Improving rubber quality in Lubuk Beringin, Bungo District, Jambi Province, Indonesia: an initial analysis of its financial and social benefits

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Report to Bridgestone Cooperation Japan

Submitted by the World Agroforestry Centre on August 26, 2011

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ABSTRACT

Smallholder rubber agroforestry is an economically and ecologically important agroforestry system in Jambi Province, Indonesia. It contributes to rubber production at national level and is the main source of income for farmers with land less than 5 hectares. The rubber agroforestry acts as buffer zone for national parks and maintains local biodiversity. Farmers cultivating rubber agroforestry usually have lower financial profitability compared to ones cultivating monoculture rubber and oil palm. The main reasons are old age of plantation causing low quantity of rubber latex and low quality of rubber slab due to unsound harvest and post harvest procedures. In addition, the marketing system in Jambi's villages depends on local traders called *tokes* who mostly do not inform transparently about the real value of dry rubber content and its market price. Our hypothesis is that by providing incentives to smallholder rubber agroforestry farmers, they are willing to conserve their jungle rubber garden and delay their conversion to other land uses that providing less environmental services, such as monoculture rubber and oil palm. This report describes different procedures in harvesting, post-harvesting practices and marketing channel of traditional and improved rubber quality production system. It highlights the ratio of revenue and cost that are borne by the farmers through new innovations and collective action. Our results show that improving rubber quality can increase farmers' income from agroforestry system when the dry rubber content (DRC) of their rubber slabs is more than 70% and they sell to agents that can transparently inform the DRC and fairly determine the price according to the DRC level. When the DRC is lower than 70% and the price at minimum and average levels, selling rubber to *toke* is more profitable compared to selling to the factory. The improved rubber quality activities coordinated by ICRAF and partners could increase their knowledge and skills. These include practical skills to enhance their livelihood and capability to organize collective action, which at the end can increase the efficiency of their smallholder rubber business. Moreover, communities at neighbouring villages consider these activities useful and profitable. Therefore, the potential to scale out these activities is high. Raising awareness about the ecological importance of rubber agroforestry is needed constantly in this area since there is no formal agreement that only farmers practicing rubber agforestry can get access to innovation and direct selling to factories. From the perspective of environmental friendly rubber business, it is essential for rubber industries to recognize rubber slabs coming from jungle rubber so farmers are encouraged maintaining this ecosystem.

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I. INTRODUCTION

Rubber agroforestry is a multistrata system of rubber garden practiced traditionally by the communities in Lubuk Beringin sub-village, Muara Bungo, Jambi Province, Indonesia. A multistrata rubber garden forms a secondary forest with multiple functions (Michon et al. 2007). Economically, these small-holder rubber gardens producing latex contribute to the main income source of the Bungo local communities. These gardens also provide local fruits and medicines for self-consumption and sale. Ecologically, the ecosystem of rubber agroforestry can provide ecosystem services i.e. benefits that provided by the ecosystems for human well-being (MA 2005), such as watershed protection, biodiversity conservation and carbon sequestration. Ecosystem services provided by the rubber agroforestry can benefit both the local communities and external beneficiaries, for example, people living downstream of this watershed can have more access to clean water filtered by this ecosystem. In addition to that, the capability of this ecosystem to protect biodiversity and sequester carbon contributes to wider beneficiaries, such as global communities.

In this decade, the conversion of rubber agroforestry to monoculture rubber and oil palm plantation has increased. The reasons are that the local communities have less opportunity to expand their rubber gardens extensively to forest land since the forest also has been depleted, and that rubber agroforestry produces less latex compared to monoculture one does. The latex production of rubber agroforestry is about one third of intensive monoculture rubber plantation and is harvested conventionally. This condition puts the rubber agroforestry in extinction because farmers do not consider it economically attractive (Budidarsono, Joshi, and Wibawa 2010). Loss of such ecosystemswill threaten both the current environmental services and the intactness of neighbouring national parks since these gardens have an important role as a buffer zone for national parks and functions as an animal corridor for these parks (Ekadinata, Zulkarnain, and Widayati 2010).

Farmers of rubber agroforestry system (RAS) rationally will preserve their current system if they can have better profitability compared to the monoculture one. Low productivity and low quality of RAS latex are some pitfalls causing low income from this system. The low productivity is due to the old age of about 90% of the plantation and the selection of inferior seedlings (Akiefnawati et al. 2010). The low quality of latex is due to the treatment during and after harvest of creating thick slabs. They usually immerse the rubber in stagnant water or in the river and add tapping bark or battery acid, TSP fertilizer and other compound into the rubber harvested. They presume that the selling price for their latex is directly related to the weight of the rubber instead of its quality. Therefore, these farmers try many ways to add to its weight. In addition to that, the harvesting procedure is still poor. They use conventional harvesting tools, such as using rubber branches as tapping pipes and coconut shells as cisterns for latex.

The post-harvest procedure was found to be unsound. Farmers use improper coagulants, such as thin vinegar solution, battery acid, TSP fertilizer and floor cleaners. They transport their harvests from their gardens to villages through river and sell their products immediately to local collectors (known as *toke*). The local collectors usually provide them with a low selling price because of low quality of unprocessed wet rubber

product. Then the *toke* will cut the price by 10% from the total rubber weight to compensate for water shrinkage, making the money received by farmers even lower. The *tokes* mostly determine the price subjectively. The price is not based on the dry rubber content (DRC), i.e. indicators of rubber quality, since most of the farmers do not know their DRC either. The *tokes* test the DRC by trampling on the slabs.

Support for RAS farmers to improve the quality of its rubber harvest are essential to increase their financial profitability that at the end will provide incentives for them to conserve their rubber agroforestry systems. The World Agroforestry Centre (ICRAF) has carried out its activities in partnership with local NGOs, WARSI and Gita Buana and have been supported by PT. Bridgestone, Japan is promoting the continued existence of rubber agroforestry in Bungo Jambi due to its economical and ecological importance and supporting small holder RAS farmers to improve their rubber harvest. The collaborative activities during April 2010 to March 2011 were to conduct training for better harvest and post-harvest treatment and to test a direct selling to the rubber product factory, in this case PT. Bridgestone. This report hence describes the different procedures in harvesting, post-harvesting practices and marketing channel of traditional and improved rubber quality production system. It highlights the ratio of revenue and cost, and social implications that are born by the farmers through new innovations and collective action.

II. METHODS

The ICRAF team organized a series of focus group discussion (FGD) with the villagers in Lubuk Beringin to discuss the financial farm profitability from improving rubber quality and the social implications of getting such incentives. The team also conducted focus group discussions in Senamat Ulu sub-village, where people in this location have not been familiar with any practices to improve their rubber quality. The purpose of this observation was to check if communities of neighbouring villages gained any benefits from activities that we conducted in Lubuk Beringin.

2.1 Smallholder rubber production in Bungo

Rubber as the prime commodities in Bungo District mostly is cultivated by smallholder farmers owning lands less than 5 hectare. The overall productivity of smallholder rubber in Bungo is relatively low with an average annual productivity of 725 kg/ha/year (Akiefnawati et al. 2010) compared to the productivity in Sulawesi and Java, i.e. more than 1000 kg/ha/year (Sopian 2008).

Farmers plant about 300 rubber trees per hectare with the planting distance of 4 metre by 4 metre 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 trees and wood trees such as *jelutung (Dyera spp).*

Initial production of rubber is up to 10 kg/ha/day and the production reaches its maximum at 15-20 year old of plantation, i.e. 15 kg/ha/day. The production decreases after the plantation age is more than 20 years, i.e. 8 kg/ha/day. The current marketing channel in Lubuk Beringin and surrounding is via local traders called *toke*. These *tokes* usually informally provide financial services for the farmers. They lend money for daily and household needs and are paid back after the farmers sell their rubber. Strong social relationship exists between farmers and *tokes*. Other marketing channels are mid-level *toke* (from other districts or villages) and direct selling to biweekly rubber auctioneer. Each marketing channel has its own benefits and costs for the farmers as discussed by Akiefnawati et al (2010). For example, selling to the rubber auctioneer is more transparent so they might have better price and farmers will not trapped in debt dependence to *toke*. However, farmers have to queue about 2-3 days to wait for the auction and payment. In addition to that, there is no social interaction with this formal institution.

2.2 Measuring effects of improving rubber quality

The economical effects of improved rubber quality practice are expressed by two indicators: (1) increase in DRC; and (2) increase in cash income received by farmers. The increase of cash income is calculated by comparing the profit from traditional practices to the profit from improved rubber quality sold through toke and factory. The profit is calculated based on the ratio between profit gained by traditional system via toke, and improved rubber quality practices sold to *toke* and factory. The profit is calculated by measuring the differences between revenue from selling rubber slab and

operating expenses (i.e. 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) transporting)[1]. We assume that the costs of inputs for both traditional and improved rubber quality practices are similar. Innovations are made only during the harvesting and post-harvesting processes and channelling the rubber slab. The formulation of such change in profits is:

$$\% P_{IRQi} = P_{IRQi} / P_{TT}$$

$\% P_{IRQi}$	=	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 its 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.

III. RESULT

3.1 Financial profitability of improved rubber quality

The field survey showed that the most significant innovations occurred between traditional and improved rubber quality practices are during the harvest, post-harvesting and marketing of the rubber slab. Besides improved technique in tapping the rubber, the farmers also changed some harvesting tools: (1) using small plastic pipes to flow the latex from the bark instead of branches or leaves; and (2) using plastic bowls to collect latex instead of coconut shells. During the post-harvest, farmers use special acid as latex coagulants called *cuka getah "Gentong"* instead of batteries, fertilizers and floor cleaners. Farmers do not immerse their rubber slabs in water but put the rubber slabs under their elevated huts to maintain full dry content of rubber. They also use wooden moulds to form the slabs into regular forms. They also treat their latex carefully to reduce the spill over.

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

Farmers with improved rubber quality have more options in selling their rubber slabs. The new option is to send directly to rubber product factories in Muara Bungo and other places in Sumatra, such as Medan. Findings from the field showed that farmers gained higher price when they sold their rubber slabs to the factories directly. The rubber price selling to factories ranges from IDR 24,200 to 37,000 (USD 2.85 – 4.35[2]) per kilogramme, which is about more than 60% higher compared to selling rubber to *toke*. The weight of rubber slab sold to factories is deduced by the real value of DRC measured in the laboratory. The weight reduction can vary between 52-73%[3]. In addition to that, the payment from the factory is reduced by another 5% for tax. The most important cost component of selling to factory is transportation cost. In this case, farmers in Lubuk Beringin organize the transportation collectively through the farmer group. Each farmer has to pay about IDR 1,300 per kg of slab. This is cheaper than the price in other villages, i.e. more than IDR 1,500 per kg. Table 1 describes the comparisons of traditional and improved rubber quality practices and financial implications for the farmers in Lubuk Beringin.

[2] 1 USD = IDR 8,500

[3] The weight of rubber slab under traditional practices is reduced by 10% when it is sold to *toke*. For improved rubber quality sold to *toke*, the weight of the slab is reduced by 8% disregard to 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) disregarding to the DRC. Selling to factory, DRC (in bracket) measured in laboratory using about 0.5 kg of slab
Young rubber	3,900	3,510	2,044 (52%) 2,367 (61%) 2,836 (73%)	
Old rubber	7,800	7,020	4,088 (52%) 4,734 (61%) 5,671 (73%)	
Component of cost for harvest, post harvest and marketing (IDR/hectare/year) [1]				
Flowing latex from the bark	-	3,000 (0.35)	3,000 (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 on soil
Transportation for marketing	-	-	5,070,000 (596.47)	Collectively through farmer groups

Note:
[1] The US$ price is in bracket.
[2]The weight of rubber slab sold to *toke* will be 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 contribute 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 of rubber to *toke*, the weight of their rubber slab is reduced due to higher DRC (about 10%) then further reduced by 8% without considering the real value of DRC of the product. It differs from the practice in the factory. The weight is determined by the real value of DRC measured in the laboratory. However, this is compensated by higher price received by the farmers.

The results show that for low DRC, i.e. between 52-62%, the additional profit received by farmers almost has no difference between selling to *toke* and selling directly to factory. Moreover, selling to *toke* is more beneficial at almost all price levels. Selling to factory with low price will even cause some negative profitability when the price is only minimum or average levels. Farmers gain relatively significant changes in profit selling to factory if they produce rubber with high quality, i.e. DRC 73%. This impacts the most in increasing their income (48-66% at maximum price with increased of DRC 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 discussion with villagers in Lubuk Beringin and Senamat Ulu revealed that the trainings and introduction of new innovations to improve rubber quality have some positive implications for the communities. The villagers perceived that the most signification implication was the increase and diffusion of information in improving rubber quality confirmed by villagers in both Lubuk Beringin and Senamat Ulu. Although people from Senamat Ulu did not get direct training from both ICRAF and Bridgestone, they got the information from farmers in Lubuk Beringin. However, the implementation of such information in Senamat Ulu is still low, while not all farmers in Lubuk Beringin completely practice the new innovations.

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		
Conducting book keeping	++	++
Managing financial report in farmer group transparently	++	++
Organizing farmer groups	++	++
Networking	++	○○
Solving problems and conflicts	++	++
Knowing about *green rubber* concept	++	○○

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

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

The improved rubber quality activities in Lubuk Beringin result in a new collective action to organize money for transporting the rubber to the factory. A farmer 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 will be expelled from the membership. This local institution has been proven to reduce transaction cost, thus enhancng farmers' income. For example, they managed to reduce the transporting cost by 15% compared to other villages' and collect the slabs among members to despatch slabs more efficiently. Above all, it improves community's skills in managing an organization and strengthens their social relationship.

IV. 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 show that improving rubber quality can increase farmers' income from agroforestry system when the DRC of their rubber is more than 70% and they sell to agents that can transparently inform the DRC and fairly determine the price according to the DRC level. When the DRC is lower than 70% under minimum and average price level, selling rubber to factory is less profitable compared to selling to *tokes*. Our focus group discussions with the communities described that the improved rubber quality activities could increase their knowledge and skill, including practical skill to improve their livelihood and capability to organize collective action, which at the end can increase the efficiency of their smallholder rubber business.

The current innovation is only applied to rubber agroforestry in Lubuk Beringin without any written contracts emphasizing that this innovation is as a reward for their practices to maintain environmental services. There is potential risk that these farmers at the end will convert their agroforestry systems to monoculture ones to even enhance their profitability. Therefore, raising awareness about the ecological importance of rubber agroforestry is constantly needed in this area. If rubber industries consider sound environmental friendly business, it is essential for industries to recognize rubber slabs coming from jungle rubber so farmers are encouraged in maintaining this ecosystem.

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