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THE ECONOMICS OF REPLANTING IN RUBBER PLANTATIONS PART III : FINANCIAL AND SENSITIVITY ANALYSIS

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INTRODUCTION

A rubber tree is generally considered as productive for a period of 25-30 years. Maximum yield is reached around the 10th year of tapping. About 10-12 years later, a rapid decline in yield can be observed. This initiates the requirement for reinvestment on rubber where replanting stands as the key option.

In the conventional system of monocrop farming, a considerable amount of capital is fixed during the first 5-8 years of unproductive period which generates a zero income. This can only be recovered gradually during the next 25-30 years of productive phase.

The part I and II of this paper examined the cost of immature upkeep and the cost of mature upkeep respectively. The part III of this study attempts to analyse the revenue streams and the returns on investment with particular reference to the estate sector in Sri Lanka. It further investigates the financial viability of this long-term economic activity by varying certain key parameters through sensitivity analysis.

A life span of a 33-year period is considered for the discounted cash flow analysis. Input data (on labour and material) and production data were gathered from a sample of 135 fields (planted with RRIC 100 Series Clones) randomly selected from 15 rubber estates located in Kegalle, Kalutara and Ratnapura districts (5 estates from each district). Average values of pooled data (categorized according to year of planting) were used for the analysis.

In the financial analysis, several measurements of project worth *viz.* Net Present Value (NPV), Benefit-Cost ratio (B/C), Net Benefit-Investment ratio (N/K), Financial rate of return (IRR) and Pay back period were employed as the criteria to determine the return on investment.

Income from latex and rubberwood

The income from a rubber plantation is generated mainly through the sales of latex and rubberwood. The computed average yield curve for RRIC 100 series

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clones is presented in Figure 1. Certain approximations were made in constructing the yield curve due to lack of sufficient data for the latter part of the life span (age 26 to 33) in particular. The NSA for rubber is taken as Rs.65/= per kg.

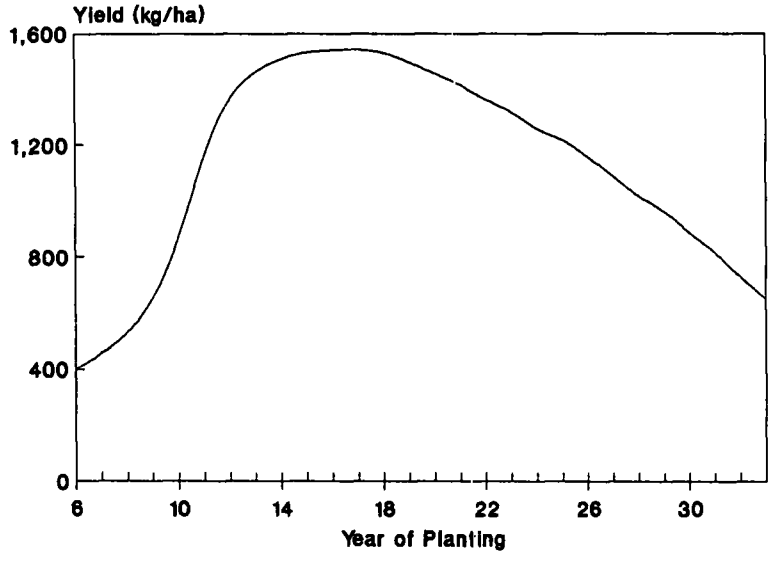

Fig. 1. Computed average yield curve for RRIC series clones under estate management

The revenue from rubber wood is calculated by taking the following average values into consideration:

a) a market value of Rs.300/= per tree at the time of uprooting and
b) a stand of 255 trees/ha at the time of uprooting.

Financial analysis

A life span of a 33-year period and a discount rate of 15% are considered for the financial analysis. The cost streams were compiled using the Annexes appeared in Part I (Annexes 01, 02, and 03) and Part II (Annexes 01 and 02) of this study. The results of the financial analysis are given in Table 1.

The behaviour of undiscounted annual cost and revenue streams is shown in Figure 2. The total cost per annum has declined from Rs.69,500/= in year 1 to nearly Rs.21,000 in year 33. The highest revenue from latex is observed between year 14-18.

Table 1. *Results of financial analysis under the standard scenario (at 15% D.R.)*

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 32	Year 33[1]
COST																
Investment cost[2]	69,513	14,941	11,842	10,884	10,763	11,593										
Running cost[3]							31,670	32,020	32,570	33,670	35,320	36,345	35,583		21,417	21,092
Total cost (at 0% D.R.)	69,513	14,941	11,842	10,884	10,763	11,593	31,670	32,020	32,570	33,670	35,320	36,345	35,583		21,417	21,092
Total discounted cost (at 15% D.R.)	60,449	11,297	7,786	6,223	5,351	5,012	11,905	10,467	9,260	8,323	7,590	6,793	5,782		244	209
RETURNS																
Rubber yield (kg)							450	520	630	850	1,180	1,385	1,465		715	650
Revenue from rubber yield (@Rs.65/kg)							29,250	33,800	40,950	55,250	76,700	90,025	95,225		46,475	42,250
Revenue from old rubber trees[4]	76,500															
Total revenue (at 0% D.R.)	76,500						29,250	33,800	40,950	55,250	76,700	90,025	95,225		46,475	42,250
Total discounted revenue (at 15% D.R.)	66,524						10,995	11,049	11,642	13,658	16,483	16,826	15,474		530	418
Total net returns (at 0% D.R.)	6,987	(14,941)	(11,842)	(10,884)	(10,763)	(11,593)	(2,420)	1,780	8,380	21,580	41,380	53,680	59,642		14,412	10,512
Discounted net returns (at 15% D.R.)	6,076	(11,297)	(7,786)	(6,223)	(5,351)	(5,012)	(910)	582	2,382	5,335	8,893	10,033	9,692		286	209
Accumulated discounted Returns	66,524	66,524	66,524	66,524	66,524	66,524	77,519	88,569	100,211	113,869	130,351	147,177	162,651		255,578	255,996
Accumulated discounted cost	60,449	71,745	79,532	85,755	91,106	96,118	108,023	118,490	127,750	136,073	143,663	150,456	156,238		190,087	190,296

[1] Analysis is based on a 33 - year life span

[2] As per Table 01 in part I of the study

[3] As per Tables 01 to 06 of part II of the study

[4] Sold @ Rs.300 per tree x 255 trees/ha

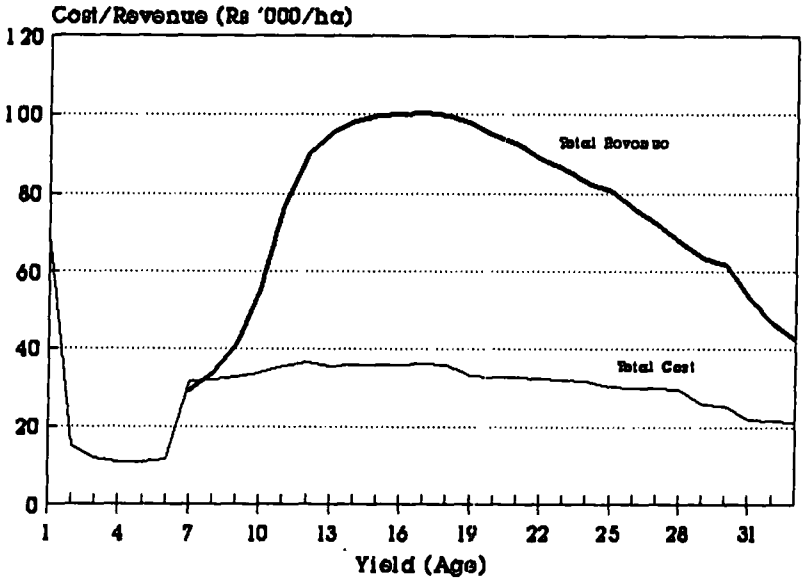

Fig. 2. Total cost and revenue streams of rubber replanting

A summary of the Financial Analysis is given in Table 2. At the end of a 33-year life cycle, one hectare of land replanted with rubber, generates a NPV of Rs.65,700. The B/C ratio and Pay Back Period are 1.35 and 11 years respectively. The Financial Rate of Return (IRR) is around 22% and Net Benefit-Investment ratio is approximately 2.80. The study therefore reflects the financial viability of reinvestment on rubber sector under the prevailed market prices.

Table 2. *Measurements of project worth under standard scenario*

Measurement	Value
NPV (at 15% D.R.)	Rs. 65,700
Benefit-Cost ratio	1.35
Net Benefit-Investment ratio	2.80
Financial Rate of Return	22%
Pay Back Period	11 years

Sensitivity analysis

Certain parameters were varied through sensitivity analysis to assess the economic viability of reinvestment on rubber under different scenarios.

The price of latex has fluctuated regularly in the past. Meanwhile, the selling price of uprooted rubber trees (rubber wood) has shown an upward trend. Also, the lending rates of financial institutions may vary from time to time. Hence, the following parameters have varied through sensitivity analysis :

a) sale value of rubber latex: 3 levels (Rs 55, 65 and 75)
b) sale value of old rubber trees: 2 levels (Rs 300 and 500 per tree)
c) discount rate: 2 levels (15% and 20%)

The results of the sensitivity analysis comprising of 12 combinations are presented in Table 3. Financial returns of replanting with rubber appear to be attractive under most of the above scenarios.

Table 3. *Results of sensitivity analysis*

SCENARIO			MEASUREMENT OF PROJECT WORTH				
NSA OF RUBBER (Rs/kg)	Income from rubber wood (Rs/tree)	Discount Rate	Discounted Measurements				Pay Back Period (Years))
			NPV	B/C Ratio	N/K ratio	IRR	
75	300	15%	94,850	1.50	3.66	23	10
65	300	15%	65,700	1.35	2.80	22	11
55	300	15%	36,551	1.19	1.93	21	12
75	500	15%	139,200	1.73	4.90	27	7
65	500	15%	110,050	1.58	4.01	26	9
55	500	15%	80,901	1.43	3.05	25	10
75	300	20%	40,532	1.28	2.32	23	10
65	300	20%	24,386	1.17	1.78	22	11
55	300	20%	8,240	1.06	1.25	21	12
75	500	20%	83,030	1.58	3.71	27	8
65	500	20%	66,884	1.46	3.13	26	9
55	500	20%	50,738	1.35	2.52	25	10

The Table 4 gives a summarized version of the variation in economic indicators under different scenarios. The NPV has varied from Rs.8240/= to Rs.130,960/=. The B/C ratio has been above 1.00 under all conditions. IRR has ranged from 21 to 27 years whereas the pay-back period has fluctuated from 7 to 12 years.

Table 4. *Variation in measurement of project worth under sensitivity analysis*

Measurement	Value		
	Lowest	Highest	Range
NPV (Rs)	8,240	139,200	130,960
B/C ratio	1.06	1.73	0.67
N/K ratio	1.25	4.90	3.65
IRR (%)	21	27	6
Pay Back Period (years)	12	7	5

Remarks and Conclusions

Certain expenditure components has not been taken into consideration in this study in compiling the investment and running costs. For instance, investment expenditure on buildings (factory, offices, workshops and housing), machinery and vehicles are ignored. Unless an estate sells its crop directly as field latex, it will require a factory with machinery to process the latex into any form of marketable rubber. Moreover, housing is always provided for staff employees. Whether tappers and field workers will be housed on the estate depends on its remoteness from villages and nature of the labour market. Furthermore, some investment is needed in purchasing of vehicles such as trucks, tractors and trailers. The aggregate of all such unaccounted expenditure components usually signifies a considerable variation from one estate to another. Therefore, it was not possible to incorporate such costs into the present analysis. Nevertheless, it is apparent that establishment of an estate is rather capital intensive even though both immature and mature upkeep needs a considerable amount of labour.

With regard to running expenditure, tapping wages reflected the largest single expenditure item. Yet, so-called fringe benefits such as medical care, annual bonuses, *etc.*, are not included in the analysis. Similarly, management and other overhead charges such as staff salaries, maintenance of buildings, land taxes, insurance, security, water and electricitv. marketing costs, *etc.*, are not taken into consideration.

The results and general conclusions derived from this study are therefore of a general nature while they appear to be representative of the estate sector. If they are to be applied by individual estates, necessary changes and adjustments have to be made based on available data to meet their specific needs.

Nevertheless, this study clearly demonstrates the financial viability of reinvesting on rubber plantations. The measurements employed in this study to analyse the feasibility of replanting of rubber is from the view point of individual entrepreneurs. It therefore does not take into consideration the impact on external factors that would bring about to the society and environment.