VIVEKANANDA COLLEGE

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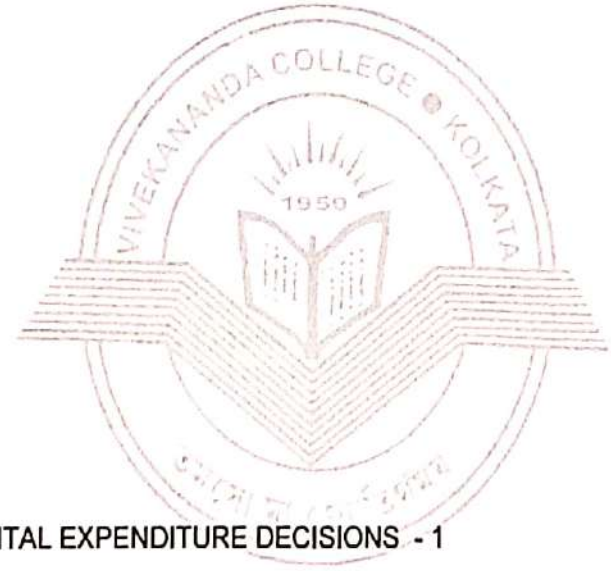
NAAC ACCREDITED 'A' GRADE



Topic: CAPITAL EXPENDITURE DECISIONS - 1

Course Title: DSE6.2A

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Capital Budgeting Techniques

Capital budgeting decisions relate to long term assets which are in operation and yield a return over a period of time. They, therefore, involve current outlays in return for series of anticipated flow of future benefits. Such decisions are of paramount importance as they affect the profitability of a firm, and are the major determinants of its efficiency and competing power. While on opportune investment decision can yield spectacular returns, an ill-advised/incorrect decision can endanger the very survival of a firm. A few wrong decisions and the firm may be forced into bankruptcy.

The capital budgeting evaluation techniques are: -

i) Traditional; comprising a) average/accounting rate of return (ARR) b) Pay-back period.

ii) Discounting cash flow; primarily consisting of,

a) Net present value.

b) Internal rate of return.

iii) Profitability/present value index.

Average rate of return (ARR): -

The ARR is obtained dividing annual average profits after taxes by average investments.

$$\text{ARR} = \frac{Average\ EAT\ X\ 100}{Average\ investment}$$

$$\text{Average EAT} = \frac{Total\ expected\ profit\ after\ taxes}{Life\ of\ the\ project\ in\ yrs}$$

$$\text{Average investment} = \frac{Initial\ investment - Scrap\ value}{2} + \text{Scrap value} + \text{Net working capital.}$$

Ex: - X Ltd. invests Rs.2000000 in a project, the scrap value of the project is Rs.200000 after its estimated life of 7 yrs. The additional net working capital requirement is Rs.150000. The estimated net earnings are as follows;

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Year	EAT (in lakhs)
1	2.0
2	2.3
3	1.9
4	2.5
5	3.0
6	2.2
7	4.0

Compute ARR

Ans: - Average EAT = $(\frac{2+2.3+1.9+2.5+3.0+2.2+4.0}{7})$ = 2.55714 lakhs or Rs.255714

Average investment = $\frac{Initial\ investment - Scrap\ value}{2}$ + Scrap value + Net working capital.

= $\frac{2000000-200000}{2}$ + 200000 + 150000 = 1250000

ARR = $\frac{Average\ EAT\ X\ 100}{Average\ investment}$ = $\frac{255714\ X\ 100}{1250000}$ = 20.46%

Ex: - Y Ltd. has a machine which has been in operation for 6 yrs. The management is considering a proposal to purchase an improved model of a similar machine which gives an increased output. The following information is given below.

Particulars	Old	New
Purchase price	60000	120000
Expenditure on account of		
a) Power		

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b) Consumable stores	7000	8000
c) Repairs and Maintenance	4000	5000
	5000	4000
Labor cost per running hr.	2.00	2.25
Output per hour	40 units	60 units
Material cost per unit	.40	.40
Selling price per unit	1.00	1.00
Estimated life	10	10
Working hours	2000	2000

Compute ARR of above machines assuming that the company follows straight line method and the rate of taxation is 35%.

Ans: -

Particulars	Old	New
Initial investment	60000	120000
Estimated life (Yrs.)	10	10
Output per annum (units)	40 x 2000 = 80000	60 x 2000 = 120000
Sales price	80000	120000
Material	.40 x 80000 = 32000	.40 x 120000 = 48000
Wages	4000	4500
Overheads		
Power	7000	8000

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Consumable stores	4000	5000
Repairs	5000	4000
Cost	52000	69500
Gross profit	80000 – 52000 = 28000	120000 – 69500 = 50500
Less: - Depreciation 10%	6000	12000
Net profit	22000	38500
Less: - Tax 35%	7700	13475
E.A.T	14300	25025
Average investment	$\frac{60000}{2}$ = 30000	$\frac{120000}{2}$ = 60000
ARR = $\frac{EAT\ X\ 100}{Average\ investment}$	$\frac{14300\ X\ 100}{30000}$ = 47.67%	$\frac{25025\ X\ 100}{60000}$ = 41.71%

Pay Back Method: -

It measures the number of years required for the cash from after tax to pay back the initial investment outlay, ignoring interest payment. It is determined as follows: -

i) In the case of CFAT p.a. are constant.

Payback period = $\frac{Initial\ investment}{Constant\ CFAT\ p.a.}$

ii) In case of mixed CFAT, it is obtained by cumulating CFAT till the cumulative CFAT equal the initial investment.

Payback reciprocal = $\frac{Annual\ earnings\ X\ 100}{Cost\ of\ investment}$

Alternatively = $\frac{1\ X\ 100}{Payback\ period}$

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Payback profitability = Surplus period X CFAT p.a. = (Expected life of the project – BP) CFAT p.a.

Or Total CFAT – Cumulative CFAT upto payback period.

Ex: - Mr. Y, the Finance Manager of the Star Ltd. desires to introduce a machine in its production process as a cost reduction program. The machine costs Rs.1000000. It has an estimated working life of 8 years with no scrap value. The company follows a straight line method of depreciation for tax purposes. The income tax rate is 35%. Application of machine will generate a saving in operating cost of Rs.240385 p.a. You are required to compute-

a) Payback period.

b) Payback profitability.

Ans: -

Savings in operating cost	240385
Less: - Depreciation = $\frac{1000000-0}{8}$	125000 = 115385
Less: - Tax 35% = $\frac{115385\ X\ 35}{100}$	40385
EAT	75000
Add: - Depreciation	125000
CFAT p.a.	200000

a) Payback period = $\frac{Initial\ investment}{Constant\ CFAT\ p.a.} = \frac{1000000}{200000}$ = 5 Years.

b) Surplus period = 8 – 5 = 3 Years.

Payback profitability = 200000 x 3 = 600000

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Ex: - From the following information, calculate a) Payback period b) Payback profitability of the following project-

Initial investment Rs.1350000

Year	CFAT p.a.
1	200000
2	220000
3	250000
4	300000
5	380000
6	400000
7	500000
8	600000

ii) What will be the revised payback period if the initial investment is Rs.1500000

Ans: -

Year	CFAT p.a.	Cumulative CFAT
1	200000	200000
2	220000	420000
3	250000	670000
4	300000	970000
5	380000	1350000
6	400000	1750000
7	500000	2250000

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8	600000	2850000

a) Payback period = 5 Yrs.

b) Payback profitability = 2850000 – 1350000 = 1500000

ii) Payback period = $5 + \left(\frac{1500000-1350000}{1750000-1350000}\right)$

Or $\left(5 + \frac{150000}{400000}\right) = 5 + .375 = 5.375$ years

Payback profitability = (2850000 – 1500000) = 1350000

Or Alternatively,

$$\frac{X-5}{6-5} = \frac{1500000-1350000}{1750000-1350000}$$

Or X = 5.375 years.

Ex: - Following are the details of three projects A, B and C.

Particulars	A	B	C
Cost	50000	70000	70000
Life (Yrs.)	10	12	14
Estimated scrap value	5000	10000	7000
Annual profit	5000	6000	5500

Select the best one using

a) Payback period.

b) Surplus life over payback period.

c) Surplus cash flow, as decision criteria.

Ans: - a) Payback period

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Particulars	A	B	C
Annual profit	5000	6000	5500
Add: - Depreciation	4500	5000	4500
CFAT p.a.	9500	11000	10000
Payback period = $\frac{\text{Initial Investment}}{\text{CFAT p.a.}}$	$\frac{50000}{9500} = 5.26$ yrs.	$\frac{70000}{11000} = 6.36$ yrs.	$\frac{70000}{10000} = 7$ yrs.
Rank	1	2	3

Project A is the best as it secures the highest rank i.e. shortest payback period.

b)

Particulars	A	B	C
Surplus life over payback period	(10–5.26) = 4.74	(12-6.36)= 5.64	(14 – 7) = 7
Rank	3	2	1

The best project is C

c) Surplus cash flow

Particulars	A	B	C
Total cash flow	95000	132000	140000
Less: - Cost of investment	50000	70000	70000
	45000	62000	70000
Add: - Scrap value	5000	10000	7000
Surplus cash flow	50000	72000	77000

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Rank	3	2	1

Best project is C

Ex: - X Ltd. considering the purchase of a new machine which will carry out some operations at present performed by labor. Two alternative models- A and B- are available for the purpose. From the information, prepare a profitability statement for submission to management.

Particulars	Machine A	Machine B
Estimated life (Yrs.)	5	6
Cost of machine (Rs.)	80000	150000
Estimated additional cost: -		
Maintenance (p.m.)	500	750
Indirect material (p.a.)	2000	3000
Supervision (per quarter)	3000	4500
Estimated scrap value	8000	12000
Estimated savings in direct wages (p.a.)		
Employees not required	10	15
Wages per employee (Rs.)	7200	7200

Depreciation is calculated using straight line method. Rate of taxation is 50% of profit.

Ans: - Profitability statement

Particulars	Machine A	Machine B
Estimated annual cash inflow: -		

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*In scrap	8000	12000
*In direct wages	7200 x 10 = 72000	7200x15=108000
Total (x)	80000	120000
Additional cost: -		
Maintenance	6000	9000
Indirect material	2000	3000
Supervision	12000	18000
Depreciation	$\frac{80000}{5}$ = 16000	$\frac{150000}{6}$ = 25000
Total (y)	36000	55000
Net annual cash inflow (x – y)	44000	65000
Less: - Tax @ 50%	22000	32500
	22000	32500
Add: - Depreciation	16000	25000
CFAT p.a.	38000	57500
Payback period	$\frac{80000}{38000}$ = 2.11 yrs.	$\frac{150000}{57500}$ = 2.61 yrs.
Rank	1	2
Payback profitability	35000 x 2.89 = 109420	57500 x 3.39 = 194925
Rank	2	1

Ex: - Calculate payback period from the following particulars under discounted payback method. Cost of the project Rs.40000, life 15 yrs. And cost of capital 10%.

Particulars Rs. P.V. of Re1

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Ans: -

Profitability statement

Particulars	Machine A	Machine B
Estimated annual cash inflow: - *In scrap *In direct wages	 8000 7200 x 10 = 72000	 12000 7200x15=108000
Total (x)	80000	120000
Additional cost: - Maintenance Indirect material Supervision Depreciation	 6000 2000 12000 $\frac{80000}{5}$ = 16000	 9000 3000 18000 $\frac{150000}{6}$ = 25000
Total (y)	36000	55000
Net annual cash inflow (x – y) Less: - Tax @ 50%	44000 22000	65000 32500
Add: - Depreciation	22000 16000	32500 25000
CFAT p.a.	38000	57500
Payback period Rank	$\frac{80000}{38000}$ = 2.11 yrs. 1	$\frac{150000}{57500}$ = 2.61 yrs. 2
Payback profitability Rank	35000 x 2.89 = 109420 2	57500 x 3.39 = 194925 1

Ex: - Calculate payback period from the following particulars under discounted payback method. Cost of the project Rs.40000, life 15 yrs. And cost of capital 10%.

Particulars	Rs.	P.V. of Re1
1	7000	0.909
2	7000	0.826
3	7000	0.751
4	7000	0.683
5	7000	0.621
6	8000	0.564
7	10000	0.513
8	15000	0.467

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9	10000	0.424
10	4000	0.386

Ans: -

Years	NCF	P.V.	P.V. of NCF	Cumulative of PV of NCF
0	-40000	1.00	- 40000	-40000
1	7000	0.909	6363	-33637
2	7000	0.826	5782	-27855
3	7000	0.751	5257	-22598
4	7000	0.683	4781	-17817
5	7000	0.621	4347	-13470
6	8000	0.564	4512	-8958
7	10000	0.513	5130	-3828
8	15000	0.467	7005	3177
9	10000	0.424	4240	7417
10	4000	0.386	1544	8961

Payback period = $7 + (\frac{0+3828}{3177+3828})$

Or $7 + \frac{3828}{7005} = 7 + .55 = 7.55$ Yrs.

Net present value method: -

The NPV may be described as the summation of the present values of (i) operating CFAT (CF) in each year and (ii) Salvage value (S) and working capital in the terminal year (n) minus the summation of present values of the Cash outflows (CO) in each year. The present value is computed using cost of capital (K) as a discount rate, symbolically,

$$NPV = \Sigma^{n}_{T=1} CF_T/(1 + K)^t + S_n + W_n/(1 + K)^n - \Sigma^{n}_{T=0} CO_t/(1 + K)^t$$

The project will be accepted in case of NPV is positive.

Ex: - Your company can make either of the following two investments at the beginning of 1988. The following particulars are available in this respect.

Particulars	Project-I	Project-II
Estimated cost	20000	28000
Estimated life (Yrs.)	4	5
Estimated scrap value	NIL	NIL

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Estimated net cash flow (Rs.): -		
End of 1988	5500	5600
End of 1989	7000	9000
End of 1990	8500	9000
End of 1991	7500	9000
End of 1992	--	9000

It is estimated that each of the alternative projects will require an additional working capital of Rs.2000 which will be received back in full after the expiry of each project life. In estimating net cash flow, depreciation has been provided under straight line method. Cost of finance to your company may be taken at 10% p.a. The present value of Re 1 to be received at the end of each year at 10% is given below-

Year	1	2	3	4	5
P.V.	.91	.83	.75	.68	.62

Ans: - Net present value method

Project – I			
End of year (1)	NCF (2)	PV factor (10%) (3)	Present value (4) = (2 x 3)
1988	5500	.91	5005
1989	7000	.83	5810
1990	8500	.75	6375
1991	7500	.68	5100
Working capital to be received back	2000	.68	1360
Less: - cost of the asset			23650 20000
Less: - working capital			3650 2000
		NPV	1650

Project – II

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End of year (1)	NCF (2)	PV factor 10% (3)	Present value (4) = (2 x 3)
1988	5600	.91	5096
1989	9000	.83	7470
1990	9000	.75	6750
1991	9000	.68	6120
1992	9000	.62	5580
Working capital to be received back	2000	.62	1240
			32256
Less: - cost of asset			28000
			4256
Less: - working capital			2000
		NPV	2256

Comments: - Project – II is more profitable since its NPV is higher.

Ex: - SP & Co. has been using a machine costing Rs.15000 for the past 5 years. The machine has 15 years of life and it has been depreciated @10% p.a. The current salvage value would be Rs.2000 and the company has been paying 50% of its profits as tax. Now the management desires to replace it by new machine costing Rs.10000 with salvage value of Rs.2000. The new machine has a life of 10 years and will be depreciated @10% p.a. The cost of capital is 10% and the expected savings is likely Rs.3000 p.a. Should the company go for a new machine?

Ans: -

Cash outlay: -	
Cost of new machine	10000
Less: - Scrap value of the existing machine	2000
Initial outlay	8000
Tax savings on loss on sales of machine to be calculated as: -	
Cost of existing machine	15000
Less: - Depreciation @10% for 5 years	7500
	7500
Less: - Scrap value	2000
Loss on sales	5500
Less: - Tax @50%	2750

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Net cash outlet	2750
Cash inflow: - Annual savings Less: - Depreciation on new machine	 3000 800
Less: - Tax @50%	2200 1100
Add: - Depreciation	1100 800
CFAT p.a. (for 10 years)	1900

Year	CFAT	P.V.
1	1900	.9091
2	1900	.8264
3	1900	.7513
4	1900	.6830
5	1900	.6209
6	1900	.5645
7	1900	.5132
8	1900	.4665
9	1900	4241
10	1900	.3865 6.1445

N.P.V.	Discounting factor	Present value
Annual cash inflow for 10 years Rs.1900 p.a.	6.1445	11675
Savings value of machine Rs.2000	.38554	771
Total cash inflow Less: - Cash outflow		12446 2750
N.P.V. Less: - Initial outlay		9696 8000 1696

The company should go for new machine.

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International Rate of Return (IRR) Method: -

It is second discounted cash flow (DCF) or time-adjusted method of appraising capital investment decisions. This technique is also known as yield on investment, marginal efficiency of capital, marginal productivity of capital, rate of return, time-adjusted rate of return and so on. Like present value method, the IRR method also considers the time value of money by discounting the cash streams. The basis of the discount factor, however, is different in both cases. In the case of net present value method, the discount rate is the required rate of return and being a predetermined rate, usually the cost of capital, its determinants are external to the proposal under consideration. The IRR, on the other hand, is based on facts which are internal to the proposal. The IRR is usually the rate of return that a project earns. It is defined as the discount rate (r) which equates the aggregate present value of the net cash inflow (CFAT) with the aggregate present value of cash outflow of a project. In other words, it is the rate which gives the project NPV of zero. The IRR is defined as the discount rate (r) which equates the aggregate present value of the operating CFAT received each year and terminal cash flows (working capital recovery and salvage value) with aggregate present value of cash outflows of an investment proposal.

Symbolically,

$$IRR = \Sigma^{n}_{T=1} CF_t/(1 + r)^t + S_n + W_n/(1 + r)^n - \Sigma^{n} CO_t/(1 + r)^t.$$

The project will be accepted when IRR exceeds the required rate of return.

Ex: - Poddar Ltd. has to select one of the two alternative projects whose particulars are given below-

Particulars	Project - E	Project - F
Project site	Rajrappa	Jhalda
Initial outlay	1187200	1006700
Net cash inflow (CFAT) End of the year		
1	1000000	100000
2	200000	100000

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3	100000	200000
4	100000	1000000

The company can arrange necessary fund at 8%. Compute NPV and IRR of each project and comment on the results.

Ans: -

Computation of NPV

Year	PV factor @ 8%	Project - E		Project - F	
		CFAT	PV of CFAT	CFAT	PV of CFAT
1	.926	1000000	926000	100000	92600
2	.857	200000	171400	100000	85700
3	.794	100000	79400	200000	158800
4	.735	100000	73500	1000000	735000
Total P.V. of CFAT			1250300		1072100
Less: - Initial outlay			1187200		1006700
N.P.V.			63100		65400

Under NPV method project F will be selected having higher NPV.

Computation of IRR: -

Project – E					
Year	PV factor (10%)	PV factor (12%)	CFAT	PV of CFAT (10%)	PV of CFAT (12%
1	.909	.893	1000000	909000	893000
2	.826	.797	200000	165200	159400
3	.751	.712	100000	75100	71200
4	.683	.636	100000	68300	63600
				1217600	1187200

IRR= 12%

Project – F					
Year	PV factor (10%)	PV factor (12%)	CFAT	PV of CFAT (10%)	PV of CFAT (12%
1	.909	.893	100000	90900	89300
2	.826	.797	100000	82600	79700

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3	.751	.712	200000	150200	142400
4	.683	.636	1000000	683000 1006700	636000 947400

IRR = 10%

So, under IRR method, project E will be selected.

The new method is more logical in the sense that all the projects can be evaluated considering cost of capital as discounting factor.

Ex: - From the following particulars, calculate IRR.

Net after Tax inflow over the four years of the project life End of the year 1 2 3 4	 Rs.5000 Rs.8000 Rs.10000 Rs.4000

Initial outlay Rs.20000. No realizable scrap value at the end of project life.

Ans: - Computation of IRR

Year	CFAT	F.V. factor		PV of CFAT (Rs)	
		13%	14%	13%	14%
1	5000	.885	.877	4425	4385
2	8000	.783	.770	6264	6160
3	10000	.693	.675	6930	6750
4	4000	.613	.592	2452 20071	2368 19663

$$\frac{X-13}{14-13} = \frac{20000-20071}{19663-20071}$$

Or $X - 13 = \frac{-71}{-408}$

$X = 13 \cdot 17$

$\therefore$ IRR = 13.17%.

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