A Cost and Benefit Analysis on Rubber Plantation in Nagaland

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Abstract- **The present study is aim at understanding the cost and benefit of Rubber plantation in Nagaland. The study reveals that the benefit-cost ratio indicates that investing in rubber farming or plantation is found to be profitable in Nagaland. In terms of the *farm size*, the medium farm size contributes the highest to the total income generated from rubber plantation. It is recommended that there is a need for y organising extensive training camp for rubber farmers by the government. Effort to enhance market linkages to facilitate sale of the rubber products and establishing rubber–based industries to foster larger-scale production is found to be pertinent.**

Keywords- ***Rubber, plantation, Cost, Revenue, Cost-benefit, farm-size***

I. INTRODUCTION

Rubber (*Hevea brasiliensis*) which is often called as *rubber tree*, belongs to the family of *Euphorbiaceae*. It is an important member of the genus Hevea from economic viewpoint. It is also one among the fastest growing upright tropical tree crop which is mainly cultivated for its production of latex, a milky (liquid) plant, which serves as a basis for various rubber products.

Columbus, (1495) was the first to report about latex, but it was not before French explorer Fusee Aublet, (1775) that the rubber tree was properly described. Almost by the same period Priestly discovered that latex could rub off pencil marks, and this gave birth to the name '*rubber*'. MacIntosh, (1823) made waterproof cloths by coating fabric with rubber dissolved in naphtha. The use of waterproof clothing in the American Civil War brought about the first rubber boom, followed by a second one after Goodyear and Hancock, (1839) had discovered the principal of vulcanization, this is the process whereby rubber is heated with Sulphur and retains its physical properties once processed into a useful shape.

Rubber plantation being an integral part of the rural economy, especially in the low lying areas of Nagaland, hence the present study will be of great help to the government in their implementation of various rural development oriented policies and programs.

II. BACKGROUND OF THE STUDY AREA

Nagaland located in the extreme North-Eastern part of India. Nagaland is bounded by Arunachal Pradesh in the north, Manipur in the south, Myanmar in the east and Assam in the west and runs parallel to the left bank of the Great Brahmaputra River. The state is inhabited by 16 major tribes, each with its own distinct language, custom and traditions. It is located between 25° 6´ and 27° 4´ latitude and between the Longitudes 93° 15´ E, measuring a total of 16,579 Sq. Kms.

III. REVIEW OF LITERATURE

Jin, S. et al. (2018), in the study reveals that composition of the household income has changed over the period between 2014 to 2012 the reason being the fall of the share of rubber cultivation and rise in the share of livestock and non-farm sector. It was found that diversification of the farming has positive impact on livelihood security. It recommended that rural development program should be focused into enhance livelihood of the rubber farmers.

A. S. Vinitha and L. P. Ramalingam (2017), in their study classified the rubber growing regions in India into two major zones viz. traditional and nontraditional. Kerala and the Kanyakumari district of Tamil Nadu constitute the major part of the traditional region which accounts for about 80 percent of the total geographical area and 93 percent of the production of rubber in the country. Karnataka, Goa, Konkan Region of Maharashtra, hinterlands of coastal Andhra Pradesh and Orissa, the north-eastern states, Andaman and Nicobar Islands constitute the Non-traditional regions. The study shows that majority of rubber sector constitute

small holding accounting for 92 per cent of the production and 89 per cent area under plantation in the country.

Ibragimov, A. and Arshad, F.M (2017), made as study to examine the structural factors that led to the reduction in the productive of rubber and suggest measures to increase productivity. It is also found that Malaysia has also grown from a rubber supplier to a manufacturing nation. However, 95 percent of the famers come under small farming. The study reveals that despite the effort from the government the productivity has declined. It was suggested that proper funding on research and development is necessary for the improvement of the yield of the rubber production and productivity.

Alexander, T.S. and Haran, B. (2016), examines the status of rubber plantation in Kerala relating to import and export, production and consumption and the effect of decline in price over the small farmers. The study is based on a sample of 120 farmers selected by way of random sampling method. The study shows that, the fall in the rubber price attributes to excess of India's import rate to export. The study also reveals that there has been as increase in the consumption of synthetic rubber in India. The mismatch between tapping cost and rubber price in the market has greatly discourages rubber farmers. Hence it was suggested for the review of the national policy so as to ensure decent livelihood to the small rubber farmers.

In Nagaland rubber plantation was introduced in 1990s, and the area of plantation has been growing over the years. Though it is in the nascent stage, yet, no scholars or rubber board in Nagaland, or Government Agencies has put an effort to study the production, pricing and marketing of rubber products. Thus, this research aims to fill the Lagunae in the literature of rubber plantation.

Methodology
This paper is an attempt to study the Benefit – Cost Analysis of rubber plantation in Nagaland.

IV. METHODOLOGY

This paper is an attempt to study the Benefit – Cost Analysis of rubber plantation in Nagaland.
The study is based on a data collected between the years 2016- 2017.

In order to analyze and examine the objectives, the study was carried out using the following methods.

IV.I.   Primary and Secondary Data:
The study was based on data collected from both primary and secondary sources. The secondary data was be collected from the various sources of books and periodicals, published and unpublished records/dissertations/thesis; journals; district gazetteers; research articles, seminar reports, newspapers, study reports of expert committees, departmental publications, plan documents, websites etc. The primary data was collected through Field Survey, questionnaire and interview methods.

B. Sample Design. The primary data was collected through Field Survey using simple random sampling method during 2016-17. Two districts, viz, Mokokchung and Wokha, were chosen for the study. From the two districts, sixty rubber farmers (30 rubber farmer from each district) were taken as a sample.

C. Data Analysis.
The collected data was analyzed using mean, standard deviation, correlation, regression, etc. For Benefit –Cost analysis, the following formulas were used.
➢ Net Present Value (NPV): The NPV of cash flows have been computed as:

$$NPV = \sum_{t=1}^{n} \left(\frac{(B_t - C_t)}{(1+r)^t} \right)$$

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.

➢ Benefit-Cost Ratio: It was estimated by using the formula:

$$B{:}C \text{ ratio} = \frac{\sum_{t=1}^{n} \left(\frac{(B_t)}{(1+r)^t} \right)}{\sum_{t=1}^{n} \left(\frac{(C_t)}{(1+r)^t} \right)}!$$

V. RESULT AND DISCUSSIONS

V.1 Cost and Revenue: Nagaland.

V.1.a Benefit – Cost Analysis.

Table No.1: Cost and Revenue: Nagaland.

YEAR	Revenue (Rs.)	Total Cost (Rs.)	Revenue-Cost (Rs.)	Discount rate (6.85%)	NPV (Rs.)
1	0	6502010	-6502010	0.94	-6085175
2	0	3115350	-3115350	0.88	-2728713
3	0	2624350	-2624350	0.82	-2151286
4	0	1048350	-1048350	0.77	-804282
5	0	985350	-985350	0.72	-707486
6	0	916350	-916350	0.67	-615764
7	0	871450	-871450	0.63	-548051
8	29145375	7963180	21182195	0.59	12467367
9	29145375	4600680	24544695	0.55	13520318
10	29145375	4600680	24544695	0.52	12653550
11	43485750	5277960	38207790	0.48	18434532
12	43485750	5031460	38454290	0.45	17364028
13	43485750	5031460	38454290	0.42	16250845
14	43485750	5031460	38454290	0.4	15209027
15	43485750	5031460	38454290	0.37	14233998
16	43485750	5031460	38454290	0.35	13321477
17	43485750	5031460	38454290	0.32	12467456
18	43485750	5031460	38454290	0.3	11668185
19	43485750	5031460	38454290	0.28	10920155
20	43485750	5031460	38454290	0.27	10220079
21	43485750	5031460	38454290	0.25	9564885
22	43485750	5031460	38454290	0.23	8951694
23	43485750	5031460	38454290	0.22	8377813
24	43485750	5031460	38454290	0.2	7840724
25	43485750	5031460	38454290	0.19	7338066
26	43485750	5031460	38454290	0.18	6867633
27	43485750	5031460	38454290	0.17	6427359
28	43485750	5031460	38454290	0.16	6015311
29	43485750	5031460	38454290	0.15	5629678
30	43485750	5031460	38454290	0.14	5268767
31	43485750	5031460	38454290	0.13	4930994
32	19862375	2522113	17340262	0.12	2080994
33	19862375	2522113	17340262	0.11	1947584
34	19862375	2522113	17340262	0.11	1822727
Total	1060224000	146701250	913522750	--	248154491

Source: Field Survey 2016-17.

The Net Present Value is calculated by taking the current market rate of interest @ 6.85. As there was no revenue generation for 1-7 years, the result of the net present value came out to be negative for the same period.

The net present value for 1st year is -6085175, 2nd year is Rs.-2728713, 3rd year is Rs. -2151286, 4th year is Rs. -804282, 5th year is Rs. -707486, 6th year is Rs. -615764 and 7th year is Rs. -548051. The net present value for the 8th year is The present value for the entire farming period from 1-34th year is Rs. 24,81,54,491/- which is higher than the cost incurred (Rs.14,67,01,250) worked out at a discount rate of 6.85%, there is profitability in this investment. The benefit-cost ratio is found to be 5.71 indicating that a rupee invested will return back Rs. 5.71. Thus the net present value and benefit-cost

ratio indicates that investing in rubber farming or plantation is profitable in the state.

V.2. Cost and Revenue (Hectare-Wise): Nagaland.

V.2.a. Benefit –Cost Analysis.

The Net Present Value is calculated by taking the current market rate of interest at 6.85. As there was no revenue generation for the bearing period from 1-7 years, the result of the net present value came out to be negative for the same period.

Under the Small Farm Size for the state, the present value for the entire farming period from 1-34th year is Rs.6,46,77,953.43/- and the average present value for the same period is Rs.19,02,292.74 per annum. Therefore it can be seen that the total Net Present Value (Rs. 6,46,77,953.43) for the small farm size for the state is higher than the cost incurred (Rs.47133320). The Benefit–Cost Ratio came out to be 4.99 which is more than unity. Thus the net present value and the benefit-cost ratio indicate that investing in rubber farming or plantation is profitable under small farm size for the state.

Under the Medium Farm Size for the state, the present value for the entire farming period from 1-34th year is Rs.9,81,27,887/- and the average present

value for the same period is Rs.28,86,114.32. Therefore it can be seen that the total Net Present Value (Rs. 9,81,27,887) for the medium farm size for the state is higher than the cost incurred (Rs.5,30,12,390). The Benefit –Cost Ratio came out to be 6.04 which is more than unity. Thus the net present value and the benefit-cost ratio indicate that investing in rubber farming or plantation is profitable under medium farm size for the state.

Under the Large Farm Size for the state, the present value for the entire farming period from 1-34th year is Rs.8,53,48,651/- and the average present value for the same period is Rs.25,10,254.44 per annum. Therefore it can be seen that the total Net Present Value (Rs. 8,53,48,651) for the large farm size for the state is higher than the cost incurred (Rs.4,65,55,540). The Benefit–Cost Ratio came out to be 4.99 which is more than unity. Thus the net present value and the benefit-cost ratio indicate that investing in rubber farming or plantation is profitable under large farm size for the state.

The percentage distribution of revenue for different farm size shows that the medium farm size contributes the highest with 39.54% and the least by small farm size with 26.06%.

Table No.2: Cost and Revenue (Hectare-Wise): Nagaland.

FARM SIZE	Revenue (Rs.)	Total Cost (Rs.)	Revenue-Cost (Rs.)	Net Present Value (Rs.)
SMALL	283776000 (26.7)	47133320 (32.1)	236642680 (25.9)	64677953.4 (26.1)
MEDIUM	414912000 (39.1)	53012390 (36.1)	361899610 (39.6)	98127887 (39.5)
LARGE	361536000(34.1)	46555540 (31.7)	314980460 (34.5)	85348651 (34.4)
TOTAL	1060224000 (100)	146701250 (100)	913522750 (100)	248154491(100)

Source: Field Survey 2016-17.

V.3 Cost and Revenue (Income-Wise): Nagaland.

The total cost for the rubber farmers includes expenditures like jungle cutting, jungle burning, clearing of the field, rubber stem, toilet, digging, plantation, pruning, weeding and mulching, farm house, lunch and wage of labour, farm house, smoke house, tapping materials, roller machine, toilet, firewood, and formid acid,

Under income size of Rs.5,000-10,000 for the state, the total cost incurred by the rubber farmers from 1-34 years is Rs.6,97,94,450/- and the average cost for the same period is Rs.20,52,777.94. Under income size of Rs.10,000-15,000 for the state, the total cost incurred by the rubber farmers from 1-34 years is Rs.1,40,18,290/- and the average cost for the same period is Rs.4,12,302.64. Under income size of Rs.15,000-20,000 for the state, the total cost incurred by the rubber farmers from 1-34 years is

Rs.1,77,04,030/- and the average cost for the same period is Rs.5,20,706.76. Under income size of Rs.20,000-25,000 for the state, the total cost incurred by the rubber farmers from 1-34 years is Rs.1,34,36,630/- and the average cost for the same period is Rs.3,95,195. Under income size of Rs.25,000-30,000 for the state, the total cost incurred by the rubber farmers from 1-34 years is Rs.1,00,04,840/- and the average cost for the same period is Rs.2,94,260. Under income size of Rs.30,000-Above for the state, the total cost incurred by the rubber farmers from 1-34 years is Rs.2,17,43,010/- and the average cost for the same period is Rs.6,39,500.29.

The percentage distribution of cost for different income size of the state shows that the income group of Rs.5,000-10,000 contributes the highest with 47.58% and the least by income group of Rs.25,000-30,000 with 6.82%.

V.3.a.   Benefit –Cost Analysis.

The Net Present Value is calculated by taking the current market rate of interest at 6.85. As there was no revenue generation for the bearing period from 1-7 years, the result of the net present value came out to be negative for the same period.

Under the income group of Rs.5,000-10,000 for the state, the present value for the entire farming period from 1-34th year is Rs.11,10,01,571/- and the average present value for the same period is Rs.32,64,752.08. Therefore, it can be seen that the total Net Present Value(Rs. 11,10,01,571) for the income group of Rs.5,000-10,000 for the state is higher than the cost incurred (Rs.6,97,94,450).The Benefit–Cost Ratio came out to be 5.49 which is more than unity. Thus, the net present value and the benefit-cost ratio indicate that investing in rubber farming or plantation is profitable under income group of Rs 5,000-10,000 for the state.

Under the income group of Rs.10,000-15,000 for the state, the present value for the entire farming period from 1-34th year is Rs.2,25,25,557/- and the average present value for the same period is Rs.6,62,516.38. Therefore it can be seen that the total Net Present Value (Rs.2,25,25,557) for the income group of Rs.10,000-15,000 for the state is higher than the cost incurred (Rs.1,40,18,290).The Benefit–Cost Ratio came out to be 5.42 which is more than unity. Thus the net present value and the benefit-cost ratio

indicate that investing in rubber farming or plantation is profitable under income group of Rs 10,000-15,000 for the state.

Under the income group of Rs. 15,000-20,000 for the state, the present value for the entire farming period from 1-34th year is Rs.3,08,26,684/- and the average present value for the same period is Rs.9,06,667.17.Therefore it can be seen that the total Net Present Value (Rs.3,08,26,684) for the income group of Rs.15,000-20,000 for the state is lower than the cost incurred (Rs.1,77,04,030).The Benefit–Cost Ratio came out to be 5.78 which is more than unity. Thus the net present value and the benefit-cost ratio indicate that investing in rubber farming or plantation is profitable under income group of Rs.15,000-20,000 for the state.

Under the income group of Rs.20,000-25,000 for the state, the present value for the entire farming period from 1-34th year is Rs.2,19,71,162/- and the average present value for the same period is Rs.6,46,210.64. Therefore it can be seen that the total Net Present Value(Rs.2,19,71,162) for the income group of Rs.20,000-25,000 for the state is higher than the cost incurred (Rs.1,34,36,630).The Benefit–Cost Ratio came out to be 5.59 which is more than unity. Thus the net present value and the benefit-cost ratio indicate that investing in rubber farming or plantation is profitable under income group Rs.20,000-25,000 for the state.

Table No.3:   Cost and Revenue (Income-Wise): Nagaland.

INCOME (Rs.)	Revenue (Rs.)	Total cost (Rs.)	Revenue-Cost (Rs.)	Net Present Value (Rs.)
5000-10000	477120000 (45)	69794450(47.6)	407325550 (44.6)	111001571 (44.7)
10000-15000	97536000 (9.2)	14018290(9.5)	83517710 (9.14)	22525557 (9.1)
15000-20000	131904000(12.4)	17704030(12.1)	114199970 (12.50)	30826684 (12.4)
20000-25000	94272000 (8.9)	13436630(9.2)	80835370 (8.85)	21971162 (8.8)
25000-30000	86592000 (8.2)	10004840(6.8)	76587160 (8.85)	20552013 (8.3)
30000 above	172800000 (16.3)	21743010(14.8)	151056990 (16.54)	41277504 (16.6)
TOTAL	1060224000(100)	146701250(100)	913522750 (100)	248154491(100)

Source: Field Survey 2016-2017. Figure in parenthesis represents percentage.

Under the income group of Rs.25,000- 30,000 for the state, the present value for the entire farming period from 1-34th year is Rs.2,05,52,013/- and the average present value for the same period is Rs.6,04,470.97. Therefore it can be seen that the total Net Present Value (Rs.2,05,52,013) for the income group of Rs.25,000-30,000 for the state is higher than the cost incurred (Rs.1,00,04,840).The Benefit–Cost Ratio came out to be 6.58 which is more than unity. Thus the net present value and the benefit-cost ratio indicate that investing in rubber

farming or plantation is profitable under income group Rs.25,000-30,000 for the state.

Under the income group of Rs.30,000-Above for the state, the present value for the entire farming period from 1-34th year is Rs.4,12,77,504/- and the average present value for the same period is Rs.12,14,044.23.Therefore it can be seen that the total Net Present Value (Rs. 4,12,77,504) for the income group of Rs.30,000-Above for the state is higher than the cost incurred (Rs.2,17,43,010). The Benefit –Cost Ratio came out to be 6.2 which is

more than unity. Thus the net present value and the benefit-cost ratio indicates that investing in rubber farming or plantation is profitable under income group Rs.30,000-Above for the state. The percentage distribution of Net Present Value for different income group of the state shows that the income group of Rs.5,000-10,000 contributes the highest with 44.73% and the least by the income group of Rs.25,000-30,000 with 8.28%.

The above study reveals that rubber plantation can be a major contributor to the state income as shown from the Net present value and the benefit-cost ratio.

VI. CONCLUSION AND SUGGESTION

The above study reveals that, the *net present value* and *benefit-cost ratio* indicates that investing in rubber farming or plantation is profitable in the state. In terms of the *farm size*, the medium farm size contributes the highest with 39.54% and the least by small farm size with 26.06%.

Also, in terms of income size, the income group between Rs. 5,000 - 10,000 contributes the highest with 47.58% and the least by those between Rs.25,000 - 30,000 with 6.82%.

The net present value and the benefit-cost ratio indicate that investing in rubber farming or plantation is profitable under income group Rs.20,000-25,000 for the state.

However, the concerns relating to the implementation of policies is worth noting. Firstly, the farmers' lack of awareness of the various schemes and policies are a common concern. This further adds to the problem of ineffectiveness of the department in identifying the desired and eligible farmers. This is due to the lack of timely and proper field survey.

Thus, there is a need for organising extensive training camp for rubber farmers in the respective department to create awareness for the farmers interms of awareness on schemes, programs and markets.

There should be facilities created to enhance market linkages to further boost sale of the rubber products is found to be essential.

As the production level of natural rubber is increasing year by year in the state, there is a need for establishing rubber–based industries to further internalize the economies of scale and boost the earning capacity of the rubber farmers and thereby creating adequate employment opportunities in the state.

In a nutshell, rubber faming on one hand has the potential to provide farmers with sustainable source of livelihood while on the other has the scope of significantly impacting the dynamics of the local economy.

VII. ACKNOWLEDGMENT

REFERENCES

[1]. Abudulla, I. and Arshad, F.M (2017), *Exploring relationships between rubber productivity and R&D in Malaysia*. Available at (online): https://www.researchgate.net/publication/314166631_Exploring_relationships_between_rubber_productivity_and_RD_in_Malaysia.

[2]. Alexander, T.S. and Haran, B. (2016), Decline in rubber prices in Kerala : A case study of Vallicode Panchayath in Pathanamthitta district, *Journal of Economic & Social Development, Vol. - XII, No. 2*. Available at (online): http://www.iesd.org.in/jesd/Journal%20pdf/2016-XII-2%20Decline%20in%20Rubber.pdf

[3]. A. S. Vinitha and L. P. Ramalingam (2017), Scenario of Rubber Production and Consumption in India, *International Journal of Advance Research in Computer Science and Management Studies,* Vol. 5, Issue 6. Available at (online): http://www.ijarcsms.com/docs/paper/volume5/issue6/V5I6-0006.pdf

[4]. Bhowmik, I. (2006). Impact of Rubber Plantations on the Environment of Tripura. *SSRN Electronic Journal.* 10.2139/ssrn.2850137. Available at (online): https://www.researchgate.net/publication/318001660_Impact_of_Rubber_Plantations_on_the_Environment_of_Tripura

[5]. Binitha, M and Raj, J (2018), A Study on Socio-Economic Condition of Rubber Plantation Labourers in Kanyakumari District, *IOSR Journal of Business and Management (IOSR-JBM),* Volume 20, Issue 3. Accesed at: http://www.iosrjournals.org/iosr-jbm/papers/Vol20-issue3/Version-8/D2003083540.pdf

[6]. Chouhan, P. and Bhowmik, I. (2018), *Labour Market Conditions of Natural Rubber Plantations in Tripura: An Inquiry*, [online] Available at: https://www.okd.in/downloads/jr_17_july/article-5.pdf [Accessed 8 Sep. 2019].

[7]. Chouhan,P. at el. (2019), A study on the emerging labour relations in the rubber plantations of Tripura, *Indian Journal of Economics and Development, Vol 7 (4).* Available (online) at: www. ijed.informaticspublishing.com/index.php/ijed/article/view/138187/101134

[8]. Dissanayake, D.M.P et al. (2016), A study on smallholder rubber production in Monaragala district Srilanka, *International Journal of Advanced Research and Review (IJARR), Vol. 1, Issue 5.* Available at (online): https://www.academia.edu/27952418/A_STUDY_ON_SMALLHOLDER_RUBBER_PRODUCTION_IN_MONARAGALA_DISTRICT_SRI_LANKA?auto=download [Accessed 15 Sep. 2019].

[9]. French M.J. (1989): The emergence of a US multinational enterprise: the Goodyear Tire a Rubber Company, 1910-1939. The *Economic History Review, New Series.* Vol. 40. No. Pp. 64-79. in Northern Laos. Paper presented at the 51st Annual Conference of Australian.

[10]. Giroh, Y. D. and Adebayo, E. (2009), Analysis of the Technical Inefficiency of Rubber Tapping in Rubber Research Institute of Nigeria, Benin City, Nigeria, *Journal of human ecology (Delhi, India), Vol. 27 issue 3. Available at (online):   Avaiable   at:* https://www.researchgate.net/publication/319087404_Analysis_of_the_Technical_Inefficiency_of_Rubber_Tapping_in_Rubber_Research_Institute_of_Nigeria_Benin_City_Nigeria.

[11]. Jacob G (1985), " Co-operative workers in India" . Rubber Board Bullitin vol.21.No.2

[12]. *Lee, D (2018), Thailand Natural Rubber Economics.* Available at (online): https://www.halcyonagri.com/thailand-natural-rubber-economics/ [Accessed 15 Sep. 2019].