# SUPPLY-CHAIN OF NATURAL RUBBER IN INDONESIA

**Bustanul Arifin**

Associate Professor of Agricultural Economics at the University of Lampung (UNILA)
Lecturer in Master of Management in Agribusiness at Bogor Agricultural University (MMA-IPB)
Special Scientist at the World Agroforestry Center (ICRAF) Southeast Asia

## ABSTRACT

*The study examines the supply chain of natural rubber in Indonesia and assessing the transmission of prices to rubber growers and provides recommendations for a suitable scheme that would help to ensure high production standards and a sustainable return for natural rubber production. The frameworks to examine the performance of supply chain of rubber marketing rely mostly on the efficiency level of marketing system of natural rubbers, including the value chain principles in marketing margin, and revealed price transmission from consumers to growers. The results show that the roles of subdistrict middlemen are extremely crucial in moving up the slabs from the village level to urban areas, where trader-brokers are expecting the slabs to be forwarded directly to crumb-rubber factories. Changes in world price, hence the profits being accumulated by traders and rubber factories, are not transmitted properly to rubber farmers and/or sharetappers. Information asymmetry, the access over price information, and immediate response of rubber growers to the change in world price could explain this non-cointegration in price data between growers and exporters. In the near future, the policy reforms in supply chain of natural rubber marketing in Indonesia should carefully address these issues in a more comprehensive manner. Finally, in order to contribute to the positive environmental and social benefits, the major challenge for natural rubber production system in the future is how to integrate a high productivity promotion of new clonal rubber varieties and a decision for land use practices that satisfy sustainable resource management and ensure acceptable quality of environments in the forest margin.*

**Keywords**: natural rubber, supply chain, environmental services

## INTRODUCTION

The problems of supply chain of natural rubber in Indonesia have their roots in production system and incentives received by growers to improve the rubber quality, market structure of slabs, and stakeholders' attitudes towards environmental services provided by the natural rubber plantations. The production systems of natural rubber in Indonesia involve mostly (about 84%) smallholder growers. The rubber production centers are commonly found in Sumatra such as the province of North Sumatra, Jambi, Riau, and South Sumatra; in Kalimantan such as the province of West Kalimantan, some in Central and South Kalimantan; but very few in Java and Sulawesi. The small-scale rubber growers rely mostly on extensive jungle agroforestry system, where a combination with other tree crops, upland rice field and secondary food crops is commonly found in these areas. The above four provinces in Sumatra and West Kalimantan contribute to more than 72 percent of production of natural rubber at national level.

The Government of Indonesia has introduced clonal variety under more intensive rubber production systems for the last two decades. Several government programs have been initiated at local level to support the intensive production systems, such as PRPTE (the development, rehabilitation and rejuvenation of exportable crops), SRDP (small scale rubber development program), etc. However, the majority of small holder rubber growers have not yet adopted the high latex production system. The recommended technologies are inappropriate for most farmers because of limited capital and land available for intensification. These small farmers are more interested in continuous income from the same plots, instead of substituting the rubber trees having provided adequate income for years. However, the clonal production system has also been prone to vertebrate pest damage, especially in the plots of forest margin (Joshi *et al.*, 2002).

The average yield level of Indonesian natural rubber ranges from 550 to 600 kilograms of dry rubber contents (DRC) per hectare which is quite low compared to that of neighboring countries such as Thailand and Malaysia. There are major productivity differences between old rubber trees and new intensive clonal rubber trees. Old trees could yield an average of 1.2 ton of slabs or about 540 kg of DRC per hectare, while the clonal rubber could reach about 3 ton of slabs or 1.35 ton of DRC per hectare. Indonesia now ranks the second world producing natural rubber after Thailand, even though the harvested area of rubber is the highest in the world.

Several important questions to be answered in the study include how the productivity level affect the supply chains of rubber products, hence the whole marketing system; how the performance of marketing system relate to the marketing procedures, the market structure, and process of market discoveries; and how each marketing agent could perform well in the overall marketing system. The major challenge for natural rubber production system in the future is how to integrate a high productivity promotion of new clonal rubber varieties and a decision for land use practices that satisfy sustainable resource management and ensure acceptable quality of environments in the forest margin.

The study examines the supply chain of natural rubber production in Indonesia and assessing the transmission of prices to rubber growers. The study is a part of Rubber Eco-Project Study aimed at highlighting possibilities for improving the sustainability of the production and supply of natural rubber. The output of the study is to provide recommendations for a suitable scheme that would help to ensure high production standards and a sustainable return for natural rubber production.

Following this introduction, the paper presents methods and frameworks used in the study. Then, the production system of natural rubber is overviewed, emphasizing on problems of low yield and rubber quality. Results of the analysis of marketing chain, from the growers to end-users are presented in such a way to explain the performance of natural rubber marketing system. The paper continues with the examination of the positive environmental and social benefits of natural and rubber production. The final section is concluding remarks, thoughts and recommendation for the future.

## METHODS AND FRAMEWORKS

The study analyzes secondary data on the rubber economy and reviews previous works available on the issues of supply chain of rubber products and on possible environmental benefits from sustainable rubber growing activities. In additions, the study employs field observation and data verification to major rubber producers in Sumatra and in-depth interview with key persons in the fields, relevant stakeholders, and policy makers in the country. Discussion with fellow researchers and consultation with other experts and stakeholders are also conducted to enrich the

results and policy recommendation towards better production and marketing system of natural rubber in Indonesia.

The frameworks to examine the performance of supply chain of rubber marketing rely mostly on the efficiency level of marketing system of natural rubbers. Even though economists are not in agreement to establish the acceptable general criteria of efficiency level, but the following indicators of analysis are commonly used: value chain in the marketing margin, price transmission from consumers to growers. These indicators are quite adequate to examine the overall performance of supply chain of rubber marketing for a more general purpose, especially under the constraints of limited time and resources. Several tools of analysis of efficiency level are being developed and tested empirically such as: market integration principles, asymmetry information hypothesis, concept of transaction costs, principal-agent relationships, property-right principles and other growing importance of institutional economic principles.

The concept of marketing margin refers to price differences between marketing agents or actors involved in the supply chains. The price differences emerge because of the costs that have to be paid by the marketing agents and relevant profit margins due to the service provided by each agent. Let $P_{si}$ is the selling price of i-th marketing agent and $P_{bi}$ is the buying price of marketing agent, the marketing margin $M_{ji}$ of the i-th marketing agent can be calculated as follows:

$$M_{ji} = P_{si} - P_{bi} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

The marketing margin is actually the marketing costs of the i-th marketing agent ($c_{mi}$) after being added by the profit taken by the i-th marketing agent ($\pi_i$,). Therefore, the marketing margin can also be written as

$$M_{ji} = c_{ti} + \pi_i, \quad \ldots\ldots\ldots\ldots\ldots (2)$$

For more than one marketing agent, a generalized version of total marketing margin can be written simply as the sum of each marketing agent

$$Mj = \sum_{i=1}^{i=n} Mj \quad \ldots\ldots\ldots\ldots\ldots (3)$$

In this case, a general rule might apply, where the longer the marketing channel, the greater the marketing margin would be, and hence the less efficient of such a marketing system. One should interpret this rule with extra cautions. The level of efficiency in the marketing system does not always depend on the numbers of marketing agents or the length of marketing channels. A short marketing channel could also suffer from an acute inefficiency, especially when one or two agents collude together to control the market and to determine the price level of commodities being traded. When the marketing agents do not obtain complete information about the market price and the product quality, the marketing system leads to inefficiency. Similarly, when one or two marketing agents prevent other agents or new players to enter the marketing systems, the supply chains could also suffer from inefficiency. Therefore, the efficiency level is much more determined by the fairness of marketing procedures and the degree of market openness, market structure, and process of market discoveries and also of how each marketing agent could perform well in the overall marketing system.

Another common framework to analyze the price integration between farmgate price (pf) and FOB price (pc) on the explanatory variables is a simple regression model. The data used for this exercise are a pooled data of farmgate price and FOB price from three major producing regions in Indonesia. For more advanced frameworks to investigate market integration and price elasticity of transmission, adequate number of time series price data is required, so that a more complete multivariate vector autoregressive (VAR) can also be employed.

Rubber marketing systems in Indonesia, and possibly in other producing countries in Southeast Asia involve very straightforward supply chains from rubber growers to end consumers. Available studies on rubber marketing and value chain in Indonesia generally investigate the system up to crumb rubber factories (CRF) or exporters as the final buyers of rubber products. In this case, concerns over supply chains of natural rubber are focused on rubber materials (bokar=*bahan olah karet*), both in terms of how each marketing agent play roles in the marketing systems and of how the marketing systems could operate more efficiently according to the principles of market economy. The section considers some new developments in the supply chains and marketing literature as well as reflections on some empirical works on performance of production systems and marketing nexus of natural rubber in Indonesia. The following field works are very useful for further references, i.e.: rubber marketing studies in Jambi (Wibawa et al, 2002), efficiency analysis of rubber marketing in South Sumatra (Sulaeman, 1999), and comparative marketing studies of rubber materials in Jambi, South Sumatra, and West Kalimantan (Anwar *et al.*, 2004).

## PRODUCTION SYSTEM OF NATURAL RUBBER

As mentioned previously, rubber production systems face serious problems in low yield of latex and poor quality of rubber products. The Government of Indonesia has been trying to solve the problems of rubber production quality by enforcing a quality control on rubber products though a ministerial decree of industry and trade number 616/MPP/Kep/10/1999 in October 2000. The decree sets quality specifications rubber products and for some other agricultural products, which is generally known as the Indonesian National Standard (SNI) 06-2047-1998. The SNI for rubber suggests that the maximum thickness for slabs for categories I, II and III are 50 mm, 100 mm and 150 mm respectively. In this case, no contaminant is accepted and only recommended coagulants are permitted in rubber processing system. Crumb rubber factories (CRF) are strongly suggested to buy rubber products that meet this standard, from licensed traders and brokers equipped with special trading license. The regulation puts strong sanctions for rubber traders and brokers of revoking the trading license, and for factories of canceling the product certificate and ISO 9002 certificate.

After four years of implementation, the decree has not improved significantly the rubber quality in Indonesia, and the overall outcome of the decree is mixed. Studies by Wibawa *et al.* (2002) suggest that in the short run the overall quality of rubber production improved quickly as farmers reacted positively to the decree. However, the production of rubber has decreased significantly in the first few years. For a decrease of 10 percent or less, the farmers' income from rubber sales still increases because the revenues are proportional to the intensity of contamination prior to the decree of SNI. In other words, small-scale rubber growers who produced relatively clean slabs are benefited from the new regulations. At village level, the slab transaction became more transparent, the rate of reduction due to low quality has decreased as the collective traders and village-level middlemen only accept good quality slabs. As a result, the transportation of rubber was easier because of less time required for sorting and grading. Farmers using high quality seedling and intensive system are really in favor of the new regulation, but traditional

farmers relying on jungle rubber of agroforestry systems have experienced a decrease in farm revenues because they traditionally have produced dirty slabs.

**Table 1. Harvested Area, Production and Export of Rubber in Indonesia**

| Year | Area (000 ha) | Production (000 ton) | Export | |
|---|---|---|---|---|
| | | | (000 ton) | (US$) |
| 2000 | 2,424 | 1,212 | 1,362 | 880,898 |
| 2001 | 2,719 | 1,535 | 1,505 | 814,357 |
| 2002 | 2,853 | 1,560 | 1,460 | 1,000,458 |
| 2003 | 3,300 | 1,792 | 1,581 | 1,431,163 |
| 2004[a)] | 3,350 | 1,905 | 1,733 | 1,698,340 |
| 2005[b)] | 3,450 | 2,002 | 1,802 | 1,747,940 |

Notes: a) Preliminary estimates, from available data up to July 2004
b) Estimated figures based on the recent trends and price increase

Sources: .Data for areas and production are from Central Agency for Statistics (BPS)
.Export data are from Bank of Indonesia (BI)

The performance of rubber production in Indonesia is very much dependent on harvested area (Table 1), which experienced an increase from 3.3 million hectare in 2003 to estimated 3.4 hectare in 2004. In 2003, about 90 percent of 1.8 million ton of rubber production is exported, generating foreign reserves US$ 1.7 million. The production and export figures are expected to increase in 2004 and the following year 2005. Unless some changes in policy strategy to rejuvenate the old rubber trees and sharpening the area targeted for the intensive rubber production system, Indonesia could not fulfill the fast growing world demand of natural rubber and other rubber-based products.

Moreover, the quality of raw rubber materials from Indonesia is generally not as good as the natural rubber from Thailand and Malaysia. There are no incentive systems and quality controls for smallholder growers to produce good quality rubber. Rubber buyers such as traders and processing factories do not treat significant price differences between good and bad quality rubber from rubber growers or share-tappers. These farmers often mix bark and other debris along with the latex to increase the weight of rubber slabs. After harvest, the rubber slabs are soaked in the water for many days, especially during dry season between May and September each year.

Evidence at local level also shows that these jungle rubber farmers such as commonly found in Bungo District in Jambi Province of Sumatra has suffered from reduction in the slab production by 22 to 44 percents, resulting in a decrease of 1 to 23 percents of their income (Wibawa *et al*, 2002). However, for those who have accustomed to producing high quality rubber, even before the SNI decree, the production of slabs has not experienced a decline significantly. In shorts, rubber production areas with high productivity prior to SNI were suffered less from the regulation. On the other hand, areas with low initial productivity had a significant reduction in slab production after SNI. Farmers using clonal planting experience a decrease in slab production by 14 percent, which is only a half of the 28 percent decrease in slab production using traditional

seedling of rubber. The decline is also presumably high in the areas using extensive system of jungle rubber agroforestry system such as in Bungo District in Sumatra.

A yield factor, age of trees, and tapping management have also explained the differences between traditional jungle rubber and more intensive system using clonal high yielding rubber varieties. While traditional seedling rubber could only produce 640 kg dry rubber equivalent per hectare per year, the clonal rubber farmers could produced at 990 kg dry rubber/ha/year, especially during the live of PRPTE or SRDP projects of rubber intensive systems. A very old rubber tree of more than 20 years are not in the productive stages anymore, implying that these trees are really in needs of rejuvenation and replanting. However, the rubber yield is also influenced by tapping management of latex, where clonal rubber requires less frequent tapping, i.e. every two days using a half spiral cut. When farmers tapped the latex of clonal rubber very intensively, such as they are used to tap for 4-5 days per week in seedling rubber or jungle rubber, the latex production declines significantly. Technically, intensive tapping in clonal rubber would cause a fast consumption of bark, deceleration of tree growth, sub-normal yield and a shorter tree life compared to the recommended tapping management explained above.

In this case, the property rights and security system of household economy would influence the yield level of rubber production and plantation productivity in general. Large scale rubber growers who could employ workers and share tappers usually maintain rubber tree quality as it becomes the most important assets in the rubber economy. While small scale farmers with limited resources for crop diversifications are also tempted to tap the rubber tree more intensively without knowing the risks of declining yield, hence the sources of income in the long run. The immediate needs for subsistence incomes and limited opportunities and capital for substituting the traditional seedling rubbers obviously influence the farm-income level and the life-long of rubber trees. In additions, few options of supply chain in rubber marketing, the level of price transmission from consumers to rubber growers and the magnitude of transaction costs in rubber marketing are among important subjects needing further elaborations.

## RESULTS OF MARKETING ANALYSIS

The results of marketing analysis show that there are at least two important factors determining the performance of supply chain of natural rubber marketing in Indonesia: (1) the industrial capacity of crumb rubber factories and (2) the efficiency level of marketing systems. When the production of rubber materials cannot fulfill the factory demands, the whole marketing system tend to have problems in its efficiency level. First, these rubber factories cannot operate in its full capacity so that they suffer from considerable amount of revenue forgone. Second, the factories cannot play important roles in the world rubber market, especially cannot enjoy the "windfall profits" from high rubber price such as the time of this writing. In 2002, the data show that rubber industry in Indonesia suffer from a lack of rubber materials as much as 250 thousand ton per year, implying the loss in efficiency of marketing system. However, estimates from Rubber Association of Indonesia (Gapkindo) show significant increase in rubber production in 2004 could somehow fulfill the factory demand or the industrial capacity of crumb rubber factories (Table 2).

**Table 2. Rubber Production and Industrial Capacity of Rubber Factory, 2002-2004**

| No | Province | Production (ton) | | Capacity in | Difference (ton) | |
|---|---|---|---|---|---|---|
| | | 2002 | 2004[a)] | 2002 (ton) | 2002 | 2004 |
| 1 | N. Aceh Darusslam | 46,677 | 56,851 | 64,507 | -17,830 | -7,656 |
| 2 | North Sumatra | 339,120 | 413,036 | 448,713 | -109,593 | -35,677 |
| 3 | West Sumatra | 57,899 | 70,519 | 150,800 | -92,901 | -80,281 |
| 4 | Riau | 162,226 | 197,585 | 145,000 | 17,226 | 52,585 |
| 5 | Jambi | 208,342 | 253,753 | 131,600 | 76,742 | 122,153 |
| 6 | South Sumatra | 241,586 | 294,243 | 411,900 | -170,314 | -117,657 |
| 7 | Bengkulu | 27,474 | 33,462 | 6,000 | 21,474 | 27,462 |
| 8 | Lampung | 49,645 | 60,466 | 43,713 | 5,932 | 16,753 |
| 9 | West Java | 55,307 | 67,362 | 5,700 | 49,607 | 61,662 |
| 10 | Central Java | 22,949 | 27,951 | 70,335 | -47,386 | -42,384 |
| 11 | East Java | 18,181 | 22,144 | 3,000 | 15,181 | 19,144 |
| 12 | West Kalimantan | 152,477 | 185,712 | 173,864 | -21,387 | 11,848 |
| 13 | Central Kalimantan | 87,523 | 106,600 | 32,000 | 55,523 | 74,600 |
| 14 | East Kalimantan | 17,472 | 21,280 | 900 | 16,572 | 20,380 |
| 15 | South Kalimantan | 66,451 | 80,935 | 112,000 | -45,549 | -31,065 |
| 16 | South Sulawesi | 6,651 | 8,101 | 10,702 | -4,051 | -2,601 |
| | **Total Indonesia** | **1,559,980** | **1,900,000** | **1,810,734** | **-250,754** | **89,266** |

Notes: a) Figures in 2004 are preliminary estimates

Sources: Directorate General of Plantation, Ministry of Agriculture, 2003
Rubber Association of Indonesia (Gapkindo), 2002.

Efforts to increase rubber production and to fulfill the industrial capacity of rubber factories should be supported by strategies to improve the intensive systems of rubber trees to substitute for the old rubber trees, aging more than 50 years old. These efforts also reveal a serious call for sharpening the development strategies, involving local governments, state-owned enterprises, and private sector participations. Academic communities and government agencies are now being challenged to formulate new schemes in financial policies and investment policies to encourage new investments in both upstream and downstream rubber-based industries. Otherwise, the high potentials for Indonesia to play major roles in the world market of natural rubbers that could at the same time bring prosperity to small-scale growers and protecting the environment would vanish in the short years to come.

The following is a list of marketing agents generally involved in the supply chains of natural rubber marketing in Indonesia.

- *Village level collectors*. These agents buy and collect latex directly from growers or rubber tappers and normally found in every place of rubber production centers in Indonesia. At least more than two trader-collectors are available in each village in the rubber producing areas, providing more opportunities for rubber growers to choose the marketing channels of the slabs. These traders come from the medium-income group of the villagers, own quite considerable amounts of rubber trees, and usually trade other agricultural commodities other than rubber products. It is very normal for these village level collectors to have "special"

arrangements with share tappers and/or rubber growers, either in the form of share products and payment arrangements for the slab products. The arrangements could be in the form of loan for the purpose of advanced capital and in the form of cash money for subsistence purposes and daily needs. Village collectors who have been able to establish more dependent relationship with share tappers or rubber growers generally have more powers to determine the farm-gate price of bulks of latex and the slabs. Growers and share-tappers sometimes do not have a freedom to choose the village level collectors to work with, even though the opportunities are widely open. In other words, a control over farm-gate price level is not really determined under an open market competition, but rather using non-economic instruments such as psychological dependency between growers and the traders-collectors.

- *Subdistrict middlemen.* Middlemen serve as a real bridge between village-level rubber economy and urbanized economic activities at district or provincial level of marketing systems. These agents buy the rubber materials mostly from the village level collectors or sometimes directly from growers and tappers, to be traded to city-level rubber traders in the district and provincial capital. Middlemen generally own small trucks necessary for transporting the rubber from the village to the towns or from collectors to bigger brokers in the city. Transaction between middlemen and trade collectors at village level is normally in cash, although some non-cash transactions also take place where the collectors obtain payment one week to two weeks after the transactions. Some large-scale middlemen provide capital assistance to collectors, such as lending their trucks to be used to collect latex from points of collection in the villages.

- *Trader-Brokers.* These brokers serve as a link between middlemen and rubber processors or crumb rubber factories (CRF). Some brokers work indirectly for the CRFs, but some are independent traders who rely on 0.5 to 1 percent commission from each successful transaction. About 25 brokers in Jambi City – locally called *kaw-puek* – have been known as active agents, seeking rubber from middlemen at sub-districts, keeping the rubber in their shops or collection center, and forwarding to the factories (Wibawa, *et al*. 2002). In the city of Palembang of South Sumatra, more than 25 trader-brokers run their businesses of liaising middlemen and rubber factories, but normally keeping the rubber materials soaked in the water, before being forwarded to rubber factories. Unlike in Jambi, these agents serve as independent traders so that they could choose to sell the rubber to any CRFs offering a higher selling price (Sulaeman, 2001). In additions, the Province of South Sumatra has more rubber factories so that the brokers have more choices in choosing the rubber buyers, which could imply that the market structures in South Sumatra tend to be more competitive. In the city of Pontianak of West Kalimantan and in Pekanbaru of Riau Province, the roles of trader-brokers are almost similar to those in other producing regions, which serve as a link between subdistrict middlemen and rubber factories. However, the road quality in these provinces is relatively lower compared to other provinces in Sumatra, causing some problems for traders in fulfilling the CRF demands of rubber materials (Anwar *et al.*, 2004).

- *Rubber factories or crumb rubber processors* (CRFs). These agents serve as the last buyers of supply chain of natural rubber in Indonesia, performing processing functions from slabs to sheets. The CRFs could be seen as important players of rubber marketing in the world market, as the Indonesian rubber production is mostly allocated to fulfill the increasing world demand of natural rubber. As these players are dealing directly with the fluctuation of world price, the CRF performance is also closely affected by the world market. In a high rubber price such as during the time of this writing, which reached about US$ 1.20 per kilogram, factories could make considerable amount of profits from the rubber export markets. However, the price shares received by rubber growers are not as good as when the world price is low.

The following Table 3 presents price differences of each marketing agent from export (FOB) prices, factories/processors, traders, and farm-gate level from 2000 to 2004. Price data are calculated from monthly price data of 2000-2002 in three major producers of natural rubber in Indonesia: South Sumatra, Jambi, and West Kalimantan, such as found in the works of Wibawa *et al*. (2002), Sulaeman (2001) and *Anwar et al.* (2004). The more recent price data of 2003-2004 are calculated using extrapolation procedures from the trend or exponential growth rate of the monthly data in at provincial level.

**Table 3. Price Differences among Agents of Rubber Marketing in Indonesia**

| | **2000** | **2001** | **2002** | **2003** | **2004** | **Growth (%/year)** |
|---|---|---|---|---|---|---|
| **Price Differences** | | | | | | |
| FOB Export (Rp/kg) | 4,939 | 4,980 | 7,205 | 8,071 | 9,068 | 16.4 |
| *Share (%)* | *100.0* | *100.0* | *100.0* | *100.0* | *100.0* | |
| Factory/Trader (Rp/kg) | 4,457 | 4,124 | 5,362 | 5,882 | 6,454 | 9.7 |
| *Share (%)* | *90.2* | *82.8* | *74.4* | *72.9* | *71.2* | |
| Farm-gate (Rp/kg) | 4,022 | 3,900 | 4,947 | 5,492 | 5,918 | 10.1 |
| *Share (%)* | *81.4* | *78.3* | *68.7* | *68.0* | *65.3* | |
| **Marketing Margin** | | | | | | |
| FOB-Factory (Rp/kg) | 482 | 856 | 1,843 | 2,189 | 2,615 | 52.6 |
| *Share (%)* | *9.8* | *17.2* | *25.6* | *27.1* | *28.8* | |
| Factory-Farm (Rp/kg) | 435 | 224 | 415 | 391 | 535 | 5.3 |
| *Share (%)* | *8.8* | *4.5* | *5.8* | *4.8* | *5.9* | |
| FOB-Farm (Rp/kg) | 917 | 1,080 | 2,258 | 2,579 | 3,150 | 36.1 |
| *Share (%)* | *18.6* | *21.7* | *31.3* | *31.9* | *34.7* | |

Sources: Calculated from monthly data of 2000-2002 in major producing areas of Indonesia. Extrapolation was used to estimate the annual price data for recent years of 2003-2004 based on studies by Wibawa et al. (2002), Sulaeman (2001) and Anwar *et al.* (2004).

In the last four years, marketing margin and price differences between consumer price (FOB world price) and rubber growers have grown quite rapidly. The marketing margin between world price and factory price grew at a substantial rate of 53 percent per year, especially brought about by the rapid change in world price in the last two years. The overall marketing margin between world price and rubber growers in Indonesia grew at 36 percent per year. The margin share in 2004 reached about 35 percent of the world price, a significant increase from the 19 percent share of the margin in 2000. The marketing margin of the rubber factories, and possibly the profit generated by the CRFs, has been the largest in the marketing systems. While the marketing margin generated by middlemen and traders is not as high as that generated by the factories – hence possibly the trader-brokers of slabs and sheets in Indonesia.

Another way in reading and interpreting the marketing analysis such as presented in Table 3 above is by comparing the share or the percentage of price differences between marketing agents. When the FOB world price was dropped to the lowest Rp 5000 or less than 60 cent per kilogram such as in 2000, rubber growers were able to receive the share of 81 percent of the world price, while the factories/traders receive about 90 percent of world price. However, when the average world price increase to over US$ 1.00 such as in 2004, the shares of farmgate and

traders' decreased to only 65 percent of the world price. These phenomena could be explained by the facts that the 10 percent rate of increase in farmgate price is less than that of FOB price, reaching the rate of 16.4 percent per year. The windfall profits accumulated by traders and rubber factories cannot be transmitted very well to the rubber growers, particularly those living in remote areas and relying on subsistence practices under the jungle rubber agroforestry systems.

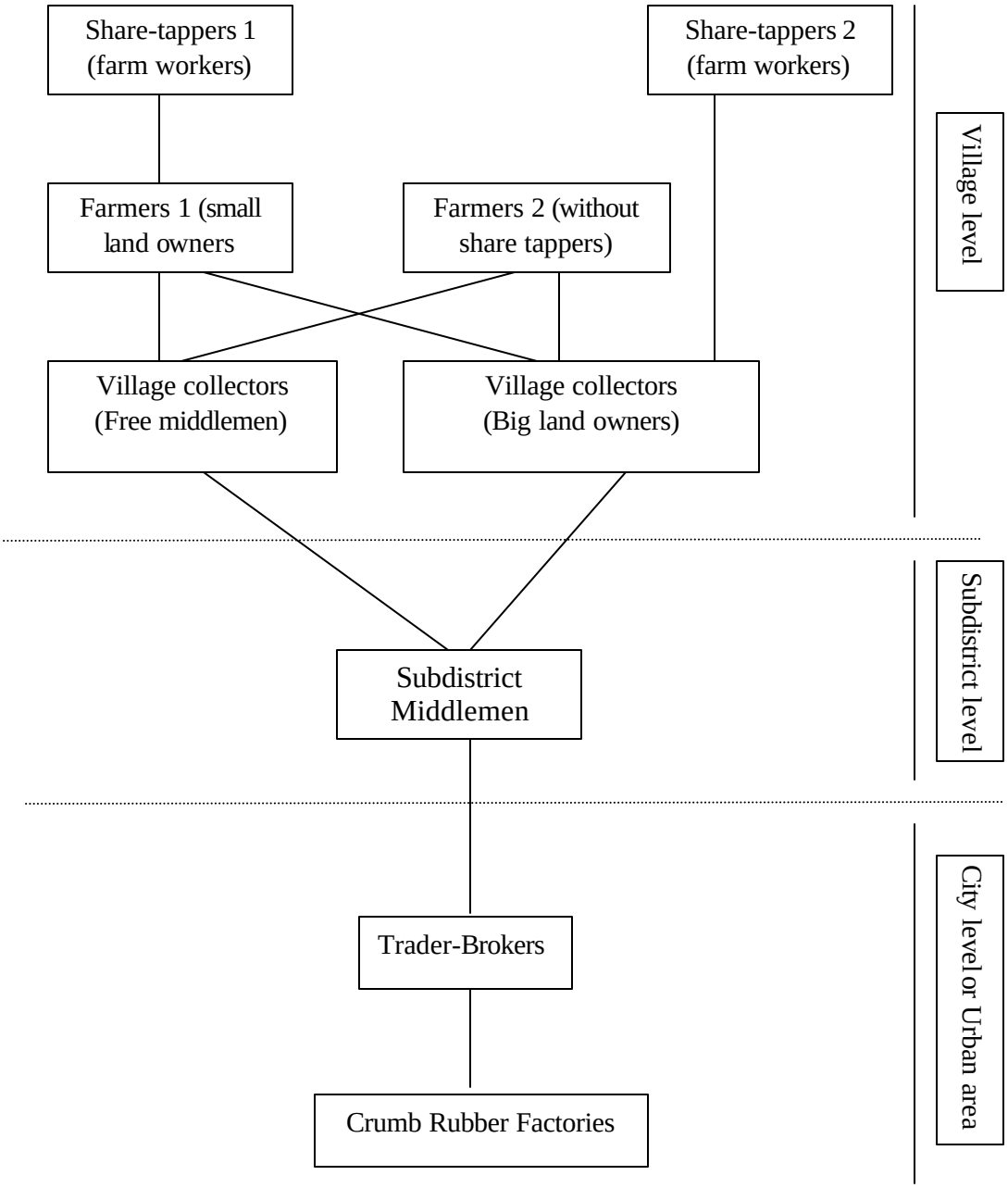


Figure 1. Generalized Supply Chains of Natural Rubber Marketing Systems in Indonesia
This figure is adapted from studies by Wibawa *et al.* (2002), Sulaeman, (2001) and Anwar *et al.* (2004)

The level of details and specific characteristics of marketing systems in major producing areas in Indonesia could also explain the differences in marketing margin of natural rubber. Studies by Anwar *et al.* (2004) suggest that the factories in Jambi has obtained the highest marketing margin, compared to other provinces, mostly because of the conducive environment of marketing structures and of a close proximity from the ports to export market destinations. A larger number of crumb rubber factories such as in South Sumatra compared to other provinces could provide more economic revenues for farmers or rubber growers because the factories and traders are facing more competitive market structures. Similarly, traders and brokers in West Kalimantan generate more marketing margins than those in other provinces, mostly because infrastructures facilities are less available in the area. However, whether or not these traders have made more money from marketing margins, more empirical investigations are yet to be done.

Empirical studies by Wibawa *et al.* (2002) in Jambi suggest that the types of marketing channels explain the differences in price differences and marketing margin of rubber marketing. These marketing channels are not a stand alone factor, but instead closely associated with the following factors: (1) distance between village and CRFs, (2) mode and performance of transportation systems, (3) payment and credit facility, (4) inter-personal relationship between farmers and middlemen, (5) relationship between middleman and brokers or processors; and (6) time and quantity of rubbers being traded. The above Figure 1 is generalized versions of marketing channels of natural rubber marketing in Indonesia, based on available works conducted previously.

The marketing channels of Indonesian natural rubber distributions from growers to consumers differ significantly at the village level. At subdistrict and district level or urban areas, the marketing chains flow directly from subdistrict middlemen to trader-brokers and to crumb rubber factories (CRFs). The differences at village level are mostly associated with share-tapping arrangements between land owners and share-tappers or farm workers. At least there are five marketing channels of natural rubber marketing systems at the village levels (Figures 1), which are summarized as follows:

Channel 1: Sharetappers–Owners–Collectors (free)–Middlemen–Brokers–Factories

Channel 2: Sharetappers–Owners–Collectors (owners)–Middlemen–Brokers–Factories

Channel 3: Farmers–Collectors (free)–Middlemen–Brokers–Factories

Channel 4: Farmers–Collectors (owners)–Middlemen–Brokers–Factories

Channel 5: Sharetappers–Collectors (owners)–Middlemen–Brokers–Factories

Channel 1 and 2 differ only in the way of choosing the village collectors. After collecting the latex from sharetappers, land owners of rubber trees sell the slabs either to "free agent" village level collectors who come directly to the land owners, or to village level collectors, who are also owners of bigger land of rubber trees. Major determinant of the selection of village-level collectors is usually the price being offered, and the needs of immediate cash in hands. Free agent collectors generally pay the slab in cash, while collectors who are also big land-owners sometimes do not pay in cash on the same day, but delaying from 2 to 7 days. Similarly, Channel 3 and 4 differ also in the way of choosing the village collectors, either the free agents or big land-owners who also collect the slabs from farmers and sharetappers. Channel 5 seems the shortest marketing channel as the sharetappers could directly bring the slabs to land-owners who happen to function as village-level collectors. These collectors then sell the slabs to subdistrict middlemen seeking the rubber materials up to village level.

As explained previously, the roles of subdistrict middlemen are extremely crucial in moving up the slabs from the village level to urban areas, where trader-brokers are expecting the slabs to be forwarded directly to crumb-rubber factories. However, the marketing margins enjoyed by these agents are quite small compared to that in factories and farm-gate level. Although the new regulations of SNI of rubber materials are now in effects, both subdistrict middlemen and city-level trader-brokers are negotiating carefully the price level before coming up with the price agreement in price, or generally known as price discoveries. Under a more competitive market structures, the revenues and income generated by middlemen and trader-brokers are not very extensive, because collectors have a freedom to choose which marketing channels they are willing to work with. Vice versa, in a monopsonistic world of rubber marketing, the middlemen and trader-brokers could collude to determine buying price to village-level collectors.

Another variation of marketing channel found in producing regions in Indonesia is an auction system (not shown in Figure 1), where village-level cooperatives play a very central role in the hypothetical futures of natural rubber marketing. Trader-brokers and sometimes the representative of crumb rubber factories make a direct deal with farmers' organizations at the village level. Auction markets are aimed at reducing the transaction costs occurred in each marketing agent to perform their major functions in the supply chain of natural rubber marketing. These methods are expected to lower the marketing margins between FOB prices and farmgate prices. Auction systems are commonly found in the pilot locations of government sponsored projects such as the SRDP and PRPTE to improve the yield level of intensive rubber production systems. The system is an ideal form of supply chain of natural rubber marketing in Indonesia that could improve the level of efficiency in the supply chain of natural rubber. But how this auction system could be spread over and implemented widely in the country, several efforts need to be formulated more carefully in the near future.

Finally, the estimated simple regression coefficient for farm-gate price against FOB price is 0.38, implying that for every Rupiah change in FOB price have cause a change in farmgate price as little as 0.38 Rupiah, *ceteris paribus*. These have supported the results on price differences and marketing margin analysis, where the changes in world price, hence the profits being accumulated by traders and rubber factories, are not transmitted properly to rubber farmers and/or sharetappers. Information asymmetry, the access over price information, and immediate response of rubber growers to the change in world price could explain this non-cointegration in price data between growers and FOB prices. The policy reforms in supply chain of natural rubber marketing in Indonesia should carefully address these issues in a more comprehensive manner. Otherwise Indonesia would have never play significant roles in the prospective world market of natural rubber.

## POSITIVE ENVIRONMENTAL AND SOCIAL BENEFITS

Concerns over positive environmental and social benefits in rubber production system have emerged recently because the development process tends to move towards more intensive practices in rubber production. The old rubber trees under extensive system and jungle rubber agroforestry have not been able to solve the problems of low productivity or latex, poor quality of slabs, hence low income returns for rubber growers. A tendency in monoculture rubber of intensive system using clonal rubber variety poses a threat to new dimensions of biodiversity issues, especially in the forest margins of Sumatra, Indonesia. The major challenge for natural rubber production system in the future is how to integrate a high productivity promotion of new

clonal rubber varieties and a decision for land use practices that satisfy sustainable resource management and ensure acceptable quality of environments in the forest margin.

This section expands previous works on the positive benefits of jungle rubber agroforestry systems both in terms of providing biodiversity services and developing fruitful development strategies contributing to the welfare of marketing agents in rubber marketing and production systems (Wibawa, 2001, Joshi *et al.* 2002, Van Noordwijk *et al.*, 2002, Arifin, 2004a etc.). The arguments on keeping the traditional system of rubber agroforest, especially in the forest margins such as in Bungo District of Jambi Province, are not only about the measures of biodiversity conservation, but mostly about the facts that small farmers are more interested in continuous income from the rubber trees. The emotional relationships between rubber growers and their lands, the property rights components in each decision on latex and slab production and tapping managements, as well as social dimensions in providing considerable amount of rural employment. Hesitation among rubber smallholders to substitute rubber intensive system for the old traditional system is associated with income security from the jungle rubber agroforestry as well as the capacity to adjust the farming practices with the methods of clonal monoculture rubber, requiring a larger amount of farmland.

The existence of jungle rubber agroforestry system is preceded with lashing and burning of previous vegetation, followed by planting of rubber seedlings with rice and other food crops based on shifting cultivation practices in the first few years (de Foresta, 1992). The shifting cultivation systems generally allow the shrubs or secondary forests to regenerate, along with the planted rubber trees from local quality of rubber seedling. After about six years, when the rubber has reached the tappable size, farmers could rely on the subsistence livings from the plots, and such land use practices are generally known as a complex multistrata system. The system has very high potentials to provide a range of harvestable products - timber, fruits, rattan, bamboo, vegetables and medicinal plants, in additions to latex from rubber trees. The forest-like structure provides environmental benefits such as soil fertility replenishment, water catchments protection and biodiversity conservation.

The positive environmental benefits such as biodiversity services could be maintained and developed further as this jungle rubber, hydrologic system of the protection forests has provided a more prosperous habitat for exotic and medicinal plants, extinct species of animals and belowground biodiversity. The complexity of institutional structures of the communities managing or controlling biodiversity-rich ecosystems is mostly related to the issues of stakeholder interests. Because the scale of biodiversity services is mostly regional and global, the development strategy should also focus on the prospective buyers or institutions interested in conserving biodiversity in a specific site and on the potential sellers of small-holder jungle rubber and sharetappers involved in the production and marketing of natural rubber, such as in Indonesia. Some issues need to be addressed include the area under threats or where the conservation activities should be implemented, the stakeholders who can effectively influence conservation uses in the area, and the level of compliance, trust, guarantee, and specific outcome of conservation efforts of the sellers or community living the area.

Rubber agroforestry system has been established either as a relatively short cyclical system or long term or "permanent" system having different social-economics and agro-ecosystem consequences (Joshi *et al*, 2002). The cyclical system involves clearing existing vegetation at a whole plot level, often through slashing and burning, followed by replanting of rubber seedlings. Annual crops are cultivated along with some weeding and cleaning, normally in the first two to three years, until rubber trees start causing significant shade. The plot is then "abandoned" until rubber trees reach tappable size, generally when the trees are six to ten years old. Meanwhile, in the long term near-permanent system, rubber seedlings are planted as enrichment planting (or gap rejuvenation) whenever sufficiently large enough gaps are formed

inside a rubber garden. Management decision is at tree or gap level rather than whole plot level. Locally, the system is known as *sisipan.* It leads to permanently vegetated plots with mixed age trees of rubber and ample natural vegetation canopy in rubber agroforestry system, with forest like vegetation. Inside such agroforestry plot, various stages of rubber, from young seedlings to mature and over-mature trees are normally encountered.

Local smallholders might not be aware of that the maintenance of existing rubber agroforestry system has contributed to the preservation of biodiversity in the humid tropics such as in Jambi. The jungle rubber system is an example of complex agroforestry system based on production of an economically important commodity - latex that provides on average 70% of the household income in the area (Wibawa *et al.*, 2001). This existing system has obtained pressures of land-use changes either to more permanent food crop system or rubber monoculture having higher yields, especially during a high level of world price of rubber. Equally important in regards to biodiversity conservation is a pressure coming from mining industries and oil-palm expansion on the very same limited upland, becoming very serious issues in Jambi Province for the few years.

The issues of social benefits of the sustainable practices of rubber agroforestry systems should be addressed more properly as the involvement of poor share-tappers – involving only on the harvest or tapping activities to collect latex – as important agents in the overall rubber production and marketing systems. Sharetapping is common arrangement between villagers with few or no tappable rubber trees, but with surplus labor. Share tapping is also common for rubber owners with surplus rubber trees for tapping but they cannot tap themselves for a number of reasons. In Jambi and in most places in Indonesia, share tapping is implemented without prior writing consent or agreement, but generally very strong commitment based on verbal agreements between the rich and the poor in the area.

Most rubber farmers in Jambi own an area of rubber field between 2 and 4 hectares; while the remaining farmers have larger areas of rubber fields. In general, farmers with more than 5 ha of mature rubber require external help, either as paid laborers or share tappers (Joshi *et al.*, 2002). Farmers with clonal rubber, due to its higher productivity and tree density generally require more share tappers per unit area. An average tapper can tap around 400 trees in a day or about one hectare for a clonal rubber plantation. On the other hand, seedling plantations have a lower rubber tree density; hence large area may be covered. However, this is also influenced by rubber tree distribution and ground vegetation. The sharing of yield from tapping in all share-tapping systems depends on productivity of rubber gardens, which may again be influenced by the planting material – seedling or clonal material.

In a sharetapping practice, such as commonly found in Jambi and most rubber producing areas in Indonesia, the tappers provide labors, but control only limited capital, and the land lords or rubber owners experience a lack of labor force to tap the latex by themselves. The common share for the results from latex is usually 75 percent for tappers and 25 percent for owners for old jungle rubber. A share of 50-50 is also found in a high variety of clonal rubber, because of its high yield or latex productivity. The arrangements on who has to burden the production costs between the tappers and the owners are generally not written, instead based mostly on verbal agreement. Sometimes psychological factors and feeling of dependence or patron-client relationship between the two have caused the labor market of share-tapping is not very flexible. Tappers have a strong tendency that they have to work for certain landlords, not for others, because these landlords sometimes provide assistance in a form of cash advance and other daily needs.

Positive environmental and social benefits could be developed based on the participatory conservation practices of biological diversity through careful formulation of a better reward

mechanism for those conserving the rubber agroforestry system or the jungle rubber for years. Because local smallholders and rubber sharetappers are generally not aware of their contribution to the conservation of biodiversity, rewarding properly these lowest quintile income groups could increase the opportunities to improve their livelihood. As these poor people are also engaged with several norms and conventions at local level, involved with societal collective actions, and important determinants of more formal collective actions on biodiversity conservation, developing participatory approach to encourage the long-term permanent jungle agroforestry systems would be an option (Arifin, 2004a). Therefore, efforts to build the capacity of these share-tappers, to provide opportunities to improve their welfare would be an important step towards more systematic reward mechanisms for those have contributed to the conservation of bio-diversity such as in rubber agroforestry system. Local government in Indonesia shall play important roles in the capacity building of poor share-tappers, instead of simply giving permissions to mining industries and oil-palm plantation that would contribute to the pressures of threatening biodiversity services in jungle agroforest.

Indonesia has passed the Law 5/1994 on ratification of the United Nations Conventions on Biological Diversity, acknowledging that "the provision of new and additional financial resources and appropriate access to relevant technologies can be expected to make substantial difference in the worlds' ability to address the loss of biological diversity". The Convention intends to develop national strategies, plans or programs for the conservation of biodiversity or adapt for this purpose existing strategies, plans or programs which shall reflect the measures set out in this Convention, and integrate, as far as possible and as appropriate, the conservation and sustainable use of biodiversity into relevant sectoral or cross-sectoral plans, programs and policies.

In shorts, formulating good rewards to the providers of biodiversity services such as smallholder rubber and poor rubber sharetappers is expected to reduce the harmful effects of biodiversity losses and to contribute to positive environmental and social benefits. Disseminating proper information and knowledge to local government officers and other stakeholders from private sectors, universities and local communities could improve common understanding on the importance of biodiversity values for human life, as well promoting sustainable rubber production managements in the forest margins. For a concern on reward mechanisms, these important stakeholders in the country could serve as intermediaries in the formulation of payment mechanism for the biodiversity services. Finally, potential buyers such as conservation organizations or even multinational corporations need to be convinced that "the market" for biodiversity service would work well, providing future streams of benefits of their own interests.

## CONCLUDING REMARKS: THE WAY FORWARD

The study has examined the supply chain of natural rubber, from the production system, value chain of the marketing system in Indonesia. The report is also aimed at formulating recommendations for a suitable scheme that would help to ensure high production standards and sustainable return for natural rubber production. The production system of natural rubber has been struggling for effective incentive systems and quality controls, especially for smallholder growers to produce good quality rubber. Although the Government of Indonesia has introduced clonal variety under more intensive rubber production systems for the last two decades, the majority of small holder rubber growers have not yet adopted this system. The recommended technologies are inappropriate for most farmers because of limited capital and land available for intensification.

New regulation of the Indonesian National Standard (SNI) –where crumb rubber factories (CRF) are strongly suggested to buy only rubber materials meeting the high standard – has not yet improved significantly the rubber quality. At the field level, farmers using high quality seedling and intensive system are really in favor of the new regulation, but traditional farmers relying on jungle rubber of agroforestry systems have experienced a decrease in farm revenues because they traditionally have produced dirty slabs. In the near future, policy intervention to provide assistance for these small farmers should be sharpened in order to broaden the limited opportunities and capital constraints to improve the income level and the sustainability of natural rubber production system.

The supply chain of rubber marketing in Indonesia is very much determined at least by two important factors: (1) the industrial capacity of crumb rubber factories and (2) the efficiency level of marketing systems. When the production of rubber materials cannot fulfill the factory demands, the whole marketing system tend to have problems in its efficiency level. Academic communities and government agencies are now being challenged to formulate new schemes in financial policies and investment policies to encourage new investments in both upstream and downstream rubber-based industries. Otherwise, the high potentials for Indonesia to play major roles in the world market of natural rubbers that could at the same time bring prosperity to small-scale growers and protecting the environment would vanish in the short years to come.

Rubber marketing systems in Indonesia, and possibly in other producing countries in Southeast Asia involve very straightforward supply chains from rubber growers to end consumers. The roles of subdistrict middlemen are extremely crucial in moving up the slabs from the village level to urban areas, where trader-brokers are expecting the slabs to be forwarded directly to crumb-rubber factories. Although the new regulations of SNI of rubber materials are now in effects, both subdistrict middlemen and city-level trader-brokers do not really bother with the standard. However, in a more competitive market, the revenues and income generated by middlemen and trader-brokers are not very extensive, because collectors have a freedom to choose which marketing channels they are willing to work with. Vice versa, in a monopsonistic structure, the middlemen and trader-brokers could collude to determine buying price to village-level collectors.

Another important point suggested by this report is that the changes in world price, hence the profits being accumulated by traders and rubber factories, are not transmitted properly to rubber farmers and/or sharetappers. Information asymmetry, the access over price information, and immediate response of rubber growers to the change in world price could explain this non-cointegration in price data between growers and export. In the near future, the policy reforms in supply chain of natural rubber marketing in Indonesia should carefully address these issues in a more comprehensive manner. Otherwise Indonesia would have never play significant roles in the prospective world market of natural rubber.

Finally, in order to contribute to the positive environmental and social benefits, the major challenge for natural rubber production system in the future is how to integrate a high productivity promotion of new clonal rubber varieties and a decision for land use practices that satisfy sustainable resource management and ensure acceptable quality of environments in the forest margin. By the time of this writing, the old rubber trees under extensive system and jungle rubber agroforestry have not been able to solve the problems of low productivity or latex, poor quality of slabs, hence low income returns for rubber growers. However, a tendency in monoculture rubber of intensive system using clonal rubber variety could pose a threat to new dimensions of biodiversity issues, especially in the forest margins. Therefore, providing incentive systems and reasonable rewards for smallholder rubber growers who have contributed to the conservation of biological diversity services could be treated as a necessary step to develop a more sustainable practice of rubber production systems. The practice is expected to both

improve the latex productivity and high quality rubber products and ensure adequate income level for the small-holder rubber growers and sharetappers, such as commonly found in Indonesia.

**References**


Anwar, Choirul, Isang Gonarsjah, Hermanto Siragar and Suharto Honggokusumo. 2004. "Marketing Margin of Raw Rubber Materials and Vertical Price Transmission: A Case Study in South Sumatra, Jambi and West Kalimantan". Poster paper presented at the International Rubber Conference and Products Exhibition 2004, Organized by the Indonesian Rubber Research Institute (IRRI), on December 14-15, 2004 in Jakarta.

Arifin, Bustanul. 2004a. "Constraints and Opportunities on Development of Environmental Service Markets: Lessons from Institutional Studies on RUPES in Indonesia". Invited paper presented at the International Conference on Compensation Mechanisms of Environmental and Ecological Services (CMEES), organized by the World Bank Institute on October 26-27, 2004 in Beijing, China.

Arifin, Bustanul. 2004b. "Policy for Rubber Industry Investment". Invited paper presented at Plenary Sessions of the International Rubber Conference and Products Exhibition 2004, organized by the Indonesian Rubber Research Institute (IRRI), on December 14-15, 2004 in Jakarta, Indonesia.

Budidarsono, Suseno, M. S. delos Angeles and G. Wibawa. 2002. A Profitability Assessment of Smallholder Rubber Agroforest Systems in Jambi, Sumatra, Indonesia. Bogor: World Agroforestry Center (ICRAF) Southeast Asia Program.

Budiman, A.F.S. 2004. "The Global Natural Rubber Industry: Current Development and Future Prospects". Keynote Speech for the International Rubber Conference and Products Exhibition 2004, Organized by the Indonesian Rubber Research Institute (IRRI), on December 14-15, 2004 in Jakarta.

de Foresta, Hubert. 1992. "Complex Agroforestry Systems and Conservation of Biological Diversity" in Kheong, Y.S. and Win L.S. (eds). *Harmony with Nature: International Conference on the Conservation of Biological Diversity*, The Malayan Nature Journal Golden Jubilee Issue 1992. pp.: 488-500.

Haris, Uhendi. 1999. "Analisis Ekonomi Kelembagaan Tataniaga Karet Rakyat: Pendekatan Hubungan Prinsipal-Agen" (*Institutional Economic Analysis of Smallholder Rubber: A Principal-Agent Approach*). Unpublished Masters' Thesis, Bogor Agricultural University (IPB), Indonesia.

Joshi, Laxman, Gede Wibawa, H. Beukema, Sandy Williams, Meine van Noordwijk. 2002. Technological change and biodiversity in the rubber agroecosystem of Sumatra. Book Chapter. CRC Press LLC.

Kuncoro, Susilo Ady. 2004. "Sustainable A Traditional Practice: A Case Study of Prioritizing Areas for Biodiversity Conservation in Jungle Rubber Systems, Bungo District, Jambi Province, Sumatra-Indonesia. Unpublished Masters' Thesis at Forest and Nature Conservation Policy, Wageningen University and Research Center, Netherlands.

Pagiola, S., J Bishop, and N Landell-Mills. 2002. *Selling Forest Environmental Services: Market-Based Mechanisms for Conservation and Development.* London: Earthscan.

Sulaeman, Achdiansyah. 2001. Analisis Efisiensi Tataniaga Karet Rakyat di Sumatra Selatan dan Lampung (*Efficiency Analysis of Rubber Marketing in South Sumatra and Lampung*). Unpublished Masters' Thesis, Padjadjaran University, Indonesia.

Van Noordwijk, Meine, Thomas Tomich and Bruno Verbist. 2000. "Negotiation Support Model for Integrated Natural Resource Management in Forest Margins and in Landscapes with Trees: Can they solve local as well as global problems?" *Conservation Ecology*, April 2000, pp: 18-46.

Wibawa, Gede. 2001. Rubber based Agroforestry Research in Indonesia. Proceedings Indonesian Rubber Conference and IRRDB Symposium 2000. in : R. Azwar, Karyudi, G. Wibawa, S. Suryaningtyas, R. Arizal, S. Honggokusumo, D. Suparto. M. Supriadi, C. Anwar and Ayuni-Dewi Suwana (*eds.*). Indonesian Rubber Research Institute. p:247-265.

Wibawa, Gede, M.J. Rosyid, C. Nancy, M.van Noordwijk, L. Joshi. 2002. "Marketing Rubber in Jambi, Indonesia: Traditional Systems and the New Indonesian National Standard (SNI)." Working Paper of the Indonesian Rubber Research Institute (IRRI) at Sembawa, Palembang and World Agroforestry Center (ICRAF) Southeast Asia, Bogor.