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Economic Analysis of Smallholder Rubber Plantations in West Garo Hills District of Meghalaya

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I

INTRODUCTION

Rubber plantations in India were started by the British. The economic importance of rubber plantation in India hardly needs any emphasis. Rubber plantations supply raw materials for the production of many industrialised goods required for automobiles, aircrafts, railways, textile industries, sports goods, engineering goods and even for building roads. On account of the multifarious uses to which rubber can be put to, the consumption of rubber in the world as well as in India has been increasing steadily. The total rubber plantation area in India is 5.70 lakh ha. India is the third largest producer of natural rubber next only to Thailand and Indonesia contributing about 9 per cent of the global output. India is the fourth largest consumer next to China, USA and Japan. More importantly India's average rubber productivity is 1631 kg. per hectare is the highest among the major natural rubber producing countries. The country has experienced substantial transformation in the production structure with the entry of the native peasantry, eventually leading to proliferation of smallholder systems under various socio-economic, political and institutional contexts. Resultantly, the Indian rubber plantation industry is dominated by small holdings having an average size of less than 0.5 ha. Smallholdings account for nearly 88 per cent of the total area under rubber and the total production of natural rubber in the country.

Rubber Board is responsible for the overall development of the rubber industry in India. Rubber Board is concentrating on enhancing production of natural rubber in non-traditional areas of North Eastern states by offering various incentives, research support, developmental packages and extension which have contributed substantially to create awareness and bringing more areas under rubber cultivation. The cases of North East India seem to be unique in terms of the dynamic responses of smallholder communities towards adoption of rubber farming systems with integration of variety of agro-forestry practices and co-existing rubber-farm livelihood systems in the emerging rubber economies of North Eastern States of India (Viswanathan and Shivakoti, 2005).

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Introduction of rubber in Meghalaya was done only in 1970 by the Government of India mediated through the institutional interventions by the Rubber Board. The rationale for introduction of rubber in Meghalaya has been justified on two grounds, viz., (a) to meet the ever growing domestic demand for natural rubber; and (b) to rehabilitate the jhum practising tribal farmers. Meghalaya accounts for 4635 ha under rubber cultivation. Altogether there are 3750 rubber smallholders in Meghalaya with an average size of holding of 0.56 ha. Most of these tribal farmers were practising shifting cultivation (jhuming) where they cut and burn the fallow vegetation, cultivate the cleared land (typically 1 to 3 years) and then abandon the site (from 3 to 20 years) to forest or bush cover (Sachchidananda, 1989). A major consequence has been the destruction of forest, increased soil erosion from crop land, resulting in declining soil fertility and lower crop yields (Moursi, 1984; Christianity, 1986). With a view to arrest the recurrent natural resource degradation and enhancing income and employment, rubber plantation was introduced as an alternative land use to shifting cultivation. The expansion of rubber cultivation in Meghalaya was promulgated under the institutional aegis of the Rubber Board (Government of India). The rubber plantation development programmes are designed under three major schemes, viz., (a) Block Planting Scheme (BPS); (b) Group Planting Scheme (GPS); and (c) Individual Planting Scheme (IPS). It is envisaged that the tribal jhum farmers are taking up rubber plantation work initially as wage workers in the plantations and earn their livelihood till the plantation starts yielding (say 5-8 years). Once the plantations attain the yielding stage, the farms are transferred to the tribal farmers for permanent cultivation. The economic life of a rubber plantation is expected to last for 20-25 years, which sustain the livelihood of smallholders (Krishnakumar and Meenattoor, 1999; Mohanan *et al*., 2003). Although the relative profitability is a critical policy input in the farm management decisions for the annual as well as perennial crops, the long run price stability has added significance in the case of perennial crops for three important reasons, viz., (1) higher initial investment, (2) longer gestation period and (3) longer economic life. Relative profitability ensured under a comprehensive institutional support mechanism in which protected price policy had been the critical component was the main reason for expansion of area under rubber (Lekshmi and George, 2003).

Statement of the Problem

Shifting cultivation, locally known as jhuming, is the predominant system of land use in Meghalaya. The significance of this land use system in the present day is more because of the maladies associated with it. Resource degradation, low productivity, little or practically no scope for application of improved agricultural production technology are some of the drawbacks of this system. 'Jhuming cycle' in the same land which extended to 20-30 years in olden days has now been shortened to 3-6 years because of increase in population pressure on land and decrease in productivity

leading to utilisation of more area under 'jhuming' (Borthakur *et al*., 1978). Continuance of shifting cultivation lead to soil erosion resulting in declining fertility and low yield. This occurs mainly due to the loss of soil organic matter and nutrients contained in the eroded sediments. The average annual loss of top soil from hill slopes (60-70 per cent) in the first year, second year and abandoned jhum in Meghalaya was estimated to be 147, 170 and 30 tonnes per ha respectively (Singh and Singh, 1978). To prevent the colossal loss of natural resources due to the practice of jhuming, rubber plantation was introduced by the Government of Meghalaya on a large scale as an alternative land use in degraded jhum land of hill slopes with the twin objectives of generating additional income and employment to jhum practicing farm families and to prevent the loss of natural resource. Rubber plantations in degraded hill slopes control erosion in two ways. As a barrier it checks run-off of water and as a cover it reduces the raindrop impact. While nitrogen and phosphorus loss is avoided under this, carbon quantity is not affected. The foliage may be used as mulch and manure. Among the districts of Meghalaya, the problem of shifting cultivation is most severe in West Garo hills district. Therefore, the Government of Meghalaya has taken up rubber plantation on a large scale as an alternative land use of jhuming. There are two reasons for introduction of rubber as the alternative land use to jhuming: (i) Rubber is a labour intensive crop and has the potential for creating higher employment opportunities and (ii) there is an organised institutionalised marketing system under the direct supervision of Rubber Board. Labour shortage is considered as the emerging problem behind the decline in natural rubber production in Malaysia (Ngkoktee, 2001). In case of land tenure system of the district where community ownership in land exists and the village head (Nokma) distributes the land for cultivation, the tribal jhumiya families preferred to go in for rubber plantation than the annual crop cultivation as they had the control over the land for a longer duration because of longer gestation period of rubber plantations (Viswanathan and Shivakoti, 2005).

The rubber marketing system is institutionalised in West Garo hills district through the licensing system regularised by Rubber Board. There are about 15 dealers in Meghalaya. There are also numerous unlicensed private rubber dealers at the village level who act as middlemen between the rubber growers and the dealers. Being the sole promotional agency for organised rubber cultivation, the Rubber Board by itself has also been very active in the market through numerous rubber producers'/growers' societies and rubber marketing societies. As per such institutional arrangements, rubber small-holders sell their produce to any of the above three sources depending on the price situation or proximity to such sources. The extension services are provided to rubber growers through field officers stationed at various locations.

Because of assured market and extension services from Rubber Board, a large number of jhum farmers have taken up rubber plantation in the West Garo hills district as an alternative land use to jhuming. Till now there is no comprehensive

study on the economics of smallholder rubber plantation in West Garo hills district. Therefore, there is an urgent need to study the economics of smallholder rubber plantation in West Garo hills district. The information generated in this study will throw light to the planners and policy makers and financial institutions to formulate suitable policy package for smallholder rubber plantation programmes for generation of additional income, employment and restoration of environmental sustainability in the district.

The specific objectives of this study are: (1) To estimate the cost and returns of the smallholder rubber plantation. (2) To measure the extent of labour absorption in smallholder rubber plantation; and (3) To evaluate the productivity of capital invested.

II

METHODOLOGY

Rubber plantation have been taken up at West Garo hills district in Meghalaya under the shifting cultivation control programme at the behest of Rubber Board. Small scale rubber plantations (0-2 ha) have been introduced in the individual jhum (shifting cultivation) plots of the tribal farmers to wean away the tribal farmers from shifting cultivation to settled cultivation. Among the blocks of West Garo hills district, maximum jhum area have been brought under small scale rubber plantations in Rongram block. Therefore Rongram block was purposively selected as the sample block for the study. Two villages where small scale rubber plantations had been taken up on a larger scale were selected at random. Forty households having small scale rubber plantations were selected from two selected villages by following the probability proportional random sampling technique. Classical percentage analysis was used to estimate the cost and returns of the rubber plantations. The study pertains to the year 1998-99. For estimating the economics and investment analysis one nodal plantation of farm having the average plantation size of one ha was selected. Since the average life span of the plantation was 32 years, the cost of nodal plantation farm on capital items, operation and maintenance and production for 32 years was calculated. While static analysis for a given year/period is more appropriate for seasonal and annual crops, perennial crops like rubber require inter-temporal analysis (Rae, 1997). Hence to account for the value of time and to include the concept of time preference, a cash-flow analysis of small holder rubber plantations is attempted following the undiscounted and discounted cash flow approach as suggested by Predo (2003) and Brian *et al.* (2004). Since the collection of time series data pertaining to single farm holding is difficult, the analysis of the life cycle data was made based on the cross sectional information from rubber holdings of different ages to approximate the entire plantation life cycle. All cost items are considered including the initial plantation development costs as well as the routine agro-management costs like the

costs for weeding, inorganic fertilisers application, tapping etc. The following undiscounted and discounted measures of project worth were used in this study.

(a) *Payback Period*: It is undiscounted measure of capital investment where time value of money is not taken into account. The payback period is the length of time from the time of plantation until the net value of the incremental production stream reaches the total amount of the capital investment. The payback period is a common, rough means of getting an idea about the time of getting back the amount of capital investment made in the plantation.

(b) *Net Present Value (NPV):* The NPV of cash flows have been computed as:

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} \qquad \ldots.(1)$$

Where, B_t = benefit from rubber plantations in each year,
C_t = Cost of rubber plantations in each year,
r = discount rate,
t = 1,2, 3…. n, the entire life of the plantation across the study region (comprising seven years of immaturity period, followed by 25 years of rubber production cycle).
n = number of years.

(c) *Benefit-Cost Ratio*: It was estimated by using the formula:

$$B:C Ratio = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$$

(d) *Internal Rate of Return (IRR):* It is used here to evaluate the overall feasibility of smallholder rubber plantations in the study area. IRR is the discount rate that would be required to make the present net value of the costs of farming operations equal to the present value of benefits accrued from rubber plantations. Derivation of the IRR is analogous to solving for 'r' in the equation 1, as:

$$0 = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} \qquad \ldots. (2)$$

III

RESULTS AND DISCUSSION

All the rubber growers in the study area were tribals. The growers belonged to the clans Marak. The profile of sample rubber growing households is presented in Table 1. The table brings out that majority of the sample households are male headed with an average age profile of growers being 41.25 years. The rubber plantation experience of the growers in the study area is only 25 years which could be explained as due to the relatively recent introduction of rubber cultivation in Meghalaya. The importance attached to educating the children is moderately higher with 36 per cent of the children being sent to school. The proportion of economically active population is found to be of higher level in the study area of about 57 per cent. In the study region, the pursuit of farm related activities other than rubber cultivation mainly include rice cultivation either in plains or hills, growing of food and cash crops and vegetables and practice of jhum with different degrees of intensity. While rice cultivation is the predominant activity in the study area (73 per cent), practice of jhum with the intensity of 42 per cent is reported. The average size of rubber holding is 1.00 ha, which also signifies the strength of the rubber households in terms of their access to natural capital which is the mainstay of their livelihood asset base. The diversification to activities other than rubber and other farming practices is also an important indicator determining the sustainability of livelihood of the rubber smallholder. In this regard, Table 1 shows that the rubber smallholders have a diversified farm livelihood system as majority of the households practice multiple farming activities like fishery, livestock, piggery and poultry. In this regard, an

TABLE 1. PROFILE OF RUBBER SMALLHOLDER IN MEGHALAYA

Sr. No.	Profile	
(1)	(2)	(3)
1.	Male lead household (No.)	40
2.	Average age of the smallholders (years)	41.25
3.	Experience in rubber farming (years)	25
4.	Total number of family members	255
5.	Male family members (per cent)	52
6.	Children studying (per cent)	36
7.	Economically active population (per cent)	57
8.	Average family size (No.)	6
9.	Farmers growing rice (per cent)	73
10.	Farmers practicing jhum (per cent)	42
11.	Farmers growing other crops (per cent)	82
12.	Average holding size (ha)	2.32
13.	Average rubber area (ha)	1.00
14.	Average rice area (ha)	0.32
15.	Household with fishery (per cent)	54
16.	Household with piggery (per cent)	61
17.	Household with poultry (per cent)	65
18.	Household with livestock (per cent)	71

Source: Farm Household Survey.

important point which deserves mention is that in the study region, the tribal communities have been following such diverse combination of activities from historic times within a 'full belly' or 'subsistence production' framework (Das Gupta, 1999; 2002).

Cost Structure:

(A) *Cost of Establishment*: Establishment cost included all the expenses incurred during the first six years till the plantation come to commercial yielding stage. The total establishment cost comprised preparatory operations, terracing, lining etc., filling and planting, cost of planting materials, pruning/brunch induction, fertiliser and manure, cultural operations, plant protection, cover crop establishment, drainage and other miscellaneous work, and boundary protection and foot path. The estimates of establishment cost computed from the data are presented in Table 2. It could be

TABLE 2. COST OF ESTABLISHMENT OF RUBBER PLANTATIONS

(Rs./ha)

Sr. No. (1)	Particulars (2)	Years I (3)	II (4)	III (5)	IV (6)	V (7)	VI (8)	Total (9)	Per cent (10)
1.	Preparatory operations	189.00	-	-	-	-	-	189.00	0.84
2.	Terracing, lining, pitting	2126.00	40.00	-	-	-	-	2166.00	9.61
3.	Filling and planting	1435.00	-	-	-	-	-	1435.00	6.36
4.	Cost of planting materials	4000.00	-	-	-	-	-	4000.00	17.74
5.	Pruning/branch induction	42.00	92.00	40.00	20.00	-	-	194.00	0.86
6.	Fertiliser and manures	1293.00	976.00	820.00	570.00	560.00	587.00	4806.00	21.31
7.	Cultural operations	1547.00	1885.00	1160.00	1145.00	679.00	570.00	6986.00	30.98
8.	Plant protection	285.00	150.00	170.00	192.00	183.00	190.00	1170.00	5.19
9.	Current crop establishment	336.00	65.00	-	-	-	-	401.00	1.78
10.	Drainage and other miscellaneous work	126.00	35.00	37.00	40.00	37.00	16.00	291.00	1.29
11.	Boundary protection and foot path	375.00	190.00	130.00	85.00	89.00	41.00	910.00	4.04
	Total establishment cost	11754.00	3433.00	2357.00	2052.00	1548.00	1404.00	22548.00	100.00
	Percentage to the total establishment cost	52.13	15.23	10.45	9.10	6.87	6.22	100.00	

seen from the table that the cost of establishment per hectare of rubber plantation up to commercial yielding i.e. up to sixth year amounted to Rs.22,548.00. More than 52 per cent of the total cost was spent during the first year itself, for the subsequent three years, the percentage of cost to the total establishment cost per year was 15.23 per cent, 10.45 per cent and 9.10 per cent respectively. Over the first two years, there is a massive labour and capital input of Rs. 15,187, most of which is labour input. The activity is predominantly labour intensive because of hedge growing at the edge of alleys, digging of pit for plantation, weeding, application of fertilisers and sprinkling of pesticides. Capital costs are small. During the fifth and sixth year, the percentage share of cost was almost uniform at 6 per cent. The establishment cost was maximum in the first year due to high labour intensive operations such as clearing of the land and leveling, pitting and refilling, planting and cost of planting material and fencing. Table 2 also reveals that the cultural operations took the highest share (30.98 per cent) of the total cultural operations took the highest share (30.98 per cent) of the total establishment cost, followed by fertiliser and manure (21.31 per cent) and planting material (17.74 per cent).

(B) *Cost of Maintenance of Rubber Plantations*: The cost of maintenance of rubber plantation was computed and is presented in Table 3. The maintenance cost included expenditure on fertiliser, manures, tapping, latex, processing and others. The average quantity of fertiliser applied was 135 kg/ha. Even the reported levels of fertiliser application (on a per tree basis) by the rubber smallholders was 340 grams per tree and is far lower than the recommended doses of 500 grams per plant for the study region (Rubber Board, 2005; p.20). However, an overwhelming majority of the smallholders apply organic manure, mainly cow dung from own sources, as growing livestock is an integral aspect of the livelihood system in the study region. The total maintenance cost of rubber amounted to Rs. 6113.75. Tapping charges constituted 51.72 per cent of the total maintenance cost. This is accounted for by the specific labour contract system involved in rubber tapping. As per the system, the tappers have to make their own arrangements for the tapping equipments. Control of competing weed is an important part of rubber plantation maintenance and constituted 8.72 per cent of the total maintenance cost. Weeding also includes cleaning and release operations which is concerned with removal or killing of perennial plants, unwanted trees, vines and creepers likely to smother trees in young plantations. Manures and manuring and processing and marketing cost formed 9.37 and 10.99 per cent of the total cost of maintenance. Since the imputed value of family labour is also included in the calculus, the cost of rubber tapping, manuring and weeding assume the highest proportion.

TABLE 3. COST OF ANNUAL MAINTENANCE OF RUBBER PLANTATION (FROM SEVENTH YEAR ONWARDS)

(Rs./ha)

Sr. No. (1)	Cost item (2)	Amount (Rs.) (3)	Percentage to total (4)
1.	Manures and manuring	573.00	9.37
2.	Weeding	533.00	8.72
3.	Pruning	26.00	0.43
4.	Plant protection charge	175.00	2.86
5.	Tapping charges	3162.00	51.72
6.	Processing and marketing cost	672.19	10.99
7.	Watch and ward miscellaneous expenditure	355.62	5.82
8.	Interest on working capital	616.94	10.09
	Total	6113.75	100.00

(C) *Cost of Production*: The cost of rubber production included both maintenance cost and fixed cost. Fixed cost included the rental value of land, land revenue and plantation tax, interest on fixed capital, depreciation on fixed assets and annual share of the establishment cost. Variable costs included cost of manures and manuring; cost of labour for weeding, pruning, tapping, plant protection, watch and ward; other input cost, processing and marketing cost and interest on working capital. The cost of production computed for one hectare of rubber plantation is presented in Table 4. The table revealed that the variable and fixed cost constituted 30.67 per cent and 69.33 per cent of total cost of production of Rs. 19,935.38. Of the total cost of production tapping charges (15.86 per cent) and rental value of land (62.20 per cent) took the major share. Net income over variable and fixed cost came to Rs. 4,528.34, while the net income over variable and fixed cost came to Rs. 16,242.95. The cost of production per kilogram of rubber is presented in Table 5. It could be seen from the

TABLE 4. COST OF PRODUCTION OF RUBBER

Sr. No. (1)	Cost item (2)	Amount (Rs.) (3)	Percentage to total (4)
A.	Variable cost		
	Manures and manuring	573.00	2.88
	Weeding	533.00	2.68
	Pruning	26.00	0.13
	Plant protection charges	175.00	0.88
	Tapping charges	3162.00	15.86
	Processing and marketing cost	672.19	3.37
	Watch and ward and miscellaneous expenditure	355.62	1.78
	Interest on working capital	616.94	3.09
	Sub-total	6113.75	30.67
B.	Fixed cost		
	Rental value of land	12400.00	62.20
	Interest on fixed capital	357.00	1.80
	Depreciation on fixed assets	250.00	1.25
	Annual share of establishment cost	704.63	3.53
	Land revenue and plantation tax	110.00	0.55
	Sub-total	13821.63	69.33
	Total cost	19935.38	100.00
	Gross income	24463.72	
	Net income considering maintenance cost only	16242.95	
	Net income considering maintenance and fixed cost only	4528.34	

table that the cost of production of one kilogram of rubber amounted to Rs. 13.45. Net income over variable and fixed cost came to Rs. 3.05, while the net income over maintenance cost amounted to Rs. 10.96.

TABLE 5. COST OF PRODUCTION PER KILOGRAM OF RUBBER

Sr. No. (1)	Cost item (2)	Amount (Rs.) (3)	Percentage to total (4)
A.	Variable cost		
	Manures and manuring	0.30	2.88
	Weeding	0.36	2.68
	Pruning	0.02	0.13
	Plant protection charges	0.12	0.88
	Tapping charges	2.13	15.86
	Processing and marketing cost	0.45	3.37
	Watch and ward and miscellaneous expenditure	0.24	1.78
	Interest on working capital	0.42	3.09
	Sub-total	4.13	30.67
B.	Fixed cost		
	Rental value of land	8.36	62.20
	Interest on fixed capital	0.24	1.80
	Depreciation on fixed assets	0.17	1.25
	Annual share of establishment cost	0.48	3.53
	Land revenue and plantation tax	0.07	0.55
	Sub-total	9.32	69.33
	Total cost	13.45	100.00
	Gross income	16.50	
	Net income considering maintenance cost only	10.96	
	Net income considering maintenance and fixed cost only	3.05	

Returns: The rubber production in the study area was mostly in the conventional form of graded sheet. The returns per hectare of rubber included the value of main product, i.e., the smoked sheet rubber and the value of shell scrape and the fuel wood obtained during pruning as a by-product from rubber plantations. The yield of rubber starts increasing from seventh year onwards to 12th year and stabilised till 28th year and then starts decreasing. Based on the reported yield level of 1482 kg/ha of the sample garden, the average price realised by the rubber growers during the study period was around Rs. 17/kg. Table 4 reveals that the average annual gross income per hectare was Rs. 24,463.72. The net income was estimated at Rs. 16,242.95 when maintenance cost alone was deducted from the gross income and the net income estimated by deducting total cost of production from the gross income was Rs.4528.34. The reason for the low net income estimated by deducting both maintenance and fixed cost was because of the high rented value of land which accounted for 62.20 per cent of the cost of production.

Labour Use Pattern

An important feature of rubber plantation was that it is highly labour intensive as the rubber plantation requires labour throughout the year for various operations like weeding, manuring, trenching and for tapping and processing. The year-wise break up of the labour utilised per hectare during the establishment period of rubber, i.e.,

1-6 years is furnished in Table 6. To bring one hectare of rubber plantation to maturity the labour consumed during the period of six years was 762 man-days. Of the total labour requirement per hectare, 47.64 per cent was supplied by men labour and 52.36 per cent by women labour. Of the total labour used, a major share of 43.57 per cent was utilised during the first year followed by 18.50 per cent, 11.81 per cent and 11.42 per cent during the second, third and fourth year respectively. High labour intensive operations like weeding, digging pits, platforming and trenching were performed during these years. Thereafter the percentage share of labour per year was only lower than in these years.

TABLE 6. YEARWISE BREAK-UP OF THE LABOUR USED DURING ESTABLISHMENT PERIOD (1-6 YEARS)

(man-days/ha)

Year	Men	Women	Total man-days equivalent	Per cent
(1)	(2)	(3)	(4)	(5)
1.	249	83	332	43.57
2.	35	106	141	18.50
3.	24	66	90	11.81
4.	21	66	87	11.42
5.	20	42	62	8.14
6.	14	36	50	6.56
Total man-days	363	399	762	100.00
Per cent to total	47.64	52.36	100.00	

The operation-wise labour requirement per hectare of rubber during the gestation period is furnished in Table 7. The cultural operation required 48.03 per cent of the total labour requirement, i.e., 366 man-days per hectare. Terracing require 113 man-days constituting 14.83 per cent of the total labour requirement. For fertiliser and manuring, the labour required was 55 man-days constituting 7.22 per cent of the labour requirement, women labour was employed for cultural operation, fertilisers and manuring.

TABLE 7. OPERATIONWISE LABOUR REQUIREMENT FOR RUBBER PLANTATIONS DURING ESTABLISHMENT PERIOD (1-6 YEARS)

(man-days/ha)

Sr. No.	Operations	Men	Women	Total labour in man-days	Per cent
(1)	(2)	(3)	(4)	(5)	(6)
1.	Preparatory operation	10	-	10	1.31
2.	Terracing, lining, pitting	113	-	113	14.83
3.	Filling and planting	75	-	75	9.84
4.	Pruning/branch induction	12	-	12	1.58
5.	Fertiliser and manuring	22	33	55	7.22
6.	Cultural operations	-	366	366	48.03
7.	Plant protection	30	-	30	3.94
8.	Cover crop establishment	17	-	17	2.23
9.	Drainage and other miscellaneous work	17	-	17	2.23
10.	Boundary protection and foot path	49	-	49	6.43
11.	Watchman	18	-	18	2.36
	Total	363	399	762	100.00
	Per cent to total	47.64	52.36	100.00	

The operation-wise labour requirement per hectare of rubber plantations during the tapping period is furnished in Table 8. On an average, per hectare of rubber plantation provided employment opportunities for 151.18 man-days per year. Of the total labour requirement per hectare, 97.86 per cent was supplied by men labour and only 2.14 per cent was supplied by women labour. This shows that the nature of work required the service of mainly male labour. Of the total labour, 79.81 per cent of the labour was utilised for tapping the latex from the tree. The weeding operations required 8.47 per cent of the total labour requirement, followed by manuring with 3.38 per cent, rolling into sheet 3.01 per cent, pruning 2.98 per cent and plant protection 1.85 per cent.

TABLE 8. LABOUR REQUIREMENT PER YEAR DURING THE TAPPING PERIOD

(man-days/ha)

Sr. No. (1)	Operations (2)	Men (3)	Women (4)	Total man-days equivalent (5)	Per cent to total (6)
1.	Weeding	12.80	-	12.80	8.47
2.	Manuring	2.63	3.23	5.86	3.88
3.	Pruning	4.51	-	4.51	2.98
4.	Plant protection	2.80	-	2.80	1.85
5.	Tapping	120.65	-	120.65	79.81
6.	Rolling into sheet	4.56	-	4.56	3.01
	Total man-days equivalent	147.95	3.23	151.18	100.00

Capital Productivity

Investment in perennial orchard is quite different from the investment in annual crops. Risk associated with perennial tree crops like rubber is much more as the investment is much higher. Gestation period of rubber is quite long and may take as long as 7-8 years to crop. Crop yield and land value may vary considerably from year to year because of soil and weather conditions and cash be received for a relatively short period of the year when the crop is marketed. The economic life of rubber is only 20-25 years though the natural life of rubber may be over 50 years. The most usual investment situation is where a single outlay is made and depreciation occurs thereafter. Perennial crops are exceptional in that there is an appreciation phase before depreciation and there is a series of annual yields. The discounted cash flow technique is very appropriate for investments of the depreciating type. As an industry concerned with plantation crops uses large amounts of capital and it is surprising to discover that very few analytical studies have been made of the extent and efficiency of use of capital in the industry. While static analysis for a given year/period is more appropriate for seasonal and annual crops, perennial crops like rubber require inter-temporal analysis (Rae, 1977). Hence to account for the value of time and include the concept of time preference, a cash flow analysis of rubber plantation is attempted here. The investment made in rubber plantations were tested

for its productivity using pay back period and discounted cash flow method such a Benefit-Cost Ratio, Net Present Value and Internal Rate of Return. The results of Pay Back Period, Benefit-Cost Ratio and Net Present Value of the rubber plantation are given in Table 9. The data revealed that the pay back period was 9.14 years. This indicated that the growers were able to get back the initial investments made during the establishment period at the 9.14 years of planning.

TABLE 9. PAY BACK PERIOD, BENEFIT-COST RATIO AND NET PRESENT VALUE OF THE INVESTMENT IN RUBBER PLANTATION

(per ha)

Years (1)	Costs (Rs.) (2)	Returns (Rs.) (3)	Net Return (Rs.) (4)	Discount factor (12 per cent) (5)	Present value of net return (6)
1.	11754.00	0	-11754.00	0.893	-10496.32
2.	3433.00	0	-3433.00	0.797	-2736.10
3.	2357.00	0	-2357.00	0.712	-1678.18
4.	2052.00	0	-2052.00	0.636	-1305.07
5.	1548.00	0	-1548.00	0.567	-877.72
6.	1404.00	0	-1404.00	0.507	-711.83
7.	5483.60	17514.08	12030.48	0.452	5437.78
8.	5483.60	20500.40	15016.80	0.404	6066.79
9.	5483.60	20950.98	15467.38	0.361	5583.72
10.	5483.60	23400.60	17917.00	0.322	5769.27
11.	5483.60	24642.70	19159.10	0.287	5498.66
12.	5483.60	25360.08	19876.48	0.257	5108.26
13-28	5111.68	26215.78	21104.10	1.793	37839.65
29-32	5111.68	18900.10	13788.42	0.136	1875.23

Pay Back Period = 9.14; Benefit-Cost Ratio = 2.41; Net Present Value = 55014.11.

The Benefit-Cost Ratio for the rubber plantation was 2.41. Since the ratio was more than unity, it implied that the rubber cultivation was a profitable venture.

The Net Present Value of the stream of returns from one hectare of rubber plantations worked to Rs. 55014.11 at a discount rate of 12 per cent. The high positive Net Present Value indicates the soundness of the investment.

The Internal Rate of Return computed for one hectare of rubber plantation is presented in Table 10. It could be seen from the table that the Internal Rate of Return was 14.40 per cent for the expected life span of 32 years. The Internal Rate of Return value was above the market rate of interest which clearly illustrates the 'high pay off' nature of the investment.

The positive Net Present Value, Benefit-Cost Ratio of 2.41 and Internal Rate of Return of 14.40 per cent implied that the investment made in smallholder rubber plantations are highly paying propositions. Overall, the analysis indicates that rubber plantation as prevalent in the study region brings out that rubber as a single crop is a resilient system provided the price remain remunerative and marketing practices transparent and effective.

TABLE 10. INTERNAL RATE OF RETURN OF INVESTMENT IN RUBBER PLANTATIONS

(per ha)

Years (1)	Costs (Rs.) (2)	Returns (Rs.) (3)	Net Return (Rs.) (4)	Present value of net return at 8 per cent discount rate (5)	Present value of net return at 16 per cent discount rate (6)
1.	11754.00	0	-11754.00	-10884.20	-10131.95
2.	3433.00	0	-3433.00	-2942.08	-2550.72
3.	2357.00	0	-2357.00	-1871.46	-1510.84
4.	2052.00	0	-2052.00	1508.22	-1132.70
5.	1548.00	0	-1548.00	-1054.19	-736.85
6.	1404.00	0	-1404.00	-884.52	-575.64
7.	5483.60	17514.08	12030.48	7013.49	4258.79
8.	5483.60	20500.40	15016.80	8109.07	4580.12
9.	5483.60	20950.98	15467.38	7733.69	4115.26
10.	5483.60	23400.60	17917.00	8295.57	4067.15
11.	5483.60	24642.70	19159.10	8219.25	3736.02
12.	5483.60	25360.08	19876.48	9878.61	3339.25
13-28	5111.68	26215.78	21104.10	74180.91	20112.21
29-32	5111.68	18900.10	13788.42	5570.52	689.42

Internal Rate of Return (IRR) = 14.40 per cent.

IV

CONCLUSION

The analysis on the rubber smallholder plantation system in the study region brings out that rubber plantation as a single crop is a resilient system provided the prices remain remunerative and marketing practices transparent and effective. The analysis indicated that rubber plantation is a sustainable proposition. The sustainability of natural capital asset base of the smallholder largely depends on their access to secure property rights over the rubber grown area, which are alloted for rubber cultivation on certain conditionality. This necessarily calls for ensuring the smallholder with secured property rights.

The study revealed that the total establishment cost worked out to Rs. 22,548.00 per hectare. This situation calls for increased credit supply in tune with escalation of input costs. Though the Rubber Board and the Government of India launched special programmes for smallholding sectors with long term loan, input subsidies and interest subsidies, still the content of the programme is not known to many and there were cases where the rubber growers could not avail the subsidies on account of the rigid terms and conditions imposed on the beneficiaries. A flexible approach is called for in view of the problem faced by the small scale sector.

Socio-political disturbances and non-availability of sufficient investment resources are problems hampering the expansion of rubber plantation. The area under rubber has been on the increase in the study region. So there is urgent need for developing skills in the art of tapping and cultural operations. In this context the training programme organised by Rubber Board could be strengthened to cope with the increased demand for skilled labour.

A harmonious policy of transferring the ownership right of the rubber grown areas to the tribal farmers, integrated with a sound credit plan and skill development training programme, can transform the smallholder rubber plantation programme as a suitable alternative land use for shifting cultivation; it would sustain income, employment and prevent environmental degradation.

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