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and fertilizers, both types of farms are conscious of putting the credit in the right direction. However, the less progressive farms are not rational in the use of credit for draft cattle, because its impact on farm return is not significant.

¶ Thus it could be concluded that the progressive farmers are using the credit in the right direction along with its nearly rational allocation between fertilizers and owned irrigation equipment as reflected through nearly equal marginal return per unit of cost of credit in these two resources. But the less progressive farmers are making rational use of credit in the purchase of draft cattle. Although they are channellizing credit for the purchase of fertilizer and developing owned irrigation facilities, they are not making rational allocation of credit fund between these two resources because the marginal return per unit of credit cost is not equal.

Since the productivity level of owned irrigation equipment and fertilizers on the less progressive farms is considerably higher than the credit cost, it would be appropriate for these farms to increase the credit level and channelize it to these two resources to maximize farm net returns. For the lending agencies it is safer to lend the money for these two purposes as they are sure of the return of the loan from the less progressive farm.

FORMULATION, EVALUATION AND FINANCING OF A PROJECT FOR AGRICULTURAL DEVELOPMENT

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Irrigation is one of the key parameters of output expansion and increase in resource productivity in agriculture. For lack of rivers for watershed development in a substantial way, Tamil Nadu faces serious problem of water shortage for irrigation. Sustained efforts are, therefore, being made to tap groundwater resources in this State. Investment in minor irrigation projects is steadily increasing over the past two decades.

The need for sound investment strategies for developing irrigation potential of the State becomes imperative in recent times since funds for investment are provided at economic cost.

The financing institutions would like to have minor irrigation projects proposed be subject to careful scrutiny for its technical and economic feasibility. An investment appraisal is a pre-condition for financing a particular project of agricultural development.

The investment appraisal poses problems of its own characteristic, *i.e.*, evaluation of uncertain future cash flows in relation to cash outlays, in the immediate and near future. The solution of this general problem involves an understanding of the basic technique of evaluating the investments. The worth and benefits of the investment can be evaluated at macro and micro levels.

Macro Analysis

This is concerned with assessing the benefits and costs of an investment from the viewpoint of the economy as a whole. Under the method, the measurement of benefits considers indirect, secondary and tertiary benefits along with direct primary benefits. In the measurement of costs, the annual recurrent costs consist of the operation and maintenance expenditure on the investment and the associated cost in terms of the additional expenditure on material inputs consumed as a result of investment. The annual capital cost is measured as the sum of annual depreciation charge and the interest due on capital.

Micro Analysis

This technique examines the benefits and costs of an investment from the viewpoint of the investor. In regard to the measurement of benefits it is mostly restricted to direct primary benefit due to an investment. In the measurement of costs, the annual recurrent costs consist of the operation and maintenance expenditure and the associated cost, but the latter includes the additional expenditure on material as well as non-material (*e.g.*, hired labour) inputs. Moreover this method considers the annual capital cost on the proposed investment not in relation to the expected life of the asset but in relation to the period of loan allowed by the financing bank.

An investor would have to consider the productivity of the various alternate projects. Since the amount of resources and money available are limited relative to the requirement a line must be drawn in such a way that as large a surplus is created.

In the present paper, an attempt is made to formulate a project and to evaluate the same for technical, financial and economic feasibility.

PROJECT PROPOSAL

The Pollachi taluk in the Coimbatore district is located on the eastern slopes of Western Ghats. The entire area being rain-shadow gets only occasional showers. The average rainfall is about 28 inches in a year. Out of the geographical area of 4,53,640 acres, the area covered by Parambikulam-Aliyar Project is 84,375 acres. The area under well irrigation is about 52,800 acres and the area under rain-fed dry lands is about 99,140 acres. The lands under Parambikulam-Aliyar Project Scheme get irrigation

only for $4\frac{1}{2}$ months in a year and that too, the period of irrigation synchronizes with the rainy season and therefore, the scope of raising further crops is limited. Ryots in the area who have sunk new wells out of their own resources in rain-fed dry area and in the ayacut area, have found it a more successful venture resulting in a substantial additional income than any other possible investment on the farm. It is noticed that the water-table has gone down considerably during the past one decade necessitating deepening of existing wells by one to three metres to sustain and maximize farm income. Since most of the agriculturists could not undertake the work of sinking new wells and deepening of existing wells for want of funds, there is an immediate and urgent necessity to advance long-term finance to the agriculturists on a project basis.

The area for implementation will be the four community development blocks, viz., Pollachi (South), Pollachi (North), Kinathukadavu, and Anamalai in Pollachi taluk.

The number of wells proposed to be sunk in the area is restricted to 500 and deepening of the wells will be confined to 1,000 wells in the light of the hydro-geological recommendations. All the new wells proposed to be sunk will be installed with electric motor pump-sets.

			New wells	Deepening of wells
Anamalai (Region 1)	..	..	100	250
Pollachi (North and South) (Region 2)	..	..	250	500
Kinathukadavu (Region 3)	..	..	150	250

TECHNICAL FEASIBILITY

Groundwater Resources

The quality of groundwater available in the area is good without alkalinity or salinity. The depth of water-table goes up to 13 metres in the Anamalai region, 15 metres in Pollachi region and 18 metres in Kinathukadavu region. Therefore for the purpose of sinking of new wells, different depths are adopted while arriving at the average size of a well for the region concerned. There is scope for deepening by another 3 metres on an average in all the three regions. The sub-soil consists of ordinary soil, hard gravel, disintegrated rocks, soft rock and hard rock. The springs are confined to fissures found in different directions in rocky formation. Weathered rocky formation is a common feature in all the wells but the availability of water varies from well to well. In locating new wells, the minimum distance need not be specified between two wells on account of non-interference.

Cost of Development

Unit cost: Unit cost has been arrived at for new wells and deepening of wells taking into account the average size of the wells in the area.

New wells : The following three sizes are adopted.

Size	Cost	Region
1. 6.10 metres × 4.80 metres × 13 metres	Rs. 10,500	Anamalai
2. 6.10 metres × 4.80 metres × 15 metres	Rs. 15,050	Pollachi (North and South)
3. 6.10 metres × 4.80 metres × 18 metres	Rs. 23,000	Kinathukadavu

As per the distribution of new wells suggested under 'location' the weighted average for a well works out to as follows:

For 100 wells at the rate of Rs. 10,500	=	.. .. .	Rs. 10,50,000
For 250 wells at the rate of Rs. 15,050	=	.. .. .	Rs. 37,62,500
For 150 wells at the rate of Rs. 23,000	=	.. .. .	Rs. 34,50,000
			<u>Rs. 82,62,500</u>
Weighted average		Rs. 82,62,500	<u>Rs. 16,525</u>
		500	

In the light of the experience gained in the area, an average of Rs. 15,000 for sinking of a new well is adopted as unit cost instead of Rs. 16,525.

The weighted average per well for deepening

For 250 wells at Rs. 5,900	=	Rs. 14,75,000
For 500 wells at Rs. 6,850	=	Rs. 34,25,000
For 250 wells at Rs. 8,100	=	Rs. 20,25,000
		<u>Rs. 69,25,000</u>
Weighted average	<u>69,25,000</u>	<u>Rs. 6,925</u>
	1000	

The cost of deepening may vary from Rs. 5,000 to Rs. 8,100 depending upon the size of the wells and therefore maximum limit for the purpose of deepening alone is fixed at Rs. 6,000.

The average cost of an electric motor of 5 H.P. and 7½ H.P. with other accessories will work out at Rs. 2,000 to Rs. 3,000. The average cost of an electric motor pump-set is arrived at Rs. 2,500 and the cost of pump-shed to Rs. 500 and in all the unit cost will be Rs. 3,000.

With the sinking of new wells, it is likely that the area to be brought under irrigation requires reclamation by the levelling and bunding. The amount of investment needed for such work is around Rs. 100 per acre.

TABLE I—FINANCIAL OUTLAY AND PHASING

Nature of development	Number of units			Cost of develop- ment per unit (Rs.)			Financial outlay (lakh Rs.)			Total (lakh Rs.)
	New wells	Pump- sets	Re- cla- mation	New wells	Pump- sets	Re- cla- mation	New wells	Pump- sets	Re- cla- mation	
1. New wells with pump-set + pump-shed + reclama- tion	500	500	500	15,000	3,000	500	75	15	2.5	92.5
2. Deepening of wells ..	1,000	—	—	6,000	—	—	60	—	—	60.0
Total							135	15	2.5	152.5

It is proposed to deepen 100 existing wells in the first year and 400 and 500 each in the second and third year, respectively. Similarly 100 new wells will be installed with electric motor pump-sets in the first year and 200 each in the second and third year.

TABLE II

				Physical target				Financial outlay (lakh Rs.)
				New wells	Pump- sets	Reclamation (number of five-acre farms)	Deep- ening of well	
1971-72				100	100	100	100	24.5
1972-73				200	200	200	400	61.0
1973-74				200	200	200	500	67.0

FINANCIAL AND ECONOMIC ANALYSIS

Based upon the data available with the Department of Agriculture, Land Development Banks and case studies in the three sub-regions mentioned, three crop mix situations are identified and considered for working out the economics of farming after development.

Sinking of New Wells

The size of a holding which a well irrigates is arrived as 5 acres. The crops raised in the dry lands are groundnut and millets like *chulam*, *ragi*, yielding a net income of Rs. 1,680 and after development, the crops raised are sugarcane, cotton, *ragi*, paddy, groundnut and irrigated millets.

The incremental income obtained by the agriculturists in the three situations are Rs. 5,290, Rs. 5,100 and Rs. 4,425 respectively.*

* The detailed tables of farm budgets are available for supply on request.

The period of repayment of loans for sinking new wells and installation of pump-sets have been fixed as 15 years with interest at the rate of $8\frac{1}{4}$ per cent by the Land Development Banks. Moreover the additional income will be had only at the end of the year after the well is sunk, the Land Development Banks recover the interest for the first and second year at the end of the second year while repayment of equated instalments of capital + interest commence from the third year onwards.

The agriculturists will be in a position to repay the annual instalments of principal and interest of Rs. 2,373 after meeting the additional family consumption.

The average holding for the purpose of deepening of existing wells has also been taken as 5 acres and the income before development is Rs. 4,050, Rs. 4,520 and Rs. 4,790 in the three regions respectively, while the net income after development will be Rs. 6,970, Rs. 6,780 and Rs. 6,105 resulting in an incremental income of Rs. 2,920, Rs. 2,260 and Rs. 1,315 respectively. The farmer who gets Rs. 6,000 for deepening of well will be required to pay only Rs. 1,164 per annum. As the development will be completed within a period of four months and the benefits will be derived in the first year itself, no postponement of instalment is required. The above facts justifies the financial feasibility of the project.

MEASURING THE ECONOMIC FEASIBILITY OF THE PROJECT

(i) *Pay Back Period*

The 'pay back' is the time period for an investment to generate sufficient incremental cash to recover its initial capital outlay in full. When the cash flows are not constant from year to year, the pay back period is determined by calculating the cumulative proceeds in successive years until the total is equal to the original outlay.

TABLE III—PAY BACK PERIOD OF INVESTMENT

			Investment — digging wells			Investment — deepening well		
			Region 1	Region 2	Region 3	Region 1	Region 2	Region 3
Investment (Rs.)	..	..	18,500	18,500	18,500	6,000	6,000	6,000
Returns (Rs.)	..	..	5,290	5,100	4,425	2,920	2,260	1,315
Pay back period	..	..	2.05	2.65	2.44	3.5	3.6	4.2

The 'pay back period' of the investment both in digging and deepening of the well indicates the soundness of the project (Table III).

(ii) *Profit Rate*

The average income during the period of life time is equated to the depreciation of the capital stock of the investment. The net income over

and above the depreciation expressed as percentage is known as the 'profit rate.'

TABLE IV—PROFIT RATE

			Digging well			Deepening well		
			Region 1	Region 2	Region 3	Region 1	Region 2	Region 3
Investment (Rs.)	..	..	18,500	18,500	18,500	6,000	6,000	6,000
Depreciation (Rs.)	..	..	1,230	1,230	1,230	1,000	1,000	1,000
Profit per year (Rs.)	..	..	5,290	5,100	4,425	2,920	2,260	1,315
Profit rate	..	..	21.9	20.9	17.2	32.0	21.0	5.2

As these investments yield higher 'profit rates' they are considered worthy for investment.

(iii) *Pay Back Reciprocal*

The pay back reciprocal is defined as $P = \frac{u}{c}$, where 'u' is the cash proceeds per year and 'c' is the initial cost of investment. The higher the pay back reciprocal, the greater the worth of investment.

TABLE V—PAY BACK RECIPROCAL

			Digging new well			Deepening well		
			Region 1	Region 2	Region 3	Region 1	Region 2	Region 3
Investment (Rs.)	..	..	18,500	18,500	18,500	6,000	6,000	6,000
Increment income (Rs.)	..	..	5,290	5,100	4,425	2,920	2,260	1,315
Pay back reciprocal	..	..	0.29	0.28	0.24	0.49	0.38	0.22

(iv) *Return-Cost Ratio*

The returns accruing out of the project and the capital invested at different periods of time during the project have been amortised.

$$a = P \frac{r(1+r)^n}{(1+r)^n - 1}$$

where 'a' = annual cost of capital investment; p = initial capital investment; r = rate of interest; n = number of years of life of the project.

The amortised returns and costs are considered to work out the return-cost ratio. The return-cost rate of the project as indicated in Table VI shows the soundness of the investment.

TABLE VI—RETURN-COST RATIO OF PROJECT

				Digging well			Deepening well		
				Region 1	Region 2	Region 3	Region 1	Region 2	Region 3
Return (Rs.)	..	..	..	154,200	131,400	123,150	29,460	29,910	15,000
Cost (Rs.)	..	..	..	93,350	85,400	84,765	17,940	19,350	13,110
Return-cost ratio	..	..	..	1.65	1.54	1.45	1.64	1.39	1.14

(v) Present Value Analysis

The time value of money arises because any investment will have an opportunity cost. Once this investment opportunity rate is found out, the net present value (NPV) is calculated by subtracting the present investment cost from the stream of future cash proceeds worked out at the said investment opportunity rate.

The present value of P of any project is found by discounting at the firm's cost of capital all future net cash flows to their present value equivalent. Assuming a project gives rise to end year cash flows designated by the symbol A at the end of each year and that the firm's cost of capital is r per cent, then

$$P = \sum_{i=1}^n \frac{A_i}{(1+r)^i}$$

where A_i is the net cash flow at the end of the year i, where the project has a life of 'n' year, and 'r' is the firm's cost of capital. The net present value is found by subtracting the capital cost 'c' of initiating the project, thus the net present value is (P-C)

$$NPV = \sum_{i=1}^n \frac{A_i}{(1+r)^i} - C$$

where the capital outlays occur over more than one period, the 'C' in the above equation should refer only to the initial capital outlay, all other capital outlays being incorporated into the net cash flow of future period. Where the net cash flows arising from a project are risk free, then any project giving rise to a positive NPV should be accepted in that it will increase the profitability of the firm.

Applying the above formula to this project the net present value is worked out in Table VII.

TABLE VII—NET PRESENT VALUE OF PROJECT

				Digging well			Deepening well		
				Region 1	Region 2	Region 3	Region 1	Region 2	Region 3
Present value of cash flow (Rs.)				55,090	58,780	68,980	20,410	20,618	23,068
Investment (Rs.)	..	..	..	18,500	18,500	18,500	6,000	6,000	6,000
NPV (Rs.)	..	..	..	36,590	40,280	50,480	14,410	15,618	17,068

The positive NPV indicates the soundness of the project.

(vi) *Internal Rate of Return (IRR)*

This is defined as the rate of discount which would equate the present value of capital expenditure to the present value of net cash flow during the life of the project: that is, it is the rate of interest which results in a zero NPV. Putting it clearly IRR is the solution 'r' to the following equation.

$$C = \sum_{i=1}^n \frac{A_i}{(1+r)^i}$$

where the symbols are defined under the NPV technique.

There is no need to calculate depreciation as the computational procedure of internal rate of return takes care of depreciation via the sinking fund method with a given salvage value of capital at the end of the project life.

Where the net cash flows are irregular it is necessary to solve for 'r' by trial and error using tables, until the rate of return is found which exactly discounts the cash flows to the cost of investment. The procedure for calculating IRR is based, first of all, on the assumption that the project will have a life of a certain number of years. In the present study, instead of taking the life of the well, we have confined to the period of the project.

For the purpose of estimating the cash flow and the rate of financial return, the incremental receipts and incremental costs have been taken into consideration. Government subsidies are also reckoned. The purpose in drawing up such an account is to assess the yearly repayment capacity and ensure a reasonable cash balance position for both the agency in charge and the farmers. The positive cash balance even in the early years shows the magnitude of the income generation of the project.

The rate of financial return amounts to 29.8 per cent on the average over the period of the project. When the investment is completed, the incremental receipts will be of the order of Rs. 44 lakhs per annum. This is a rather conservative estimate and there is scope for larger receipts due to increased income, savings and investment. Since the estimated IRR of the investment is high and the farmers will be in a position to repay the loans as per repayment schedules, the project is worthy of consideration and implementation.

The rate of return considered above is of static concept both for factor costs and product prices. But in practice, both may vary over time. Under such situations the sensitivity of the project has to be analysed considering these changes. From a study of the price trends a change of 10 per cent is visualized during the period of the project. Therefore, a sensitivity analysis both for positive and negative changes of prices, input and output in their various combinations is made and presented in Table VIII.

TABLE VIII—SENSITIVITY ANALYSIS

Cost	Benefit	Internal rate of return (per cent)
I. Original	Original	29.8
II. 10 per cent increase	Original	25.4
III. 10 per cent decrease	Original	33.9
IV. Original	10 per cent increase	37.9
V. Original	10 per cent decrease	21.5
VI. 10 per cent increase	10 per cent increase	33.6
VII. 10 per cent decrease	10 per cent decrease	26.4
VIII. 10 per cent increase	10 per cent decrease	15.5
IX. 10 per cent decrease	10 per cent increase	42.2

The most adverse situation, *viz.*, 10 per cent increase in added costs and 10 per cent decrease in added return also bring in 15.5 rate of return which satisfies the minimum norm of 10 per cent.

A number of measures have been used in testing the financial and economic feasibility. These include the pay back period, profit rate, pay back reciprocal, return-cost ratio, NPV and IRR. The conceptual approach and mathematics of these are not the same, hence, comparison of projects in terms of the different measures will not show the same result. The first three methods are used on a purely financial approach while the last three provide the basis for an economic judgment. The pay back period is preferred when there is uncertainty in future. Full finance of the project is not taken care of and it also ignores the life of the project. The pay back reciprocal is a rough and ready technique to measure the rate of return of an investment. It can be proved mathematically that it is an approximation to the discounted rate of return when the life of the investment is fairly long. Profit rate method is also justified as the annual income does not fluctuate and the whole investment is at one point of time.

The results of benefit-cost ratio are similar to those of the IRR when the discounting rate is used for deriving the present value of costs and benefits. The IRR and NPV methods are most commonly used by financing agencies like the International Bank for Reconstruction and Development. The IRR does not depend upon any assumption of cost of capital like the NPV and it does not depend upon the size of the project unlike the NPV.

The important point to note is that any project analysis has to take into account a spread of costs over a number of years and a flow of benefits over the life of the project and relate the two in a meaningful way. Thus there is need both for a financial analysis and assessment of economic return.

Conclusion

In this paper an attempt is made to formulate a project for investment in minor irrigation development. While doing so some of the conceptual problems are brought into sharp focus. Investment criteria are discussed and evaluated in terms of technical and economic feasibilities of the proposed project. Further refinements in evaluation of projects in the context of overall strategy for developing and sustaining groundwater resources through programming sites of investment, and crop mix are possible.

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A STUDY OF IMPACT OF MEDIUM AND LONG-TERM LOANS ON SHORT-TERM CREDIT NEEDS OF THE PUNJAB FARMERS

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Introduction

In the context of technological break-through in agriculture, the problem of farm finance has assumed new and wider dimensions. The core of this

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