vs. staggered replanting)*:

Rubber-only (no other crops)

- Rubber-only with replanting 100 percent of the plot at one time.
- Rubber-only with replanting staggered in two periods (50 percent in year 1 and 50 percent in year 2[20]).

Agroforestry model
(mix of rubber and other crops)

- Rubber plus intercrops with replanting 100 percent of the plot at one time.
- Rubber plus intercrops with replanting staggered in two periods (50 percent in year 1 and 50 percent in year 2).

For each production model and variant, three rubber prices scenarios (pessimistic, neutral, and optimistic) define the expected range of returns.

20. Farmers could replant the second half of their plot two or more years later, but we are considering here a situation where trees are already past their economic life and should be replanted as soon as possible to maintain a viable yield.

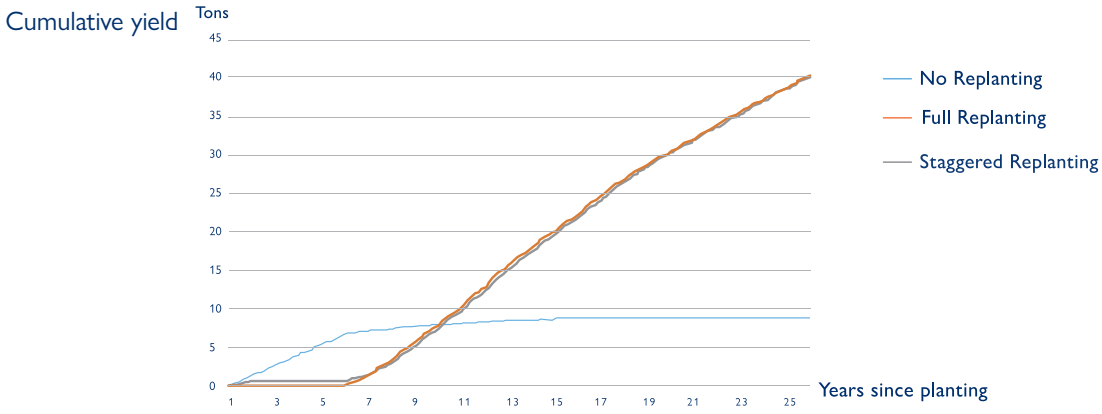
Rubber-only model

Rubber yields

Cumulative income from newly planted trees surpasses that of non-replanting within 11 years.

Figure 26 shows three different cumulative yields for a 1 ha plot with 20-year-old trees. In the first scenario, no replanting is undertaken, and the trees remain productive for another five years, when it becomes uneconomical to continue tapping rubber trees (in practice smallholders may sometimes continue tapping without any maintenance for a few more yeas with very low yields). The second scenario is where all rubber trees are replanted at the beginning of the period, i.e. when the old trees are 20 years old.

FIGURE 26: CUMULATIVE YIELDS UNDER DIFFERENT RUBBER-ONLY REPLANTING SCHEMES



The third scenario considers staggered replanting, where half the trees are replanted in year one and the other half in year two. These yields are all based on an optimal-growth scenario.

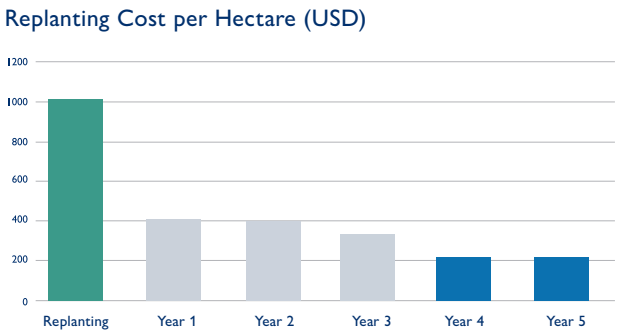
It appears that although the two replanting scenarios are different in the beginning, they yield very similar results over time. In both cases there is also a significant amount of time where the rubber trees do not yield any latex, five years in the case of full replanting, and four years in the case of staggered replanting (though yields are below their full potential at that time). Yields are highest between years 8 and 17. After year 17, yields start declining until year 25.

Cost

The costs of replanting are estimated at $2,600 per ha over a 5-year period. After that, operational costs are estimated at $460 per year when trees become productive.

The replanting process can be broken down in roughly three stages.

FIGURE 27: REPLANTING COSTS PER HECTARE ($)



The first stage is replanting, where old trees are cut down, land cleared, and new saplings planted. This process takes a few months and costs around $1,000 per hectare, roughly two-thirds of which goes to clearing the land and one-third to buying and planting new saplings.

The next stage encompasses the first three years after replanting. This stage is critical for the tree's development; suboptimal growth during these years will lower yields for the entire productive life of the tree. As trees are still young, they require ample nutrients from the soil, and fertilizer and weeding are vital.

Furthermore, young trees are susceptible to numerous diseases and pests, which must be prevented using the right herbicides and pesticides. The costs of these inputs and activities is around $400 per year for Year 1 and Year 2 and slightly less in Year 3. Farmers need to be trained and supported in this stage to ensure high productivity of trees over their entire life cycle.

The third and final stage is reached at the start of year 4 and ends when the rubber becomes productive in year 6. Using the right management practices is still important to ensure tree growth, but they require almost no herbicides to prevent diseases. Annual costs decrease to about $220.

Costs incurred during these three replanting stages is around $2,600 per hectare over a five-year period. During the sixth year the trees will become productive and operational costs will be around $460 per year, including external labor to harvest the latex.

Household costs

Farm finances are usually closely integrated with those of the household. To forecast accurately smallholders' financing needs, household finance must be incorporated in farm financing (including replanting)[21]. A typical household of two adults with two children, one below school age and one in primary school, will be considered. Family household income is about half of total expected household expenses in the first year, meaning the other half would normally come from the farm, in line with field survey findings. Household cash flow is based on a 2 ha plot of land, the median plot size in the survey.

Returns for rubber-only scenario with 100-percent replanting

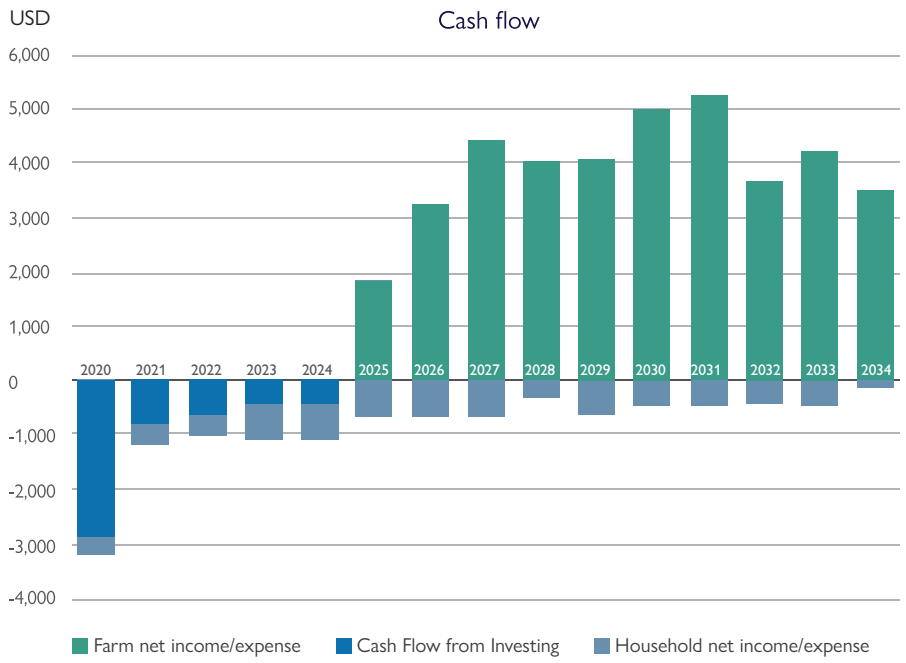
Under the one-time replanting scenario, capital expenditures are only $5,200 but with household costs included, the financing need is much higher. With commercial loan terms, it is impossible to design an appropriate loan product for smallholders in this scenario.

The financial return to replanting will be gauged by its internal rate of return (IRR)[22]. The IRR is calculated on an annual basis over 25 years. The IRR of a rubber-only model without including household costs ranges between 23 and 33 percent. However, smallholder finances are fully integrated and separating household costs from 'business' costs' is not realistic and does not represent smallholders' daily reality.

21. Ignoring household costs and dynamics in financial analysis omits an important source of income, expenses, and risks for smallholder lending. A further complication is that a household's composition, and associated costs, are destined to change during the tenure of a long-term loan.
22. Discount rate needed to set the present value of the replanting opportunity equal to zero.

When including typical expenses for a household of four people and an external income of around $30 per month, the cash shortfall, or financing needs, increases to $7,590 at the end of year 5.

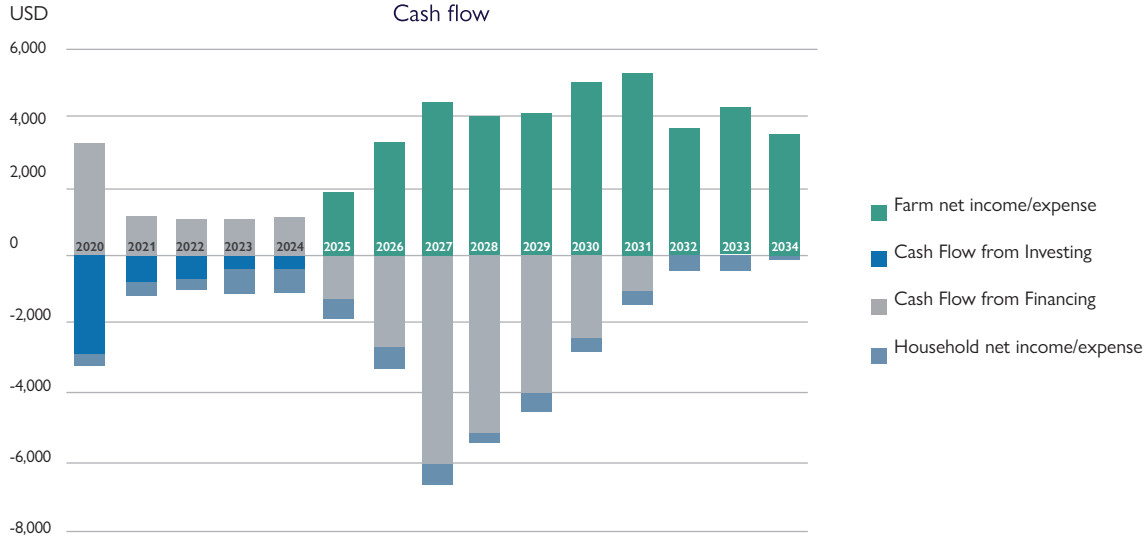
FIGURE 28: FARM CASH FLOW FOR RUBBER-ONLY WITH 100-PERCENT REPLANTING



IRR Scenario	IRR
Pessimistic	16.5%
Neutral	22.3%
Optimistic	26.8%

The large cash shortfall is a challenge to design a viable loan product. With a low but commercial interest rate of 15 percent per annum, a 12-month grace period and a 5-year repayment period, a total loan size of around $28,900 is necessary to prevent a cash shortfall for the smallholder. The loan should be disbursed in seven tranches over the first seven years, each of which is taken as a separate loan (meaning each tranche has its own grace period). However, though this product can prevent the smallholder from having a cash shortfall during replanting, the large loan size means their repayments reach such a high level that they experience a cash shortfall after replanting. Hence, with a commercial interest rate, it is impossible to design a viable loan product for this scenario.

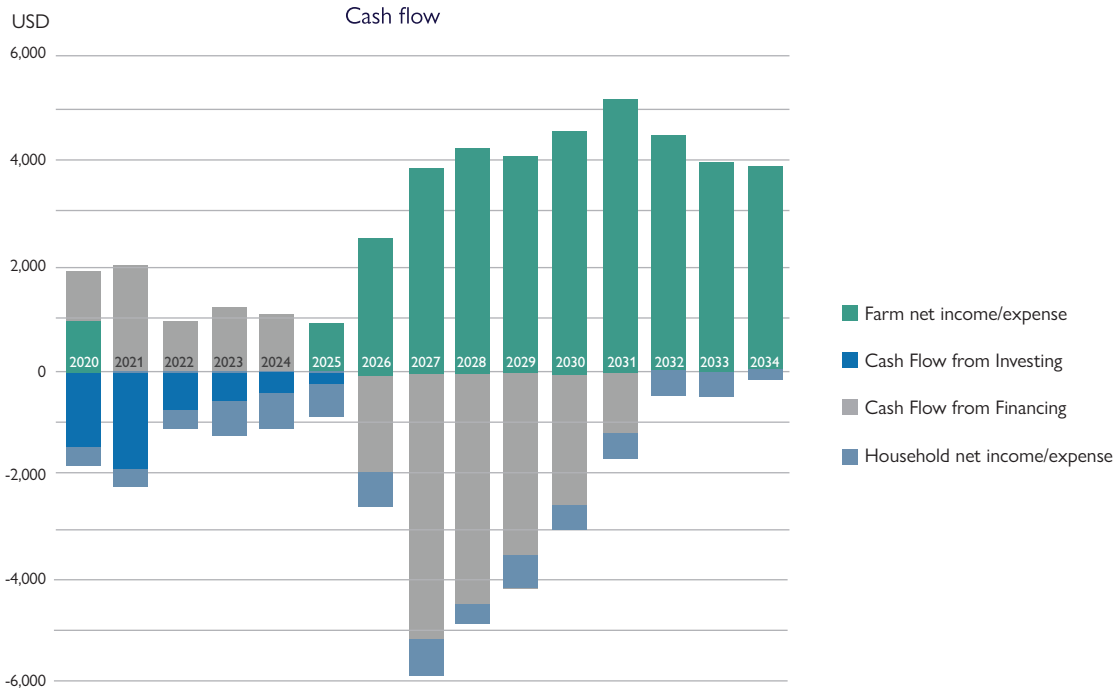
FIGURE 29: CASH FLOW FOR RUBBER-ONLY WITH 100-PERCENT REPLANTING MODEL WITH COMMERCIAL-RATE LOAN



Returns for rubber-only scenario with staggered replanting

Typically, smallholders make the costs of replanting more manageable by using staggered replanting. They initially replant just half their plot, with the other half being replanted the next year. The advantages of the scheme are twofold: first it spreads replanting costs over a longer period and second, it provides farmers with an income in the first year, as their old rubber trees remain productive. However, the drawback of staggered replanting is that half of the rubber trees become productive one year later than under a full replanting scheme and there is a slight increase in costs (time and resources). At the end of the productive period the farmer can choose to replant the plot in two phases, using the available space for additional intercrops until the rubber trees have reached their productive age, or to replant progressively, a few trees at a time. The progressive approach is possible due to the existing intercrops providing intermediary incomes.

FIGURE 30: CASH FLOW WITH COMMERCIAL-RATE LOAN FOR RUBBER-ONLY STAGGERED REPLANTING



IRR Scenario	Pessimistic	Neutral	Optimistic
IRR	17.6%	24.4%	30.3%

The first year of replanting still shows positive cash flows due to the presence of productive rubber trees, though net cash flows are negative. The impact over the long term is minimal, as trees in the second planting are almost as productive as the first planting within a few years after becoming productive. Cumulative cash after 15 years remains around $13,500. The cash shortfall decreases by $1,150 to $6,440. The IRR increases slightly as some income is pulled forward and some costs are pushed back. The impact on IRR is, however, limited.

The financing need over the first seven years does decrease significantly, from $29,000 to $22,500. However, designing a commercial loan product with the specifications mentioned in the previous scenario, remains unviable. The seven-tranche loan totaling $22,500 would prevent the smallholder from having a cash shortfall during those seven years but would leave them with a shortfall of over $3,500 two years later due to high repayment costs.

Commercial-rate loan products are not viable to finance rubber replanting because replanting costs are incurred long before the farmer starts to generate income and while household expenses accumulate.

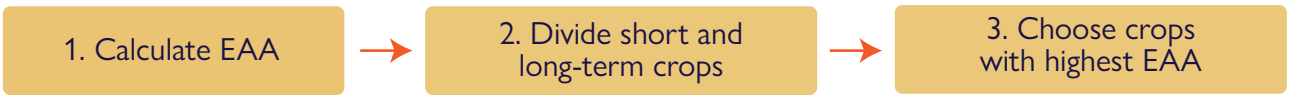
Agroforestry model

Enabling smallholders to generate income during the first five years after replanting is necessary to enable commercial financing. An agroforestry model where rubber is grown alongside several other crops offers a solution to this cash shortfall. Apart from the obvious benefit of making financing, and therefore commercial replanting, possible, it also enables income diversification for smallholders as well as a positive environmental impact.

Selection of intercrops

A double cash flow model which includes monthly expenses and revenues associated with intercrops as well as rubber production is used to determine which intercrops are optimal for a smallholder.

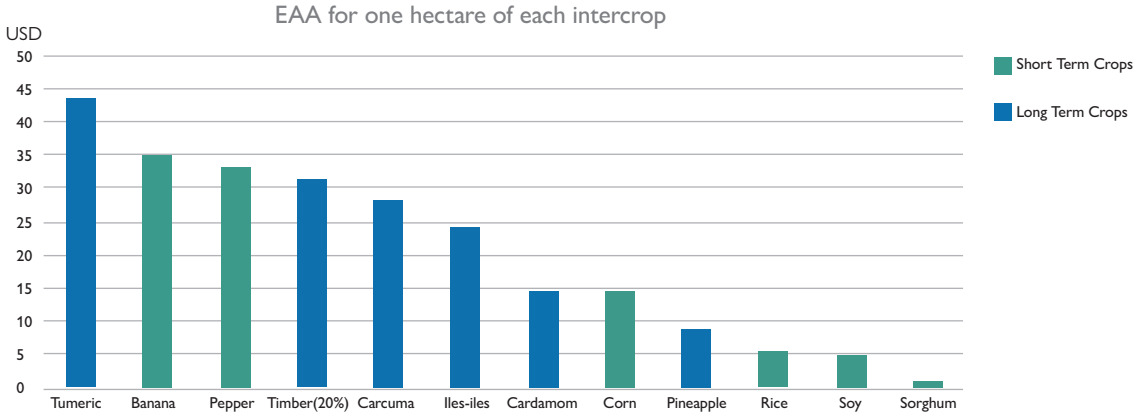
In order to select the intercrops, a three-step approach was followed. The first step is to calculate the Equivalent Annuity Approach (EAA) of intercrops, using the costs and revenues of intercrops and rubber on 1 ha[23]. An EAA analysis compares crops with different growth cycles[24]. In the second step the crops are divided into two categories: those which generate income only in the first two years after replanting before the canopy is fully closed, and those that generate income from year three onward. Finally, the two crops with the highest EAA in each category are chosen as the optimal mix of intercrops. All crops considered have strong local markets and are known to farmers in Indonesia, meaning that selling produce is not a major factor in determining the optimal crop mix. These three steps identify the most profitable mix of crops and ensure well-diversified incomes to smallholders.



23. This means that when deciding whether planting an intercrop that generates revenues in year 1 and 2, and another that generates revenues from year 3 onwards the IRR is not the right measure on which to base this decision

24. The technical description of the EAA is the constant cash flow that is generated by an investment over its lifespan as if it was an annuity. In lay terms a (rational) farmer would be indifferent between planting his crop and harvesting it according to the specific crop cycle or receiving the EAA amount every month for the duration of the crop cycle. In practical terms the EAA consists of two steps. First the Net Present Value (NPV) of the crop cycle is calculated, which means discounting all future cash flows to their current value and summing them up. However, just considering the NPV would be an invalid measure of comparison, as different crop cycle lengths are not explicitly considered. To do this the second step takes the NPV and calculates the monthly annuity payment over the length of the crop cycle. For consistency the discount rate and interest rate are the same and equal 15 percent per annum, in line with interest rates considered throughout this report.

FIGURE 31: EQUIVALENT ANNUITY APPROACH VALUES FOR ONE HECTARE OF DIFFERENT TYPES OF INTERCROPS



For the remainder of this analysis, an agroforestry model where 20 percent of the space available for rubber trees is used for growing trees for timber is considered. In years 1 and 2, bananas and peppers will be grown on the spaces between the newly planted trees. As the canopy closes in year 3, these intercrops will be replaced by turmeric.

The approach chosen here is not normative in the sense that it uses selected crops to define the most economically viable model, but doesn't require a farmer to use this crop mix. The financial model created for this study is able to define the appropriate loan amount and terms for any mix of the studied nine intercrops[25]. Other crop mixes can be designed based on local weather and soil compatibility as long as the distributed income and expenses pattern, market attractiveness, and access remain similar to that of the selected model.

Agroforestry model – 100-percent replanting of rubber with intercrops

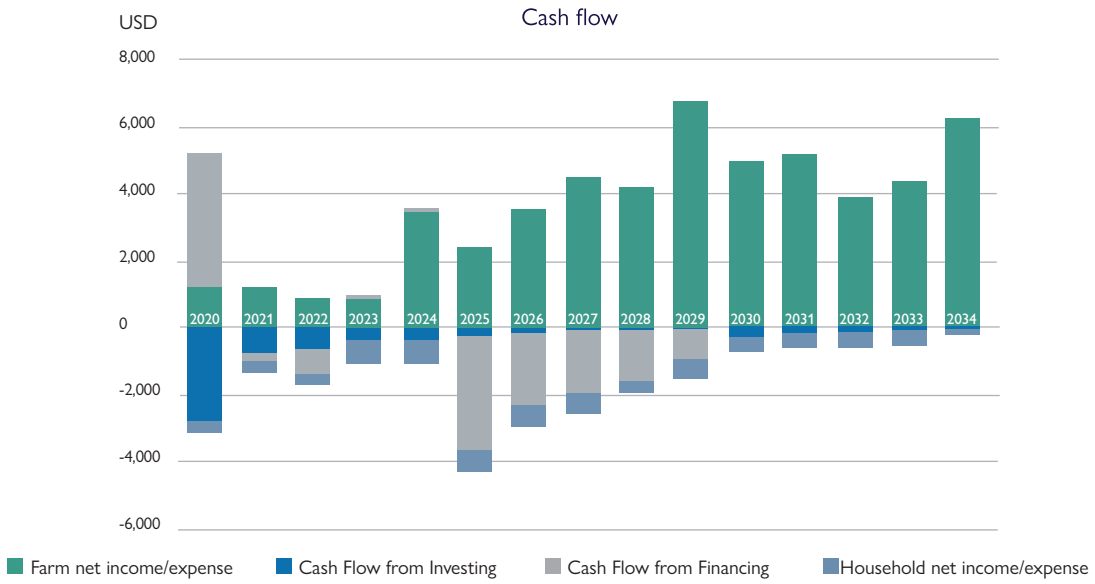
Under an agroforestry model with full replanting of rubber, the cash shortfall almost halves to $4,000. This maximum shortfall is reached in year 1 and net income in the following three years is around zero. Though this builds a strong basis from which to build a financing product, monthly fluctuations must be considered rather than the net zero cash flows on an annual basis. After 15 years, cumulative cash reaches $33,000 after taking loan repayments into account.

The IRR values of agroforestry are about 10 percentage points higher than for monoculture plantations (with full replanting), a relative improvement of 38 percent to 79 percent confirming the importance of intercropping.

IRR Scenario	IRR
Pessimistic	30.4%
Neutral	34.3%
Optimistic	37.5%

25. It is possible to include other intercrops when available but for technical reasons the study opted to work with the most common intercrops for rubber.

FIGURE 32: CASH FLOW FOR 100 PERCENT REPLANTING OF RUBBER WITH INTERCROPS WITH COMMERCIAL RATE LOAN



A commercial loan product (with a 15-percent interest rate, one-year grace period and five-year repayment period) of five disbursements over five years can ensure there is no cash shortfall for smallholders. The total value of the loan over that period is $12,800, made of instalments of $2,254, $3,483, $2,186, $2,459, $2,049 and $410 per year. The total loan value is roughly three times the investment need. As the smallholder starts repaying in year 2, the total outstanding principal is a maximum of $9,420.

The fact that the financing need is larger than the cash shortfall is explained by two factors:

1. The household costs use up significant portions of the income generated by intercrops in the early years.
2. Intercrops provide lump-sum costs and income during the year, which must be smoothed out through the loan product.

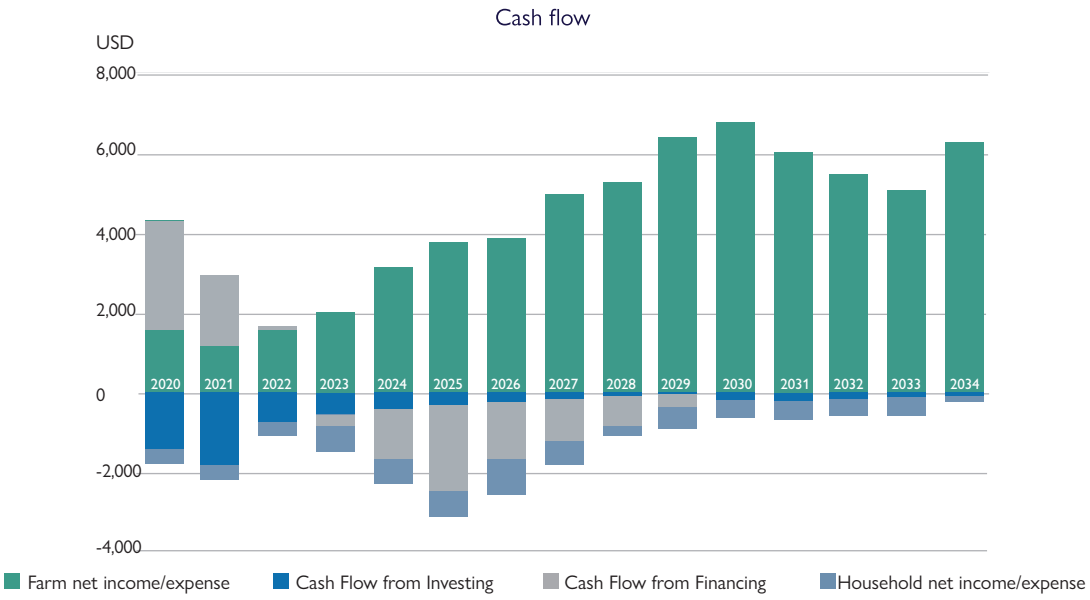
Agroforestry model - staggered replanting of rubber with intercrops

Staggered replanting spreads replanting costs over a longer period and provides farmers with an income in the first year. In addition, planting costs of intercrops in the second planting can be almost fully offset by the income generated by these same intercrops in the first planting. Costs are incurred much closer to when income is received. Banana, pepper, turmeric, and timber remain the optimal mix of intercrops in the agroforestry model when using staggered replanting.

For staggered replanting, the cash shortfall is the smallest of all scenarios considered and stands at $3,370. The cumulative cash grows by 35 percent to $45,000 in year 15. The IRR also increases further to 46.9 percent in the neutral scenario, almost double what it was under monoculture and 35 percent higher than under full replanting of agroforestry.

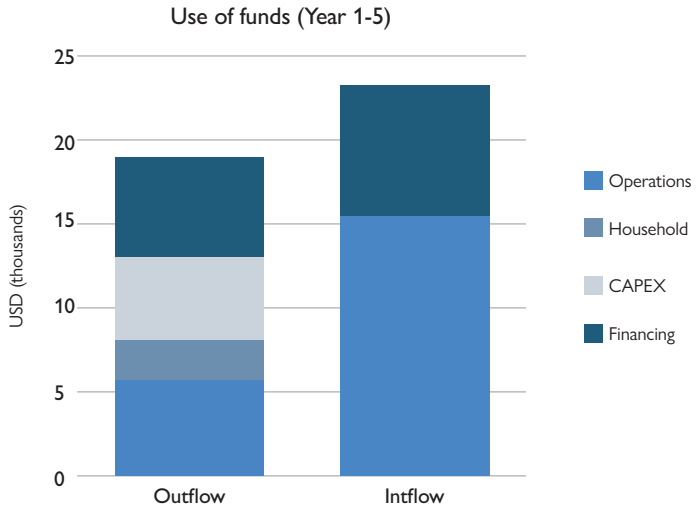
IRR Scenario	IRR
Pessimistic	41.7%
Neutral	46.9%
Optimistic	52.1%

FIGURE 33: CASH FLOW FOR STAGGERED REPLANTING OF RUBBER WITH INTERCROPS WITH COMMERCIAL RATE LOAN



The loan product is also more attractive for financial institutions and smallholders than under full agroforestry replanting. There is no cash shortfall and the five loan instalments over five years total $7,855. The maximum principal outstanding at any point is $6,085, or one and a half times the total investment need. The five installments are $1,571, $2,527, $1,434, $1,503, $820 respectively. The second instalment is the largest as half the replanting costs are incurred, but there is no longer any rubber income to help cover these costs.

FIGURE 34: USE OF FUNDS FLOW OVER FIVE YEARS FOR AGROFORESTRY MODEL WITH STAGGERED RUBBER REPLANTING[26].



Over a five-year period, the cash outflows on capital expenditures, operations, and financing are roughly equal, between $5,000 and $6,000, while household needs stand at $2,400 over the period. Almost all operational expenditures are for intercrops, as the rubber is only partially productive in the first year during staggered replanting. Profitability of intercrops can be gauged by cash inflow from operations, of which only a small part is generated by rubber in the early years. The inflow from financing equals the total size of the loan product, or $7,855 over five years.

26. CAPEX: Capital expenditures (are funds used by a company to acquire, upgrade, and maintain physical assets such as property, buildings, an industrial plant, technology, or equipment. CapEx is often used to undertake new projects or investments by the firm.

9. FINANCING MODELS FOR SMALLHOLDER FARMERS IN INDONESIA AND SOUTHEAST ASIA

Section 7 analyzed the financing needs and economic viability of two potential replanting models for rubber smallholders. This section will review financial products available in Indonesia that can potentially meet this need; list lessons learned in smallholder finance from other commodities and countries in the region; and identify (financing) gaps in the market. Six success stories in financing are outlined.

Challenges and opportunities for smallholder finance

Value chain finance actors and challenges

The focus of financial inclusion in Indonesia has recently moved from urban centers to smallholder farmers in rural areas. Given the complexities of agricultural finance, innovative models involving multiple stakeholders and supply chain actors have been designed.

FIGURE 35: MAIN VALUE CHAIN FINANCING ACTORS

Supply chain actors: Value chain financing provided by actors downstream in the supply chain (off-takers) or upstream (input providers) to improve farmer productivity. Successful examples of long-term replanting finance in Indonesia include the palm oil supply chain and Syngenta's SEEDS2B program to improve access to better inputs.

Commercial (non-state-owned) banks: Large banks (i.e. Bank Central Asia, Bank Tabungan Pensiunan Nasional, CIMB Niaga) serve large agricultural clients through their corporate lending departments and creditworthy smallholders via their micro, small and medium-sized enterprises (MSME) departments or retail banking. Banks tend to avoid the latter.

State-owned banks: While the government tasks Bank Mandiri, Bank Negara Indonesia (BNI) and Bank Rakyat Indonesia (BRI) to increase their exposure to MSME/smallholder farmers, these banks' efforts are limited to disbursing the government's credit facility program, KUR (Kredit Usaha Rakyat, People's Loan for Business).

Regional development banks (BPD): Twenty-six regional development banks, with regional governments forming part of the shareholder structure, aim to strengthen regional economies through financial inclusion. Professionalism, and rate of non-performing loans, vary by region.

Credit unions and local development banks: (People credit banks BPR and Micro Finance Institutions) Though active in the rural agriculture financing space, regulatory and balance sheet constraints, operational costs, and competition from KUR and money lenders limit outreach.

Venture capital funds: These funds are more interested in agritech start-ups (due to higher scale potential – as shown by the recent success story of Tanihub and CROWDE[27]) than investing in agricultural small and medium enterprise (SME). The government attempts to fill this gap by providing venture capital-like funding to BUMDES (village enterprises) and Bahana Artha Venture, a state-owned venture capital company with the goal of growing SMEs in Indonesia.

Impact investors: A growing number of international impact investors are attracted to Indonesia and farmers' access to finance to achieve decent economic returns with good ESG impacts. Challenges to scale include currency risk; regulatory barriers for foreign currency denominated loans; lack of aggregation points and high-ticket sizes; limited management capacity, and; governance of prospective investees.

Development finance institutions: The Dutch development bank (FMO), IFC, Norfund, Proparco and others are increasingly active[28], but face similar challenges as impact investors to reach appropriate farmers and cooperatives.

Government of Indonesia: Its subsidized financing schemes and grants for farmers face challenges to scale in rural areas due to onerous bureaucracy for approvals.

27. Tanihub raised $10 million series A fund (Jakarta Post, 2019). CROWDE received an investment by Mandiri Capital Indonesia, the venture capital arm of Bank Mandiri.
28. A prime example is the Smallholder Finance Facility, a collaboration between FMO and the International Trade Initiative (IDH) to invest up to EUR 50 million into upstream supply chain projects in oil palm. Another example is Proparco (subsidiary of the French development bank) and FMO who committed $5 million to support SMEs in Indonesia.

Before exploring some success stories in smallholder financing, Figure 36 summarizes financial service providers' (FSP) key challenges financing rural clients, especially small and medium-sized farms.

FIGURE 36: KEY CHALLENGES FOR FINANCIAL SERVICE PROVIDERS IN SMALLHOLDER FINANCING

Lack of Cashflow Information

Many if not most, smallholders do not keep financial records and have a limited understanding of their agricultural production, meaning FSPs lack essential information to accurately evaluate their cashflows and creditwothiness.

Lack of Formal Land Rights

Many, smallholders do not have a formal land title for the land they farm, which is often required as collateral for commercial banks, even if they finance farmers indirectly through other supply chain actors.

Payment Schedule

Especially for replanting loans, the principal is so large that it need to be paid back over several years, often with a grace period during the early, unproductive years. This is exacerbated by seasonal fluctuations in yields and thus repayment capacity.

Financing Needs Assessment

The financing need of farmers can be distinguished into short-term (for working capital and input), and long-term (for replanting or land expansion). The latter is riskier, thus more reliance on collateral, especially if off-taker agreements are missing.

Risk Aversion

FSPs often regard smallholders credit risk as much higher than warranted. This leads to cream skimming of customers, which prevents the FSPs from reaching the scale required for profitability.

Production Risk

Smallholders often farm on small, non-contiguous plots. This often inhibits implementation of good agricultural practices, lowering yields, increasing production risk and increasing post-harvest losses.

High Administrative Costs

Working with individual smallholders, who often live in remote places, involves high acquisition and serving costs as FSPs need to conduct several home visits before or after loan disbursement.

Source: Adapted from SIIA, 2018

Successful financing case studies

The following six case studies have been identified as good practices from Indonesia and are summarized in Table 7.

- **Tropical Landscape Finance Facility (TLFF):** First green bond in Indonesia for sustainable rubber production.
- **PTPN XIII:** Increasing palm oil production and establishment of new smallholder plasma plantation[29] in Kalimantan through a state-owned enteprise.
- **Golden Agri Resources (GAR):** Innovative financing scheme that includes land title support in Sumatra.
- **Cargill I:** Supports oil palm replanting in several areas in Indonesia.
- **Cargill II:** An integrated supply chain approach to provide finance and market access for corn farmers.
- **Mars Inc.:** Increasing cocoa farmers' productivity in Sulawesi through business-oriented distribution systems.

29. Plasma smallholders are farmers who took part in the Plasma Transmigration Program (Perkebunan Inti Rakyat, also known as PIR-Trans), set up by the Indonesian government in 1987.

TABLE 7: SUMMARY OF INDONESIAN GOOD PRACTICES FOR FINANCING SMALLHOLDERS

	TLFF Tropical Landscape Finance Facility	PTPN XIII	gar Golden Agri Resources	Cargill I	Cargill II	Mars Inc.
Location	Jambi and East Kalimantan	West Kalimantan	Riau and Jambi	Sumatra, West Kalimantan	East Java	Sulawesi
Crop	Rubber	Oil palm	Oil palm	Oil palm	Corn	Cocoa
Lead	Public-private partnership with key borrower PT Royal Lestari Utama (RLU)	State-owned company	Privately-owned company	Privately-owned company	PISAgro's Corn Working Group (CWG)	Privately-owned company
Name of scheme	Tropical Landscape Finance Facility (TLFF)	Revitalisasi program and PSR (Perkebunan Sawit Rakyat)	Innovative Financing Scheme	Support smallholder farmers with replanting	Corn Working Group (CWG)	Triple productivity package and business-oriented distribution mechanism
Period	Announcement of inaugural transaction in 2018. Ongoing	2015–2018	2014–2022	n/a	2012–2014	2013–2024
Number of farmers	24,000	2,700	20,000 by 2022	n/a	50	48,000 by 2020
Numbers of ha	Out of a concession area of 91,000 ha, 34,000 ha will be planted with commercial rubber.	5,400 ha (2,700 ha replanted, and 2,700 ha newly established of target 15,000 ha).	5,000 ha replanting	n/a	163 ha	50,000 ha
Scheme rationale	Sustainable bond of $215 million to improve Indonesia's climate and development commitments, which includes $35 million for smallholder financing.	Low productivity due to aged trees.	Low-productivity, and low-income levels by farmers.	Low-productivity, due to aged trees.	Limited market access, low quality.	Low-quality supply, low productivity due to poor GAP/product and development control, reduction of cocoa farm area (shift to other crops).
Methodology	Replanting and forest protection	Replanting	Replanting	Replanting	Improve productivity, access to finance and market.	Grafting and/or replanting.
Support to farmers	Technical assistance, agriculture infrastructure, rubber tapping, extension services, guaranteed fair pricing.	Agronomist, PTPN XIII provides seedlings.	Access to high-quality seeds, land certification support to achieve freehold title, sustainability certification by ISPO (Indonesian Sustainable Palm Oil certification).	Access to finance and markets.	Training GAP, access to quality seeds, access to finance, access to off-takers.	Mars supplies clonal material to CVCs. CVCs sell seedlings and grafting services to farmers.

	TLFF Tropical Landscape Finance Facility	PTPN XIII	gar Golden Agri Resources	Cargill I	Cargill II	Mars Inc.
Structure	TLFF acts as issuer/lender in Singapore (Class A, B1 and B2 Notes) supported by ADM Capital (Facility Manager) BNPP (Agent) and Citibank (Administrator). Michelin off-takes up to 70% of harvest. Initial funding of $7 million grant from UN to start program.	Simple structure with SOE and on-lending to smallholders. (Re)planting of the smallholder plasma plantations (2 ha) in one tranche to improve efficiency.	Simple structure with domestic banks, corporate guarantee, and government subsidy.	On-lending with cooperative involved. Works with KKPA (Kredit Koperasi Primer Anggota) applicable only for members.	BRI provides up-front capital through seeds distributor (Monsanto).	Initial investment to develop the package and related service delivery model funded by Mars. The CDC/CVC system is designed as a self-financed system. In a later stage this model was modified into a PPP program, called READ, and supported by the International Fund for Agricultural Development (IFAD) provided loan $4,181,937 (83.1% of total), government provided $526,252 (10.5%) and Mars $325,000 (6.5%).
Guarantee scheme	Guarantee on $70 million (guaranteed loan portion): $3.5 million of first losses absorbed by the joint venture, Royal Lestari Utama (RLU) and 50% of remainder (50% of $66.5 million) absorbed by USAID, capped at $33.25 million.	BRI guaranteed by PTPN XIII. Uses government subsidiary PSR funding with BPDP-KS (replanting subsidy).	Bank Syariah Mandiri requires corporate guarantee from GAR. BRI Agro helped to get government subsidiary PSR funding from BPDP-KS.	Only off-take agreements from Cargill.	Only off-take agreements from Cargill.	n/a
Financing need	Funding replanting activities. Overall financing need: Tranche 1 ($95 million). Tranche 2 ($120 million, including $35 million smallholder finance).	Funding of replanting activities. Required $75 million to revitalize 15,000 ha of land at prices in 2014.	Funding of replanting activities. Required IDR 240 billion ($17.6 million) replanting finance for 1,400 farmers for 2014–2018.	Funding of replanting activities not specified but can be assumed to be similar to other oil palm schemes on a per ha basis.	Funding for replanting corn and other inputs for production cycle. Required IDR 305 million ($23,500) as seed inputs and working capital loans.	Funding investments CDC-CVC network and at farmer level input/investment finance.
Loan features	n/a	Investment of $3,200/ha, with a corresponding repayment period of 10 years at an interest rate of 7–12.5%.	Investment for only replanting $5,000/ha, with an interest rate at 11–12.5% (repayment period not specified). For replanting schemes, GAR typically needs a minimum block around 100 ha.	Characteristics not specified.	IDR 7 million ($495)/ha with 9% p.a. interest rate, loan period not specified.	READ Revolving fund (financed by IFAD) of IDR 21 million ($1,750) per farmers group, with interest rates between 1% and 5% per month, with loan duration of 4-6 months.

To compare best practices from neighboring countries, see below.

TABLE 8: SUMMARY OF RUBBER AND OIL PALM FINANCING SCHEMES IN MALAYSIA, THAILAND, AND VIETNAM

	Malaysia	Thailand	Vietnam
Crop	Oil palm	Rubber	Rubber
Date rubber established	1950s	1960s	1990s
Overview of rubber sector	The development of oil palm in Malaysia can be roughly distinguished into three phases: • Resettlement Scheme (1950-1960s) • Block-Share System (1970s-1990s) • Konsep Baru (New Concept) (1990s-now)	Thailand is the largest exporter of rubber in the world. A key factor in its long-term approach is the selection of quality its clones managed by the government and their scaling replanting subsidiary scheme known as CESS.	Vietnam is the third-largest rubber producer globally, which is a noteworthy achievement as rubber just started to become a strategic crop in the 1990s. The state-operated Vietnam Rubber Group (VRG) is the country's main producer.
Government involvement	In the past decade, the government has shifted its focus further into yield improvements, as land scarcity makes expansion difficult. It has implemented a Replanting Subsidy for Oil Palm Smallholders (TSSPK) to incentivize and support replanting.	The government is highly involved in the rubber sector and started the Office of Rubber Replanting Aid Fund (ORRAF) in the 1960s. ORRAF provides subsidized quality seeds for smallholder use. Other smallholder financing needs are provided by the Bank for Agriculture and Agricultural Cooperation with a smallholder financing scheme.	Vietnam has continuously focused on large-scale rubber plantation development, because smallholder production is costly with low quality results. In 2007, the VRG established joint stock companies with farmers; the farmers provide the land and labor but are not involved in management decisions.
Government subsidizes microcredit for agriculture	In 2011, TSSPK provided approximately $2,500/ha collateral-free loans with interest rates of 2% per annum, 12 years tenure with four years moratorium on repayment.	In 2008, Bank for Agriculture and Agricultural Cooperatives provided long-term loans for rubber planting amounted to 26,500 Thai Baht ($850) per ha. Granted a grace period of 7 years with interest 10.5% per annum.	In 2009, farmers in Viet Nam, with VBARD (Vietnam Bank for Agriculture and Rural Development), through SBV (State Bank of Vietnam), were able to obtain a maximum of $1,700 with an interest rate of 9.72% and grace period of 7 years. Requires land parcels as collateral.
Additional sources of funding for replanting	Collects taxes on Malaysia Palm Oil Board (MPOB) exporters (Ringgits 13 ($3.18) /metric ton) to help fund sustainable plantations.	A Scaling Tax program levied on rubber exporters (1-10 Baht per kg based on total export). Rubber exporters in return also benefit from certain subsidiaries sourced from their taxed profit.	Obtained grant and loan assistance from World Bank and AFD (French Development Agency), allocated through VBARD officers.

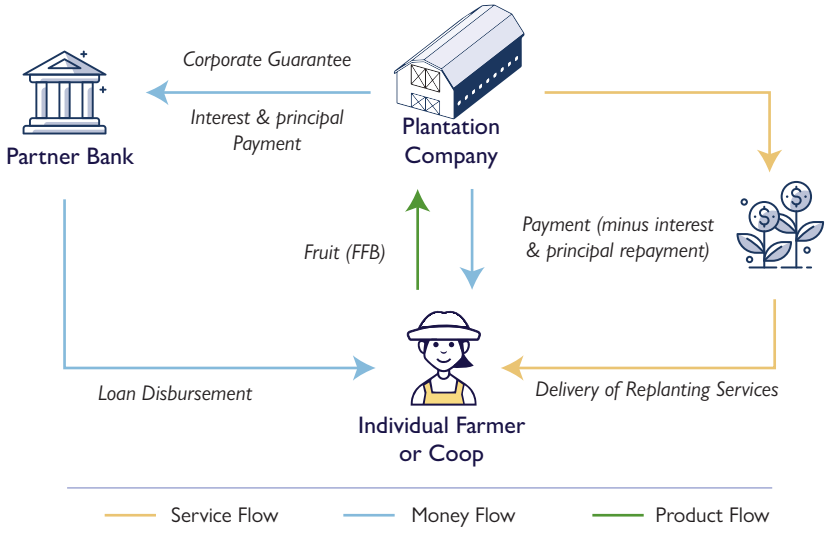
Key findings from oil palm smallholders

As presented in the section above, oil palm smallholders have been able to obtain replanting finance when well-integrated in the supply chain. Key differences in profitability and credit risk mitigants (collateral, off-take agreements and subsidy availability) between oil palm and rubber explain financial sector providers' willingness to engage with oil palm smallholders rather than rubber smallholders.

	Oil palm	Rubber
Immature period	Four years	Five years
Yields	2.7 mt (metric ton)/ha/year	2 mt/ha/year
Price	$769.93/mt as of December 2019. Up 12% from November 2019 and 44% from December 2018. Mean-reverting.	$ 1,570/mt as of December 2019. Up 5% from November 2019 and 16% from December 2018. Downward trend since 2011 (down 70% from peak in 2011).
Monoculture profitability/ha[30]	IRR (yearly over 26-year horizon): 35.7%	IRR (yearly over 26 year horizon): 27.7%
Land titles	Differs geographically but ex nucleus-plasma schemes (e.g. Sumatra) do have land titles.	Differs geographically with land titles being scarcer on agriculture land and completely missing on forest land.
Outgrower schemes	Yes, with nucleus-plasma schemes ensuring higher quality, yield and off-take.	Mainly independent farmers.
Rationale for off-takers agreements	(i) Fresh fruit bunches need to be processed in 48 hours before degrading. (ii) Mills incur daily loss if not operating at break-even capacity.	Ensure stable supply and operate at full capacity. However, tree tapping can be delayed while waiting for higher prices.
Replanting cost and government subsidies available for replanting	Estimated at IDR 60 million ($3,873) per hectare (at minimum catchment area of 300 ha) with subsidy available (Badan Pengelola Dana Perkebunan Kelapa Sawit or CPO Fund) of IDR 25 million ($1614) per hectare.	Estimated at IDR 45 million ($2,909) per hectare (government indication is IDR 79 million- $5107- over the entire immature period). Easier to conduct staggered replanting as little economies of scale exist. No direct subsidy currently available, but the government announced a grant scheme of IDR 7–13 million/ha ($452-$839) in 2019.

Indonesia's oil palm sector has also developed a financing model that integrates banks, large plantations, and smallholders. The Guaranteed Partnership Lending model is common in Indonesia (see Figure 37). While there are almost as many variations on partnership models as there are implementing companies, the core common element is that partnership models learn from and adopt the classic plasma model.

FIGURE 37: GUARANTEED PARTNERSHIP LENDING MODEL IN OIL PALM SUPPLY CHAINS



30. IRR calculated for rubber monoculture planting

TABLE 9: KEY CHARACTERISTICS[31] OF GUARANTEED PARTNERSHIP MODEL SCHEMES

• **Value -adding:** As farmers are under no obligation to sign such agreements, the financial terms and value-adding features of partnerships must be sufficiently attractive to convince groups of smallholders (expected to be organized into cooperatives) to accept this medium-to-long term commitment. Companies provide training and technical assistance to cooperatives and farmer groups and, in most cases, farmers provide all post-replanting labor, including harvesting.
• **Financial terms:** Financing will typically be for 12–13 years, with a four to five-year grace period on repayment of principal and, in some cases, interest. Interest rates vary within a range of 10–13 percent per annum, relatively low when one considers bank lending rates for other activities and the relatively long terms of replanting loans. This type of lending is usually carried out with a corporate guarantee to provide banks additional assurance. Credit enhancements are provided by a letter of guarantee or in extreme cases by posting deposits with partner banks. Data on non-performing loans, defaulted loans, and guarantees called are not publicly available, however, companies often have little choice as most banks remain risk- averse. These agreements are one of the few ways to lock-in supply from neighboring smallholders for the long term, especially critical for those companies with small land banks.
• **Partner banks:** These are Indonesian domestic banks, usually state-owned, with a stable, relatively low-cost rupiah deposit base and a significant branch footprint within reasonable proximity of the plantation areas being financed. State-owned banks have an added incentive to lend as they support the Government of Indonesia's replanting objectives.

Continued dependence on corporate guarantees highlights a key limitation of this model – even large, relatively healthy companies face limits in the size of corporate guarantee they can provide. Such guarantees constitute a contingent liability that must be accounted for and disclosed, and well-run companies would normally also need to calculate a capital charge, which could affect both the capital requirement and the target return on capital for the company[32]. As farmers move to production after years 4 or 5, companies should phase out their guarantees as banks should bear at least part of the remaining risk at this point.

In at least one case (Cargill), a stable partnership combined with guarantees on replanting quality and output purchase was deemed sufficient by the lending bank.Though many companies do not have Cargill's banking relationships and may not be able to provide corporate guarantees, they can create partnerships with local farmers. Also, from the lending side, there are still many potential lenders who could provide stable, long-term funding but do not want to bear the full credit risk themselves because of lack of experience or perceived risk.

31. More information available in Johnston, D., Smit, H. H., Bronkhorst, E., van Dorth tot Medler, M. M., Adjaffon, I., and Cavallo, E. 2018. Innovative replanting financing models for oil palm smallholder farmers in Indonesia. Tropical Forest Alliance 2020.

32. From a FSP perspective the corporate guarantee (unless in terms of deposits) is discounted according to the corporate credit rating with AAA discounted at 20 percent.

This is a key potential space for financial service providers willing to bear the credit risk, particularly in pre-production stages, to partner with a funding bank in financing the farmer–company partnership in a "distributed-risk partnership." Participants might include foreign banks lacking a strong local funding base, development banks, credit guarantee providers, or financial funds/institutions willing to offer guarantee facilities or other products allowing them to bear more of the risk burden. These actors could cover risk of default on the principal including natural disasters, replanting (e.g. seeds not performing as expected) and production risk.

Other key learnings

No one-size-fits-all. Farmer segmentation is key since different types of farmers require different levels of technical support and dedicated financing solutions.

TABLE 10: FARMER SEGMENTATION

- **Small-size (less than 2 ha):** The productivity of this category of farmers is low and attributed to lack of access to appropriate inputs, over-aged trees and little knowledge of GAP. Their farming business is highly unstable and susceptible to shocks. The need for technical assistance is high and their financing needs may be covered by KUR programme, if less than IDR 25 million ($1,615), otherwise access to finance mainly depends on the status of land titles. Based on analysis of data collected, about 80 percent of farmers fall into this category, of whom 40 percent have a formal land title for at least one plot of land.

- **Mid-size (2–5 ha):** The main goal in this category is increasing productivity of the farming business. The level of sophistication and required technical support varies. Similarly, access to finance will also depend on status of land title, but these farmers may be at an advantage as they can easily conduct staggered replanting and pay for household needs with the remaining land. This category includes around 15 percent of smallholders and half of them own at least one land title.

- **Large-size (5+ ha):** These farmers are usually more sophisticated, have land titles or other hard collateral and are able to access formal finance. Around 5 percent of farmers have large farms, three-quarters of whom own a land title.

This segmentation is only indicative and does not consider other important factors such as alternative sources of income, access to market, and proximity to bank branches.

Support and technical assistance are critical. Combining loans with training on GAP, in-kind inputs, and land titling support are risk mitigants. As farmer management capacity improves, the risk of misuse of funds is reduced, and farmer commitment increases when, for example, their land title is recognized. During rubber's immature period, the establishment of intercrops has been shown to significantly reduce cash shortfalls; technical support for these alternative, and often new crops is critical.

Farmer aggregation is required. FSPs can reduce loan distribution costs by relying on agency distribution agreements with cooperatives (Koperasi Unit Desa, Village Cooperative System).
Branchless banking schemes, where cooperatives act as agents for the bank, also offer the possibility of establishing digital payment systems and increasing rural financial inclusion. Depending on their legal status, cooperatives may also be able to attract funding from local banks as well as Development Finance Institutions (DFIs) and impact investors. Key challenges remain the lack of adequate governance, operational and financial capacity, and foreign exchange risk considerations for impact investors lending in foreign currency.

Ketiara (a 2000 coffee farmer cooperative) in Sumatra represents a success story, having attracted debt funding from Root Capital. A $550,000 trade credit loan was successively increased to $1.5 million in 2016 and paid back in full[33].

Loan collateral and credit risk enhancements: The financial institution perspective

Collateral

Collateralized loans are an important feature of any financial system. Indonesia's financial service authority (otoritas jasa keuangan/OJK) defines collateral as an additional guarantee submitted by the debtor to banks against loan or financing facilities.
According to Indonesian law, there are two types of guarantees, underwriting guarantee and material guarantee. An underwriting guarantee (borgtocht) is an agreement between a debtor or creditor with a third person who guarantees debt fulfillment (article 1820 of the Civil Law Book). An underwriting guarantee covers personal, corporate, and bank guarantees. A material guarantee is movable or immovable property pledged to guarantee the debtor's debt to creditors. There are four material guarantees: gadai (pawning), fidusia (fiduciary), hipotik (mortgage) and hak tanggungan (mortgage right). Hak tanggungan is applied for land and buildings, yet not all types of land title ownerships can be pledged as collateral.

For farmers, land titles are the most common collateral accepted by banks and often the only type available. Under Indonesian law there are three types of land title ownership: primary right, secondary right, and wakaf. Only primary rights can be directly pledged as collateral to financial institutions. Primary rights consists of Hak Milik/HM (Ownership Right), Hak Guna Bangunan/HGB (Building Right), Hak Guna Usaha/HGU (Cultivation Right), and Hak Pakai/HP (Usage Right). HM is the strongest ownership as there is no end to the land claim. Tenures of HGB, HGU and HP are 30, 25, and 25 years, respectively. Loan tenure should not exceed the land title ownership tenure.

Secondary right is an extension of the primary right due to lease, collateral, or other agreement. The secondary right can be pledged as collateral if approved by the primary right holder. Wakaf is a transfer of property to be used in perpetuity for religious purposes or general welfare from the primary right holder to wakaf manager (Nazhir). Therefore, wakaf land cannot be pledged as collateral.

33. One eligibility condition for Root Capital is that the borrower must have hard currency purchase commitments from established companies or reasonable assurance of hard currency revenues to service the loans. More information is available: https://rootcapital.org/meet-our-clients/stories/ketiara-advancing-womens-inclusion-in-indonesia/.

In addition, there are smallholders cultivating rubber on state-owned or forest land. In light of this, the government created Program Perhutanan Sosial (Social Forestry Program), a national program that aims to enhance economic equality by providing legal access to forest area management for communities near state forest areas, covering 12.7 million ha. One social forestry program, Hutan Tanaman Rakyat/HTR (Community Plantation Forests), allows community groups to manage plantations in production forests using silviculture to improve forest quality and sustainability. HTR's certificate can be used as collateral of the KUR program in BNI '46 (a state-owned bank).

Hard assets pledged as collateral play a central role in access to formal finance, especially for large long-term loans. This section evaluates the implications of collateral on provision for asset losses (Penyisihan Penghapusan Aktiva) and related impacts on income statements.

As of 2015, 80 percent of loans in Indonesia required collateral. The average collateral value required by banks for companies was 241 percent of the loan value[34].

TABLE 11: ACCEPTED COLLATERAL TYPES FOR AGRICULTURAL LENDING IN INDONESIA

Smaller loans (~IDR 20 million/ $1292)	Larger loans (> IDR 20 million/ $1292)
• Land and building • Movable limited to vehicles • Business license • Letter from village head • Marriage and education certificates	• Immovable (mostly land) • Movable limited to vehicles • Insurance in case of insufficient collateral value

In an assets review, FSPs are required to set aside provisions for their earning assets (i.e. loans) depending on categorization as shown in Table 12.

TABLE 12: ASSET LOSS PROVISIONING FOR LOANS

Reserve	Category	Commercial banks	Rural banks
General	Current	1%	0.5%
Special	Special Mention (30 days in arrears)	5% net of deductible collateral	NA
	Sub-Standard (60 days in arrears)	15% net of deductible collateral	10% net of deductible collateral
	Doubtful (90 days in arrears)	50% net of deductible collateral	50% net of deductible collateral
	Loss	100% net of deductible collateral	100% net of deductible collateral

Source: Adapted from Indonesia Market Study, IFC, 2014.

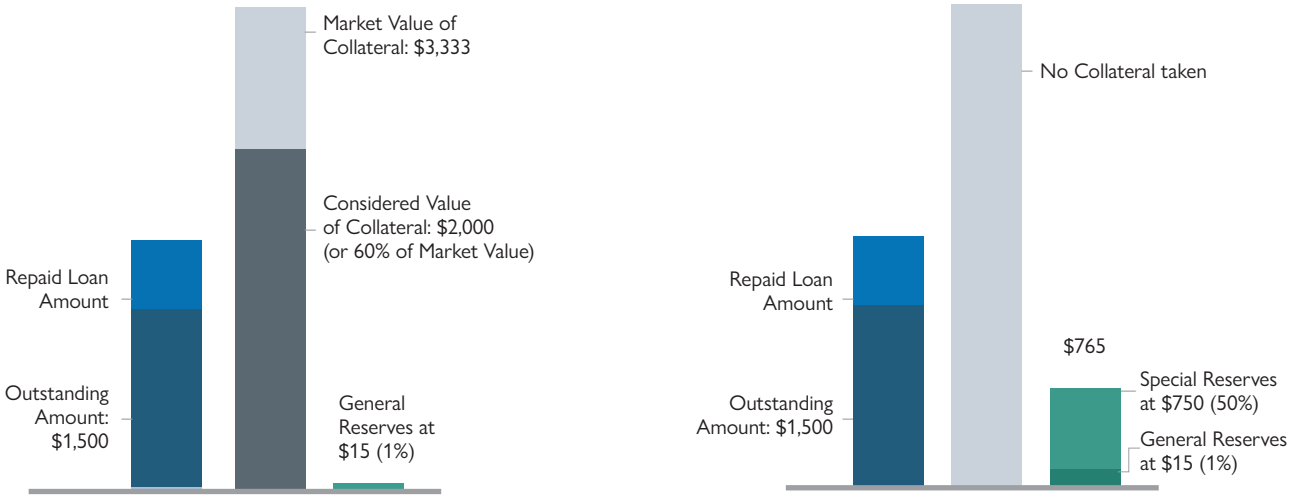
Regulations on reserve requirements and collateral value have a strong impact on FSP balance sheets and represent a direct incentive to maintain or increase collateral. Figure 38 presents an example for a loan outstanding of $1,500 with payments 90 days in arrears.

34. https://www.enterprisesurveys.org/en/data/exploretopics/finance

In scenario A, the bank has taken land as collateral with market value (Tax Object Sale Value or NJOP) of $3,333. Assuming the land has an official land title, the liquidation value considered by the bank is $2,000 (60 percent)[35]. The loan loss provision is calculated as (a) general reserve at $15 or 1 percent of outstanding amount (b) special reserve $0 or 50 percent of outstanding amount ($750) less deductible collateral ($2,000).

In scenario B, the bank has granted an uncollateralized loan and needs to provide a total of $765 with clear repercussion on the income statement.

FIGURE 38: EXAMPLE OF DIFFERENT PROVISIONS FOR COLLATERAL VERSUS UNCOLLATERALIZED LOANS



Loan-to-value (LTV) ratios for investment loans vary by sector ranging from 75 to 90 percent. As a benchmark, Bank Indonesia has relaxed the LTV ratios in the property sector as of 2018 to a minimum of 80 percent from 75 percent[36]. Table 13 shows an approximate calculation of loan amounts based on survey data collected in South Sumatra, Jambi and West Kalimantan, assuming the lender considers the liquidation value as the basis to determine the loan amount (most conservative scenario). It is important to note the Tax Object Sale Values (NJOP) vary considerably and are dependent on idiosyncratic land characteristics.

TABLE 13: CALCULATION OF LOAN AMOUNTS BASED ON NJOP VALUES IN SUMATRA, JAMBI, AND KALIMANTAN

	SOUTH SUMATRA		JAMBI		WEST KALIMANTAN	
NJOP (1ha)	IDR 75 million ($5,357)		IDR 50 million ($3,571)		IDR 60 million ($4,286)	
LAND TITLE	Official	SPPT or equivalent	Official	SPPT or equivalent	Official	SPPT or equivalent
Liquidation value ($)	3,214	2,679	2,143	1,786	2,571	2,143
Loan amount ($) @ LTV (90%)	2,893	2,411	1,929	1,607	2,314	1,929
Loan amount ($) @ LTV (80%)	2,571	2,143	1,714	1,429	2,057	1,714
Loan amount ($) LTV (75%)	2,411	2,009	1,607	1,339	1,929	1,607

35. In case of Tax Payable Notification Letters/Surat Pemberitahuan Pajak Terhutang (SPPT) or equivalent document, the liquidation value is 50 percent. (Indonesian Banking Booklet, 2018)

36. For more information, see https://www.indonesia-investments.com/news/todays-hea lines/a-closer-look-at-bank-indonesia-s-latest-ltv-ratio-relaxation/item8867.

Credit enhancements

As outlined in the case studies, supply chain actors can provide credit enhancements in the form of corporate guarantees, off-taker agreements, or a combination of the two. Whereas off-take agreements are common in the oil palm sector, they are limited in the rubber sector. These contracts entail active engagement from the off-taker and lock in partnerships over long time horizons, at least as long as the loan is outstanding, which decreases smallholders' willingness to participate. Price and yield fluctuations, two factors very pronounced in rubber production, are additional elements that make drafting and enforcing off-take agreements challenging.

Natural rubber supply is dependent on wintering seasons, where rubber trees do not produce much latex. This means yields and dry rubber content can drop as much as 50 percent on average. Typically, in Indonesia, the wintering season lasts from March–April in North Sumatra, August–September in South Sumatra, November–February in West Kalimantan and April–July in South Kalimantan. Climate change has also resulted in wintering seasons becoming more erratic. Together, these conditions do not facilitate the establishment of off-take agreements.

Compared to palm oil, natural rubber also experiences more price volatility making it difficult for two parties to lock a long-term partnership in the form of an off-take agreement. Non-written, verbal commitments based on mutual trust are a key facet in the natural rubber supply chain between farmers and dealers where payments can be made in advance, in arrears, or in-lieu of cash. Until there is greater stability in natural rubber prices and less variation in yield during wintering seasons, there will be less willingness to transition to off-take agreements or similar contracts in the natural rubber supply chain.

One potential alternative collateral in the rubber sector is to secure the loan not only with land titles, but also with the trees (wood) grown on the land. Although Indonesian plantation companies account for biological assets in their financial statements according to IFRS – IAS 41[37] (International Financial Reporting Standard), the financial sector and, most importantly, Bank Indonesia do not recognize them as viable collateral. A method of how to value timber trees that may be applicable to rubber plantations is presented in Box 4.

BOX 4: VALUATION OF TIMBER TREES AS COLLATERAL

In the Lao People's Democratic Republic, there has been a large expansion of smallholder teak plantations due to the influx of government-initiated teak projects since 1975, as well as favorable land allocation policies in the 1990s. With high demand for teak wood in the global market, there is potential for high returns from teak farming. However, teak production is largely dominated by smallholder farmers who face increasing competition for land, exacerbated by often unclear land tenure. The Center for People and Forests (RECOFTC), in conjunction with the Lao Provincial Organization for Forestry and Agriculture and the Lao Department of Agriculture and Forestry, developed a teak tree valuation methodology to assist smallholders estimate the value of trees as collateral.

The first step is to estimate the volume of wood and market value. Although financial institutions can have their own valuation method, they largely fall into two broad categories, stumpage value and predicted value.

Stumpage value refers to the volume of the wood multiplied by today's market price of the tree. Many factors determine stumpage value, but the most important are tree species, quality, size, age, location, prevailing market conditions, terrain, and amount of wood.

The predicted value calculates the expected future financial return from harvesting a mature stand at today's value, corrected for expected inflation. The primary purpose of the predicted value method is to compare forestry investment to other forms of investment in terms of the opportunity cost of planting trees for the wood.

37. Accounting of Biological Assets in Indonesian Plantation Companies (N. Baroroh et al, 2018)

External guarantors or guarantee providers can also provide alternative collateral. Credit guarantee providers can be categorized into international, national, and regional providers.

The authors could not find any recent publicly available data on existing schemes where a third party provided guarantees at the individual loan level[38], with pricing information and guaranteed amount. As a benchmark, individual loan and portfolio guarantees offered by ARIZ[39]in 2018 were priced at 1.7 percent per annum on the outstanding guaranteed amount[40]. In addition, subsector-level data on non-performing loans for agricultural commodities was not available; at sector-level non-performing loans for agriculture, hunting and forestry stand at 1.4 percent of outstanding loans as of November 2019, considerably lower than in the fishery, mining and quarrying, processing and hospitality sectors where non-performing loans are 5.5 percent, 3.8 percent, 4.2 percent and 5.5 percent, respectively[41].

FIGURE 39: CREDIT GUARANTEE MECHANISMS IN INDONESIA

INTERNATIONAL Risk weight 20%	Active: USAID – DCA*, AFD - ARIZ
NATIONAL Risk weight 20%	Indonesia Entrepreneurs Credit Guarantee Institution (PKPI), Indonesia Credit Insurance (ASKRINDO), Public company and Regional Credit Guarantee Corporation
REGIONAL Risk weight 50%	Regional Credit Guarantee Corporation such as Jamkrida

Source: Risk weighted ratio mandated by Indonesia's financial authority (OJK) for loans, adapted from The Role of Credit Guarantee Schemes for Financing MSMEs: Evidence from Rural and Urban Areas in Indonesia, 2019.

** USAID Credit Development Authority; now incorporated into the U.S. International Development Finance Corporation.*

Credit products and government financing schemes

Due to collateral requirements, smallholder farmers are pushed toward informal financing sources with more flexible rules, quicker and less bureaucratic processes, but with very high interest rates. Often, local traders provide working capital and cover household consumption needs. The loan is repaid by deducting the money paid to farmers for their produce, tying farmers to a specific trader for the duration of the repayment.

However, informal finance is often limited to financing trade and short-term loans and does not offer long-tenure products needed for financing replanting. This section explores long-tenure financing options offered by the formal financial sector and government programs to assess whether there are gaps in current supply.

38. At bond level, guarantees were provided by USAID DCA in the TLFF scheme presented above.
39. French Development Agency risk sharing mechanism
40. Based on a presentation shared by AFD with prospective clients.
41. Indonesian Banking Statistic: November 2019, https://www.ojk.go.id/en/kanal/perbankan/data-dan-statistik/statistik-perbankan-indonesia.

Financial service providers

Four domestic banks, Bank Rakyat Indonesia (BRI), Bank Mandiri, Bank Negara Indonesia (BNI), and Bank Central Asia (BCA) dominate Indonesia's formal banking sector. BRI champions MSME lending with approximately 75 percent of its total loan portfolio exposed to this segment as of 2019 and a geographic reach of over 5,000 micro units in rural areas nationwide[42].

Other commercial banks lend to MSMEs either directly (most notably Bank Mandiri, Danamon, BTPN, and CIMB Niaga) or through wholesale lending and linkage programs with rural banks, cooperatives, and venture capital funds. To meet MSME lending targets dictated by Indonesia's financial authority OJK[43], commercial banks have two types of linkage programs, channeling and executing, which differ on the level of risk sharing. These schemes help commercial banks increase their outreach in rural areas in a cost-effective manner as they save on administrative, marketing, and credit collection costs. Under the channeling program, funds for MSME lending are routed through rural financial service providers (FSPs) who charge an administration fee, whereas under the executing program, rural FSPs take the loans on their books and further lend to MSMEs.

Credit unions and local development banks (BPR) are often located in rural areas and are accessible to smallholder farmers, but the loan amounts are low (up to IDR 7–10 million, or $452-$646), repayment tenure is short (usually up to 1–2 years) due to the liquidity and balance sheet constraints of these institutions, and interest rates are high (around 27 percent). Therefore, these loans are suitable for short-term working capital or household needs, but less appropriate for long-term replanting finance.

TABLE 14: OVERVIEW OF FINANCING OPTIONS AVAILABLE TO FARMERS

Source	Coverage	Finance type	Standard terms	Eligibility	Accessibility	Suitability
Formal banking sector	BRI, Mandiri and BNI have the largest MSME portfolios within the formal banking sector. They have branches Indonesia-wide.	IDR 25–500 million, or $1600-$32,000 (average IDR 30 million, or $1900 per ha)	1–4 years for working capital. 5-10 years for investment capital with a 1-year grace period. 12–22% interest per annum (excluding KUR).	Bank account. Appropriate collateral. Minimum 6+ months business experience.	Available to farmers with banking history and appropriate collateral (e.g. land title).	Working capital Investment capital
BPRs/Credit unions	Over 1,600 across Indonesia with significant variation in regional coverage.	IDR 7 million ($452) average loan size.	Loan terms up to 5 years. 27% interest per annum.	Opening deposit and other conditions may apply.	Available to all farmers or credit union members.	Working capital Limited investment capital.
Islamic MFIs	Branches Indonesia-wide, but with significant regional variation. Only 5% of the formal MSME lending in 2015.	IDR 3–4 million ($194-$258) average loan size.	22% per annum equivalent (cost-recovery rather than loan finance).	Islamic and other conditions may apply.	Available to member farmers.	Working capital
Pawn shops	Present in all regions. 4,500+ branches.	IDR 500,000+ ($32+)	1.2% for 15 days 1+% per month for 6–36 months.	Suitable collateral (e.g. land, car, house, jewelry etc.).	Available to all farmers.	Working capital Limited investment capital
Commercial moneylender	Present in all regions.	IDR 500,000+ ($32+)	Average 10 weeks at 10%, i.e. at least 52% per annum.	Varies	Available to all farmers.	Working capital
Local trader/ agent	Present in all regions.	IDR 500,000–1 million ($32-$65) or more.	Interest rate deducted at sale of rubber.	Ongoing trading relationship	Available to member farmers (with trading relationship).	Working capital

Source: Adapted from Daemeter, 2016

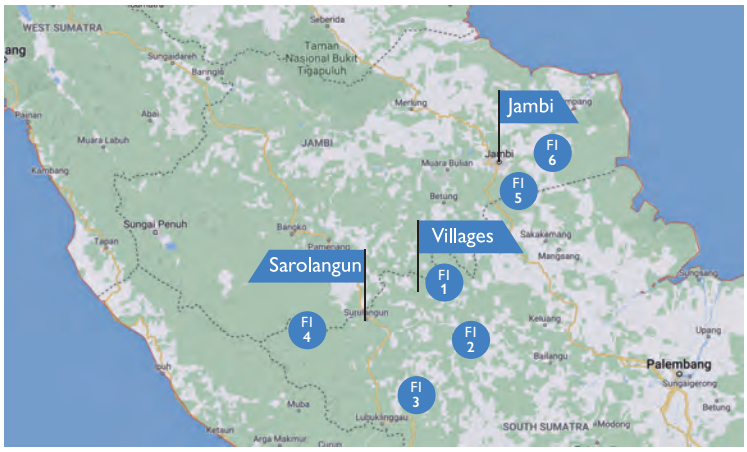
42. https://www.idnfinancials.com/news/27861/bank-bri-increase-portion-lending-msmes and New Indonesian 'Branchless Banking' and Microfinance Laws - a catalyst for microfinance growth? KPMG Indonesia, 2014.

43. OJK mandates that all banks have 20 percent of their portfolio dedicated to MSME by 2021.

Agriculture finance strategy

Based on survey data, Jambi region has high potential for rubber replanting with 40 percent of interviewed farmers expressing interest in replanting. The authors conducted a scoping visit to interview microfinance institutions, state-owned banks, commercial banks, and BPRs in the area, and to assess smallholder engagement, agri-finance strategy, capacity, and willingness to participate in a pilot project[44].

FIGURE 40: DISTRIBUTION OF SIX FINANCIAL INSTITUTIONS INTERVIEWED IN JAMBI



None of the interviewed financial institutions has a dedicated agrifinance strategy at branch level or a product tailored to meet smallholder needs for working capital or replanting. However, all the institutions do lend directly to smallholder farmers via their MSME or retail banking department. The institutions lacked a clear definition of the agricultural segment, as evidenced by lack of accurate data on smallholder loans in their portfolio.

Only one state-owned bank has dedicated staff for the agriculture sector. Over the past five years all banks decreased the size of their loan portfolio in rubber due to declining prices of natural rubber. For instance, one commercial bank completely halted financing rubber smallholders in 2016, and the portfolio significantly decreased from IDR 30 billion ($1.9 million) to IDR 8 billion ($517,000) as of November 2019.

However, the banks have expanded their exposure to the palm oil sector, as many smallholders have shifted from rubber to palm oil production because of higher profitability.

Respondents agreed agricultural lending is a large market opportunity, however the dispersed location of farms makes tapping into this segment difficult without dramatically increasing operational costs. The other most-mentioned challenge is smallholders' lack of formal land certificates. For banks that do not provide KUR loans, it is difficult to be competitive on price. Banks with KUR loans can offer not only lower rates but also more flexibility in terms of collateral. In Sarolangun village, the state-owned banks are the only KUR providers with BRI being significantly more competitive in the agricultural segment.

44. An overview of the questionnaire can be found in Appendix 5.

It is, however, important to note that the type of KUR provided is the simple KUR micro loan with shorter tenure and monthly principal repayment schedule and inadequate for replanting. Anecdotally, respondents have also indicated that use of funds are not monitored. Hence, it is foreseeable that farmers may have already taken out a KUR loan to fund other (consumption) expenses and would now face difficulties accessing a new larger loan for replanting.

For distribution channels, the state-owned banks and BPRs prefer to engage with agri-customers through cooperatives (KUDs). These entities help financial institutions with farmer selection and loan monitoring, decreasing costs and risks. Previously, there were many cooperatives in the region but falling rubber prices led many to disband.

TABLE 15: AGRI-FINANCE PORTFOLIO AND LOAN PRODUCTS AVAILABLE IN JAMBI

	Agrifinance strategy	**Lending to smallholder farmers**	**Agri-customers percentage of portfolio (estimated)**	**Loan product**	
	Location			**Type of loan (general loan)**	**Suitable for rubber replanting**
BPR I	Sarolangun No	Yes	30% of total	Working capital and investment	Tenure of 60 months but monthly instalment of principal.
BPR II	Sarolangun No	Yes	80% of total	Working capital and investment	Tenure maximum of 24 months and monthly principal repayment.
State-owned Bank I	Sarolangun No, but in the last four years bank has decreased exposure in the rubber sector due to low commodity prices.	Yes, but only at branch level.	n/a	Working capital and investment	Provision of KUR is limited to KUR Mikro and Kecil and thus with monthly instalment. Also minimum land size of 4 ha excludes smallholders.
State-owned Bank II	Sarolangun No, but the bank works with associations and cooperatives.	Yes	< 4%	Working capital and investment	Provision of KUR is limited to KUR Mikro and Kecil and thus with monthly instalment.
BPR III	Jambi No	Yes, but for the last few years only farmers with more than 10 ha.	10%–20%	Working capital and investment	Tenure of 60 months but monthly instalment of principal.
BPR IV Local trader/ agent	**Jambi** No	Yes	< 1%	Working capital and investment	Same as above.

Government credit programs

The Government of Indonesia recently launched a new rubber replanting plan for 2019–2027 (Appendix 2). During the Rubber Conference on October 19, 2019, the Ministry of Agriculture announced a replanting goal of 700,000 ha across Indonesia during 2019–2027. The three main areas for replanting are South Sumatra (92,600 ha), South Kalimantan (76,550 ha) and Jambi (69,900 ha). Other regions with large replanting targets are the remainder of Sumatra and Kalimantan islands. This plan, however, has no large-scale lending program associated with it and will be executed through local governments. Due to these and other difficulties, it has not been implemented yet.

With 30 percent of total land dedicated to agricultural production and over 90 percent of the total farmer population categorized as smallholders[45], the government has initiated several credit programs in an attempt to bridge the finance gap in the agricultural sector.

Out of several Government of Indonesia subsidized lending schemes for agriculture, only the Special KUR demonstrates the required features for rubber replanting. However, based on analysis and anecdotal evidence from the field, uptake of the Special KUR is low and rarely used for rubber replanting.

People's Business Credit - Kredit Usaha Rakyat

Kredit Usaha Rakyat (KUR) (People's Business Credit) is the government's most relevant initiative to improve MSME financing. This government-guaranteed and subsidized loan[46] facility provided by state-owned banks and selected non-banking financial institutions targets MSMEs lacking adequate collateral. The guarantee is executed through state-owned loan guarantee companies PT. Asuransi Kredit Indonesia (Persero) and Perum Jamkrindo, whose premium the government subsidizes.

To tackle replanting and rejuvenation in the agricultural sector, the government introduced a modified version of KUR in 2018, tailored to the agriculture, animal husbandry, and fishery sectors to allow longer tenures and grace periods[47]. The loan amount varies from IDR 25 to 500 million ($1,615-$32,310) per individual. The interest rate is 7 percent effective per annum, similar to other KUR loans[48]. However, the loan period can be up to 10 years with a grace period of up to five years, or the second productive year of the replanted crop, whichever is shorter.

45. Food and Agriculture Organization of the United Nations Country Factsheet 2017.

46. KUR is implemented based on the following legal standings: (i) Decree of the President of Republic of Indonesia number 14/2015 concerning micro, small and medium business financing policy committee amended by Decree of President of Republic of Indonesia number 19/2015/ (ii) The Regulation of the Minister of Finance number 180/PMK.05/2017 concerning procedures for interest/margin subsidy for KUR.

47. Regulation of Coordinating Ministry of Economy number 11/2017 concerning Implementation Guidelines of Kredit Usaha Rakyat/KUR (Pedoman Pelaksanaan Kredit Usaha Rakyat/KUR). The guidelines were enhanced by the Regulation of Ministry of Agriculture number 16/PERMENTAN/SR.230/4/2018 concerning facilitation of kredit usaha rakyat of agriculture sector (fasilitasi kredit usaha rakyat sektor pertanian) and technical guidelines for facilitation of kredit usaha rakyat of agriculture sector of 2018 issued by Directorate General of agriculture infrastructure and facilities.

48. In January 2020, the government announced the KUR (People's Business Credit) budget would increase to IDR 190 trillion ($12.2 billion) with interest rates reduced from 7 percent to 6 percent. For the purpose of this report, 7 percent is taken as the reference rate. https://www.kemenkeu.go.id/publikasi/berita/pemerintah-ingink-an-umkm-berdampak-anggaran-kur-ditingkatkan-rp190-triliun-sekaligus-turunkan-suku-bunga-jadi-6/

TABLE 16: GRACE PERIODS FOR AGRICULTURAL COMMODITIES UNDER SPECIAL KUR

Crop group	Period	Period length according to KUR guidelines (in years)	
		1st Category	2nd Category
Annual crops	Construction period (planting, maintenance of immature crops)	1–5	1–7
	Period of productive crops	6–4	8–18
	Commodity	Cocoa, coffee, tea, nutmeg, pepper	Rubber, clove, oil palm, coconut
Seasonal crops	Construction period (planting, maintenance of immature crops)	0–1	
	Period of productive crops	2	
	Commodity	Sugar cane, tobacco	

TABLE 17: COMPARISON OF DIFFERENT TYPES OF KUR

Loan features	KUR Mikro for micro entrepreneurs	KUR Kecil for small entrepreneurs	KUR Khusus (Special KUR)
Loan amount	IDR 25,000,000 (maximum) ($1,615 equivalent)	IDR 25,000,000–500,000,000 ($1,615-$32,310)	IDR 25,000,000–500,000,000/individual member of group ($1,615- $32,310)
Interest rate	7% effective per annum (Decreased to 6% in January 2020)		
Loan period **Working capital loan** **Investment loan** **Grace period**	 3 years (maximum) 5 years (maximum) Possible	 4 years (maximum) 5 years (maximum) Possible	 4 years (maximum) 5 years (maximum) Possible
Terms of repayment	Regular payment	Regular payment	Regular payment
Other requirements	Bullet payment (i) Six months in the business. (ii) Must have ID number and ID card.	Bullet payment Same as KUR Micro + (i) Must have Tax ID Number for loan above IDR 50 million.	Bullet payment Same as KUR Kecil + (i) Group lending scheme in a cluster. (ii) Farmers must own the land they farm; sharecropper farmers must have power of attorney from the landowner acknowledged by the village head. (iii) Farmer must be willing to follow instructions of technical field officers (petugas penyuluh) and business partners.

Partnership and community development program - Program Kemitraan dan Bina Lingkungan (BUMN)

For communities in the vicinity of state-owned banks (SOEs), another funding channel is Program Kemitraan dan Bina Lingkungan (PKPL), a partnership and community development program[49]. The program's funds are disbursed as working capital or investment loans to increase production and sales or to finance short-term needs. It is targeted to not-yet-bankable MSMEs[50] and is funded by SOEs that must deposit 2 percent of net profit for partnership development and 2 percent for community development.

The loan has a maximum amount of IDR 200 million ($14,285) with an interest rate of 3 percent flat per annum and tenure of 1–3 years without a grace period and in monthly instalments. The loan comes with a 20-percent technical assistance facility to provide support in the form of training, promotion, or participation in a bazaar or exhibition on a local, national, or even international level.

49. Regulation of the Ministry of State-Owned Enterprises number 09/MBU/07/2015.
50. Eight months in the specific business, maximum assets of IDR 500 million (landbank excluded), maximum turnover of IDR 2.5 billion. Independent company with legal status.

Revolving Fund Management Agency for MSME - Lembaga Pengelola Dana Bergulir Koperasi Usaha Mikro Kecil dan Menengah

The Ministry of Cooperative, Micro, Small, and Medium Enterprises also manages a credit program, the Revolving Fund Management Agency for MSMEs (LPDB–UMKM)[51].

There are three types of loan schemes: direct financing, channeling, and executing. It is important to note that these financing opportunities are only targeted at legal business entities and not available to individual farmers. Under a direct financing scheme, prospective borrowers directly apply and receive disbursement from LPDB-UMKM. Under a channeling scheme, the application is administered through a BPR, MFI or cooperative but the analysis and credit decision lies with LPDB–UMKM. Loans under the executing scheme are directly approved by the managing entity.

TABLE 18: TERMS AND CONDITIONS OF LPDB-UMKM CREDIT PROGRAM

	LPDB - UMKM	
Loan features	**Direct and channeling scheme**	**Executing scheme**
Loan amount	IDR 150 million–50 billion ($9,685-$3.2 million)	IDR 150 million–250 billion $10,714–17 million
Interest rate	4.5% effective per annum (agriculture and fishery)	7% effective per annum
Loan period **• Working capital loan** **• Investment loan** **• Grace period**	 5 years (maximum) 10 years (maximum) Possible	 3 years (maximum) 5 years (maximum) 6 months
Terms of repayment	Flexible based on cash flow Bullet payment	Monthly interest Principal monthly or semiannually
Other requirements	Being legally registered Maximum loan from secondary to primary cooperative IDR 1 billion ($64,635). Maximum loan from non-banking financial institutions to cooperatives/MSME IDR 500 million ($32,323). Maximum loan from coop to member is IDR 250 million ($16,161).	Subject to due diligence

Forested land programs

Rubber cultivation in forest land is under authority of the Ministry of Environment and Forestry (MoEF) and can be further categorized into state forest (hutan negara) and private forest (hutan hak)[52]. In 2016, MoEF introduced the Social Forestry System, allowing local communities to access a total of 12.7 million ha to be utilized for nursery, planting, cultivating, harvesting, processing, and marketing of timber and non-timber forest products. Under this system, farmers or farmer groups can obtain Surat Keterangan Pengakuan dan Perlindungan Kemitraan Kehutanan/KULIN KK (certificate of recognition and approval of forest partnership), which qualify for the Special KUR mentioned above as well as BLU funding.

BLU (Pusat Pembiayaan Pembangunan Hutan) was established in 2008 as a working unit of the MoEF. The unit manages state funds and a channeling revolving fund facility for forestry development and environmental investment in the framework of forest and land rehabilitation.

51. Regulation of the Minister of Cooperative and SME number 19.4/Per/M.KUMKM/VIII/2006 amended by Decree of Minister of Cooperative and SME number 11/Per/M.KUKM/VI/2008.

52. Law number 41/1999 on forestry and under the regulation number: P.83/MENLHK/SETJEN/KUM.1/10/2016

The revolving fund is provided to individuals, cooperatives, and business entities, especially micro- and medium-scale enterprises engaged in forestry business and environmental investment. As of October 2019, the unit's assets under management totaled IDR 2.1 trillion ($135.7 million) and an additional funding commitment of IDR 2 trillion ($129.2 million).

TABLE 19: TERMS AND CONDITIONS OF BLU REVOLVING FUND

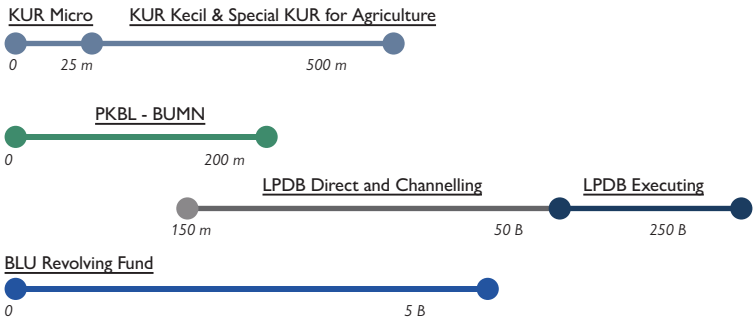
Period	BLU Revolving Fund	
	Forestry plan as staple crops	**Cultivation of non-forestry commodities**
Maximum amount	State forest: IDR 40 billion ($2.8 million)	State forest: IDR 20 billion ($1.4 million)
	Private forest: IDR 5 billion ($357,000)	Private forest: IDR 2.5 billion ($128,000)
Interest rate	BI[53]rate +4%	
Loan period	Maximum 16 years with maximum grace period of 8 years.	

In addition to lending schemes for agroforestry in forest land, there are also grant schemes provided by MoEF of up to IDR 50 million ($3,230)[54]. These grants can be used to develop agroforestry projects combined with construction or maintenance of land and water conservation infrastructure, non-timber forest commodities as well as livestock/fisheries in relation to river basin conservation.

Comparison of existing loan schemes

Despite the existence of several programs and loan schemes, many rubber farmers are still not able to engage in long-term investment activities. The analysis below compares different programs and their suitability for rubber replanting (unfortunately data on farmer uptake of the different programs is rarely publicly available and there is no sub-sector data available on financing of rubber through these schemes).

FIGURE 41: LOAN AMOUNTS ALLOCATED BY GOVERNMENT CREDIT PROGRAMS (IN IDR)



With PKBL's tenure capped at three years, this facility does not appear adequate to finance replanting. The facility should, however, be explored for communities near SOEs in need of working capital and inputs once trees are productive. Given its interesting feature of 20 percent technical assistance support, PKBL could be used to provide training on intercropping/agroforestry schemes, enhancing the capacity of cooperatives or UPPBs. The direct and channeling LPDB facility with a maximum loan period of 10 years and interest rate at 4.5 percent effective per annum would be suitable for natural rubber replanting. However, this facility can only be accessed by legal business entities and would require an on-lending scheme with a cooperative as the applicant, for example.

53. Bank Indonesia, Indonesia central bank.

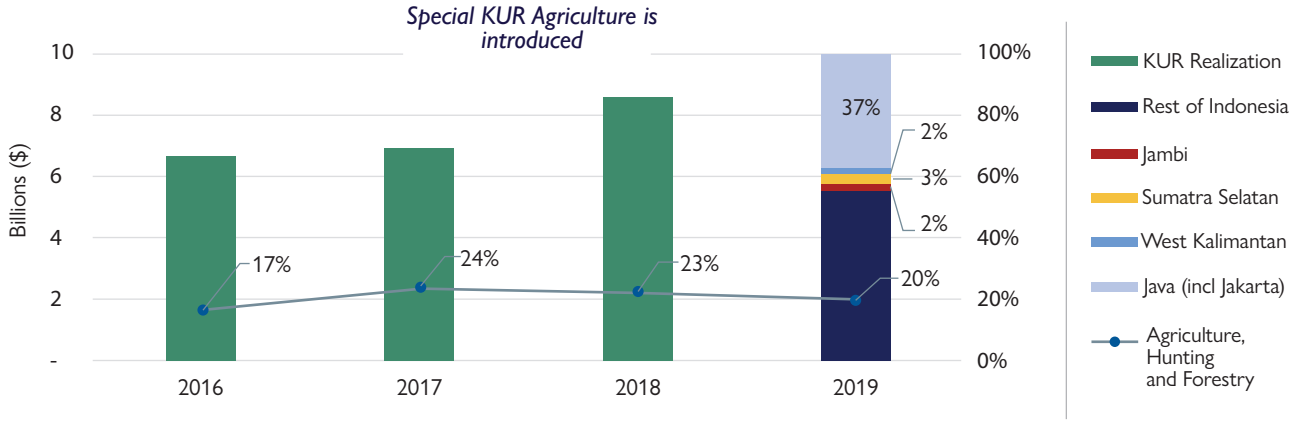
54. Minister Regulation Number P.20/Menhut-II/2014 regarding General Guidelines for Development of Conservation Based Forest Village Community (Pedoman Umum Pengembangan Perhutanan Masyarakat Pedesaan Berbasis Konservasi) dated 20 March 2014.

Given the minimum loan size of IDR 150 million (approximately $10,000) and a first-year financing need of $1,571 under a staggered replanting scenario, only seven farmers would be needed as a minimum size. Except for the BLU Revolving Fund that only applies to forest land, **KUR appears the most popular credit program, with the special KUR for agriculture having most features required for a replanting loan.**

Disbursement of KUR has increased from approximately $7 billion to about $10 billion in the last four years with Bank BRI being the largest provider (62 percent in 2019).[55] Two issues are important to flag:

- The majority of KUR is disbursed in Java, which represents 37 percent of total disbursement in 2019. The target regions in South Sumatra (3 percent), Jambi (2 percent) and West Kalimantan (2 percent) only received a small percentage of the allocation. Although Java is considerably more populous than the other islands, agricultural activity is more concentrated in Sumatra and Kalimantan.
- Allocation to the agriculture, hunting, and forestry sector did not reach its target for Special KUR in 2018. The government expected to allocate $2 billion at the beginning of 2019 for this program. Although statistics are not available, full realization of the $2 billion target would mean all KUR loans disbursed to the agriculture, hunting and forestry sector in 2019 (20 percent of $10 billion) would pertain to this category, which seems unlikely.

FIGURE 42: DISBURSEMENT OF KUR 2016–2019



Based on analysis and anecdotal evidence from the field, the following reasons explain low uptake of the Special KUR:

- High complexity compared to KUR Micro and Kecil. Farmers need to own the land or, in the case of sharecropping, have power of attorney from the landowner acknowledged by the village head to be eligible for the program. Moreover, they need to be part of a registered farmer group and have agreements in place with a business partner for implementation.
- Bank capacity and offering. Partner banks may lack the technical capacity to assess the feasibility of an investment loan for replanting activities and do not actively promote special KUR to (prospective) clients.
- Farmer indebtedness. Many farmers have already taken advantage of normal KUR products to fund other (consumption) expenses. If these loans are still outstanding, they may not be able to access new loans for replanting.

55. Statistics on KUR accessible at http://kur.ekon.go.id/realisasi_kur.

10. DESIGNING A LOAN PRODUCT FOR REPLANTING RUBBER

Rubber replanting models

Two models outlined in Section 7 were (i) full replanting or staggered replanting and (ii) monoculture or an intercropping agroforestry model. Table 20 summarizes each scenario, assumptions and projected cash flow.

TABLE 20: SUMMARY OF RUBBER REPLANTING SCENARIOS

One-time replanting

Rubber only

1. Rubber-only with replanting 100 percent of the plot at one time.

2. Rubber plus intercrops (planting of two or more crops in the same field) with replanting 100 percent of the plot at one time.

Agroforesttry

3. Rubber-only with replanting staggered in two periods (50 percent in year 1 and 50 percent in year 2).

4. Rubber plus intercrops with replanting staggered in two periods (50 percent in year 1 and 50 percent in year 2).

Staggered replanting

General assumptions		Replanting model	
		Monoculture	Agroforestry
Family consists of two parents, one primary school-aged child, and one child of pre-primary school age. Half of initial household costs are paid for by external income sources. Land holding 2 ha. Rubber price scenario is neutral/most likely scenario.		600 rubber trees per ha are planted.	480 rubber trees per ha are planted alongside 120 timber trees. In years 1 and 2 bananas and peppers are grown as intercrops. From year 3 onwards turmeric is grown as an intercrop.
REPLANTING TIME	2 ha of rubber are replanted in year 1.	**Scenario 1** Monoculture one-time replanting Maximum cash shortfall in year 5 of $7,600.	**Scenario 2** Agroforestry one-time replanting Maximum cash shortfall in year 1 of $4,000.
	1 ha of rubber is replanted in year 1; the other ha is replanted in year 2. The second hectare remains productive as a 20-year old monoculture rubber plantation.	**Scenario 3** Monoculture staggered replanting Maximum cash shortfall in year 6 of $6,450	**Scenario 4** Agroforestry staggered replanting Maximum cash shortfall in year 3 of $3,370.

The main difference between full replanting and staggered replanting is the initial investment is spread out over two years and part of the replanting costs can be covered by income from the second hectare, which remains productive for the first year. There is an important extra benefit to staggered replanting – it creates opportunity for learning for smallholders, where experience from the first replanting can help improve the second replanting, increasing yields in the long run.

The most important difference in financial viability, however, is the type of replanting. For smallholders, switching from a monoculture to an agroforestry model increases their IRR under the neutral scenario by 11.8 or 22.1 percentage points under full and staggered replanting, respectively. The main indirect benefit agroforestry provides is a mechanism for smallholders to diversify their income, while still relying on their farming knowledge and experience. This diversification not only minimizes the impact of pests, diseases or erratic weather events, but also helps mitigate the impact of world rubber price volatility.

Table 21 illustrates the maximum cash shortfalls for each scenario. Staggered replanting leads to a significant decrease in the maximum cash shortfall. Under monoculture there is continuous decrease in cash on hand over time, as there is no outside income. Under agroforestry, however, intercrops are harvested at regular points in time, which brings regular income during replanting. Though the staggered approach creates a significant cash shortfall in year 1, this shortfall is quickly reversed when intercrop income flows in.

TABLE 21: SENSITIVITY ANALYSIS OF REPLANTING SCENARIOS

IRR (yearly over 25 years)	FULL REPLANTING		STAGGERED REPLANTING	
	Monoculture – Scenario 1	**Agroforestry – Scenario 2**	**Monoculture – Scenario 3**	**Agroforestry – Scenario 4**
Pessimistic	16.5%	30.4%	17.6%	41.7%
Neutral	22.3%	34.4%	24.4%	46.9%
Optimistic	26.8%	37.5%	30.3%	52.1%

With a 15-percent interest rate (used in Section 2), 1-year grace period and five years for repayment, Table 22 summarizes the minimal viable loan products for a household of four[56].

TABLE 22: LOAN REQUIRED FOR ZERO CASH SHORTFALL (IN USD)

LOAN DISBURSEMENT ($) * indicates this loan still fails to create a zero cash shortfall after 7-year period	**YEAR 1**	**YEAR 2**	**YEAR 3**	**YEAR 4**	**YEAR 5**	**YEAR 6**	**YEAR 7**	**CUMULATIVE**
Monoculture – Scenario 1*	3,757	2,596	3,210	4,440	5,806	5,123	3,961	28,891
Agroforestry – Scenario 2	2,254	3,483	2,186	2,459	2,049	410	-	12,841
Monoculture – Scenario 3*	1,024	2,800	2,459	3,483	4,508	4,644	3,620	22,539
Agroforestry – Scenario 4	1,571	2,527	1,434	1,503	820	-	-	7,855

56. *It must be noted that this is an average household but actual financing needs must incorporate family structure and external income sources.*

Monoculture clearly creates the highest financing needs, as no income is generated until the rubber trees are mature. Large loan installments are needed to pay for farm inputs, household costs, and earlier loan tranches. Disbursements are so large that after seven years, the smallholder accumulates high amount of debt, leading to a cash shortfall. There is no monoculture scenario where loan disbursements over seven years succeed at keeping a smallholder solvent throughout the plantation's lifetime.

When considering the subsidized interest rate under KUR (7 percent per annum), staggered replanting of monoculture (Scenario 3) would need seven loan disbursements of a cumulative size of $22,539, but would still not succeed in guaranteeing zero cash shortfall for the smallholder over time.

Cash needs of the agroforestry model are much smaller due to income generated by intercrops. Cumulative loan disbursements amount to double or triple the $4,000 capital need for replanting and pose a significant, though manageable, risk for financial service providers. Both loan products for agroforestry succeed in guaranteeing the smallholder has no cash shortfall during the 25-year period under consideration. When rubberwood of the old plantation is sold, the disbursement loan size for agroforestry decreases evenly by around $300 per disbursement across the five years, lowering the cumulative loan from $7,855 to $6,215.

Considering both the IRR and loan products described, it is obvious staggered replanting using an agroforestry model should be strongly preferred over any other scenario.

Where selling rubberwood is an option, this would provide a clear financial benefit to the smallholder and to the financial service provider as it brings the total loan size closer in line with capital expenditure. After cutting down old trees, virtually none of the interviewed farmers in West Kalimantan sold the rubber wood -- they just left it or dumped it. In Jambi and South Sumatra, however, 45 percent and 30 percent, respectively, sold their old trees as timber wood.

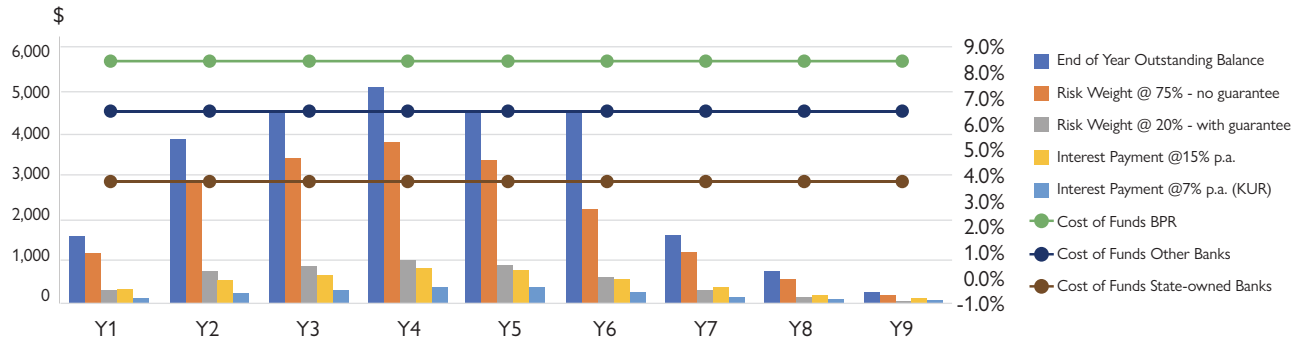
Interest rate analysis of agroforestry model with staggered replanting

With an average cost of funds at 3.8 percent[57], state-owned banks can realize an 11.2 percentage point spread over the suggested replanting loan at 15 percent interest rate per annum. Other commercial banks usually have a higher cost of funds at average 6.6 percent per annum. For BPRs (rural banks) and rural microfinance institutions (MFIs), the cost of funding is significantly higher at around 8.5 percent as they are perceived as much riskier. With KUR at 7 percent per annum (to be reduced to 6 percent per annum) representing the floor and 15 percent per annum the interest rate ceiling subject to the zero cash shortfall constraint[58], a commercial loan product should be priced within this range; a higher interest rate is possible but would add high financial burden on smallholders.

As shown in Figure 43, another factor to consider besides cost of funding[59]is the risk-weighted ratio. It is calculated based on loan outstanding with a reduction of 55 percent if guaranteed by a national or international (AAA) credit guarantee company.

57. DBS research, 2018.
58. Important to note that the loan amount could be increased to accommodate a higher interest rate, however this is not best practice as the recipient of the loan would be charged on a higher outstanding amount.
59. Assumed to be stable across the projection period.

FIGURE 43: INTEREST RATE ANALYSIS OF AGROFORESTRY MODEL WITH STAGGERED REPLANTING



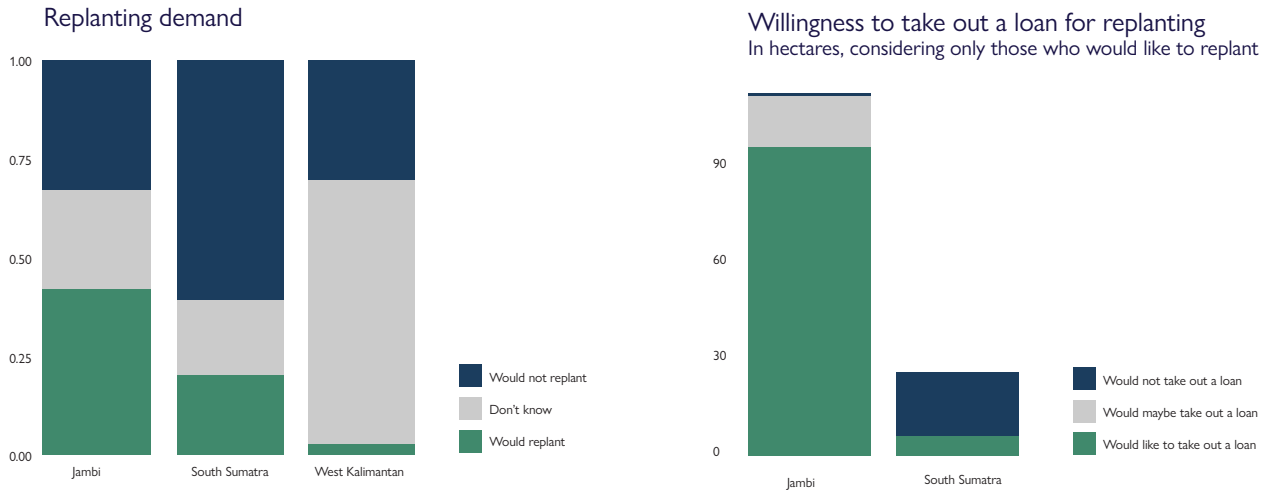
From a smallholder's perspective, KUR, rather than commercial loans, will serve as a baseline for comparing the cost of loan products. Total interest payments for a six-year KUR loan of which the first year is a grace period, are $179. A commercial loan product would be more than twice as expensive and would need to target market subsegments that the KUR is not reaching and with faster and less bureaucratic delivery processes.

Market sizing

Demand for financing for replanting is extrapolated from survey data by examining smallholders' past replanting and gauging their interest in taking a loan for replanting[60].

Despite low rubber prices and low yields, only 7 percent of farmers grow other crops besides rubber. Up to 10 percent of farmers said they will switch to another crop in the future because of low rubber prices and 20 percent of farmers have replanted part of their plots in the last decade. Over half of these farmers (10 percent of the farmers interviewed) replanted 20 percent less. Virtually all farmers planted less than 60 percent of their land.

FIGURE 44: FARMERS' INTEREST IN REPLANTING RUBBER AND WILLINGNESS TO TAKE A LOAN



From the analysis, demand for replanting is strongest in Jambi, where 40 percent of farmers are willing to undertake replanting. Replanting demand is lowest in West Kalimantan, where only one farmer out of 79 was contemplating replanting. There is no single feature that explains the higher demand for loans in Jambi compared to other areas.

60. Unfortunately data from the KUR program for allocated financing for rubber replanting are not publicly available.

Most likely reasons for this demand are that: The main peak planting in Jambi happened in 1995-2005 and the majority of trees are now approaching their maximum productive age; Jambi's farmers are more aware of the importance of good quality clones and their impact on yield (they have the highest rate of nursery clones purchase); they have suffered less from disease in recent years and they benefit from a stronger presence of financial providers.

Taking a conservative estimate that only half of the Jambi farmers who expressed interest in replanting (40 percent expressed interest) would actually replant with an alternative loan product from KUR, this indicates that around 50,000 of the 263,000 rubber smallholders in Jambi represent the potential market for financing to replant, with a total of around 100,000 to 125,000 ha. With an estimated loan amount of $7,855 per smallholder, this translates into a serviceable available market of $400 million.

In South Sumatra the situation is quite different. Even though this region has over twice the number of smallholders in Jambi, only 20 percent want to replant. Again, taking the conservative estimate that only half of those would replant, this also leaves 50,000 farmers willing to replant. However, as these farmers are less willing to use a loan to finance their replanting, this means the market size would be equivalent to 13,000 smallholders or $100 million.

In West Kalimantan the situation is less attractive, with just 1 percent of farmers willing to replant and none interested in taking a loan to finance replanting. Though it is unlikely not one single farmer in West Kalimantan would accept financing, it does point to the difficulty of reaching scale in this province.

Recommendation on rubber replanting (asset-based) loan design

The Special KUR for agriculture already presents some key features required for replanting activities. The new product design recommended in this report has several similar features but is tailored for rubber production and for a farming household profile. The product is designed to solve the challenges posed by KUR loans in terms of service delivery, accessibility, control of the usage of funds, and extension services for the farmer.

This new product's target market is a rubber farm of medium size (2 ha) with a household of two dependents and a member of a cooperative or UPPB. The farmer is interested in replanting his or her rubber plantation in a staggered manner, while practising efficient agroforestry land management. Regions of interest are Jambi and South Sumatra – two regions where the uptake for rubber replantation is higher, because of tighter value chain organization. Timing is right given the average rubber tree age is 20 years, making them ready for replanting.

Core financial features of the product are tailored to the targeted farming household's income. The minimum loan amount ($7,855) is the financing necessary for replanting the rubber plantation in a staggered manner over two years (50 percent in the first year, and 50 percent in the second year). The price (12 percent to 15 percent) is the maximum interest rate the client can afford, as per their seasonal income. The loan design is based on a 1-year grace period followed by five years of repayment according to an annuity schedule, where both interest and principal payments are made monthly. However, due to the seasonal nature of intercrops, monthly interest payments and bullet payments towards the principal at harvest time would be better suited for smallholders. The farmer would make small payments throughout the year and when they harvest their crops and have significant surplus cash in the household, they would pay 20 percent of the initial principal back to the financial service provider.

Similar to the Special KUR for agriculture, agreements with business partners (off-takers, service providers, UPPBs, and/or cooperatives) along the value chain reduce operational risk and potential misuse of funds. These actors could provide parts of the loan in-kind (e.g. inputs and/or replanting services) but also support the financial institution in monitoring progress, thus reducing loan monitoring costs.

TABLE 23: RECOMMENDED FEATURES OF RUBBER REPLANTING LOANS FOR SMALLHOLDERS

Product	**Loans – for planting**
Loan amount	$1,500 to $10,000 (equivalent in IDR)
Term	5 to 6 years
Interest rate	12% to 15% effective per annum
Risk mitigants	Proof of land title or letter from village head. Must be a member of a cooperative or UPPB. Co-guarantee by a subgroup of 5 members within the cooperative or UPPB group. Movable limited to vehicles. Co-guarantee of 50% in case of losses by off-taker. Co-guarantee a cooperative or UPPB that meets the minimum requirements.
Repayment	• Interest monthly payment • Bullet yearly payments (+- equal every year)
Purpose	Planting – to (re)plant rubber plantation with establishment of intercropping system.
Requirements	Documentation • Business license • Letter from village head • Marriage and education certificates • Other documents in line with KUR loan requirements Activity: • Current rubber farmer, farming a land of 2 or more ha. • Farmer committed to implement agroforestry intercropping and staggered replanting with 50% over the first year, and 50% over the second year. • Financial institution provides in-kind loan. • Commitment from the farmer in being part of an independent replanting monitoring program. • Income source independent from the rubber income equivalent sufficient to cover the monthly interest repayments. Limited household expenditure by family with a maximum of 2 minors. Agricultural best practices: • Attend GAP training for 6 months. • Agricultural field-certified independently as compliant with training principles.
Main target market	Small/medium-sized farms with replanting needs in the region of Jambi and South Sumatra.

11. CONCLUSION

Replanting high-quality rubber trees and improving planting and tapping practices has potential to increase yields and smallholders' incomes as well as maintain existing rubber plantations and jungle rubber plots. However long-term financing for replanting is rarely available for Indonesian smallholders leading to an aging tree population and declining rubber yields.

The financial sector, formal and informal, does not offer products meeting all requirements for rubber replanting: tenor equal or greater than 5 years, appropriate repayment schedule, affordable interest rates for long-term borrowing, collateral requirements, appropriate amount and eligibility of smallholders without formal land title.

Out of several Government of Indonesia-subsidized lending schemes for agriculture, only the Special KUR demonstrates the required features. However, based on analysis and anecdotal evidence from the field, uptake of the Special KUR is low and rarely used for rubber replanting.

Using desk research and interviews with smallholders in Sumatra and Kalimantan, a financial model was created to analyze the economic viability of four different replanting approaches and identify the features required for loan products to meet smallholder needs. An agroforestry approach with staggered replanting of rubber trees over two years, interplanted with other crops over seven years, was clearly the most economically viable model for smallholders, particularly where selling rubberwood is also an option.

The survey highlighted a potential market demand for financing rubber tree replanting in three regions in Indonesia. The highest potential is in Jambi, Sumatra, amounting to 100,000–125,000 ha at an approximate investment requirement of over $400 million.

Study findings resulted in a concept note for investors outlining the design of a facility combining technical assistance for agroforestry and improved yields with a financing mechanism to channel blended finance sources to smallholders through local financial institutions.

For more information, please contact *info@greeninvestasia.com.*

APPENDIX 1: RUBBERWOOD

Due to the low and diminishing productivity of many rubber plantations, the Government of Indonesia indicated a large need for a long-term replanting plan encompassing approximately 50,000 ha per year starting in 2019 (Wibowo, 2019). This replanting plan creates an opportunity to optimize rubberwood use as timber. According to Towaha and Daras (2013), rubber timber can be used as processed wood/sawn-wood and plywood. As processed wood, rubberwood yield is around 50 percent and can be made into furniture and builder woodwork for house construction. Plywood is fabricated wood made of veneers with thickness of 0.25–0.75 mm.

There is also rubberwood waste, which can be used as particle board, fiber board, lamina wood, paper, handicrafts, and charcoal:

► Particle board made of rubberwood chips has a density of 0.5–0.8 g/cm3 suitable for interior and exterior purposes. It can also be processed into wood plastic particle board that is waterproof.

► Fiberboard is a wood panel product made from fine wood powder reinforced with resin. Most are produced in the form of medium-density fiber (MDF) boards with a density of 0.4–0.8 g/cm3 with a smooth, solid surface where paint or coating can easily be applied and it is well suited for screws and nails. In general, rubberwood is more widely used as raw material for MDF. MDF production does not require high specifications, so almost all the main stems of rubberwood can be used. Using rubberwood as furniture raw materials will be difficult because the rod specifications should not be exposed to wood wounds, which usually occurs during tapping.

► Lamina wood is made from small pieces of rubberwood that are glued together with synthetic adhesive to form wooden beams in various shapes and sizes.

► With a holocellulose content of about 67 percent, rubberwood can be processed into pulp which is a raw material for paper.

► Rubberwood waste can also be used for handicrafts, such as wooden toys, charcoal and to produce liquid smoke. The optimum condition of rubberwood liquid smoke is at 420o C in 100 minutes, which is applicable for food preservation and for latex coagulant. This is essential for the improvement of natural rubber post-harvest processing.

Agustina (2012) compares the use of rubberwood in three major rubber producer countries, Thailand, Malaysia and Indonesia. Up to 40 percent of total utilization of rubberwood in Thailand is for timber products (furniture, household appliances, toys, etc.), 30 percent for firewood, 17 percent for wood particles, 11 percent for charcoal, and 2 percent for building pillars. Thai rubberwood furniture contributes 60 percent of the total production of wooden furniture in the country.

In Malaysia, the rubberwood industry was originally utilized as furniture raw material. Today rubberwood has also been used for door and window components, parquet, flooring, molding, laminating, finger jointing, plywood, particleboard, MDF, wood cement board, blockboard, and wood pulp.

The development of a large-scale rubberwood processing industry in Indonesia started in the late 1980s in North Sumatra, Jambi, South Sumatra, Lampung and Java due to limited forest wood. Before its characteristics were widely known, rubberwood was only used as firewood and charcoal. At present, rubberwood timber is mostly used as MDF.

APPENDIX 2: REPLANTING 2019–2027 PLAN

The Government of Indonesia recently launched a new replanting plan for rubber for 2019–2027. During the Rubber Conference on October 19, 2019, the Ministry of Agriculture announced the replanting goal of 700,000 ha across Indonesia during 2019–2027. The program will be executed through local governments and includes only minimal help to smallholders and does not include large scale financing, which will happen through other government channels such as KUR. This replanting program is not implemented yet, due to limited budget availability.

RENCANA REPLANTING KARET (2019-2027)

PROVINSI/KAB.	TAHUN (ha)									
	2019	2020	2021	2022	2023	2024	2025	2026	2027	JUMLAH
JAWA BARAT	-	-	-	-	1,000	1,500	1,000	1,000	1,000	**5,500**
JAWATENGAH	-	-	-	-	1,000	1,500	1,000	1,000	1,000	**5,500**
ACEH	200	1,000	4,000	4,000	7,000	6,000	6,000	5,000	4,000	**37,200**
SUMATERA UTARA	-	2,000	5,000	6,000	7,000	7,000	6,000	6,000	6,000	**45,000**
SUMATERA BARAT	200	3,000	7,000	7,000	7,000	8,000	6,000	6,000	4,000	**47,200**
RIAU	400	5,000	10,000	9,000	8,000	8,000	6,000	8,000	5,000	**57,400**
JAMBI	900	8,000	12,000	13,000	9,000	9,000	6,000	7,000	6,000	**69,900**
SUMATERA SELATAN	1,600	15,000	16,000	14,000	12,000	11,000	8,000	7,000	7,000	**92,600**
LAMPUNG	-	2,000	6,000	8,000	8,000	7,000	7,000	7,500	3,000	**51,000**
KALIMATAN BARAT	400	6,000	8,000	7,000	7,000	8,000	7,000	8,000	1,500	**57,400**
KALIMATAN TENGAH	200	4,000	7,000	8,500	9,500	9,500	7,500	7,500	2,000	**60,200**
KALIMATAN SELATAN	1,050	10,000	12,000	11,000	10,000	9,000	8,000	8,000	1,000	**76,550**
KALIMATAN TIMUR	360	2,000	6,000	5,000	5,000	5,000	5,000	4,000	1,000	**35,360**
PAPUA	200	-	1,000	1,000	1,500	1,500	1,500	1,500	1,000	**9,700**
BENGKULU	-	1,500	3,000	3,000	3,000	3,000	2,290	2,000	2,000	**20,490**
KEPULAUAN BANGKA BELITUNG	-	500	1,000	1,500	1,500	1,500	1,500	1,500	1,000	**10,000**
PAPUA BARAT	-	-	1,000	1,000	1,000	1,500	1,500	1,500	1,000	**8,500**
KALIMANTAN UTARA	-	-	1,000	1,000	1,500	2,000	2,000	2,000	1,000	**15,000**
JUMLAH	6,010	60,000	100,000	100,000	100,000	100,000	83,990	80,000	70,000	**700,000**

APPENDIX 3: AGROFORESTRY

Biodiversity and carbon stock

A diversity of vegetation has a positive relationship with animal diversity: forest vegetation supports animal life, especially birds and bats for foraging and nesting sites. Loss of forest vegetation in monocultural rubber plantations and smallholder rubber areas has decreased the number of bird and bat species. Some bird species, such as hornbills and woodpeckers, need big trees for nesting and have special guild feeding types. For these reasons, monocultural rubber plantations are not appropriate to support their existence. However, some other bird families such as Pycnonotidae (Bulbuls), Columbidae (Pigeons and Doves) and Sylvidae (Prinias and Warblers) have wider ranges of adaptation and can still be found in rubber plantations. Some bat species such as Rhinolophuspussilus, R.affinis (Microchiroptera) and C. melanocephalus were only encountered in forest habitat whereas C. sphinx was found in all habitat types (Tata, 2011).

In a study conducted in West Kalimantan, plant diversity inside RAS1 plots was found to be relatively high and the succession of the vegetation was close to that of natural secondary forests, when species are not deliberately removed (Ihalainen, 2007). Similarly, 15 plant species of medicinal value that farmers use were encountered inside RAS1 plots (Sitepu, 2006). The surrounding vegetation has a significant effect on biodiversity within the plantation. However, pre-existing vegetation does not have a significant effect on the biodiversity of rubber inter-row vegetation.

Agroforestry creates a richness of biodiversity and sequesters carbon in tree biomass. A study of agroforestry systems in Hamlet II of Harapan Makmur Village of Bengkulu Province, Indonesia, Wiryono, Putri and Senoaji (2016) found 101 species of plants, 38 of which were trees with diameter more than 10 cm with rubber being the most dominant tree. Some plants were intentionally planted, and the others grew naturally. The community used plants for several purposes, such as food, firewood, ornamental plants, medicines, construction wood, shade tree, handicraft, hedges, foraging and coloring. Only 23 species were not used.

Rahayu and Pambudi (2017) estimated above ground carbon stock of the rubber monoculture of PT. Perkebunan Nusantara IX in Banyumas, in which trees were planted between 1996 and 2011. The above ground carbon stock found in the plantation was 49.6 tons per ha with total carbon stock, including the tree, necromass, understory, and litter at 50.7 tons per ha. Compared with undisturbed forest, carbon stock was about 30 percent less and total carbon stock was 28 percent less. The study estimated above ground carbon stock of undisturbed forest at 162.7 tons per ha with total carbon stock of 182.4 tons per ha. Wiryono, Putri and Senoaji (2016) in their study in Bengkulu estimated carbon stock in trees was about 95.2 tons per ha. Meanwhile Dewi et.al. (2009) estimated averaged carbon stock of oil palm plantations in two estates in Sumatra and Kalimantan is 38.8 tons per hectare and 39.2 tons per hectare, respectively, for sites in Sumatra and Kalimantan, with a 25- year planting cycle.

Agroforestry policies in Indonesia

Agroforestry systems are not under the supervision of the Ministry of Agriculture, although the Ministry has included intercropping systems into their natural rubber replanting guidelines. In 2018, the Coordinating Ministry of Economy launched the technical guidelines of Special KUR for replanting of natural rubber by suggesting intercropping commodities such as corn in the first five years of cultivation.

The cultivation of rubber in forest areas is supervised and regulated by the Ministry of Environment and Forestry (MoEF), which promotes agroforestry with other forest management systems. Law number 41/1999 on forestry divides the forest based on its status to "forest state" (hutan negara) and "forest rights" (hutan hak). State forests are forests that are unburdened land rights, while forest rights are forests located on land that come with land rights.

There are several possible community-based forest management options in small-scale forestry including: community forest (hutan kemasyarakatan) (regulated in Permenhut No. P. 37/Menhut-II/2007 Jo No. P. 52/Menhut-II/2011), village forest (hutan desa) (regulated in Permenhut No. P. 49/Menhut-II/2008 Jo No. P. 53/Menhut-II/2011), the forest of folk crops (hutan tanaman takyat) (regulated in Permenhut No. P. 23/Menhut-II/2007 Jo No. P. 5/Menhut-II/2008), and indigenous forest (hutan adat). In forest rights, the concept of community-based forest management is implemented as the public forest (hutan rakyat). The public forest is a forest that grows on an ownership land title with a minimum area of 0.25 ha. The land should be dominated by timber plantation, i.e. at least 500 timber plants. Forest management in public forest can be done through agroforestry.

In Ministry Regulation Number P.20/Menhut-II/2014 regarding General Guidelines for Development of Conservation Based Forest Village Community (Pedoman Umum Pengembangan Perhutanan Masyarakat Pedesaan Berbasis Konservasi) dated March 20, 2014, agroforestry (wanatani) is defined as resource management that combines forest management activities, or timber trees, with the planting of commodities (short-term crops), such as agricultural plants. The guidelines differentiate various models of agroforestry from simple agroforestry, combination of tree-type planting with one or two types of agricultural commodities (intercropping/tumpang sari), to complex agroforestry that combines management of many species of trees with various agricultural crops, or even livestock and fisheries. The decree grants up to IDR 50 million ($3,246)/ group to develop agroforestry combined with construction/maintenance of land and water conservation buildings, development of non-timber forest commodities as well as livestock/fisheries.

In 2016, MoEF introduced the Social Forestry System in Ministry Regulation number: P.83/MENLHK/SETJEN/KUM.1/10/2016. Social forestry is a sustainable forest management system of state forests (hutan negara) or indigenous forests (hutan adat) implemented by local communities to improve their livelihoods, environmental conditions and socio-cultural dynamics. It allows local communities to access and utilize 12.7 million ha of social forestry areas for nursery, planting, cultivating, harvesting, processing, and marketing of timber and non-timber forest products based on social and environmental principles of sustainable forestry, including agroforestry activities.

APPENDIX 4: TECHNOLOGY TOOLS

Digital tools for monitoring last-mile operations

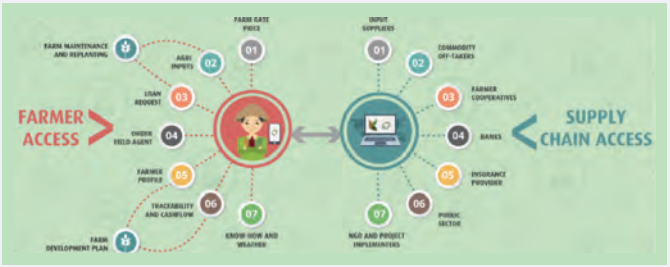
There is a growing need for a sustainable and traceable rubber value chain. Digital tools help optimize last-mile operations and develop more reliable value chains (GSMA, 2019). A number of companies are profiled in this section.

There are two dominant models for last-mile tools targeting agribusinesses:

1) Tech provider-led, which includes most start-ups that use mobile network operator assets to provide data collection and connectivity tools.
2) Agribusiness-led model in which an agribusiness may use resources from a specialist software firm.

An Indonesian start-up called **Koltiva**, has been developing digital tools under a tech provider-led model. The company offers a suite of cloud-based mobile and web applications, called Rubbertrace, for project and supply chain management that targets commodity buyers operating in a range of value chains, including rubber.

KOLTIVA Koltiva solution



Koltiva's product contains systems covering agri-input management, farmer group administration, training administration, farmer organization management, trader information and traceability, as well as smallholder plot and financial profiles, and interface to export warehouse and processing units. PT Koltiva field agents collect farmer data, conduct internal audits, map farmers' plots, train farmers and develop long-term production and commercial plans with them. Rubbertrace includes a financial inclusion and credit-risk scoring system under development. This allows an off-taker to assess a farmer's replanting requirements and loan requests.

Cropin is another company that takes a tech-led approach and has created an app-based technological solution that connects various stakeholders in the natural rubber supply chain. This digital solution enables plot- level analytics and production forecasts through farmer inputs and enables integration with financial lending institutions and crop insurance providers to manage risk and provide risk coverage, respectively. Advisories can also be issued through the application to improve productivity and maximize quality.

Data collection modules allow for geo-tagging and geo-fencing of farmer plots. These plots can also be "polygon-mapped" or monitored by satellite. Potential yields and losses at various stages as well as expected tapping dates can be monitored this way.

Cropin

Dashboard Cropin

The geotagging and polygon-mapping features are date and time stamped. Pictures of the land plot can be taken and uploaded. The dashboard also tracks field activity progress and yield parameters. For instance, the number of fertilizer application and yield obtained per tapping cycle can be monitored in a time-bound manner. Alerts can also be disseminated should there be any pending field activity. There is a module for pest and disease management. Automated SMS advisories can be issued to single or multiple farmers on best tapping and agricultural practices.

A rule-based predictive advisory engine forecasts weather conditions and is auto-programmed to send automated weather advisories. A yield quality evaluation feature ensures production meets market needs and demand. The feature allows for the reporting and planning of tapping and yield collection and segregation of yields by various grades resulting in customized yield estimation reports.

Functionalities allow for dealer management and tracking. Inventories can be monitored and transferred between farmers and dealers. Payments and returns can be made and monitored through the application, enabling traceability and cash flow management.

PT Kreditek Financial Access (KFA) focuses on reducing risk for financial institutions. It has built several tools, including data collection, loan originating and credit scoring solutions, as well as capacity building programs for financial institutions. KFA has worked with GRAS, a satellite analytics company, to include environmental risk assessment in credit assessment of farmers. GRAS supports the environmental assessment of landscapes and farmer fields and monitoring of these landscapes against any land use change, including fire alerts. Acquired farmer data and pictures can be managed through a mobile application. The system offers a traceability function through a mobile tracking app.

KREDITEK Financial Access

Credit Assessment Dashboard KFA

Digital tools for market access

Several agritech innovations support the development of digital tools to improve farmers' market access and formalize the agriculture last mile. For instance **TaniHub**, an Indonesian start-up runs a smartphone-operated application that directly links crop producers and buyers, eliminating the need for multiple traders, and formalizing last-mile procurement. Tanihub aims to secure a fair price and reliable payment services while also cutting the buyer's internal marketing or sourcing team. Tanihub integrates farmers' trading records with other farm and farmer data on their lending platform, called Tanifund. By collecting and compiling this data, Tanihub is able to provide Tanifund recommendations in the credit risk assessment. Recently, TaniGroup raised $10 million in May 2019 (Jakarta Post, 2019).

Digital solutions for rural finance with lack of banking infrastructure

DBS has set up a smartphone application to digitize banking in Indonesia. DBS digibank has an e-wallet integration that enables retailers and individual distributors to perform transactions with any Indonesian citizen above the age of 18 with a registered account within the digibank coverage area. The application does not require a minimum balance, monthly administration fees or an initial deposit. It enables deposits, remittances, acquiring personal loans, credit management, and buying/selling of Indonesian government bonds.

The current roll has been in the urban areas of Indonesia. The use case for this application is strong in rural areas due to the lack of need for physical banking infrastructure. Payments can be made and time-stamped between dealers and farmers, enabling farmers to record and maintain a history of transactions and better manage their finances.

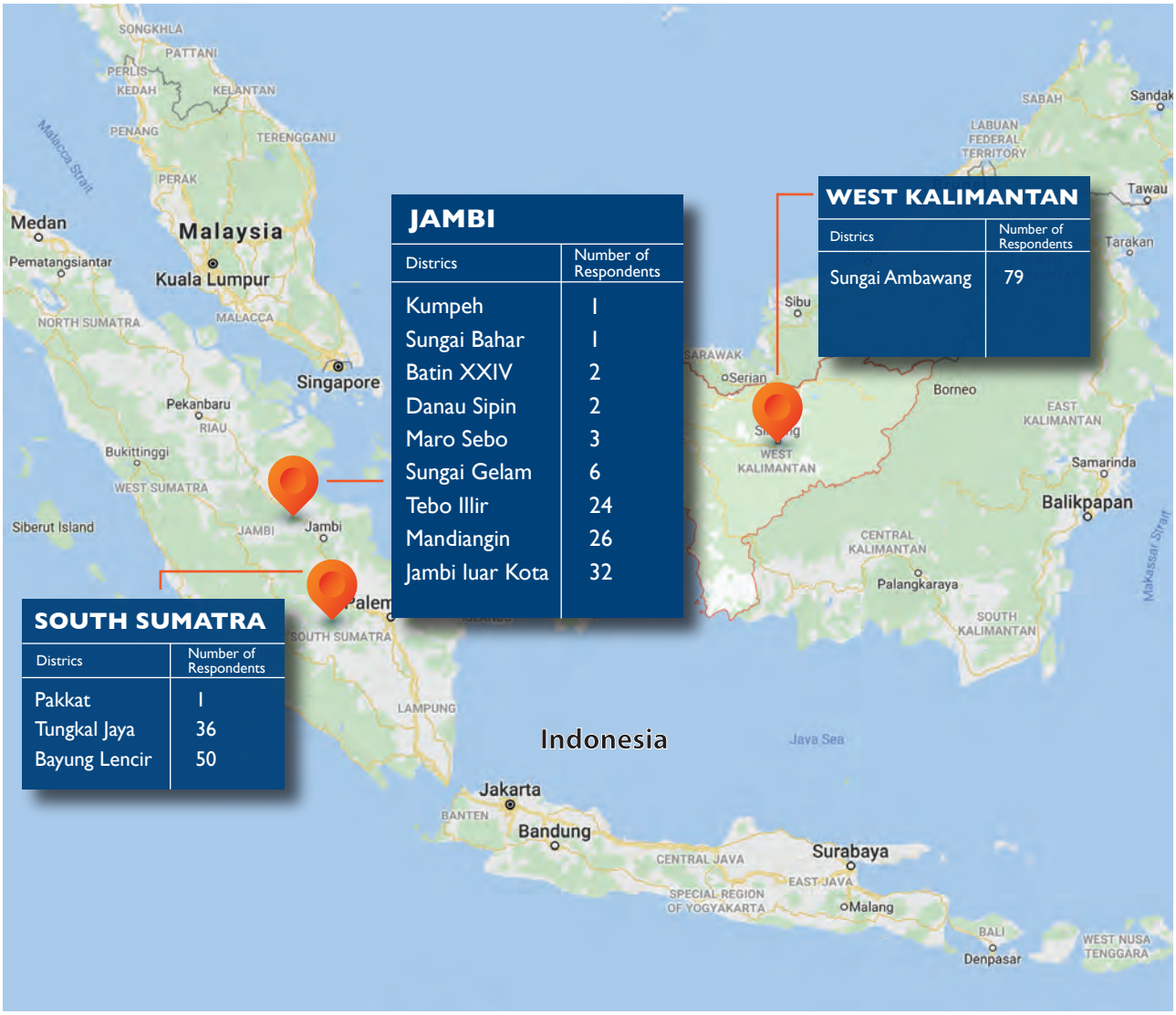
But challenges lie in the implementation of digital banking in rural areas and within the natural rubber supply chains due to a lack of digital infrastructure and literacy. Many rural areas lack internet connectivity and farmers do not have smartphones to enable digital banking.

APPENDIX 5: DATA COLLECTION

A field study was carried out to compare common practices of smallholder farmers with best practices throughout the production and marketing process. In September and the first week of October 2019, 263 rubber smallholder farmers were interviewed. Three main areas in Indonesia for rubber production were targeted, Jambi, South Sumatra and West Kalimantan. The number of interviews is roughly equal between the three regions at 97, 87 and 79 interviews, respectively. The farmers were not chosen at random and were accessed through rubber processors and cooperatives.

The interviews were conducted at the farmer's home or a place suggested by them using tablets or phones using software from Kreditek Financial Access in Indonesia. Three groups of enumerators were used, to ensure farmers were interviewed by someone from their own community. Most enumerators had conducted surveys before, and all received two days of training to ensure they were able to elicit proper, informative responses. Three-quarters of the respondents were male, and the average age was 45 years old. Of the respondents, 95 percent were married and the average household consisted of two adults and two children.

Respondents were selected among the supply chains of Kirana Megatara and Halcyon Agri.



JAMBI

Districts	Number of Respondents
Kumpeh	1
Sungai Bahar	1
Batin XXIV	2
Danau Sipin	2
Maro Sebo	3
Sungai Gelam	6
Tebo Illir	24
Mandiangin	26
Jambi luar Kota	32

WEST KALIMANTAN

Districts	Number of Respondents
Sungai Ambawang	79

SOUTH SUMATRA

Districts	Number of Respondents
Pakkat	1
Tungkal Jaya	36
Bayung Lencir	50

A full version of the questionnaire is presented below.

What is your full name?
Gender?
What is your date of birth?
What is your marital status?
What is your spouse's name?
What is the highest level of education you completed?
What is your phone number?
What is your address?
How many adults (>18 years) are part of your household?
How many of them are involved in farm-related activities?
How many children are part of your household?
Number of people in the household with an income outside the farm, including the household head?
What is the total average monthly income from outside of the farm per month?
What is the total value of remittances you receive per year?
What are your monthly average expenses on food and meals?
What are your monthly average expenses on utilities and communication?
What are your monthly average expenses on health care?
What are your monthly average expenses on clothes and entertainment?
What are your monthly average expenses on ceremonies and cultural/religious activities?
What are your other monthly average expenses?
Have you ever borrowed money from a formal institution?
How many loans (formal or informal) do you currently have outstanding?
For your largest loan: Where did you get the loan from?
For your largest loan: Do you often borrow from this person?
For your largest loan: What form did the loan have?
For your largest loan: What did you get the loan for?
What is the total value of all outstanding loans?
How many years of rubber farming experience do you have?
What is the total size of your farmland?
On how many separate plots of land do you grow crops?
For each plot: What is the size of the plot?
For each plot: What is the main crop type on the plot?
For each plot: Do you use seeds from a certified/branded source?
For each plot: How many trees are on the plot?
For each plot: When was it first planted?
For each plot: Have you undertaken partial replanting since then?
For each plot: How often?
For each replanting: When did you replant?
For each replanting: What percentage of the plot did you replant?
For each plot: What status of land ownership do you hold?
For each plot: What is the total value of the plot?

On your rubber fields, do you also grow any other intercrops?
Which ones?
When you replanted, what did you do with the cut down trees?
Around how much did you receive per kilogram of wood?
When you replanted your trees previously, did you increase your yields per tree or ha?
Where did you get your new saplings from?
How much did they cost each?
When you replanted, after how many years did the trees become productive?
Do (part of) your rubber trees need replanting?
Why not?
Why do you want to replant?
How many ha need replanting?
What do you think the total cost of this replanting would be?
Would you be willing to take out a loan for this replanting?
What yearly interest rate would you be willing to pay for your loan?
In how many years do you think you can repay the loan?
Are you considering growing less rubber or switching to another crop?
To what crop would you switch?
Why would you switch?
Have you heard of the KUR loan program of the government?
How many people do you know who have received a KUR loan?
Have you ever tried to apply for a KUR loan?
What is the reason you did not apply for KUR?
What loan size would you have liked to apply for?
What is the interest rate the KUR program offers?
When did you apply for KUR?
What size was the loan you for?
What was the interest rate offered to you?
What was the duration of the loan?
Did you receive your KUR loan?
When?
Labels?
How satisfied are you with the KUR application process?
How satisfied are you with your KUR loan?
What was your average monthly rubber yield in the past 6 months?
What was the price per kilogram you received for your rubber the past 6 months?
Does this price vary a lot per week/month?
In the past 12 months, how much money have you spent on fertilizer for your rubber trees?
In the past 12 months, how many bags of fertilizer for your rubber trees did you buy?
In the past 12 months, how much money have you spent on pesticides for your rubber trees?
In the past 12 months, how many bags of pesticide for your rubber trees did you buy?

In the past 12 months, how much money have you spent on average per month on hiring external labor for rubber?
How many days did you have external laborers work on your rubber trees?
What percentage of all farm labor is done by external laborers?
In the past 12 months, how much money have you spent on average per month to transport your rubber?
Over the past 12 months, what would you estimate the total average monthly cost of your rubber production to be?
Over the past 12 months, what was the total income from any other crop besides rubber?
Over the past 12 months, what were your total expenses on hiring labor for your other crops?
Over the past 12 months, what were your total expenses inputs, transport or anything else besides labor for your other crops?
Where do you usually get information about the daily rubber price?
Do you have a place where you can store the rubber you produced?
How many days can you store your rubber produce for?Do you preprocess your rubber produce?
Do you receive advice from your off-taker or factory staff on how to best grow and harvest your rubber trees?
Is the price you receive for your rubber dependent on the quality?
Do you provide the highest quality rubber?
Do you know how to provide better quality rubber?
Have you ever taken part in training on cultivation and rubber quality improvement?
What are the main barriers to attending training?
How do you make the tapping slices?
What is the best tapping time?
Are you a member of a cooperative, UPPB or farmer group?
What is the name?
Does your cooperative meet regularly?
What gets discussed during the meetings?
Are the meetings useful?
What is the main value you get from the meetings?
What is the main problem with the meetings?
Do you usually sell your rubber to the same off-taker?
What type of off-taker?
To whom?
Are there different off-takers in your area that you could maybe sell to?
Why don't you sell to those other off-takers?
Do you get paid immediately by your buyer?
After how many days do you usually get paid?
How much money does your buyer currently owe you?
Is your rubber currently certified?
Which certification do you have?
Is your plantation close to a conservation area?
Did you expand your farmland in the past 5 years?
How did you expand your land?
Do you have issues/conflicts with wildlife?
How do you manage these conflicts?

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Tanes Ngamsom/iStock. Photos: A roll of rubber sheet dry hanging on wood rack.