Working Paper

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An initial analysis of the financial and social benefits

Beria Leimona, Ratna Akiefnawati, Rachman Pasha and Suyanto

Southeast Asia

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Abstract

Smallholder rubber agroforestry is an economically and ecologically important agroforestry system in Jambi province, Sumatra, Indonesia. It contributes to rubber production nationally and is the main source of income for farmers with land of less than 5 hectare. The rubber agroforests act as buffer zones for national parks and help maintain local biodiversity, earning them the name 'jungle rubber'. Farmers cultivating these agroforests usually have lower financial profitability compared to those cultivating monoculture rubber and oil palm. The main reasons for this are the older ages of the agroforests, which causes low quantities of rubber latex, and the low quality of the rubber slabs owing to unsound harvest and post-harvest procedures. In addition, the marketing system in Jambi's villages depends on local traders, called *toke*, who mostly are not transparent about the real value of dry rubber content and the market price.

Our hypothesis was that by providing incentives to 'jungle rubber' farmers they would be willing to conserve their rubber-tree gardens, delay or obviating their conversion to other land uses that provide less environmental services, such as monoculture rubber and oil palm.

This report describes the different procedures employed in harvesting, post-harvesting and marketing in traditional and improved production systems. It highlights changes in the ratio of revenue and costs that were borne by farmers, through the deployment of technical innovations and collective action.

Our results showed that improving rubber quality could increase farmers' incomes from agroforestry systems when the dry rubber content (DRC) of their rubber slabs was more than 70% and they sold to agents who could transparently advise on the DRC and fairly determine the price according to the DRC level. When the DRC was lower than 70% and the price at minimum or average levels, selling rubber to *toke* was more profitable compared to selling direct to the factory.

The activities that improved the rubber quality, which were coordinated by the World Agroforestry Centre and partners, also increased farmers' knowledge and skills. These included practical skills to enhance their livelihoods as well as the capability to organize collective action, which, in the end was able to increase the efficiency of their smallholding rubber businesses. Moreover, neighbouring villages considered these activities useful and profitable, indicating a potential for expansion.

Raising awareness about the ecological importance of rubber agroforestry was constantly needed in this area since there was no formal agreement that only farmers practising 'jungle rubber' agroforestry could enjoy access to innovative technologies and sell direct to factories. From the perspective of an environmental friendly rubber business, it is essential for rubber industries to recognise the environmental and economic value of rubber slabs coming from jungle rubber so that farmers are encouraged to maintain this ecosystem.

Keywords

rubber agroforestry, improving rubber quality, financial and social benefit analysis

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1. Introduction

Rubber agroforestry is a multistrata system of rubber-tree gardens practised traditionally by the communities of Muara Bungo district, Jambi province, Sumatra, Indonesia. A multistrata rubber garden forms a secondary forest with multiple functions (Michon et al. 2007). Economically, these latex-producing, smallholding rubber-gardens have contributed significantly to the income of the Bungo communities and, in particular, to that of Lubuk Beringin, the sub-village that was the site of this study. These gardens also have provided local fruits and medicines for self-consumption and sale. Ecologically, the ecosystems of rubber agroforests have provided services that benefit human wellbeing (MA 2005), such as watershed protection, biodiversity conservation and carbon sequestration. Ecosystem services provided by rubber agroforests benefit both local communities and external beneficiaries, for example, people living downstream of the watershed who have access to clean water filtered by the ecosystem. In addition, the ability of this ecosystem to protect biodiversity and sequester carbon contributes to beneficiaries on a planetary scale.

In this decade, the conversion of rubber agroforests to monoculture rubber and oil palm plantations has increased. The reasons for this are that 1) local communities have less opportunity to expand their rubber gardens extensively into forests since the forests have also been depleted; and 2) rubber agroforestry produces less latex compared to monoculture plantations. The latex production of rubber agroforests is typically about one-third that of intensive monoculture plantations and has been harvested using traditional methods. This places rubber agroforests under threat of extinction because they are not economically attractive to farmers (Budidarsono et al. 2010). Loss of such ecosystems will threaten both the current environmental services and the intactness of neighbouring national parks since the gardens play an important role as a buffer zone and wildlife corridor for the parks (Ekadinata et al. 2010).

Farmers of rubber agroforests are likely to preserve their current system if they enjoy improved profitability compared to monoculture plantations. The low productivity and low quality of the agroforests' latex are two problems that cause low incomes from this system. The low productivity is a result of the old age of about 90% of the gardens and the selection of inferior seedlings (Akiefnawati et al. 2010). The low quality is an outcome of traditional methods used during harvest and post-harvest treatment to create thick slabs of rubber latex. The farmers usually immersed the rubber in stagnant water or in a river and added tapping bark or battery acid, TSP fertiliser and other compounds into the latex. They assumed that the price for their latex was directly related to weight rather than quality. Therefore, the farmers tried many ways to add to the latex slabs' weight.

In addition, the harvesting procedure was poor. The farmers used conventional harvesting tools, such as rubber-tree branches as tapping pipes and coconut shells as cisterns. The post-harvest procedure was also found to be unsound. Farmers used improper coagulants, such as thin vinegar solution, battery acid, TSP fertilizer and floor cleaners. They transported the harvest from their gardens to their villages along the river and sold their products immediately to the *toke*. These local collectors usually offered the farmers a low price because of the low quality of the unprocessed, wet rubber. Then the *toke* would cut the price by a further 10% from the total rubber weight to compensate for water shrinkage, making the amount received by the farmers even lower. The *toke* mostly determined the price subjectively. The price was

not based on the dry rubber content (DRC) as an indicator of rubber quality, since most of the farmers did not know the DRC either. The *toke* tested the DRC by trampling on the slabs.

Support for farmers to improve the quality of their rubber harvest is essential to increase their financial profitability, which, ultimately, will provide sufficient incentive for them to conserve their rubber agroforestry systems.

The World Agroforestry Centre carried out its research in partnership with local non-government organizations WARSI and Gita Buana, supported by Bridgestone Corporation Japan, to encourage the continued existence of rubber agroforestry in Bungo owing to its economic and ecological importance. The collaborative activities from April 2010 to March 2011 involved training in better harvest and post-harvest treatments and testing selling directly to the rubber-processing factory, in this case, Bridgestone Corporation.

This report describes the different procedures used in harvesting, post-harvesting and marketing in both traditional and improved rubber quality production systems. It highlights the ratio of revenue and costs borne by the farmers in both systems and the social implications of innovation and collective action.

2. Methods

The World Agroforestry Centre team organized a series of focus group discussions with the villagers of Lubuk Beringin to discuss their farms' financial profitability from improving rubber quality and the social implications of such incentives. The team also held focus groups in Senamat Ulu sub-village, where people were not familiar with any practices to improve their rubber quality. The purpose of this observation was to check if communities of neighbouring villages gained any benefit from the activities that we conducted in Lubuk Beringin.

2.1 Smallholder rubber production in Bungo

Rubber is the main commodity in Bungo district that is mostly cultivated by smallholder farmers owning land less than 5 ha. The overall productivity of smallholder rubber in Bungo is relatively low, with average annual productivity of 725 kg/ha/year (Akiefnawati et al. 2010), compared to Sulawesi and Java, where productivity is more than 1000 kg/ha/year (Sopian 2008).

Farmers planted about 300 rubber trees per hectare, at a planting distance of 4 m x 4 m, mixed with other trees such as *petai*, *duku*, durian, jackfruit and *bedaro*. All rubber gardens were old (between 20 and 81 years) and seedlings came from local rubber species. The rubber garden pattern was a simple rubber agroforest consisting of rubber, fruit and wood trees such as *jelutung* (*Dyera* spp).

Initial production of rubber was up to 10 kg/ha/day with production reaching its maximum at 15–20 years, that is, 15 kg/ha/day. Production decreased after the plantation age was more than 20 years, that is, to 8 kg/ha/day. The marketing channel in Lubuk Beringin and surroundings was via local traders called *toke*. These *toke* usually provided informal financial services for farmers. They lent money for daily and household needs and were repaid after the farmers sold their rubber. A strong social relationship existed between the farmers and the *toke*.

Other marketing channels were mid-level *toke* (from other villages or districts) and direct selling to a bi-weekly rubber auctioneer. Each marketing channel had its own benefits and costs for the farmers, as discussed by Akiefnawati et al. (2010). For example, selling to the rubber auctioneer was more transparent so the farmers might receive better prices and would not be trapped in debt dependence to *toke*. However, farmers had to queue 2–3 days for the auction and payment. In addition, there was no social interaction with this formal institution.

2.2 Measuring the effect of improving rubber quality

The economic effect of improved rubber quality is expressed by two indicators: 1) increased DRC; and 2) increased cash income received by farmers. The increase in cash income was calculated by comparing the profit from traditional practices to the profit from improved rubber quality sold through *toke* and to the factory. The profit was calculated based on the ratio between profit gained through the traditional system via the *toke* and that from the improved rubber quality practices sold to *toke* and factory. The profit was calculated by measuring the difference between revenue from selling rubber slabs and operating expenses,

that is, cost of 1) inputs: seedling, fertilizer and chemicals, labour from planting up to harvesting and post-harvesting; 2) additional harvesting and post-harvesting materials; 3) transportation[1]. We assumed that the costs of inputs for both traditional and improved rubber quality practices were similar. Innovations were made only during the harvesting and post-harvesting processes and channelling the rubber slab. The formulation of such change in profits is:

$$\% P_{IRQi} = P_{IRQi} . P_{TT}^{-1}$$

$\% P_{IRQi}$ = Changes in profit of improved rubber quality

P_{TT} = Profit in traditional practice via *toke*

P_{IRQi} = Profit in improved rubber quality practice

i = Selling via *toke* or directly to factory

The calculation does not include depreciation, investment and change in inventory value, and in-kind income or family living expenses, including income from other agroforestry products. It also excludes owner withdrawals for unpaid labour and management.

[1] Budidarsono et al. (2010) provides more information about the profitability of smallholder rubber agroforestry.

3. Results

3.1 The financial profitability of improved rubber quality

The field survey showed that the most significant innovations to improve rubber quality were deployed during harvest, post-harvesting and marketing. Besides an improved technique in tapping the rubber, the farmers also changed some of the harvesting tools: 1) small plastic pipes were used to drain the latex from the bark, instead of branches or leaves; and 2) plastic bowls were used to collect the latex instead of coconut shells. During post-harvest, farmers used a special acid as latex coagulant, called *cuka getah gentong*, instead of battery acid, fertilizers or floor cleaners. Farmers did not immerse their rubber slabs in water but put the rubber slabs under their elevated huts to maintain the full dry content of the rubber. They also used wooden moulds to form the slabs into regular forms and handled their latex carefully to reduce spill.

The focus group participants also mentioned some changes in the establishment and maintenance of their gardens, although these were not generally applied. For example, some of the farmers who improved their rubber quality rejuvenated their garden with superior rubber clone seedlings (that is, type PB 260), which can produce about three times more latex than from unselected rubber seedlings (Wibawa et al. 2008). For maintenance, the farmers mentioned that they applied chemical herbicides and fertilizers and fenced their gardens. Some farmers also used some chemicals to catalyse and increase latex production.

Farmers with improved rubber quality had more options for selling their rubber slabs. The new option was to send directly to rubber-processing factories in Muara Bungo and other places in Sumatra, such as Medan. Findings from the field showed that farmers gained higher prices when they sold their rubber slabs to the factories directly. The direct-sale price ranged IDR 24 200–37 000 (USD 2.85–4.35[2]) per kilogram, which was about 60% higher than selling to a *toke*. The weight of rubber slabs sold to factories was deduced by the real value of DRC as measured in the laboratory. The weight reduction can vary 52–73%[3]. In addition, the payment from the factory was reduced by another 5% for tax. The most important cost component of selling to a factory was the transportation cost. In this case, farmers in Lubuk Beringin organized transportation collectively through their farmers' group. Each farmer paid about IDR 1300 per kilogram of slab. This was cheaper than the price in other villages, that is, more than IDR 1500 per kilogram.

[2] USD 1 = IDR 8500

[3] The weight of a rubber slab produced using traditional practices is reduced by 10% when it is sold to a *toke*. For improved rubber quality sold to a *toke*, the weight of the slab is reduced by 8%, regardless of its DRC.

Table 1. Comparing practices of traditional and improved rubber quality

Variables	Traditional	Improved rubber quality		Note
	via *toke*	via *toke*	via factory	
DRC (%)				
Minimal	45%	52%	52%	
Average	50%	57%	61%	
Maximal	55%	62%	73%	
Component of revenue from rubber production 2010/2011 (IDR/hectare/year)[1]				
Price of rubber slab (IDR/kg)				
Minimal	14 000 (1.65)	14 000 (1.65)	24 200 (2.85)	
Average	15 000 (1.76)	17 500 (2.06)	29 060 (3.42)	
Maximal	16 000 (1.88)	21 000 (2.47)	37 000 (4.35)	
Production of rubber slab (kg/hectare/year)[2]				Selling to *toke*, all weights are reduced by 8% (improved quality practice) and 10% (traditional practice) regardless of the DRC. Selling to factory, DRC (in brackets) measured in laboratory using about 0.5 kg of slab
Young rubber	3900	3510	2044 (52%) 2367 (61%) 2836 (73%)	
Old rubber	7800	7020	4088 (52%) 4734 (61%) 5671 (73%)	
Component of cost for harvest, post-harvest and marketing (IDR/hectare/year)[1]				
Draining latex from the bark	-	3000 (0.35)	3000 (0.35)	Using small plastic pipes instead of leaves and branches
Collecting latex	20 000 (2.35)	350 000 (41.18)	350 000 (41.18)	Using plastic bowls instead of coconut shells
Coagulating latex to slab	-	144 000 (16.94)	144 000 (16.94)	Using proper coagulant
Forming latex into regular slab	-	40 000 (4.71)	40 000 (4.71)	Using wooden board instead of burying in soil
Transportation for marketing	-	-	5 070 000 (596.47)	Collectively through farmers' groups

Note:
[1] The USD price is in brackets
[2]The weight of a rubber slab sold to *toke* is reduced by 10% under the traditional practice and 8% under the improved rubber quality practice. At the factory, the payment is determined by the dry weight of the rubber, with DRC tested in the laboratory

These innovations directly contributed to farmers' revenue and operating expenses. Table 2 and Table 3 describe the changes in DRC and profit of improved rubber quality practice for each marketing channel compared to traditional practices via *toke*. When farmers sell their improved quality rubber to *toke*, the weight of their rubber slab is reduced owing to higher DRC (about 10%) then further reduced by 8% without considering the real value of the DRC of the product, which differs from the practice in the factory. There, the weight is determined by the real value of DRC as measured in the laboratory. However, this is compensated by the higher price received by the farmers.

The results show that for low DRC, that is, 52–62%, the additional profit received by farmers made almost no difference to selling to *toke* or the factory. Moreover, selling to *toke* was more beneficial at almost all price levels. Selling to the factory at a low price will even cause some negative profitability when the price is only at minimum or average levels. Farmers gain

relatively significant changes in profit by selling to the factory if they produce rubber with a high quality, that is, DRC of 73%. This has the most effect on increasing their income (48–66% at the maximum price with increased DRC of about 32%).

Table 2. Changes in DRC and profit through improving rubber quality for young rubber

Variables	**Improved rubber quality via *toke***	**Improved rubber quality to factory**		
DRC	*52–62%*	*52%*	*61%*	*73%*
Changes in DRC	*13–14%*	*16%*	*21%*	*32%*
Changes in profit				
Minimum price	-11%	-19%	-1%	25%
Average price	7%	-4%	8%	51%
Maximum price	23%	21%	17%	48%

Note: negative profitability is underlined

Table 3. Changes in DRC and profit through improving rubber quality for old rubber

Variables	**Improved rubber quality via *toke***	**Improved rubber quality to factory**		
DRC	*52–62%*	*52%*	*61%*	*73%*
Changes in DRC	***13–14%***	***16%***	***21%***	***32%***
Changes in profit				
Minimum price	-9%	-24%	-3%	19%
Average price	7%	-11%	-13%	36%
Maximum price	20%	16%	13%	66%

Note: negative profitability is underlined

3.2 Social implications of information dissemination and innovation testing

The discussions with villagers in Lubuk Beringin and Senamat Ulu revealed that the training in, and introduction of, innovations to improve rubber quality had some positive implications for the communities. The villagers perceived that the most signification implication was the increase and diffusion of information about improving rubber quality (confirmed by villagers in both Lubuk Beringin and Senamat Ulu). Although people from Senamat Ulu did not receive direct training from the World Agroforestry Centre and Bridgestone, they did receive the information from farmers in Lubuk Beringin. However, the application of the information in Senamat Ulu was low, while not all farmers in Lubuk Beringin completely practised the innovations. The changes are shown in Table 4.

Table 4. Implications of improved rubber quality training and testing in Lubuk Beringin and Senamat Ulu

Type of information and capability	Farmers improving rubber quality in Lubuk Beringin	Traditional farmers in Senamat Ulu
Improving rubber quality		
Rejuvenating using superior seedlings	++	○○
Tapping rubber following correct procedures	++	+○
Processing latex to slab, including using proper chemicals	++	+○
Drying rubber slab	++	+○
Storing rubber slab	++	+○
Transporting slab following correct procedures	++	○○
Organization capability		
Bookkeeping	++	++
Managing financial reports in farmers' group transparently	++	++
Organizing farmers' groups	++	++
Networking	++	○○
Solving problems and conflicts	++	++
Knowing about *green rubber* concept	++	○○

Note: ++ : information existing and applied; +○ : information existing but not yet applied; ○○ : no information and no application

The discussions in the two villages revealed that farmers outside Lubuk Beringin were willing to be trained in improving rubber quality, as was conducted in Lubuk Beringin. The Lubuk Beringin villagers expected more capacity building in other income sectors, such as enhancing paddy field productivity and family budget planning, to improve their financial management literacy. In addition, the Senamat Ulu villagers were willing to learn about the development of some local institutions in Lubuk Beringin, such as the women's cooperatives.

The improved rubber quality activities in Lubuk Beringin resulted in a new collective action to organize money for transporting rubber to the factory. A farmers' group called Agro Pores was formed for this purpose. The members of Agro Pores have written rules agreed among members. Members who disobey the rules are expelled from the membership. This local institution has been proven to reduce transaction costs, thus enhancing farmers' income. For example, they managed to reduce the transportation cost by 15% compared to other villages and collect the slabs from members to despatch them more efficiently. Above all, it improved the community's skills in managing an organization and strengthened their social relationships.

4. Discussion and conclusion

From the results of this study, we conclude that opportunities to conserve rubber agroforestry in Lubuk Beringin, Jambi province, still exist. Our results showed that improving rubber quality can increase farmers' incomes from agroforestry systems when the DRC of their rubber was more than 70% and they sold to agents that could transparently advise on the DRC and fairly determine the price according to the DRC level. When the DRC was lower than 70% at minimum and average price levels, selling rubber to a factory was less profitable compared to selling to *toke*. Our focus group discussions with the communities revealed that the activities employed to improve rubber quality could increase their knowledge and skills, including practical skills to improve their livelihoods and their ability to organize collectively, which, ultimately, could increase the efficiency of their smallholding rubber businesses.

The innovations were provided to farmers of rubber agroforests in Lubuk Beringin without any written contracts emphasizing that the innovations were a reward for their practices that maintained environmental services. There is a risk that these farmers will convert their agroforestry systems to monoculture to enhance their profitability. Therefore, raising awareness about the ecological importance of rubber agroforestry is needed in this area. If rubber industries consider environmentally friendly practices as sound business practices, then it is essential for the industry to recognize the value of rubber slabs coming from 'jungle rubber' so farmers are encouraged to maintain this ecosystem.

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The World Agroforestry Centre is the international leader in the science and practice of integrating 'working trees' on small farms and in rural landscapes. We have invigorated the ancient practice of growing trees on farms, using innovative science for development to transform lives and landscapes.

Our vision

Our Vision is an 'Agroforestry Transformation' in the developing world resulting in a massive increase in the use of working trees on working landscapes by smallholder rural households that helps ensure security in food, nutrition, income, health, shelter and energy and a regenerated environment.

Our mission

Our mission is to advance the science and practice of agroforestry to help realize an 'Agroforestry Transformation' throughout the developing world.

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