

Rattan in Java, Indonesia : a Case Study of the Production-to-Consumption Systems

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**Hariyatno Dwiprabowo
Setiasih Irawanti
Rahayu Supriyadi
B.D. Nasendi**

**Forest Products and Forestry Socio-economic Research
and Development Centre
Bogor, Indonesia**

International Network for Bamboo and Rattan (INBAR)

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FOREWORD

The Indonesian government has followed a policy that imposes prohibitive export taxes on raw and semi-finished rattan. Java, which has a strong manufacturing base, has benefited from this, emerging as the main exporting region for finished rattan products. However, as Javanese forests are weak in rattan resources, this has caused the island to be dependent on other islands for raw material. From the socio-economic perspective, the Javanese rattan sector is important in terms of employment and cash income generation. The sector has also made significant contributions to the national economy. These aspects make a study of the sector an enlightening exercise to those engaged in policy and developmental research.

Socio-economics of bamboo and rattan being one of its strongest program areas, the International Network for Bamboo and Rattan (INBAR) has been interested in the production-to-consumption systems that operate in these two sectors in various countries. This study is part of a wider program of research on production-to-consumption systems of bamboo and rattan economies of several Asian countries.

The present study was carried out by Hariyatno Dwiprabowo, Setiasih Irawanti, Rahayu Supriyadi and B.D. Nasendi from the Forest Products and Forestry Socio-economic Research and Development Centre of Bogor, Indonesia. It analyses the opportunities and constraints present in the rattan production-to-consumption system of Java, and suggests interventions for the overall improvement of the sector.

It is our hope that the information and data presented here will lead to further research into the potential of the rattan sector in Indonesia and other countries.

I.V. Ramanuja Rao
Senior Manager (Programs)

Cherla B. Sastry
Director General

1 INTRODUCTION

The vast potential of Indonesian rattans has long been harnessed through their collection from natural forests and trading in domestic as well as overseas markets. Earlier, rattans used to be sold - either in the raw form or processed into semi-finished products - as starting materials for the manufacture of a variety of products ranging from curios to furniture. In 1979, with the intention of generating more job opportunities and adding value locally, the government imposed a ban on the export of raw rattan (rotan asalan). The ban was extended in 1988 to cover semi-finished products. In 1992 the government lifted the export ban on semi-finished products, but imposed prohibitive export taxes to virtually prevent such exports.

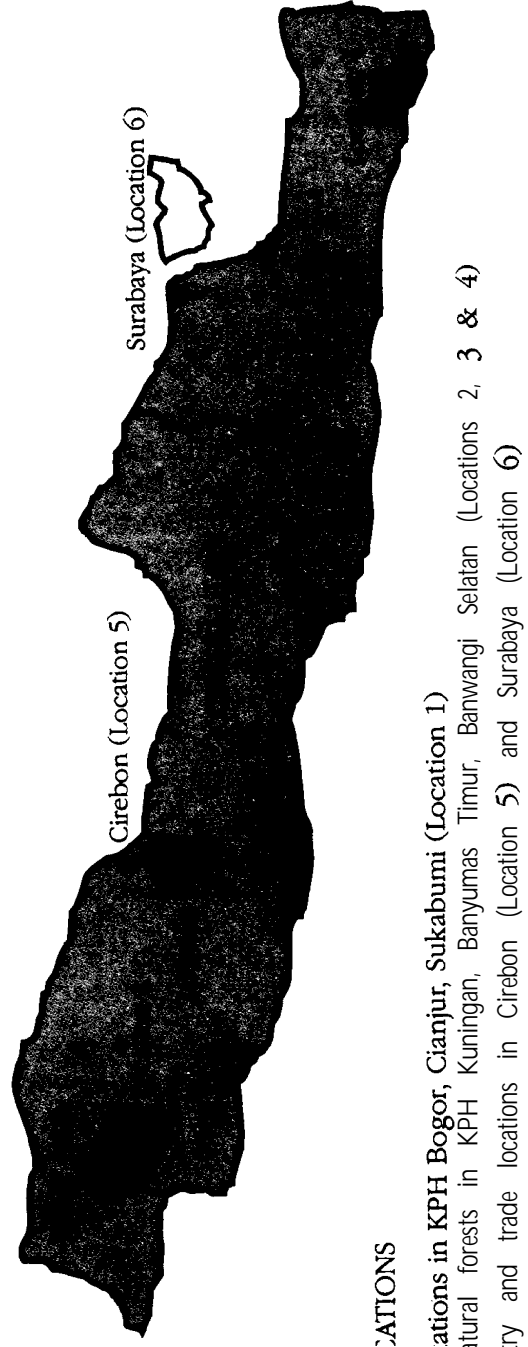
These regulations have had significant effects on rattan trading and processing in the country. In the case of Java, the rattan manufacturing industry has grown tremendously since the regulations were imposed. Being the most populous island (107 million in 1991) with better infrastructure, Java is a favoured industrial location. The rattan industry in Java, particularly in the Cirebon region, has existed since the late 19th century, giving the island an edge as a rattan products manufacturing centre. With the imposition of the ban, raw and semi-finished rattan, which in pre-ban years used to be exported directly from other islands, began to be sent to Java for further processing.

The development of the rattan processing industry in Java created a great dependence on raw rattan from other islands such as Sulawesi, Kalimantan and Sumatera. Approximately 95% of the raw rattan processed in Java comes from these islands, and wild rattan from the natural forests in Java meets less than 5% of the market demand. Since 1983, Perhutani, a state forest enterprise which manages forests in Java, has introduced rattan cultivation to ease this overt dependence. At present, it has cultivated approximately 37000 ha of the forests with rattan.

The rattan production-to-consumption system in Java involves various stakeholders, such as plantation enterprises, plantation workers, rattan collectors, traders of raw rattan and finished products, and manufacturing firms of different sizes. Activities such as planting, processing and trading are generally labour-intensive and are, therefore, socio-economically important to the region. Java makes a significant contribution to the national economy through export earnings from rattan. For instance, in 1995, Cirebon and Surabaya, the main rattan industry regions in Java, contributed US\$293.5 million (approximately 69.4% of the national export earnings) from rattan products export.

This study examines the various aspects of the rattan production-to-consumption system in Java: the stakeholders, opportunities, constraints, challenges and possible interventions to sustain the system. The study was conducted in the main industrial locations of Cirebon and Surabaya regions, Kuningan Forest District (where rattan collection takes place), and Cianjur and Sukabumi Forest Districts (where rattan plantations exist). The study area is indicated in Fig. 1.

Fig. 1: Area of study in Java



STUDY LOCATIONS

- Rattan plantations in KPH Bogor, Cianjur, Sukabumi (Location 1)
- Rattan in natural forests in KPH Kuningan, Banyumas Timur, Banjwangi Selatan (Locations 2, 3 & 4)
- Rattan industry and trade locations in Cirebon (Location 5) and Surabaya (Location 6)

2 THE PRODUCTION-TO-CONSUMPTION SYSTEM

Raw Material Supply

From other islands

Approximately 95% of rattan raw material consumed in Cirebon and Surabaya originates from other islands - Sulawesi, Kalimantan and Sumatera - and a small quantity from Nusa Tenggara and Irian Jaya (Fig. 2). Large diameter rattan species commonly used are lambang ombulu, seuti, tarumpu, mandola, semambu, sampang, manau, noko, tohiti and uban, while the small diameter rattan species are sega, jahab, pulut, locek, datuk, jarmasin and cacing. The estimated percentages of large and small diameter species originating from Java and other islands are given in Table 1.

Table 1: Estimated percentages of rattan originating from Java and other islands

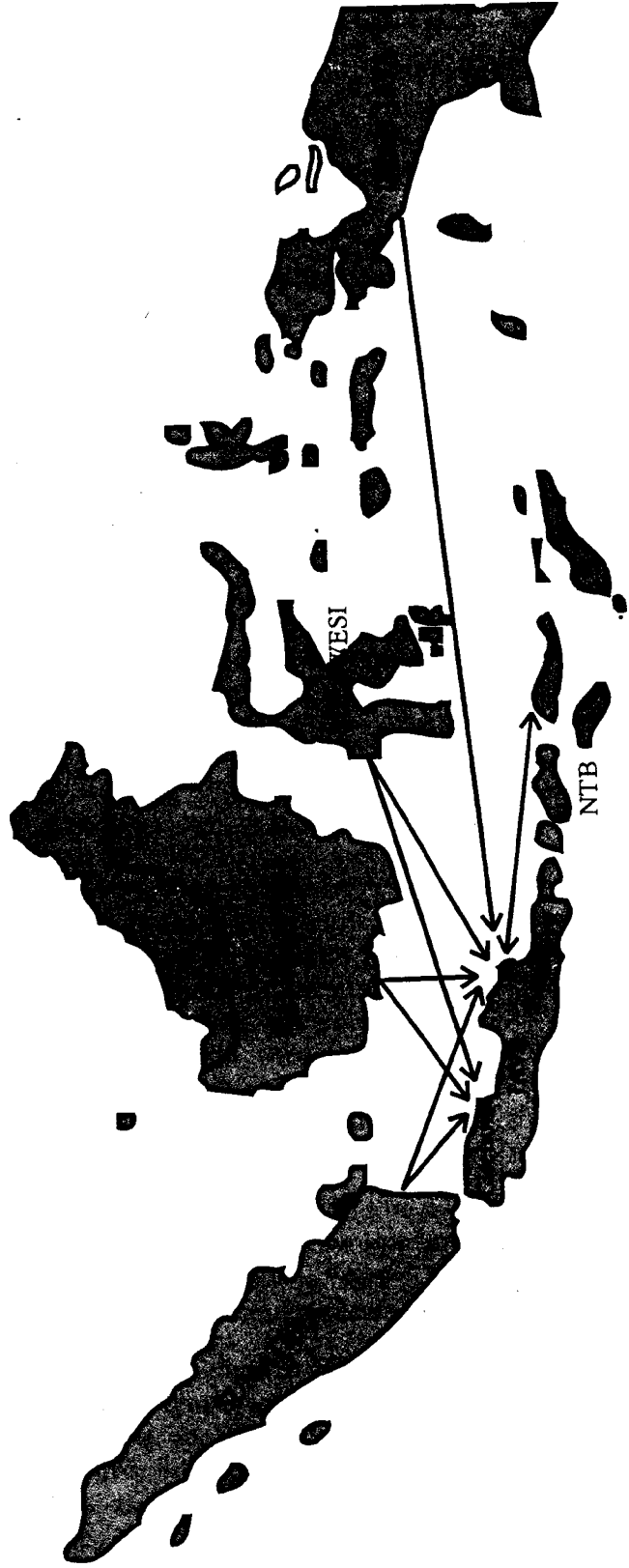
Place of origin	Large dia.	Small dia.	Total
Java	1	4	5
Other islands	69	26	95
Total	70	30	100

Large diameter rattans are normally processed to get polished rattan cane for making furniture frames. Small diameter rattans are processed into core, fitrit and peel, all used as plaiting materials. In Surabaya, approximately 70% of the large diameter rattan comes from Sulawesi, 10% from Kalimantan, 10% from Sumatera, and the remainder from other regions. The role of Sulawesi as a source of raw material is significant. The island produces several species suitable for rattan products, particularly furniture frames, such as batang (*Calamus ornatus*), semambu (*Calamus scipionum*) and tohiti (*Calamus inops*).

Data on recent rattan consumption rates for the whole of Java are not available; however, a report from Kanwil Kehutanan Jawa Timur (1990) estimates the consumption at around 118 000 tons. This figure may have slightly increased in recent years as indicated by the consumption in Surabaya and Cirebon (Table 2).

Raw rattan enters Java in various forms: green cane, washed and sulphurized (W&S) rattan, rattan core, rattan split, polished rattan, and weaving material. These are used by the industry to produce various products, mostly furniture, baskets, and handicrafts and other decorative items. The study discovered no major problem associated with raw material supply, except that it fluctuates from time to time in both volume and price. Prices have shown a tendency to increase over time, owing probably to the characteristics of rattan trade in the other islands on which

Fig. 2: Flow of rattan into Java



Java depends for rattan supplies (please see similar studies conducted in Kalimantan and Sulawesi for further reference).

Table 2: Consumption of rattan by industries in Cirebon and Surabaya (in tons)

Year	Cirebon	Surabaya	Total
1991	19 849	n.a.	n.a.
1992	24 154	46 616	70 770
1993	32 421	44 443	76 864
1994	35 998	38 879	74 977
1995*	36 373	44 148	80 521

Notes: n.a. = not available; * = estimated.

Sources: Koperasi Kerajinan Rotan Tegalwangi, Cirebon 1995; Port Administrator Tanjung Perak and Gresik.

From Java

As mentioned earlier, rattan supplies from Java account for less than 5% of the market consumption. Rattans grow in primary forests scattered over the island. The common species are balukbuk (*Calamus burckianus* Becc.) with 3-4 cm diameter, seuti (*Calamus omatus*) with 2-3 cm diameter, and seel (*Daemonorops melanochaetes*) and cacing (*Calamus adspersus* Bl.) having less than 2 cm diameter. Rattans are harvested mostly by local collectors, although in some forest districts where the stocks are more abundant, harvesting is done by Perum Perhutani, the forest management enterprise.

Statistics for various species of wild rattan collected by the local people are not recorded. However, the quantities harvested by Perum Perhutani in different forest districts are available (Table 3).

Table 3: Rattan harvested in Java by Perum Perhutani

Forest district (KPH)	Quantity (Number of pieces)			
	1992	1993	1994	1995
Banten	5 560	—	12 500	—
Purwakarta	1 700	—	---	—
Garut	12 110	47 361		—
Tasikmalaya	15 188	9 064	1660	—
Bogor	21 600			—
Bandung Utara	—	1250	2000	—
Ciamis	—	3 702	—	—
Kuningan	—			26 493
Banyuwangi Selatan	29 950	8618	272 645	596 478
Total	86 108	69 995	288 805	622 971

Notes: — = no harvest done; a piece is 3.5-4 m long. Source: Perum Perhutani 1995.

It may be stated here that the planned production target in Kuningan forest district was 200 000 pieces in 1995 (compared with the actual production of 26493 pieces) and 1.2 millions pieces in 1996. With the exception of Banyuwangi Selatan, and to a lesser extent Tasikmalaya, no other forest district could sustain supply for more than two years. Harvesting was selective, whereby only mature stems were cut from each rattan cluster. The rotation period of wild rattan is normally 10 years. The quality of rattan obtained from Java is inferior when compared with rattan from other islands. Still, the price of rattan from Java is comparable to that of rattan from other regions (please see Annexe 1 for a calculation of the base price of rattan from Java)

In Kuningan, a harvesting plan for rattan is submitted by the Forest District Office (Kesatuan Pemangkuan Hutan or KPH) to the West Java Perhutani Unit (Provincial level) for approval at least one year in advance. The approved plan is then handed down by KPH to the Sub-Forest District Office (BKPH) at Garawangi for implementation. The harvesting activity is managed by the Sub-Sub-Forest District Office (KRPH) at Haur Koneng, the lowest level of Perum Perhutani management units, which hires people from surrounding villages to collect rattan.

Gatherers

Rattan collection is supervised by a foreman hired from the village. The foreman is also responsible for keeping a record of the rattan collected by each worker. Payment is made once the rattan collected is sorted according to stem diameter. Rattan collection from natural forests in Java generates employment, although the quantum is much less significant compared with that in other islands because Java accounts for less than 5% of rattan supply. At the time of this study, for instance, there were only around 60 workers in Kuningan engaged in rattan collection (this may have increased in 1996 as the production level increased).

Rattan is collected mainly by men because the work is strenuous. The collectors (gatherers) live in areas surrounding the forest. Their main livelihood is farming, and collecting rattan is a part-time activity for supplementing incomes. Their land ownership is less than 1500 m² per family. The distance from the work place to the settlement is, on an average, 4 km. The average family size is four persons. Besides farming and cattle raising, the villagers may take up labour in other sectors. As alternative jobs are frequently available in the neighbouring villages, the wage rate for rattan collection has to be competitive and is occasionally adjusted by Perhutani to hire adequate numbers of people. Rattan gathering comprises activities such as searching for suitable rattan; cutting; cleaning of stems; hacking stems into pieces of 3-4 m; bundling (each bundle consists of 15-35 pieces depending on the diameter and species), and carrying the bundles to the village road.

In the case of KPH Kuningan, the rattan collected by the local people is transported by the buyer (manufacturer) to the rattan processing (factory) in Cirebon. The rattan from KPH Banyuwangi is mainly consumed by the local home-based industry, which procures the raw material through intermediaries from several surrounding cities, such as Jember, Banyuwangi, Purbolinggo and Malang.

Surveys showed that the quantity gathered by a person may vary with the rattan species. Working from 6 A.M. to 3 P.M., it is possible to gather 15-20 stems of balukbuk (3-4 cm diameter); 20-30 stems of seuti (2-3 cm diameter) or 30-35 stems of seel (1-2 cm diameter). The collection may also be mixed. Usually the buyer informs the gatherers about the species preferred. The daily earnings from rattan collection may reach Rp. 4 125-5 500 per person (please see Annexe 1). The gathering may continue round the year according to the company plan.

Traders

According to the Forestry Regional Office of West Java, there were about 25 producers in Cirebon who traded in rattan from other islands during July-September 1995. Of these, 10 were raw material wholesalers while the others were manufacturers of finished products. In Surabaya, according to ASMINDO (Indonesia Association of Furniture and Handicrafts Manufacturers) there were six rattan wholesalers in 1996, including PT Saripermino Murni, founded by ASMINDO and existing both in Surabaya and Cirebon. Thus, these two regions together had around 16 rattan wholesalers in 1996.

It is worth noting that although there are several rattan wholesalers in Cirebon, some medium to large manufacturers of finished products maintain direct relations with rattan suppliers in other islands, as a way of securing the flow of raw material and ensuring lower costs.

Manufacturers

Classification

Based on the transformation stages of rattan, the processors and manufacturers in Cirebon can be classified as follows:

- 1 Producers who cut, collect and remove the stem sheath (sizing) to provide raw rattan (rotan asalan). The number of such processors in Java is very small owing to the limited availability of rattan.
- 2 Producers who process raw rattan both from Java and other islands into washed and sulphurized (W&S) rattan. Some processors of this category also produce semi-finished and finished products.
- 3 Producers who process W&S rattan from Java and other islands into semi-finished material (polished rattan, core/firit, peel/bark and weaving material). Some processors of this category manufacture finished products.
- 4 Producers (manufacturers) of finished products such as furniture, baskets, and handicrafts and other decorative items. This category of producers can be sub-classified into five types:
 - a. Those who produce the main frame, leaving plaiting and finishing to other manufacturers;

- b. Those who do plaiting, leaving finishing to other manufacturers;
- c. Those who produce the main frame and do plaiting, leaving finishing to others;
- d. Those who do finishing and selling/exporting; and
- e. Those who produce the main frame, and do plaiting, finishing and selling/ exporting.

The total number of producers under types 4a to 4c is around 750. They play an essential role in the rattan industry in Cirebon which is mostly a home-based industry. These producers possess specialized skills and high efficiency in raw material utilization (around 95%), and make a substantial contribution to fulfilling production targets, particularly when the demand is high.

The size of a manufacturer of finished products is determined based on either the number of workers employed or the size of capital (Table 4).

Table 4: Classification of rattan manufacturers

Size	Criteria	
	Capital (million Rp)	No. of workers
Large	>1000	>100
Medium	600 - 1 000	20 - 100
Small	190 - 599	5 - 20
Home-based	< 190	1 - 5

Note: Exchange rate US\$1 = Rp. 2 300. Source: Office of Ministry of Industry, Cirebon, 1995.

The rattan business is one of the fast developing economic activities in Java. It changes so rapidly over a relatively short time that it is difficult to keep track of the stakeholders. The number of industrial-level manufacturers in Cirebon is 30 (8 small-scale, 12 medium-scale and 10 large-scale; source: Office of Ministry of Industry, Cirebon, 1995) while home-based manufacturers number 750. In Surabaya and its vicinity, the number of home-based producers, according to a report from Kanwil Departemen Perdagangan Jawa Timur (1990), is around 3 837, while the number of industrial-scale manufacturers is around 80 (large and medium-scale manufacturers; source: ASMINDO-Surabaya 1996).

The characteristics of manufacturers surveyed in Cirebon can be seen in Annexe 2a. Rattan products manufacturing is labour-intensive. However, it is less capital-intensive compared to the wood-based furniture industry. As can be seen from Annexe 2a, home-based manufacturers, sub-contractors, and small, medium and large-scale manufacturers require Rp. 2.2 million, Rp. 1.47 million, Rp. 5.82 million, Rp. 11.3 million and Rp. 11.36 million per worker, respectively. Comparison between manufacturing scales in this context may not be valid because

¹ As even government offices find it difficult to monitor the development of the rattan industry, the data obtained from different government sources and presented in this paper may not be accurate.

the units produce different kinds of products, and the level of sophistication of equipment/machinery used varies.

Among manufacturers of finished products, particularly rattan furniture manufacturers in Cirebon and Surabaya, sub-contracting practices are very common. The manufacturer sub-contracts part of the job to others; for example, the main frame, components or even the complete furniture item excluding the finishing may be sub-contracted. This is done especially when the demand is high. Home-based manufacturers are the ones who most commonly engage in subcontracting though small and medium scale manufacturers occasionally take similar jobs especially when they have spare capacity.

Profitability

Calculations indicate that the larger the scale of production, the higher the profitability in rattan products manufacture. Based on financial analysis conducted on 13 manufacturers of different scales in Cirebon (see Annexe 2b), the average Internal Rates of Return (IRR) are as follows:

- Large-scale manufacturer (2 samples) 26.21%
- Medium-scale manufacturer (3 samples) 21.86%
- Small-scale manufacturer (3 samples) 21.42%
- Home-based manufacturer (5 samples) 13.55%

Larger manufacturers have better accessibility to capital, raw material and markets. Large and medium-scale manufacturers, therefore, have some advantages in sub-contracting - very common in rattan products manufacturing industry - especially when dealing with home-based manufacturers. Some self-supporting home-based manufacturers are less dependant on sub-contract deals and produce finished products independently. However; they normally sell their products only in the local market, while the medium and large manufacturers export their products to earn more profits.

The role of associations

The objective of an association like ASMINDO is to represent the interests of its members, mainly to secure adequate raw material for its members and promote marketing of products. However, it seems that these two roles are not being carried out effectively. The first role is implemented by PT Saripermindo Murni, which functions as the rattan supplier in Surabaya and Cirebon. However, the demand for raw material far exceeds the supply capacity. Shortages were experienced in recent years, caused in part by the restrictions that the Sulawesi local government placed on inter-island trade of raw rattan, seriously affecting the availability of raw rattan (mainly a few species of large diameter) in Cirebon and Surabaya. Efforts made by the association to overcome this problem have met with some success. ASMINDO has not been effective in its second role of implementing a marketing strategy as there is a fierce competition in the international market.

Employment profile

Data on the amount of employment generated by the rattan industry in Java is rather patchy. Secondary data from some sources in Cirebon and Surabaya indicate that the home-based industry generated most of the employment. Small, medium and large-scale manufacturers in Cirebon generated 12 578, 6 395 and 2950 jobs, respectively, while home-based manufacturing' created around 30 000 jobs through direct and indirect employment (source: Office of Ministry of Industry, Cirebon, 1995). In Surabaya, the largest industrial region, medium and large-scale manufacturers generated around 35 000 jobs (source: ASMINDO-Surabaya, 1996), while home-based industry is estimated to have provided employment to 11511 workers (3 837 home-based units x 3 workers).

Women make up a significant proportion of the workers. The proportion of female workers in factories varies from 25 to 50%. Interviews conducted with 40 workers representing several manufacturers, mostly home-based manufacturers/sub-contractors, revealed that female workers generally did jobs that needed accuracy and 'careful attention such as banding, plaiting, burnishing and sorting. On the other hand, male workers usually performed tasks which tended to be more strenuous, such as cutting, sizing, stem bending, frame making, finishing and transporting the products.

Workers' incomes vary significantly, depending upon productivity and the type of activity, between Rp. 20000 and Rp. 90 000 per week or between Rp. 100 000 and Rp. 350000 per month. On a daily basis, the average worker's income is Rp. 6 797, which is well above the 1995's regional minimum wage (Rp. 3800). About 87.5% of workers stated that the reward was adequate and matched the kind of work carried out. Almost all workers (92.5%) agreed that their earnings were sufficient to meet their daily needs.

3 RATTAN PLANTATIONS

Resources

Some of the fast-growing rattan species are: *Calamus manan* and *C. axillaris* with a 1-2 m annual increment, and *C. caesius* with 4 m annual growth (Menon 1979). Most rattans harvested in Java come from natural forests, the main species being balukbuk (*Calamus burckianus* Becc), seuti (*C. ornatus*), cacing (*C. adpersus* B1.) and seel (*Daemonorops melanochaetes*). Wild rattan grows in some West Java KPHs, such as Purwakarta, Banten, Sumedang, Garut, Tasikmalaya, Bogor, Sukabumi, Bandung Utara, Bandung Selatan, Ciamis, Kuningan and Cianjur. Some KPHs in Central Java and East Java also have wild rattan. The actual stock of rattan in all these forests is unknown, but only meagre quantities of such rattan is harvested. This has prompted the establishment of commercial-scale rattan plantations.

Commercial-scale rattan plantations are located mainly in production forest (a forest earmarked for the extraction of timber and non-timber products) areas where the main tree species are teak (*Tectona grandis*), merkusi pine (*Pinus merkusii*), mahogany (*Swietenia macrophylla*), agathis (*agathis* sp.), rasamala (*Altingia excelsa*), puspa (*Scbima* spp.), etc. as these tree species provide suitable support for rattan.

Rattan generally grows on various types of soil. Irit (*Calamus trachycoleus*), which requires a humid alluvial soil condition (Menon 1979 is an exception. Some rattans grow on lowland areas at an altitude of 0-300 m, while others grow on highland areas at an altitude of more than 300 m (Dransfield 1974; Alrasyid 1986). Sega (*C. caesius*) and irit (*C. trachycoleus*) are examples of rattan planted on lowland areas. Examples of highland (more than 600 m) rattan are manau manan and tohiti (*C. inops*).

Rattan plantations in Perum Perhutani forests are set up using two techniques: agroforestry in production forest areas, and enrichment planting in protected and natural forests. Since rattan plantation is meant for commercial purposes, the species chosen are those with high economic values such as sega (*C. caesius*) and manau (*C. manan*). Other species such as seel (*Daemonorops melanochaetes*) and seuti (*C. ornatus*), known as the local species, are also planted to a limited extent.

The development of rattan plantations in Java started as a pilot project in 1982. Planting activities started in 1983 in the forest areas of West Java Perum Perhutani, followed by those of Central Java and East Java Perhutani. Earlier, the rattan seedlings required used to be imported from other islands. Later, in order to overcome this dependence, Perhutani developed seed orchards in KPH Bogor and KPH Cianjur. In 1994, a rattan germination centre was established in BKPH Jonggol, West Java, with the seeds coming from KPH Cianjur and KPH Bogor. The extent of rattan plantation in Java up to 1992 is shown in Table 5. Around 50% of rattan plantations are located in West Java Perum Perhutani areas. One reason for this is the availability of ecologically suitable sites. Both manau and local

species are being cultivated (proportion 61% and 36%, respectively). Recent data (1995) show that the extent of plantation in West Java was 20 548.8 ha. Taking this into account, the total extent of plantation in Java adds up to around 37 000 ha.

Table 5: Areas in Java planted with rattan (1983-92)

Species	Planted area (ha)			Total (ha)
	Central Java	East Java	West Java	
Local	3 005.15	3 785.95	5 021.01	11 812.11
Irit	0.00	9.60	30.00	39.60
Sega	533.20	5.40	579.60	1 118.20
Manau	3 655.30	5 868.70	10 504.42	20 028.42
Total	7 193.65	9 669.65	16 135.03	32 998.33

Source: Perum Perhutani, Jakarta, 1995.

Rattan is planted during the rainy season (December-January) when the rainfall is relatively high and the ground wet. Sega and irit grow in clusters which require wider spacing of supporting trees: 8 x 8 m, or 160 trees/ha. Two planting holes are made close to each supporting tree and two or three seedlings are planted in each hole. Approximately 600-650 rattan seedlings are planted in 1 ha of land. Replacement planting is not necessary in this case.

The number of seedlings planted per hectare is more in the case of manau than for irit or sega as this species grows individually. The supporting trees are spaced out 6 x 6 m, that is, 250 trees per hectare are needed. Two planting holes are made close to each supporting tree and one or two seedlings are planted in each hole. Approximately 750-1 000 seedlings will be required for a 1 ha plantation. Like sega and irit, manau does not need replacement planting but it needs some protection against pest infection.

Rattan plantation development in West Java has decreased since 1992, as shown in Table 6. The area of rattan plantation in West Java is 20 548 ha which is only 4% of the total production forest area (511578 ha). In East Java, rattan planting has stopped since 1992. The main reasons for this situation are scarcity of daily workers and the difficulty in applying a rattan-support tree management regime that fits in with the company's timber management plans.

Table 6: Development of rattan plantations in West Java and East Java

Year	West Java		East Java	
	Area (ha)	%	Area (ha)	%
1983	30	0.2	—	—
1984	114	0.6	—	—
1985	482	2.3	—	—
1986	166	0.8	—	—
1987	221	1.1	—	—
1988	119	0.6	—	—
1989	2291	11.2	2522.8	21.2
1990	4238	20.6	2850.6	23.9
1991	3656	17.8	3582.8	30.1
1992	4889	23.8	2959.5	24.8
1993	1731	8.4	—	—
1994	1609	7.8	—	—
1995	988	4.8	—	—
Total	20548	100	11914.7	100

Note: — = No planting activity. Source; Perum Perhutani West and East Java, 1995.

To assess the profitability of rattan plantation, KPH Cianjur in West Java can be taken as a sample. Trees used here for supporting rattan are species such as meranti (*Shorea* spp.), Puspa (*Scypha bancana*), Acasia mangium and merkusi pine (*Pinus Merkusii*). Rattan species planted are mostly sega and manau, exotic rattan species from other islands, and local species like seel and seuti. A pine-and-manau plantation is taken here as a sample for financial analysis.

The Perhutani pays the plantation workers on a daily basis (*banjar Barian*) or on the basis of the *taungya* system (*tumpang sari*). Wage payment on a daily basis is more prevalent. Activities paid for on a daily basis are site preparation, planting and plantation maintenance. The amount of the wage is determined based on a fixed daily rate or on the volume of work accomplished.

Plantation maintenance is carried out twice during the rattan rotation period, in the first and second years. Thinning of pine is done three times during the tree rotation - firstly when the tree is 5 years old, secondly when it is 10 years old and thirdly when it is 15 years old. The trees are clear-felled when 25 years old. The establishment of the rattan plantation takes place after the second thinning of the pine stands, when the trees are 10 years of age. Therefore, the establishment of rattan plantations is done only once during the tree rotation period. The first revenue from a pine-rattan plantation is generated after 15 years, by way of sale of timber from the third thinning, and the second is after 25 years, when the clear-felled trees and the rattan harvested are sold. Normally, the company does not earn any revenue from the first and second thinnings.

From interviews and field observations, it was gathered that manau can grow to 30 m long in 11 years. In 15 years, a mature stem may reach 40-45 m in length, constituting around 10 pieces of rattan. An empirical study showed that on an average, manau grows 2.4 m annually. Taking the rattan rotation period to be 12 years, the length of stem for harvest may reach 31 m. The number of stems harvested per hectare is 750. Assuming a recovery of 90%, the number of pieces (each piece is 3.5 m long) will be more than 5 450 per hectare. The projected output of pine-rattan plantation is given in Annexe 5.

Plantation Management

Seed

Manau planted for seeds in 1985 in BKPH Jonggol and in 1994 in BKPH Leuwiliang, Bogor, produced enough fruits to meet the seed and seedling requirements of 1995 to 1996 plantations. The seed production in two BKPHs was less than 0.5 ton in 1994, but had reached 5 tons (gross weight) in 1995.

Rattan generally starts fruiting in February-March. The fruits are ready for harvest in July-August. Rattan fruits are stored for only less than 10 days after harvest to maintain their high viability. Pre-treatment of seeds to remove their scales and flesh is needed before planting.

Labour and wages

Work related to germination includes rattan fruit collection from seed orchards; their transportation to the germination centre; fruit processing by removing flesh; soaking of seeds and their germination. Rattan fruit collection and transportation are done by both men and women. The tools used for fruit collection and processing - knives, sacks and boxes - are provided by Perum Perhutani.

Germination work provides good employment opportunities. On an average, a worker works for 7 hours a day and 26 days a month. The workers are employed on a contractual basis, with a standard payment of Rp. 100/Kg for fruit collection plus the cost of transportation to the germination centre at the rate of Rp. 50/Kg. The processing wage is Rp. 150/fruit. The workers thus may earn about Rp. 12 450 per day for fruit collection and Rp. 2 400-14 250 for fruit processing.

The workers' monthly incomes from rattan germination activity may vary between Rp. 63 000 and Rp. 285000. However, the work lasts for only one month in a year. Therefore, its contribution to the workers' annual household incomes is relatively low, ranging from 6% to 26%

Work in rattan nurseries involves several activities such as soil sieving, weaning, tending and weeding, polybag filling, field cleaning and seed-bed construction. These are carried out by men, women and children. A study shows that 70% of nursery workers are women and children. Children normally do the work after school or during the school holidays. Since work in the nursery provides employment

round the year, it has become an attractive occupation for the people in the study area.

This study found workers to be satisfied with their work in the nursery. Working hours vary slightly from one nursery to another, depending on the work demands and wages in the local agricultural sector. Perum Perhutani has established payment based on the local wage standard and number of working hours in the agriculture sector in that particular area. The effective working day in the nursery is 5-7 hours, while the average working month is 26 days. The workers are paid daily for all types of work, except for polybag filling which is contracted. This job may also be done by children after school. Men and women are paid differently as in the agricultural sector. Men are paid Rp. 3000/day while women get Rp. 2 500/day for the same working hours (8 A.M. to 3 P.M). The contractual payment for polybag filling is Rp. 3/bag, made once a week'.

The workers may earn, on an average, Rp. 65 000/month from nursery work. In general, the men work in the agricultural sector, trading or poultry farming, 'while their women and children work in the nurseries to earn an average household income of Rp. 116 480/month. As rattan nursery activities take place all the year round, they contribute about 56% of a worker's annual household income.

Rattan plantations are established in production and natural forests which generally have rough terrain conditions. Therefore, planting is done mainly by men, as a seasonal activity which lasts for three months in a year from December to February. A normal working day is 7 hours and a working month 24 days. Payment, at an average of Rp. 3500 per day per person, is made once a week. The total monthly earning from planting averages Rp. 81000 per worker, and may contribute as much as Rp. 18 500/household/month to the family income when annual income is considered.

The other main occupation of the people in the area is farming. They work as labour in farms, tea plantations, and for pine or damar tapping. The total income from these activities averages Rp. 91300/household/month. Work in rattan plantations is estimated to contribute 17% of the total household income.

Cost Structure

As can be seen from Table 7, development costs for one hectare of nursery with 400 seed beds is Rp. 46139750. Each seed bed may contain 750 seedlings and one hectare nursery may contain 300000 seedlings. Costs for planting and tending of rattan in a plantation are given in Table 8.

Table 7: Expenditure for developing rattan nursery (per ha, 1994-95)

Work	Cost (Rp)
Germination*	24 000 000
Land preparation	
a. Site preparation	45 000
b. Weaning bed construction	90 000
c. Path construction	16 000
d. Workit construction	350 000
e. Nursery tags	25 000
Sub-total	1336 000
Equipment, supplies and transportation	
a. Top soil	1 599 000
b. Fertilizer	630 000
c. Sand	612 000
d. Polybag	14658 750
e. Watering can	80 000
Sub-total	17 579 750
Nursery preparation	
a. Polybag filling	393 000
b. Weaning	65 500
c. Weeding	1 350 000
d. Watering	1 350 000
e. Seedling selection/transportation	65 500
Sub-total	3 224 000
Grand total	46 139 750

Note: * = at the rate of Rp. 80/seedling. Source: Office of KPH Bogor, 1995.

Till the completion of this study, no harvesting had been carried out by Perhutani in its 'plantations. Therefore, for analytical purposes, the base price of plantation rattan is calculated based on the planting costs in KPH Cianjur and KPH Sukabumi, and harvesting costs incurred in natural rattan collection in KPH Kuningan. The analysis shows that base price of rattan plantation per piece of rattan (4 m in length) is Rp. 737 (Table 9).

Table 8: Expenditure for developing rattan plantation (per ha, 1994-95)

Work	Cost (Rp)
Seedling transportation	50 000
Site preparation	32 000
Planting hole preparation	48 400
Planting	13 600
Tending	51 200
Total	195 600

Source: Kantor Kesatuan Pemangkuan Hutan Bogor, 1995.

Table 9: Estimated base price of plantation rattan in KPH Cianjur and KPH Sukabumi

Cost components	Volume or unit	Cost per unit (Rp)	Total cost (Rp)
Seeding	750 pieces	135	102 250
Planting	1 ha	126 430	126 430
Tending (thrice)	1 ha	39 375	39 375
Harvesting	5 451 pieces	275	1 499 025
Sub-total			1 766 080
Overheads	20%		353 216
Marketing	15%		264 912
Forest products fee	5 451 pieces	300	1 635 300
Grand total			4 020 508

Base price per piece of rattan = 4 020 508 + 5 451 = 737.50

Note: Base price includes land rent incurred for rattan seedling establishment.

Cost-Benefit Analysis

Costs incurred are for Year 0 (establishment of supporting trees), Year 1 (first year tending), Year 2 (second year tending), Year 5 (first thinning of trees), Year 10 (second thinning), Year 15 (third or commercial thinning), and Year 25 (clear-felling of trees and harvest of rattan). Rattan base price used in the analysis is Rp. 737.50 per piece. Based on diameter, length and quality, the assumed price of pine logs from commercial thinning (Year 15) is Rp. 37 150 per m³ and Rp. 90000 per m³ from clear-felling.

On the basis of the data and assumptions above, the cost incurred during rotation (25 years) period of the plantation is Rp. 2 003 997, while the sales of pine and manau earn Rp. 13 847 635. Thus, the profit margin is Rp. 11 843 638 (please see Annexe 5). In comparison, forest land planted with only pine will incur in 25 years a cost of Rp. 913 082 and earn from sale of logs Rp. 9 830 248. The profit margin earned is thus only Rp. 8 917 166 (please see Annexe 4). Hence, it follows that forest land intensification using pine-manau intercropping is financially a more attractive option than monocropping with pine.

The two management regimes can be compared during the rotation period. Results show that forest land monocropped with pine tree gives an internal rate of return (IRR) of 14.8% while forest land intercropped with pine tree and manau yields an IRR of 15.6%. The results of the net present value calculation at different discount factors can be seen in Annexes 4 and 5.

4 DISCUSSION

Plantations

Policy

As a state-owned enterprise, Perum Perhutani has two objectives: to generate profit from forest management and to function as an agent of development. The second objective carries a social responsibility discharged by providing job opportunities for the people living near the forest areas. Rattan plantation development and natural rattan collection are thus in line with this objective. Presently, rattan is not considered as economically significant as timber and other forest products. However, rattan plantations, as shown in this study, are expected to enhance forest value in the future. This is in line with the first objective.

Constraints

Some constraints, such as the non-availability of daily workers and of production forest area suitable for rattan plantation, may hamper future development of rattan plantations. The first constraint is in part caused by the non-competitiveness of the wage rates compared with other jobs. The second is mainly attributed to the company's tendency to give priority to some forest products, like timber, over rattan.

Opportunities

Rattan plantations bring certain socio-economic benefits to people. If properly managed, they safeguard the sustainability of the forests while providing additional income for people who live in the surrounding areas. The demand for raw rattan in Java is increasing in line with the 'demand for finished rattan products. This, in turn, can create market opportunities for rattan plantation.

Manufacturing Industry

Policies

Government policies on rattan are clearly in favour of the development of the finished products industry, which can generate employment and add value. This attitude is consistently reflected in export regulations, and has boosted the development of the rattan manufacturing industry in Java.

Constraints

The development of the manufacturing industry in Java has created dependence on raw rattan from other islands. Some local government restrictions on inter-island trade of raw rattan, such as in Sulawesi, may cause a price increase for raw rattan. This is likely to make the industry less competitive.

The role of small and home-based manufacturers is very important to the overall well-being of the manufacturing industry as these contribute substantially to the manufacture of finished products under sub-contract. However, the profitability of the home-based manufacturers is relatively low when compared with that of larger manufacturers, and this issue needs to be addressed to make the business more attractive. This may be done through improving the accessibility of home-based manufacturers to raw material, capital and markets.

Opportunities

The immediate future of rattan products, in both international and domestic markets, is quite promising. This is clearly reflected in the ever-increasing export value of Indonesian rattan products and the steady growth of the domestic market.

5 RECOMMENDATIONS

Policies

1. The inter-island trade restrictions on raw rattan imposed by local governments in other islands may hamper the development of the rattan industry in Java. Such restrictions are inconsistent with the national policy and should therefore be lifted.
2. To avoid further decline in rattan plantation activities, the scarcity of workers needs to be overcome by improving the existing wage rates so that they are competitive with other jobs.
3. The tree species-rattan intercrop management regimes need to be improved to fit with the existing stand management practices so as to maximize financial returns from rattan plantations.
4. Rattan should be given more attention at the top management levels so that it can be integrated into corporate plans.

Technical

1. The know-how and technical skills of home-based and small-scale manufacturers need to be improved if the industry is to be transformed into one that produces high-quality finished products.
2. The accessibility of home-based and small-scale manufacturers to market information, raw material and capital needs to be improved. This will enable them to increase their profits, improve the welfare of their workers and strengthen their role in the overall development of the industry.
3. Although intercropping of trees and rattan results in improved profitability of rattan plantations, further research on an optimal management regime is needed to maximize profitability.

Institutions

1. The functions of industry associations should be modified to create a beneficial impact on its members.
2. Policies that lead to the formulation and implementation of a strategy that would sustain the availability of raw material at reasonable and stabilized prices need to be pursued. The price at the collectors' level should be improved so as to encourage the collectors to stay in the business. Although in the short run it may cause some price increase, it will sustain supply of raw material in the long run.

3. An auction market for raw rattan may be established through a cooperative of rattan collectors.

4. The government should strengthen cooperatives through provision of capital and improvement of their management and product marketing skills, so that such cooperatives will serve the interests of their members (such as home-based and small-scale manufacturers) in acquiring raw material at reasonable prices and marketing products.

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ANNEXE 1

The following table shows the production costs and base price of natural rattan in Java (KPH Kuningan). The data show the average costs paid by raw rattan (semi-dry) consumers: Rp. 625 per cane from Perum Perhutani including transporting cost to the factory in Cirebon.

Base Price of Natural Rattan in Java, KPH Kuningan

Cost components	Rattan cost (Rp/cane)		
	1-2 cm dia.	2-3 cm dia.	3-4 cm dia.
Harvesting	25	25	25
Transporting to village border'	150	200	250
Transporting to collecting yard ²	50	50	50
Transporting to factory ³	50	50	50
Forest products fee	300	300	300
Total	575	625	675

Notes: 1 = manual transportation; 2 = transportation in pick-up van; ; 3= transportation in truck. Price calculation is based on green semi-dried cane of 3.5-4 m length. Harvesting, transportation charges (to village) and the forest product fee are set by the company.

Calculation of collector's (worker's) earnings per day:

1. A worker who collects 15 pieces of balukbuk (diameter 3-4 cm) earns:
 Collecting (harvesting) wage = 15 x 25 = Rp. 375
 Carrying to village = 15 x 250 = Rp. 3750
 Total earning = Rp. 4125 a day.

2. A worker who collects 30 pieces of seel (diameter 1-2 cm) earns:
 Collecting wage = 30 x 25 = Rp. 875
 Carrying to village = 30 x 150 = Rp. 4500
 Total earning = Rp. 5375 a day.

Variations may occur as the workers collect mixed species. Factors that limit a worker's capacity include his carrying capacity (normally 45-50 kg; a piece of green rattan with diameter 3-4 cm can weigh 3-3.5 kg). It is worth noting that there is another practice whereby the collector carries semi-cleaned rattan from the forest to the village, where the rest of the work (cutting to size and cleaning up the nodes) is done. The cleaned rattan is subsequently carried to the collecting point after a few days'.

ANNEXE 2A

Characteristics of the rattan manufacturing industry in Cirebon

Sample	Fixed (000 Rp)	Capital Working (000 Rp)	Total (000 Rp)	Average (000 Rp)	No. of workers	Production capacity (pieces)	Product	Raw material (tons)	Remark
1	7500	2000	9500	11000	5	150	CS	10	IHM
2	10000	2500	12500		5	300	CS	12	IHM
3	7500	6500	14000	18563	6	1200	PAR	12	SC
4	10000	8750	18750		18	1800	PA	5	SC
5	12500	10500	23000		14	3600	PA	9	SC
6	75000	75000	150000	190000	22	5500	PR	25	S M
7	75000	120000	195000		20	6240	PA	50	S M
8	100000	125000	225000		56	12870	PA	35	S M
9	450000	200000	650000	716667	75	40000	PAR	150	M M
10	450000	250000	700000		55	40000	PAR	125	M M
11	500000	300000	800000		60	25000	PRF	195	M M
12	1250000	500000	1750000	1950000	150	35000	PRF	240	L M
13	1650000	500000	2150000		365	45000	PRF	385	L M

Notes:

. Product: CS = Chair sets, ready to use; PAR - Pieces of woven chair + chair frame; PA = Pieces of woven chair; PR = Pieces of chair frame; PRF = Pieces of woven chair + finished chair frame.

Remark: IHM = Independent home-based manufacturer; SC = Sub-contractor (home-based); SM = Small-scale manufacturer; MM = medium-scale manufacturer; LM = Large-scale manufacturer.

Exchange rate: US\$1 = Rp. 2300.

ANNEXE 2B

Benefit-cost (BC) ratio, internal rate of return (IRR) and net present value (NPV) based on financial analysis

Sample	BC ratio DF = 12%	Average BC ratio	IRR (%)	NPV DF=12%	NPV Average	Remark
1	1.0046	1.0021	13.34	975.3	431.6	IHM
2	0.9996			-112.1		
3	1.0009	1.0047	13.77	240.8	662.7	SC
4	1.0138			1944.6		
5	0.9995			-197.2		
6	1.0212	1.0250	21.42	17403.7	30307.5	SM
7	1.0212			19374.5		
8	1.0327			54144.3		
9	1.0418	1.0359	21.86	166215.1	180669.0	MM
10	1.0290			138753.2		
11	1.0367			217038.7		
12	1.0874	1.0790	26.21	791136.9	936658.2	LM
13	1.0706			1082179.5		

Notes:

BC = Benefit-cost; DF = Discount factor; IRR = Internal rate of return; NPV = Net present value. IHM = Independent home-based manufacturer; SC = Sub-contractor (home-based); SM = Small-scale manufacturer; MM = Medium-scale manufacturer; LM = Large-scale manufacturer.

ANNEXE 3

Projected output of manau rattan and pine during 25 year rotation (per ha)

output	Unit	Year 1	Year 2	Year 15	Year 25
Pine* (roundwood)	m ³			10.72*	104.80
Rattan	piece	-			5451

Notes: 1 = Data on pine from Perum Perhutani West Java (1995); 2 = Volume of commercial thinning.

ANNEXE 4

Costs, revenue, NPV and IRR of pine plantation (per ha)

Year	cost	Revenue	Net revenue	DF=15%	DF=14%	NPV at DF=15%	NPV at DF=14%
0	154626	0	-154626	1	1	-154626.00	-154626.00
1	132691	0	-132691	0.8696	0.87719	-115388.10	-116395.61
2	70865	0	-70865	0.7561	0.76947	-53581.03	-54528.316
5	10300	0	-10300	0.4972	0.51937	-5121.16	-5349.4972
10	10300	0	-10300	0.2472	0.26974	-2546.16	-2778.3612
11	0	0	0	0.2149	0.23662	0	0
12	0	0	0	0.1869	0.20756	0	0
13	0	0	0	0.1625	0.18207	0	0
14	0	0	0	0.1413	0.15971	0	0
15	10300	398248	387948	0.1229	0.1401	47678.809	54350.15
25	524000	9432000	8908000	0.0304	0.03779	270803.2	336634.734
Total	913082	9830248	8917166	-	-	-12780.43	57307.0955

Notes:

Costs in Year 25 are mainly the harvesting cost for pine, calculated at the rate of Rp. 5000/ m3. DF = Discount factor; NPV = Net present value.

ANNEXE 5

Costs, revenue and NPV of pine+rattan (manau) plantation

Year	Pine cost	Rattan cost	Total cost	Pine revenue	Rattan revenue	Total revenue	Net revenue	DF=15%	DF=18%	NPV at DF 15%	NPV at DF 18%
0	154626	0	154626	0	0	0	-154626	1	1	-154626	-154626
1	132691	0	132691	0	0	0	-132691	0.8696	0.8475	-115388.09	-112455.62
2	70865	0	70865	0	0	0	-70865	0.7651	0.7182	-53581.027	-50895.243
5	10300	0	10300	0	0	0	-10300	0.4972	0.4371	-5121.16	-4502.13
10	10300	0	10300	0	0	0	-10300	0.2472	0.1911	-2546.16	-1968.33
11	0	110000	110000	0	0	0	-110000	0.2149	0.1619	-23639	-17809
12	0	32750	32750	0	0	0	-32750	0.1869	0.1372	-6120.975	-49393
13	0	32750	32750	0	0	0	-32750	0.1625	0.1163	-5321.875	-3808.825
14	0	16000	16000	0	0	0	-16000	0.1413	0.0985	-2260.8	-1576
15	10300	0	10300	398248	0	398248	387948	0.1229	0.0835	47678.809	32393.658
25	524000	899415	1423415	9432000	4017387	13449387	12025972	0.0304	0.016	365589.549	192415.552
Total	913082	1090915	2003997	9830248	4017387	13847635	11843638			44663.268	127325.24

Internal rate of return (IRR) = 15.6%.

Notes:

Costs at Year 25 are the harvesting cost for pine and rattan, calculated at the rate of Rp. 5000/m³. Harvesting cost for rattan is assumed as 60% x Rp 275 = Rp. 165 per piece, where Rp. 275 is the rate per piece for harvesting rattan from natural forest.
DF = Discount factor; NPV = Net present value.