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Smallholder farmer harvesting rubber near Laman Satong village, West Kalimantan, Indonesia. Photo: Irpan Lamago

Towards a sustainable business model for rubber agroforestry in Indonesia

Elok Mulyoutami, Dia Mawesti, Triana, Edi Purwanto and Atiek Widayati

"Our rubber plot is a mixed rubber garden, where many other valuable plants can grow and be harvested for home use and to generate additional income."

Ms. Rupina, Dayak rubber smallholder farmer, Mekar Raya village

Agroforests: traditional and functional

The significance of agroforestry systems to Dayak communities, particularly rubber (*Hevea brasiliensis*) agroforests, is deeply rooted in their social and cultural setting. For decades, this land-use system has provided economic benefits as well as other vital assets for their various livelihood elements.

In Simpang Dua sub-district, Ketapang District, West Kalimantan, Indonesia, agroforests have flourished for generations. There are two common types: *tembawang* and rubber agroforest. *Tembawang* is a traditional fruit garden, with illipe nuts (*Shorea* spp., or *tengkawang*) as the primary commodity and also including fruit and food trees such as durian (*Durio zibethinus*), *langsat* (*Lansium domesticum*), *cempedak* (*Artocarpus integer*) and *jengkol* (*Archidendron pauciflorum*). Smallholders usually establish *tembawang* after cultivating upland (rain-fed) paddy fields for a few years, or in homegardens that are planted with the various tree species. The second

type is rubber agroforest, a mixed garden with rubber as the primary commodity and dominant tree (Michon et al. 2007). It is locally called *kebun karet*, literally "rubber garden."

In the past decades, *tembawang* and rubber agroforests have faced threats of conversion, due to the plunging rubber price at the farmers' level, from around EUR 900/tonne in 2011 to EUR 300 in 2023 (Figure 1). With such a low rubber price, rubber smallholders can no longer rely on this commodity as their primary livelihood source. The oil palm boom in West Kalimantan since the early 2000s has made it even more difficult to resist land conversion. Although both agroforestry systems are threatened, *tembawang* is considered more resilient since it provides more socioeconomic benefits for local communities, and its tenure rights are better protected under local customary law.

Some Dayak communities maintain rubber agroforests more to respect their ancestors' clan and traditions than for tangible economic benefits. Traditional rubber agroforests are perceived as low-input and low-output systems and are economically marginal (Grass et al. 2020). However, for some other communities, rubber agroforestry is still valuable economically, since farmers can earn income from other commodities when the rubber price is low. Rubber agroforests can potentially reduce smallholders' vulnerability to volatile rubber markets, particularly if their income from other tree species is substantial (Huang et al. 2022).

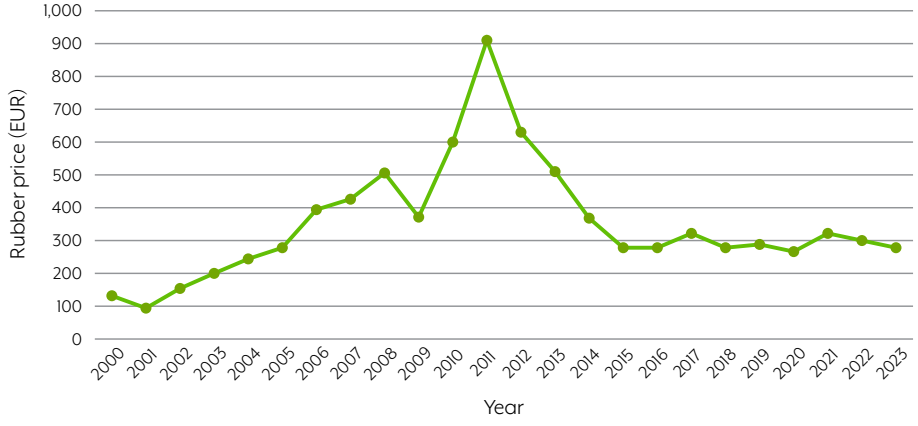

Figure 1. Rubber price per tonne (EUR), 2000–2023
Source: Malaysian Rubber Board

***Tembawang* in Mekar Raya, West Kalimantan, Indonesia. Photo: Abdul Hadedi**

Rubber agroforest in Mekar Raya; rubber trees can be recognized by the scars on the bark from collecting. Photo: Abdul Hadedi

Values of agroforests to the communities

Sociocultural values

In rubber agroforests, individual ownership applies only to rubber trees, while other commodities belong to all and may be harvested by other members of the community. For instance, *bemban* (*Donax canniformis*), various species of rattan (*Calamus* sp.) and bamboo (*Bambusoideae*) are harvested for crafting materials. Conversely, *tembawang* is entirely communally owned and managed by the family clan. In addition, *tembawang* is a social space for annual collective fruit harvesting and gatherings. Overall, different agroforests of Kalimantan have strong traditional importance linked to spiritual life, respect for ancestors and other sociocultural values. In contrast, plots with oil palm and *jengkol* do not have such values (Table 1).

Table 1. Agroforest functions and sociocultural values

System	Functions	Collective action	Natural and spiritual values	Land-related property right
Rubber agroforests	Food, income, other locally used products	—	Ancestor reverence	Individual-semi-communal based
Tembawang	Food, income, other locally used products, identity, knowledge	Annual social and cultural events	Ancestor reverence	Communal
Oil palm with *jengkol*	Food, income	—	—	Individual-based

Adapted from Mulyoutami et al. 2023

Economic values

Rubber agroforests provide diversified income. Huang (2022) highlights that diversified farms have higher returns when rubber prices are low, but this depends on whether the commodities chosen provide good returns in terms of land and labour. In the current situation in Simpang Dua, where rubber agroforests are mostly intercropped with subsistence crops (see photos), market opportunities for secondary products such as *jengkol* and sugar palm (*Arenga pinnata*) exist only in the neighbouring villages.

A modelling study carried out in 2021 using the FarmTree Tool (DIBcoop 2021) showed that rubber agroforests

Oil-palm plot in Simpang Dua. Photo: Gusti Suganda

provide higher income than oil-palm plantations despite their higher labour requirements (Table 2). The model calculated the potential production of several commodities in different scenarios, assuming a 10% discount rate of the present price. The model assumes that all crops are sold on the market; therefore, results for the *tembawang* show high potential income, while in reality many crops are grown for subsistence and thus have a low market value. Rubber is intended for market use and is the most significant regular source of income.

Table 2. Potential revenue (IDR/EUR) from three agroforestry systems in Simpang Dua sub-district

System	Trees and commodities	Modelling result, 30-year life cycle			Production orientation
		Labour investment (per ha per year)	Net income (NPV @10% DR) per year	Input costs (NPV @10% DR) per year	
Rubber agroforests	Rubber, *jengkol*, sugar palm	EUR 331.4	IDR 12,048,000 (EUR 753)	EUR 931	Market
Tembawang	*Durian, langsat, cempedak, jengkol,* sugar palm, *Coffea robusta*	EUR 169.6	IDR 13,346,666 (EUR 834)	EUR 1,083	Subsistence
Oil palm	Oil palm	EUR 172.3	IDR 10,257,066 (EUR 641)	EUR 925	Market

Notes: Data source: DIBcoop (2021). NPV: Net present value; DR: Discount rate

In 2022–2023, however, primary data collection in Simpang Dua and Sinar Kuri sub-districts shows results that differ from the modelling results. Income from rubber agroforests was IDR (Indonesian rupiah) 12,921,600 (EUR 777) per ha per year, while oil palm monoculture generated a higher income of IDR 15,652,500 (EUR 941). So, modelling data and actual field data indicate that rubber agroforests and oil palm monocultures are both promising. While data showed that oil palm provides higher income in the short term, rubber agroforests can provide higher income over the entire system cycle. This difference is also due to the fact that oil palm requires more inputs such as fertilizers, particularly during the non-productive stage, which is accounted for in the DIBcoop model. More intensive economic analysis is needed to understand this further.

Financing agroforests: challenge and opportunity

In many countries, agricultural loans and investment portfolios are disproportionately low compared to the agriculture sector's share of gross domestic product. The financial sector, including banks and microfinance institutions, provides only minimal resources to the agricultural sector. A World Bank Brief (World Bank 2022) lists the reasons why more financial support is not provided: inability to manage the specific (e.g., climatic) risks of agriculture; high transaction costs in dealing with a large number of smallholders; the presence of micro, small and medium enterprises along agriculture value chains; limited effective demand for finance; and the lack of expertise of financial institutions in managing agricultural loans.

Long-term financing would be ideal for supporting smallholder rubber agroforests, improving yields and adding value to community livelihoods from secondary commodities. Unfortunately, obtaining this type of financing faces many obstacles related to the lack of productivity of agroforestry crops and the low attention on the part of investors, financiers and markets. Another form of support for small-scale agroforest products would be to link them to markets and communities of buyers, in order to help communities increase production from their agroforests.

A similar situation is observed in the case of cocoa agroforests in Côte d'Ivoire, where long-term financing is needed to target on-farm agroforest activities to sustain and improve profitability while transforming farming systems. Klein et al. 2021 recommends that funding be obtained through loans and that funders estimate a minimum level of cash flow generated by sales to cover producers' needs and ensure repayment of the loan without burdening family budgets.

Smallholder farmers who do not achieve adequate profitability need non-commercial financial support (i.e., support that does not to be repaid), including technical support, to strengthen their farming practices (Klein et al. 2021). In Central Sulawesi, Indonesia, incentive mechanisms such as carbon payments seem to have positive impacts on the income derived by cocoa smallholders for the households that have the fewest financial resources. In addition, carbon payments may reduce the need for smallholders to clear the forest and sell their land (Seeberg-Elverfeldt et al. 2009). Multiple market-based instruments (such as premium prices for eco-certification, carbon payments, and taxes on conversion processes) can stabilize farmer income and reduce income inequality among farmers (Djanibekov and Villamor 2017).

Non-financial incentives, such as for performance-based results, might also be considered, not only for smallholders but also for wider communities. Incentives for local people in Bungo District, Jambi Province, Indonesia, were not provided directly for agricultural businesses, but for measures such as the establishment of micro-hydro power plants, setting up rubber nurseries, and installing demonstration plots of improved rubber cultivation systems and seedlings (Joshi et al. 2011). In the case of Simpang Dua, payments for ecosystem services from the Gunung Juring Protection Forest, located in the sub-district, have been used to establish a mineral-water business. This effort was initiated by one village in the sub-district, Mekar Raya, with the support of the local forest authority. Both financial and non-financial support from local authorities can assist local business initiatives.

Will the rubber agroforest business model work?

The business model for rubber in Simpang Dua sub-district is currently managed by households. Financial support is necessary, although at the current stage, the most crucial support needed is for improving the quality and quantity of rubber production. Credit Union (CU) Semandang Jaya, a local financial institution, expressed little interest in further assisting rubber smallholders (Mawesti et al. 2021). The major reason was that production is low due to falling rubber prices, and yield is low due to the variety of rubber trees, which has low agronomic productivity. Other factors contributing to low production and/or productivity are poor seedling quality, dense spacing between trees, no pruning, no agricultural inputs, old unrevitalized trees, and inappropriate harvesting techniques. Another factor that deters involvement by the CU is the low quality of the latex produced. Smallholder farmers often mix dirt into coagulated rubber to increase its weight, but this stratagem does not work, because the rubber market demands good-quality rubber that is free of dirt.

CU Lantang Tipo did provide financing to rubber smallholders for replanting, with a four-year grace period for repaying the loan and a 14-year payback period. However, most local smallholder farmers hesitate to take such loans because rubber rejuvenation is a low priority. They maintain ancestral rubber plots without fertilizers or pesticides (i.e., low maintenance). Oil palm and fruit trees are more attractive than renewing rubber plots.

UPPB purchases *bokar* from rubber smallholders in Simpang Dua. Photo: Sulaiman

In four villages in Simpang Dua — Mekar Raya, Gema, Kamora and Batu Daya — at least 150 smallholders have been identified as active rubber tappers. For decades, these smallholder farmers have relied on local (village-level) buyers to purchase the raw rubber (*bokar*) and sell it to local agents at the sub-district level who have purchasing agreements with rubber factories. These different intermediaries in the rubber supply chain have put smallholder farmers in a vulnerable state: the farmers do not have the bargaining power to determine the selling price amid the steadily decreasing price of rubber. Smallholder farmers are not well informed about the rubber price at the factory level, and in addition, some of them are already in debt due to pre-financing from buyers for working capital and daily costs. Therefore, rubber smallholders have limited options to earn better and more fair prices.

Rubber smallholders thus face various types of difficulties. The lower global demand for natural rubber weakens prices and devitalizes the business process. Some factories are closed, some buyers are no longer purchasing rubber, and some smallholder farmers are reluctant to sell. The expansion of nearby large-scale oil palm plantations has shifted the rural labour force from rubber smallholders to plantation workers, especially the younger generation. The temptation to change land use to oil-palm farms is high, given the more stable and relatively high price of palm oil. Rubber smallholders also face other challenges that are part of locally controlled forest and farm businesses: insecure tenure; inadequate technical capacity; lack of business and market know-how; and limited cost efficiencies and bargaining power (Macqueen et al. 2018).

Aggregation as the key for market access

In Simpang Dua, although obtaining financing remains challenging, access to the market can be improved by establishing a rubber processing and collective marketing unit (*Unit Pengolahan dan Pemasaran Bokar* or UPPB). In 2022, farmers' groups in the four villages formed a UPPB and registered it with the Agriculture, Livestock, and Plantation Agency of Ketapang District. The unit would arrange collective marketing and provide technical capacity for farmers to meet the specifications of Standard Indonesia Rubber, a quality standard for *bokar*. By establishing the UPPB as a legal entity, farmers

UPPB sells *bokar* to PT NKP, a rubber-processing company. Photo: Triana.

can collectively sell rubber slabs (coagulated latex in thick sheets) directly to crumb rubber factories (which process natural rubber into rubber granules, mostly to supply tire manufacturers; see photo previous page), and earn prices up to 25% higher than they would get by selling as individual farmers.

> *"I am happy to sell bokar to UPPB. So far, the buying price from the middlemen is much lower than the UPPB, though we need to sell it collectively to reduce the transportation cost."*
> Ms. Heni, a rubber farmer from Kamora village

Being a newly established institution, Simpang Dua UPPB faces several challenges. Despite 80% of active rubber smallholders in the four villages being members, regular delivery to crumb rubber factories is still a challenge because of irregular supplies from farmers. The recent price is still far below the high price of the last decade, which demotivates farmers to tap their rubber trees. Among local smallholder farmers, rubber slabs that they sell to local traders are also kept at home instead of being sold and are commonly used as savings for urgent needs or when the rubber price picks up, even though the quality of the slab will deteriorate after three months of storage.

The actions and commitments that Simpang Dua UPPB must undertake can be summarized as follows:

- UPPB must gradually improve rubber slab quality to obtain a better price, thus unleashing the potential to get a premium price (Fair Rubber). Even so, 70% of all natural rubber production goes to car tire manufacturers, and convincing them to try Fair Rubber is tough. Hence, the Fairtrade label for rubber production involves a very narrow market (Kunz 2021). However, with direct links to rubber factories through UPPB, local smallholder farmers can also access private financial resources to improve their technical capacity in product knowledge and standard quality, as required by the industry.
- As a business unit, UPPB must also have a solid business case in which they remain profitable even without external support. Currently, there are various supports and facilitation options for local rubber smallholders in Simpang Dua, in the form of intervention strategies (Figure 2).

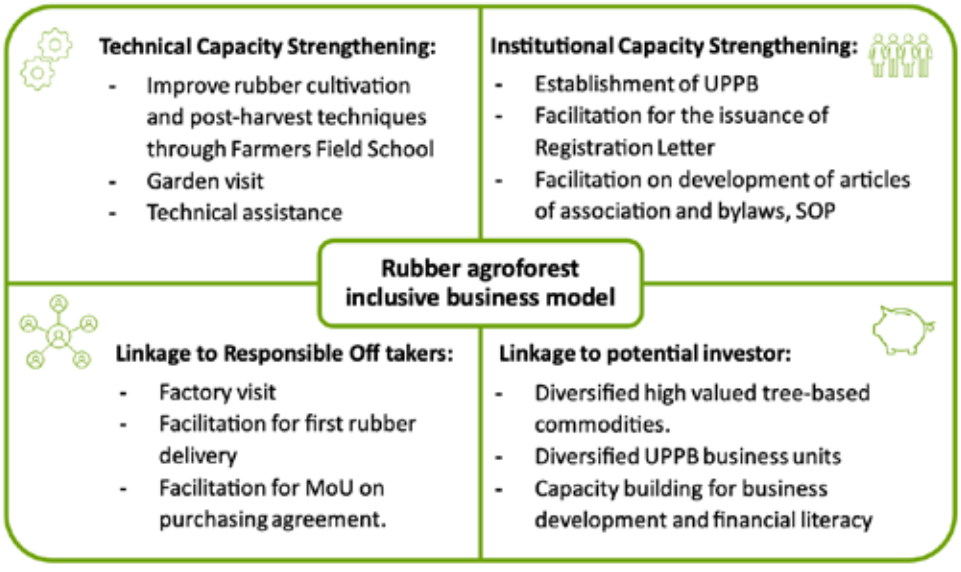

Figure 2. Intervention strategies for sustainable business model, rubber agroforestry

In the long run, these intervention strategies will lay the foundation for UPPB to be a strong farm producer organization running an inclusive business model for rubber agroforests. By improving their institutional and technical capacities, local smallholder farmers are expected to increase their production capacity and the quality of their rubber, which is their main or "anchor" commodity. Macqueen et al. (2018) found that many successful forest and farm producer organization (FFPO) business models started with a particular anchor value chain; they then diversify into various production lines because doing so will reduce the risk of failure. In this

case, once the anchor product has a well-established market, UPPB can potentially facilitate market aggregation of diversified commodities to provide an additional source of income for local smallholder farmers from rubber agroforestry plots.

Conclusions

To promote sustainable and inclusive rubber agroforest businesses, commitment from all relevant stakeholders — including smallholder farmers, government at all levels, NGOs and the private-sector — is needed. Through regulatory support, the government can incentivize farmers to maintain agroforests. However, even with the current lack of interventions from the government, local farmers' groups have shown high resilience by organizing themselves to improve the system and to develop their business as well, with the support of NGOs. And as a vital part of the rubber supply chain, crumb rubber factories can also play an essential role in supporting rubber agroforests. With initial support from the government and through local collective actions, a rubber agroforestry business is expected to be established, and responsible financial institutions and investors can provide financial support to further develop this business.

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