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An Economic Analysis of Oilpalm Cultivation in West Godavari District of Andhra Pradesh

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ABSTRACT

Oil palm is the world's highest oil yielding crop, with an output 5-10 times greater per hectare than other leading vegetable oils. The study examines the financial and economic aspects of establishing an oil palm plantation in West Godavari district of Andhra Pradesh. A spreadsheet model was used to develop and calculate the Net Present Value (NPV), Internal Rate of Return (IRR) and Benefit Cost ratio (BCR). Sensitivity analysis of NPV to the default discount rate (11.5%) was included. A positive NPV of Rs. 157487, IRR at 41.77% and BCR of 1.63. showed that establishing an oil palm plantation to be a profitable investment. Change in selling price of FFB is more sensitive to NPV than a change in total cost and total revenue.

Key words*: BCR, IRR, NPV and Sensitivity analysis.*

India is one of the major oilseeds grower and importer of edible oils. India's vegetable oil economy is world's fourth largest after the USA, China & Brazil. The oilseed accounts for 13% of the Gross Cropped Area, 3% of the Gross National Product and 10% value of all agricultural commodities. This sector has recorded annual growth rate of the area, production and yield @ 2.44%, 5.47% and 2.96% respectively during last decade (1999-2009). The diverse agro-ecological conditions in the country are favourable for growing nine annual oilseed crops, which include seven edible oilseeds (groundnut, rapeseed & mustard, soybean, sunflower, sesame, safflower and niger) and two non-edible oilseeds (castor and linseed). Oilseeds cultivation is undertaken across the country in about 27 million hectares mainly on marginal lands, of which 72% is confined to rainfed farming. During the last few years, the domestic consumption of edible oils has increased substantially and has touched the level of 18.90 million tonnes in 2011-12 and is likely to increase further. With per capita consumption of vegetable oils at the rate of 16 kg/year/person for a projected population of 1276 million, the total vegetable oils demand is likely to touch 20.4 million tonnes by 2017. A substantial portion of our requirement of edible oil is met through import of palm oil from Indonesia and Malaysia. It is, therefore, necessary to exploit domestic resources to maximize production to ensure edible oil security for the country. Oil palm is comparatively a new crop in India and is the highest vegetable oil yielding perennial crop. With quality planting materials, irrigation and proper management, there is the potential of achieving 20-30 MT Fresh Fruit Bunches (FFBs) per ha after attaining the age of 5 years. Therefore, there is an urgent need to intensify efforts for area expansion under oil palm to enhance palm oil production in the country. Shortage of edible oils assumed a crisis situation of perennial nature during the 1980s and these prompted government agencies to evolve long term and short term mechanisms to step up production and productivity of oil seeds in the country. Part of the efforts was the launching of the Technology Mission on Oil Seeds by the Ministry of Agriculture of the Government of India in 1986 to address the problem (Rethinam, 1992). The major objective of the mission was to increase production through the improvement of productivity and providing better infrastructural facilities like irrigation. The introduction of high potential crops has been considered as a viable option to the conventional ones as a long-term measure to satisfy the increasing demand for edible oils. Palm oil is the world's highest yielding oil crop, with an output 5–10 times greater per hectare than other leading

vegetable oils. Combined with historically low prices, relative shelf stability, and reported nutritional benefits (Bethe, 2010), palm oil leverages natural advantages that position it as a likely long-term staple of the global diet. Rapidly expanding populations and changing consumption patterns, as well as increasing demand from the bioenergy and oleo chemicals industries, have resulted in sustained high prices for crude palm oil. These market forces have driven the enormous growth of the palm oil industry in recent decades. Analysts predict further palm oil demand acceleration in the near term—potentially a 36% increase by 2012 over 2010 baselines, and more than 65% growth by 2020 (Mielke, 2011). In this context, an attempt has been made to conduct a financial assessment of oil palm cultivation from the data gathered from the oil Palm cultivators of West Godavari District in Andhra Pradesh.

MATERIAL AND METHODS

This paper explores the social and economic basis of oil palm cultivation in West Godavari district in the state of Andhra Pradesh. The primary data was collected from 200 farmers who are cultivating oil palm, using survey type research with a cross-sectional design. The survey involved completing a questionnaire covering financial aspects of oil palm cultivation (Appendix 1) during a face-to-face interview with each farmer. In this study, the financial return of oil Palm is estimated by considering the financial aspects like farmer's income on oil palm and income on intercrop. This did not include any externalities. Financial performance is evaluated in terms of Net Present Value (NPV), Benefit-Cost Ratio (BCR) and Internal Rate of Return (IRR) over a period of 25 years. The costs of production taken into account are establishment cost, input cost and labour cost. Establishment costs are incurred during the first years of planting and include clearing and preparation of the land, cost of seedling and planting. The input costs include fertilizer cost, plant protection chemicals, the cost of weedicides, pruning, mulching, harvesting, fencing etc. Labour cost was incurred on fertilizing, pruning, weeding, mulching, harvesting, bunch loading etc. To evaluate the financial performance of oil palm, a spreadsheet model was constucted to describe the revenue and costs associated with oil palm plantation over 25 years. It is considered suitable to determine the cash-flow. The Net present value (NPV) was used to determine the overall financial performance of the project (Brent, 1998; Sugden and Williams, 1990). Annual income and returns were estimated for 25 years and then discounted to present values. The NPV of the project was calculated and derived from the total discounted income and costs. The net present value of a system over a period of time was derived by using Equation 1, where, Benefit in each year (Bt), Costs in each year (Ct), time period (t), the number of years (n), discount rate (d).

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

The internal rate of return (IRR) compares a number of benefits and costs. IRR is the value of the discount rate at which the present value of expected investment returns equal to the present value of investment expenditure. It is interest income expected from the investment plan. This breakthrough discount rate is the value of cash outflows equal to the value of cash inflows. It is calculated by using Equation 2.

$$IRR = \text{Lowe rates (discount)} + \text{Difference between the two discount rates} * \frac{\text{Present worth of the sum of positive net incremental benefits}}{\text{Present worth of the sum of negative net incremental benefits}} \qquad \text{.....Equation 2}$$

Benefit Cost Ratio (BCR) compare the present worth of costs with present worth of benefits. To compute the BCR equation 3 is used, where, Benefit in each year (Bt), Costs in each year (Ct), time period (t), the number of years(n), discount rate (d).

$$BCR = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+d)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+d)^t}} \qquad \text{.....Equation 3}$$

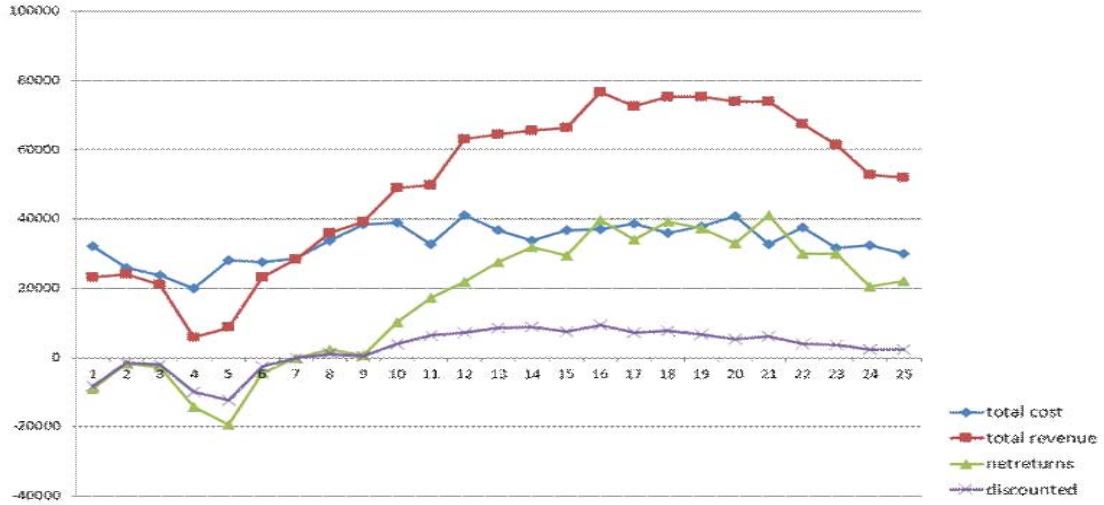

Fig.1 Estimated total annual cost, annual revenue, profit and discounted profit per acre of oil palm production in West Godavari District of Andhra Pradesh.

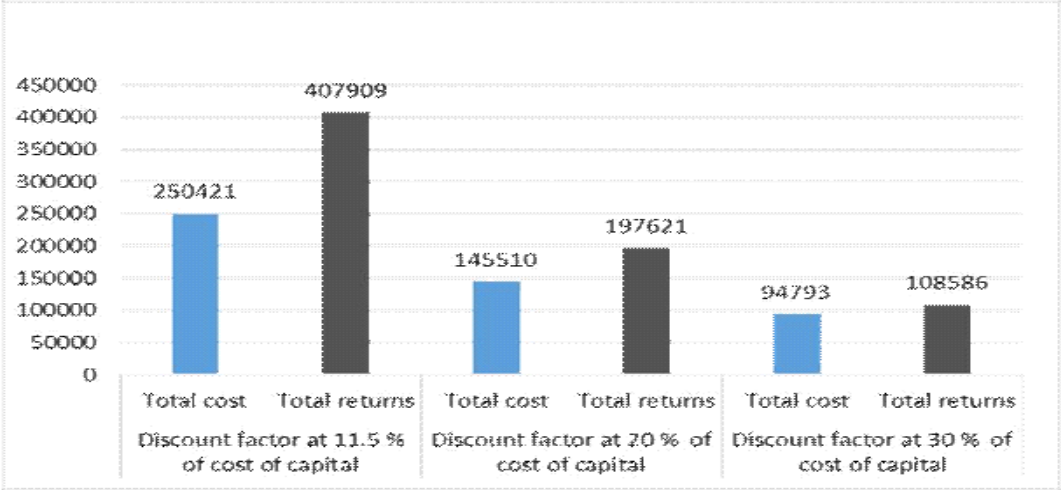

Fig. 2 Increasing cost of capital

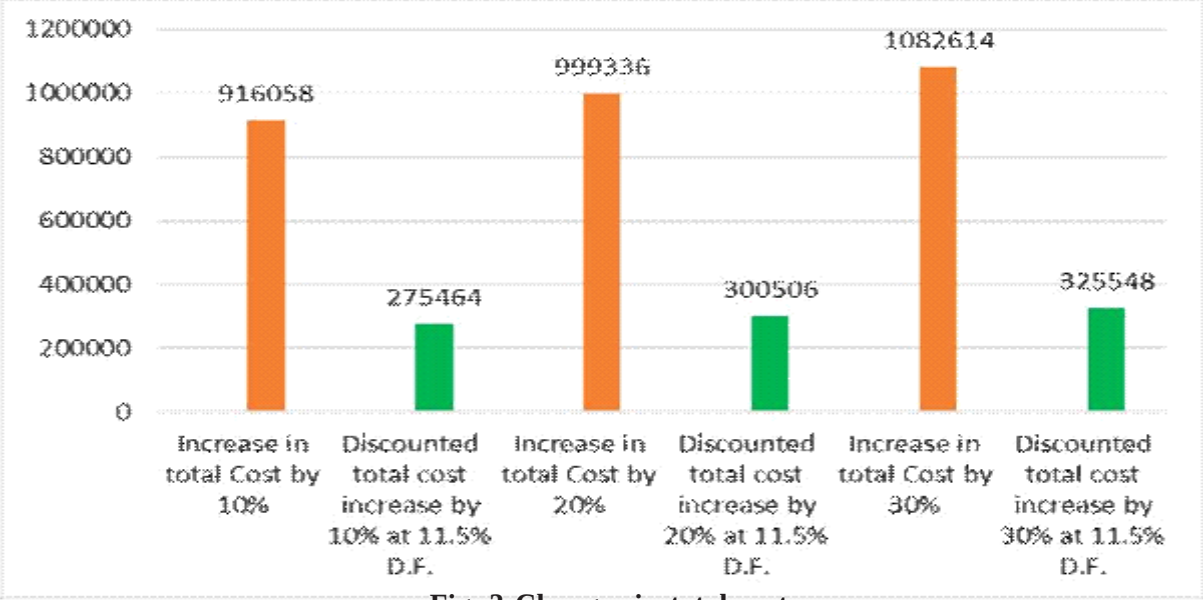

Fig. 3 Changes in total cost

ANALYSIS AND INTERPRETATION:

The yield depends on the maturity of the oil palm. It will normally start from fourth year onwards. The yield of oil palm can be affected by many factors like age of oil palm, unusual periods of drought, prolonged heavy rain etc. The profit level is influenced by planting density, yield and market price. The market price of this crop fluctuates; the FFB price has recently been increasing. When the survey was conducted the average market price was Rs.6500 per tonne.

Other data required for the calculations are discount rate and the project life (Number of years for discounting). In attaching values to the inputs and outputs, constant prices are assumed. The discounted sum of total revenue (also known as the present value of benefit) and the discounted sum of the total cost (present value of cost) are calculated annually over 25 years using an interest rate of 11.5%.

Figure. 1 showed estimated total annual cost, annual revenue, profit and discounted profit per acre of oil palm production by 200 farmers in West Godavari District with a market selling price of Rs. 6500/tonne, fresh fruit bunches and long-term interest rate of 11.5%.

The fig. 1 shows the pattern of annual cost and returns for oil palm production for 25 years. Costs are high in the first years because of establishment costs incurred in the clearing, preparing the land and planting the oil palm plants. There is no revenue during the first three years because the oil palm trees starts producing Fresh Fruit Bunches from the fourth year. In the fourth year also, the revenue is negative due to low yield and high costs. But in the oil palm cultivation, even in the initial four years, considerable revenue is obtained through the cultivation of intercrop. Revenue starts to climb steeply from the fifth year and continues to increase annually until ninth year. In the following years, income begins to fluctuate but remains fairly stable until the 19th year, after which it begins to decline due to the age of the (over mature) trees.

Applying the interest rate of 11.5% the discounted sum of total revenue is Rs. 407909 and the present value of total costs is Rs. 250421. By subtracting the present value of total costs from discounted sum of total revenue NPV is obtained for oil Palm cultivation at Rs. 157487. By calculating the ratio of these two values BCR of 1.63 is obtained. High positive NPV indicated the soundness of the investment made in oil farm orchards. The BC ratio of 1.63 indicated that a rupee invested in oil farm orchards would fetch 1.63 rupees and this proved profitability of oil farm cultivation. So the investment of oil farm cultivation was economically feasible. IRR was 41.77% which was much higher than the bank rate of interest on long term loans and hence the oil farm enterprise is economically feasible. It is evident from the above discussion that the investment on oil farm orchard is a profitable proposition.

Sensitivity analysis:

Sensitivity analysis facilitates us to assess the economic risks. We explore how strong the oil palm cultivation from the financial perspective may appear within shifting marketplace conditions. All financial indicators are affected by total costs, change in income, change in discount rate and selling price. The analysis was done by changing financial indicators for different possible changes in supposed circumstances. Results show how sensitive is the analysis to change in some factors.

We test the sensitivity of the system to changes in oil palm total cost, change in income, selling price and change in discount rate. For the accompanying oil palm plantations play out the affectability investigation for the four distinct instances of

i. Increasing cost of capital
ii. Estimation of the cost of the project due to the different risks involved
iii. Uncertainties resulting due to the difference in the price receivables
iv. Instabilities resulting due to the difference in the selling price

Case I: Increasing cost of capital

From table 2, the computation of the NPV and BCR at different costs of capital indicates that the oil palm is feasible and profitable even at 30 percent discount rate. At 30 percentages discount rate also there exists a positive NPV and BCR of more than one. The exercise indicates the high yielding capacity of the oil palm even at high discount rates.

Table. 1 Increasing cost of capital.

Total cost (25 years)	Total return (25 years)	Discount factor at 11.5 % of cost of capital		Discount factor at 20 % of cost of capital		Discount factor at 30 % of cost of capital	
		Total cost	Total return	Total cost	Total return	Total cost	Total return
832780	1662175	250421	407909	145510	197621	94793	108586
		NPV	157487	NPV	52110	NPV	13792
		BCR	1.63	BCR	1.35	BCR	1.14

Table 2. Changes in Total cost.

Total cost (25 years)	Total return (25 years)	Discount factor at 11.5 % of cost of capital		Increase in total cost by 10%	Discounted total cost increase by 10% at 11.5% D.F.	Increase in total cost by 20%	Discounted total cost increase by 20% at 11.5% D.F.	Increase in total cost by 30%	Discounted total cost increase by 30% at 11.5% D.F.
		Total cost	Total return						
832780	1662175	250421	407909	916058	275464	999336	300506	1082614	325548
		NPV	157487	NPV	132445	NPV	107402	NPV	82360
		BCR	1.63	BCR	1.48	BCR	1.35	BCR	1.25

Table.3 Changes in total returns.

Total cost (25 years)	Total return (25 years)	Discount factor at 11.5 % of cost of capital		Increase in total cost by 10%	Discounted total cost increase by 10% at 11.5% D.F.	Increase in total cost by 20%	Discounted total cost increase by 20% at 11.5% D.F.	Decrease in total cost by 30%	Discounted total cost increase by 30% at 11.5% D.F.
		Total cost	Total return						
832780	1662175	250421	407909	1552702	367118	1380180	326327	1207657	285536
		NPV	157487	NPV	116696	NPV	75905	NPV	35114
		BCR	1.63	BCR	1.46	BCR	1.30	BCR	1.14

Table.4 Changes in selling price.

Total cost (25 years)	Total return (25 years)	Discount factor at 11.5 % of cost of capital		Increase in total cost by 10%	Discounted total cost increase by 10% at 11.5% D.F.	Increase in total cost by 20%	Discounted total cost increase by 20% at 11.5% D.F.	Decrease in total cost by 30%	Discounted total cost increase by 30% at 11.5% D.F.
		Total cost	Total return						
832780	1662175	250421	407909	916058	275464	999336	300506	1082614	325548
		NPV	157487	NPV	132445	NPV	107402	NPV	82360
		BCR	1.63	BCR	1.48	BCR	1.35	BCR	1.25

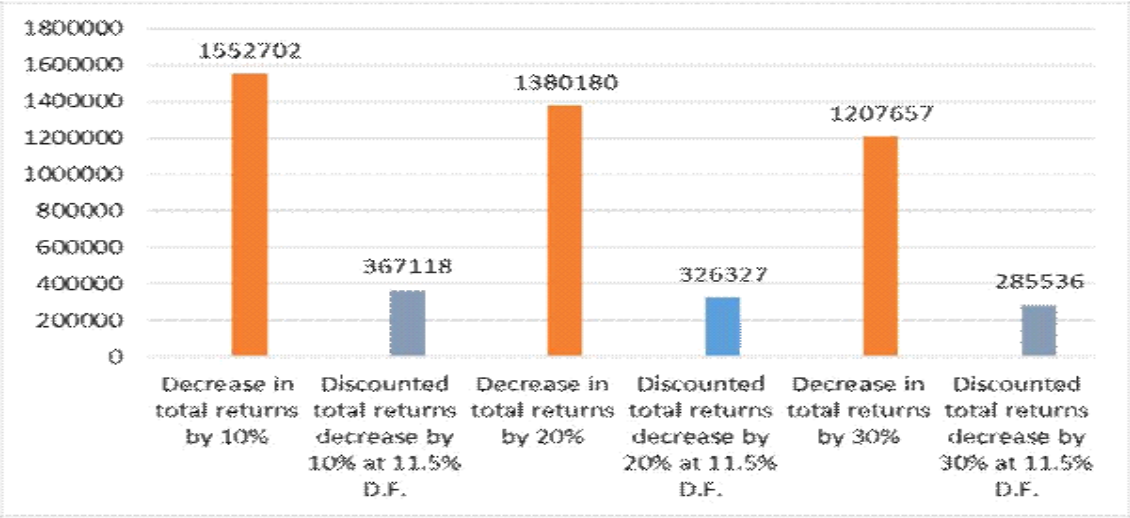

Fig. 4 Changes in total returns

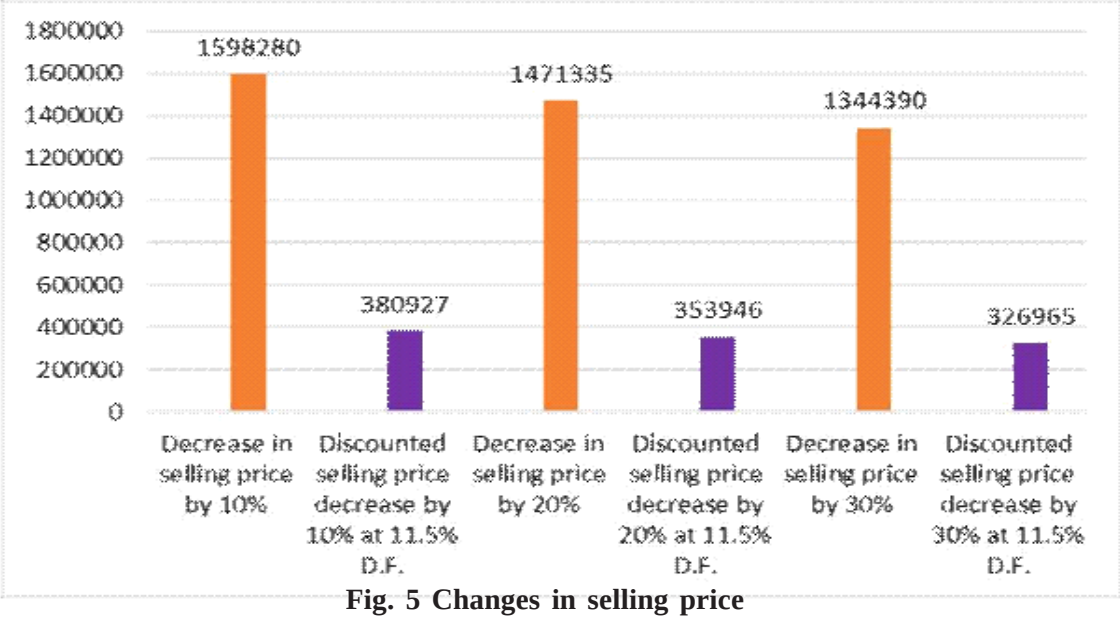

Fig. 5 Changes in selling price

On increasing the cost of the oil palm, the computed NPV and the BCR values indicate that the oil palm is feasible and economical up to a discount rate of less than 30 percent cost increase. At 30 percent increase in the total cost of the oil palm, there exists a positive NPV and BCR of more than one.

From table 3, the uncertainties in the oil palm profits can be sensitized by the ex-ante approach of reducing the anticipated oil palm profits at 10, 20 and 30 percentages. The computed NPV and BCR ratios indicate that the project can withstand uncertainties. The NPV and BCR at 30 percentage reduction in yield in the oil palm benefits were found to be Rs. 35,114 and 1.14 respectively.

From the above table the instabilities in the oil palm benefits can be sharpened by the reverse approach of diminishing the foreseen oil palm benefits at 10, 20 and 30 percentages. The registered NPV and BCR proportions demonstrate

that the oil palm cultivation can withstand instabilities. At 30 percentage lessening in yield in the oil palm, there exist positive NPV and BCR of more than one.

Conclusion:

In this study the economic analysis of oil palm plantation was developed. The practical part calculates the NPV, BCR and IRR of oil palm for 25 years long period with incorporation of 11.5% discount rate, the discounted total returns was Rs. 407909 and the present value of total cost was Rs.250421. The NPV of the oil palm was positive at Rs. 157487 and indicates that this investment is good and profitable, BCR was 1.63 and IRR was 41.77%. Sensitivity to change in total cost and total revenue up to 30% of increase in total cost and decrease in total revenue. The sensitivity analysis shows that change in selling price of oil palm is more sensitive than change in total cost and total revenue. This study presents 10, 20 and 30 percent change in selling price of oil palm causes change in NPV by Rs.1302445, Rs. 103524 and Rs. 76543 respectively. Whereas, 10, 20 and 30 percent change in total cost make Rs. 132445, Rs. 107402 and Rs. 82360 respectively and 10, 20 and 30 percent change in total returns is Rs. 116696, Rs. 75905 and Rs. 35114 respectively in NPV difference. Discount rate also one of the factor affecting NPV, when the discount rate increases to 30% the NPV reduced by Rs. 157487 to Rs. 13792 Conversely, lowering the discount rate to 20%, the NPV increases by Rs. 13792 to Rs. 52110.

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