Methods/Criteria of Project Evaluation or Measures of project Worth of Investment

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Project :

A project is an investment activity where we expend capital resources to create a producing asset from which we can expect to realize benefits over an extended period of time. Or a project is an activity on which we will spend money in expectation of returns and which logically seems to lend itself to planning, financing and implementation as a unit. A project should have the following characteristics.

1. It should have a specific starting point and specific ending point.
2. Its major costs and returns are measurable
3. It should have a specific geographic location
4. It should have a specific clientele group
5. It should have a well-defined time sequence of investment and production activities.

Methods/Criteria of Project Evaluation:

The methods/criteria more often used for evaluating a project are (1) Simple rate of return (SRR) (2) Payback Period (PBP) (3) Benefit Cost Ratio (BCR) (4) Net present Value (NVP) or Net Present Worth (NPW) and (5) Internal Rate of Return (IRR). The SRR and the PBP are the undiscounted measures while BCR, NPV and IRR are the discounted measures of project worth of Investment. A discussion on the following methods are given below:

Simple Rate of Return:

The SRR is a commonly used criterion of project evaluation. It basically expresses the average net profits (Net Cash Flows) generated each year by an investment as a percentage of investment over the investment's expected life. It is as

$$SRR = Y/I$$

Where

Y = the average annual net profit (after allowing depreciation) from the investment

I = the initial investment

The calculated SRR should be compared with the investor's Required Rate of Return (RRR) to judge the profitability of the investment. The investment will be accepted if SRR.RRR, otherwise it will be rejected. When the SRR of all the investment opportunities is greater than the RRR of the investor, then the investment yielding the highest SRR should be selected.

Pay Back Period (PBP)

The Pay back period is the length of time required for an investment to pay itself out. It is computed as

$$PBP = I/E$$

When the projected net cash flows (E) are uniform or

$$PBP = I / \sum_{t=1}^{n} En = 1$$

When the projected net cash flows are non-uniform.

Where I = the initial investment.
E = the projected net cash flows per year from the investment.
PBP = Pay Back Period expressed in number of years.

Individual investments are ranked according to their relative pay back period with the shortest being the most favored. The acceptability of the investment is determined by comparison with the investor's required pay back period (RPP). Accept the investment when the PBP<RPP, otherwise reject the investment. Although it is simple and easy to use, the PBP method has two major weaknesses as a measure of investment worth.

(1) this method fails to consider earnings after the pay back period is sreached..
(2) it fails to consider the difference in timing of cash flows.

Benefit Cost Ratio (BCR)

It is the ratio of present worth of benefit stream to present worth of cost stream i.e.

$$BCR = \frac{\text{Sum of the present worth of benefit}}{\text{Sum of the present worth of cost}}$$

Mathematically, it can be shown as

$$BCR = \frac{\sum_{t=1}^{n} Bn / (1 + i)^n}{\sum_{t=1}^{n} Cn / (1 + i)^n}$$

Where,
Bn = Benefit in each year
Cn = Cost in each year
n = number of year
i = interest (discount) rates.

The investment is said to be profitable when the BCR is one or greater than 1. This method is widely used in economic analysis and not in private investment analysis.

Net Present Value (NVP)

Net present value is computed by finding the difference between the present worth of benefit stream less the present worth of cost stream. Or it is simply the present worth of the cash flow stream since it is a discounted cash flow measure of project worth along with internal rate of return.

NPV = Present worth of Benefit Stream – Present Worth of Cost Stream.

Mathematically, it can be shown as

$$NPV = \sum_{t=1}^{n} Bn / (1 + i)^n \; - = \sum_{t=1}^{n} Cn / (1 + i)^n$$

Or NPV = Present worth of the cash flow stream.

Mathematically,

$$NPV = \sum_{t=1}^{n} (Bn - Cn) / (1 + i)^n$$

Where,

Bn = benefits in each year of the project.
Cn = Costs in each year of the project.
n = number of years in a project
i = interest (discount) rate
Bn – Cn = Cash flow in n_{th} year of the project

The project is profitable or feasible if the calculated NVP is positive when discounted at the opportunity cost of capital.

Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is that discount rate which just makes the net present value (NVP) of the cash flow equal zero. It is considered to be the most useful measure of project worth and used by almost all the institutions including World Bank in economic and financial analysis of the project. It represents the average earning power of the money used in the project over the project life. It is also sometimes called yield of the investment.

Mathematically,

IRR is that discount rate 'i' such that

$$\sum_{t=1}^{n} (Bn - Cn) / (1 + i)^n = 0 \text{ i.e. } NVP = 0$$

where

Bn = Costs in each year of the project.
Cn = Costs in each year of the project.
n = number of years in the project.
i = interest (discount) rate.

A project is profitable or feasible for investment when the internal rate of return is higher than the opportunity cost of capital.

The computation of IRR for project involves a trial and error method. Here alternative discount rates are used to the cash flow streams of the project under consideration till the NPV of the project reaches zero. However, it is not always possible to get a discount rate which makes the NPV exactly equal to zero through this trial and error method. We may get discount rate, which makes the NPV nearer to zero i.e. either positive or negative. Under such situation, we use interpolation to estimate the true value. Interpolation is simply finding the intermediate value between too discount rates we have chosen.

The rule for interpolating the value of the internal rate of return lying between two discount rates too high on the one side and the too low on the other is.

IRR = Lower discount rate _ Difference between the two discount rates (NPV at lower discount rate : Absolute difference between the NPVs of the two discount rates)

References :

1. Economic Analysis of Agricultural project by Gittinger, J.P., The John Hopkins University Press; Baltimore, USA, 1982.
2. Financial Management in Agriculture by Berry, P.J.; Hopkins, J.A. and Baker, C.B. Danville, Illinois, The Interstate Printers & Publisgers, Inc, USA, 1979.

Results of the methods of evaluation for an investment in 1 hectare of Small Tea Cultivation

Simple Rate of Return (SRR) = Average Annual Profit : Initial Investment

Again Average Annual profit = (Total Net Cash flows excluding depreciation less Initial Investment) : Investment life
= (Rs. 1072725.00 – Rs. 64699.00 30) : 30
= Rs. 1008026.00 : 30
Rs. 33601.00

Hence, SRR = Average Annual profit ÷ Initial Inestment
= Rs. 33601.00 ÷ Rs. 64699.00
= 51.93 %
= 52 %

Payaback Period :

PBP = Initial Investment ÷ ∑ Net Cash flows = 1

Year	Net Cash flows	Cumulative cash flows
1st	0	0
2nd	0	0
3rd	-2916.00	-2916.00
4th	8652.00	5736.00
5th	17973.00	23709.00
6th	27440.00	51149.00
7th	37256.00	88405.00

The payback period will be 6 years plus a fraction of a year. To calculate the fraction, we are required to simply divide the amount of funds needed to recover the investment in the 7th year by the amount of cash flows in the year.

Thus, the amount-recovered upto 6th year is Rs.51149.00. The balance amount required to recover the investment (Rs.64699.00) will be Rs.13550.00 (Rs.64699.00 – Rs.51149.00). The amount of Net cash flows in the 7th year is Rs.37256.00 The pay back fraction then will be Rs.13350.00 ÷ Rs.37256.00 = 0.36. Hence, the payback period for the investment in 1 hectare of Small Tea Cultivation is estimated as 6.36 years.

Benefit Cost Ratio @ 15% Discount Rate :
= Discounted Benefit ÷ Discounted cost
= Rs.217472.151 ÷ Rs.131712.101
= 1.651.

Net Present Value @ 15% Discount Rate :

= Discounted Benefit – Discounted cost
= Rs. 217472.151 – Rs. 131712.101
= Rs.85760.05

Or Net Present Value @ 15% Discount Rate :

= Discounted Cash flows only
= Rs.85760.00

Internal Rate of Return (IRR) :

IRR = Lower discount rate + Difference between the two discount rates (NPV at lower discounted rates / Absolute difference between the NPVs of the two discount rates).

= 25 + (30-25) x { 8855.406 ÷ (8855.406 – (6751.516)}
= 25 + 5x { 8855.406 ÷ (8855.406 – (6751.516)}
= 25 + 5x 0.5674
= 25 + 2.83701
= 27.84%

Conclusion : The investment in Small Tea Cultivation is profitable since SRR is very high (52%), BCR @ 15% discount rate is greater than 1 (i.e. 1.651), NPV @ 15% discount rate is +ve (i.e. Rs.85760.05) and IRR is 27.84%. Besides, the Payback Period is also very short (i.e. 6.36 years.).

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Financial analysis of the Investment in one hectare Small Tea Cultivatioin

Investment cost or

1. Establishment Cost : Rs.64699.00

First Year = Rs.52344.00

2nd year = Rs.12355.00

2. Planning Horizon = 30 years

3. Interest rate/Discount rate = 15%

4. Salvage value = Assume Zero

5. Net cash flow = As given below

Yea	Establishment cost	Operation & Maintenance	Gross cost	Gross Benefit	Discounted Factor at 15%	Discounted Cost at 15%	Discounted Benefit at 15%	Net Cash flow	Discounted Cash Flow at 15%
1	52344	0	52344	0	0.87	45539.28	0	-52344	-45539.28
2	12355	0	12355	0	0.756	9340.38	0	-12355	-9340.38
3		13421	13421	10505	0.658	8831.018	6912.29	-2916	-1918.728
4		12881	12881	21533	0.572	7367.932	12316.876	8652	4948.944
5		14216	14216	32189	0.497	7065.352	15997.933	17973	8932.581
6		14827	14827	42267	0.432	6405.264	18259.344	27440	11854.08
7		15962	15962	53218	0.376	6001.712	20009.968	37256	14008.256
8		16422	16422	59700	0.327	5369.994	19521.9	43278	14151.906
9		17461	17461	59920	0.284	4958.924	17017.28	42459	12058.356
10		16565	16565	59920	0.247	4091.555	14800.24	43355	10708685
11		18917	18917	59920	0.215	4067.155	12882.8	41003	8815.645
12		16565	16565	59920	0.187	3097.655	11205.04	43355	8107.385
13		17461	17461	59920	0.163	2846.143	9766.96	42459	6920817
14		16565	16565	59920	0.141	2335.665	8448.72	43355	6113.055
15		17461	17461	59920	0.123	2147.703	7370.16	42459	5222.457
16		16565	16565	59920	0.107	1772.455	6411.44	43355	4638.985
17.		17461	17461	59920	0.093	1623.873	5572.56	42459	3948.687
18.		16565	16565	59920	0.081	1341.765	4853.52	43355	3511.755
19.		17461	17461	59920	0.07	1222.27	4194.4	42459	2972.13
20.		16565	16565	59920	0.061	1010.465	3655.12	43355	2644.655
21.		18917	18917	59920	0.053	1002.601	3175.76	41003	2173.159
22.		16565	16565	59920	0.046	761.99	2756.32	43355	1994.33
23.		17461	17461	59920	0.04	698.44	2396.8	42459	1698.36
24.		16565	16565	59920	0.035	579.775	2097.2	43355	1517.425
25.		17464	17461	59920	0.03	523.83	1797.6	42459	1273.77

26.		16565	16565	59920	0.026	430.69	1557.92	43355	1127.23
27.		17461	17461	59920	0.023	401603	1378.16	42459	976.557
28.		16565	16565	59920	0.02	3313	1198.4	43355	867.1
29.		17461	17461	59920	0.017	296837	1018.64	42459	721.803
30.		16565	16565	59920	0.015	248.475	898.8	43355	650.325
`						31712.10	217472.		85760.05

Yea	Net Cash Flow	Discounted Factor at 25%	Discounted Flow at 25%	Discounted Factor at 30%	Discounted Cash Flow at 30%
1	-52344	0.8	-41875.2	0.769	-40252.536
2	-12355	0.64	-7907.2	0.592	-7314.16
3	-2916	0.512	-1492.992	0.455	-1326.78
4	8652	0.41	3547.32	0.35	3028.2
5	17973	0.328	5895.144	0.269	4834.737
6	27440	0.262	7189.28	0.207	5680.08
7	37256	0.21	7823.76	0.159	5923.704
8	43278	0.168	7270.704	0.123	5323.194
9	42459	0.134	5689.506	0.094	3991.146
10	43355	0.107	4638.985	0.073	3164.915
11	41003	0.086	3526.258	0.056	2296.168
12	43355	0.069	2991.495	0.043	1864.265
13	42459	0.055	2335.245	0.033	1401.147
14	43355	0.044	1907.62	0.025	1083.875
15	42459	0.035	1486.065	0.02	849.18
16	43355	0.028	1213.94	0.015	650.325
17	42459	0.023	976.557	0.012	509.508
18	43355	0.018	780.39	0.009	390.195
19	42459	0.014	594.426	0.007	297.213
20	43355	0.012	520.26	0.005	216.775
21	41003	0.009	369.027	0.004	164.012
22	43355	0.007	303.485	0.003	130.065
23	42459	0.006	254.754	0.002	84.918
24	43355	0.005	216.775	0.002	86.71
25	42459	0.004	169.836	0.001	42.459
26	43355	0.003	130.065	0.001	43.355

27	42459	0.002	84.918	0.001	42.459
28	43355	0.002	86.71	0.001	43.355
29	42459	0.002	84.918	0	0
30	43355	0.001	43.355	0	0
			8855.406		-6751.516

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