[Academic Script]

Investment Decision

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Academic Script

1. Introduction –Techniques of Capital Budgeting

Capital budgeting decisions needs to be evaluated carefully as it involves large amount of investment & they are irreversible.

The techniques of evaluation helps in selecting of the most profitable projects.

There are various methods of appraising the investment proposals which can be classified into two broad categories:

(1) Traditional

(2) Time adjusted.

Traditional techniques also known as **Non-discounting techniques and can further be classified into** Payback and accounting rate of return.

The time adjusted and discounting techniques can be subdivided into three such as

1. Net Present Value technique
2. Internal rate of Return
3. Profitability Index

Now lets discuss each technique in detail.

Accounting Rate of Return: It is the rate of return which is earned on a project on the basis of accounting principles. Some know this technique as Return on investment. Its calculation can be done in two ways:

In order to calculate the accounting rate of return, the return on original investment should be taken and in this case the formula would be

Accounting rate of return= Average Annual EAT or PAT

_____*100

Original Investment

The accounting rate of return is also known as Average rate of return. It is defined as:

ARR= Average annual profits after taxes

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Average investment over the life of the project

The average profits after taxes are determined by adding up the after tax profits expected for each year of projects' life and dividing the result by the number of years. In the case of annuity, the average after tax profits is equal to any years of profits.

The denominator can be calculated in the following manner:

For Original Investment = Original investment + additional net working capital + installation charges+ Transportation charges.

For Average Investment,

Average Investment= (original Investment- scrap value)/2 +Additional NWC+ Scrap Value.

Now lets understand this technique with a numerical example:

Year	B.V. of Investment	PAT
1	190000	120000
2	180000	122000
3	170000	124000
4	160000	126000
5	150000	128000

Calculate ARR.

The accounting rate of return is

$$\frac{\frac{120000+122000+124000+126000+128000}{5} \times 100}{\frac{190000+180000+170000+160000+150000}{5}}$$

$$\frac{124000}{170000} = 72.9\%$$

Decision criterion:

The higher the accounting rate of return, the better the project.

If the ARR is more than the cut off rate, the project is accepted and if lower than the cut off rate project is rejected.

Lets consider another example,

If the initial investment of the XYZ ltd. in buying a machine is 1, 21, 000, salvage value is Rs 11,000, working capital is Rs 12000 & life of the machine is 5 years and SLM is adopted. Calculate the average investment.

By using the formula,

Average Investment= (original Investment- scrap value)/2 +Additional NWC+ Scrap Value.

Average investment = ½(121000- 11000)+ 12000+ 11000

½(110000)+ 23000

55000+23000

= 78000

Lets understand this technique with one more illustration

If two machines details are given, which one would you choose on the basis of ARR.

	A	B
Capital Outlay	1,56,125	1,56,125
Annual estimated Income After depreciation & Income-tax		
Year	PAT	PAT
1	13,375	21,375
2	15,375	19,375
3	17,375	17,375
4	19,375	15,375
5	21,375	13,375
Total	86,875	86,875

Estimated life for both the machines is five years.

Estimated salvage value for both the machines are 13000 each. Depreciation has been charged on straight line basis solution.

$$ARR = \frac{\text{Average income}}{\text{Average investment}} \times 100$$

First step is to calculate Average income by dividing 86875 by five for the first machine and second machine. We will get 17375. Then using the formula for the average investment we will calculate the average investment for both the machines.

$$\frac{17,375}{84562.5} = 20.54\%$$

Using the formula,

Average investment= 13000 + ½ (156125-13000)

13000+71563 = 845625

From the numerical example , any machine can be chosen as both the machines gives the similar results but the fact is in case of the B machine the return are higher in the earlier years which is ignored by this technique so the limitations of this technique are:

The method is based on accounting profits instead of actual cash flows after taxes in evaluating the projects.

It ignores the time value of money.

The technique is incompatible with the objective of wealth maximization to the equity shareholders.

Pay back technique:

It is a technique by which the company is in a position to know that in how much time the initial investment would be recovered. It answers the question: how many years will it take for the cash inflows to recover the original cost of an investment without considering the salvage value.

There are two ways of calculating the payback period. If the nature of cash flows are annuity (when the cash flows are uniform) then in such a situation PB can be calculated by using,

Investment / constant annual cash flow

For example an investment of Rs 160000 in a machine is expected to produce CFAT of Rs 20000 for 10 years calculate the payback period.

PB = 160000 / 20000

= 8 years

If the cash flows are not uniform and vary from year to year then payback is calculated by the process of cumulative cash flows till the time of cumulative cash flows becoming equal to the original investment outlay.

Calculate the payback period from the following:

Year	Annual CFAT		Cumulative CFAT	
	A	B	A	B
1	24000	32000	24000	32000
2	26000	30000	50000	62000
3	28000	28000	78000	90000
4	30000	26000	108000	116000
5	35000	27000	143000	143000

If the initial investment in A machine is Rs 75000 then machine A's investment will be recovered in 2.35 years. The sum of Rs 74000 can be recovered in 2 years and the balance of 1000 Rs will be recovered in the third year. The CFAT is Rs 28000 so the pay back fraction is therefore 1000/28000=0.35. Therefore the pay back period is 2.35 years.

For machine B the payback period would be calculated in this way. In the first year 32000 would be recovered and in the second year 30000 would be recovered so a fraction of 13000/28000 = 0.464 would be recovered in the third year Therefore the payback period is 2.464 years. The pay back for machine A is lower than the second machine that is B.

Lets understand this technique with one more example:

Rishabh ltd is considering two projects. Each project requires an investment of Rs 1,00,000. The firm's cost of capital is 10%. The net cash inflows from investments in two projects X and Y are as follows:

Year	1	2	3	4	5
X (Rs)	50000	40000	30000	10000	-
Y (Rs)	10000	20000	30000	40000	50000

The company has fixed 3 years PBP as the cut off point. State which project should be accepted.

Calculation of Pay Back Period

Year	Project X		Project Y	
	CFAT	Cumulative CFAT	CFAT	CumulativeCFAT
1	50000	50000	10000	10000
2	40000	90000	20000	30000
3	30000	120000	30000	60000
4	10000	130000	40000	100000
5	-		50000	150000

In the first two years 90000 rs would be recovered but still 10000 is to be recovered which can be done in the third year so 10000/ 30000= .33. Therefore the payback period is 2.33 years.

PBP of project Y is four years so Project X should be accepted.

Accept reject criteria: The payback period can be used as decision criteria to accept or reject investment proposals. A machine should be accepted whose payback is a smaller period.

Pay back period is simple to calculate and simple to understand. The problem with payback is that it completely ignores all cash inflows after the pay back period. This can be misleading in such decisions. It also ignores time value of money and ignores the entire life of the project. As a result projects with large cash inflows in the latter part of their lives may be rejected in favour of less profitable projects.

To summarize, the traditional methods suffers from two serious drawbacks. They do not consider the total benefits and the timing of cash flows.

2. Time Adjusted / Discounted Cash flow techniques

The most important feature of the techniques is that they take into consideration the time value of money and they take into consideration all benefits and costs occurring during the entire life of project.

NPV- Net Present Value

NPV is the most important discounting techniques in appraising the capital budgeting decisions. It calculates the investment decisions that involve cash flow occurring over multiple periods. The NPV of a project is the sum of the present values of all the cash flows positive and negative that is expected to occur over the life of the project. It is the process of calculating present values of cash inflows using cost of capital as an appropriate rate of discount and subtracts present value of cash outflows from the present value of cash inflow and find the net present value, positive or negative.

In simple words NPV is the summation of the present values of the net cash inflows in each year over the cash outflows. The formula for NPV can be written as follows:

$$NPV = \frac{C_1}{(1+K)^1} + \frac{C_2}{(1+K)^2} + \frac{C_3}{(1+K)^3} + \ldots\ldots + \frac{C_n}{(1+K)^n} - C_o$$

The formula explains that cash flows reoccurring in all the years should be added with salvage value and working capital released at the end of the life of the project. From this summation initial

outflow should be deducted to get the absolute NPV. A project would be accepted if NPV is positive and rejected if it is negative. Zero NPV would mean that the firm is indifferent to accept or reject the project as it would leave the company's financial position unchanged. The NPV of a package of projects is simply the sum of the NPVs of individual projects.

As a decision criteria NPV can also be used to select make a choice between mutually exclusive projects. The various projects would be ranked on the basis of NPV. The project with highest NPV would be given the first rank followed by others in the descending order.

NPV is the technique which recognises the time value of money. It takes into consideration the total benefits arising over the lifetime of the project.

This measure is an absolute measure so if two projects with similar outlays have different NPVs it is possible to make a right choice. But if the projects have different outlays then NPV may not give the right decision. This method can also not be relied on if two projects having different effective lives.

This technique can be explained with the help of an example

Suppose a project PQR costs Rs 25000 now and is expected to generate cash inflows of Rs 9000, Rs 8000, Rs 7000, Rs 6000 and Rs 5000in Years 1to 5.The opportunity cost of the capital is 10%. Calculate the Net Present value for the project.

Seeing the table we would calculate the present values of cash inflows

Rs 9000($PVF_{1, 0.10}$) +Rs 8000($PVF_{2, 0.10}$) + Rs 7000($PVF_{3, 0.10}$) + Rs 6000($PVF_{4, 0.10}$) + Rs 5000($PVF_{5, 0.10}$) – Rs 25000.

=Rs 27250-25000= 2250.

The project PQR generates positive NPV and therefore creates wealth for the shareholders and hence should be accepted.

Lets understand this important technique with one more example

A new machine costs Rs 200000, requires no increased investment in working capital and is expected to yield Rs 60000 profit per year for 10 years, at that time its scrap value will be negligible. Assume SLM depreciation and a 30 % tax rate.

If management requires at least a 10 % return on any new investment, would the investment qualify?

Solution

Calculation of CFAT

EBDT	60000
Less dep	20000
EBT	40000
Less Taxes@30%	12000
EAT	28000
Add Depreciation	20000
CFAT	48000.

Computation of NPV

For the Year 1 to 10 the cash flow remains the same. In the tenth year also, there is no release of working capital and scrap value so taking value from the table A-4, the 10^{th} year at discount factor 10 %, the value obtained is 6.145 which is to be multiplied by 48000 and the present value of cash inflows would be Rs 294960.From this cash outflows is deducted and the NPV is derived of Rs 94960.

IRR- Internal Rate of Return

The second other technique of discounted cash flow for appraising capital investment decisions is the IRR. The other name for this technique is yield on investment, marginal efficiency of capital, marginal productivity of capital, rate of return, time adjusted rate of return and so on. IRR method also considers time value of money by discounting the cash streams. It is 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 inflows (CFAT) with the aggregate present value of cash outflows of a project. It can also be defined as that rate which gives the project NPV equal to zero. According to Joel Dean (1951), IRR takes into account the magnitude and timing of cash flows.

The IRR is compared with the discount rate to decide whether the proposal should be accepted or rejected. If IRR exceeds the discount rate the project would be accepted and if the IRR doesn't exceeds the discount rate it would be rejected. If IRR is equal to the discount rate the firm is indifferent as to whether to accept or reject the project.

If the project IRR is greater than the cost of capital, the project should be accepted. If the IRR is less than the cost of Capital the project should be rejected. If IRR is equal to the cost of capital, the project may be accepted.

To understand this technique lets see a numerical example

A project needs an investment of Rs 1385000. The cost of capital is 12%. The net cash inflows are as follows

Year	1	2	3	4	5
CFAT(Rs)	300000	400000	600000	300000	
	200000				

Calculate IRR

Solution

Computation of IRR is based on the cash flow after taxes. In this method the evaluator selects any discount rate (by calculating Fake Pay back period) to compute present value of cash inflows otherwise, the cost of capital taken as first trail. If calculated present value of the cash inflows is higher than the present value cash outflows, then, the evaluator has to try a higher rate and vice versa.This process will be repeated till the present value of cash inflows equals to the present value of cash outflows. Generally, IRR may lies between Two discounting factors; in that case analyst has to interpolate using this formula

$$IRR = LDF\% + \frac{[PVLDF - COF]}{PVLDF - PVHDF} * \text{Difference in the two rates.}$$

Fake PBP = (Initial Investment/Average Annual cash flow)

=1385000/360000=3.847

Referring to the PV of an annuity of one rupee table, we find that the fake payback period of 3.847 lies in between 10% and 8% so,

Year	CFAT	DF		Present Values	
		10%	8%	10%	8%
1	300000	.909	.926	272700	277800
2	400000	.826	.857	330400	342800
3	600000	.751	.794	450600	476400
4	300000	.683	.735	204900	220500
5	200000	.621	.681	124200	136200
PV of Cash inflows				1382800	1453700

So using the formula for interpolation,

$$IRR = 8\% + \frac{(1453700 - 1385000)}{(1453700 - 1382800)} * 2\%$$

= 9.94%

Here, project can not be selected as the IRR is less than the cost of capital given as 12%.

Profitability Index

This is the other time adjusted capital budgeting technique. The profitability index approach measures the present value of returns per rupee invested. It is the ratio of the present value of cash inflows at the required rate of return to the initial cash outflow of the investment.

$$PI = \frac{\text{Present value of Cash Inflows}}{\text{Initial Cash Out flow}}$$

It is a relative measure but NPV is the absolute measure. Profitability Index is measured by dividing Present value of cash inflows by Present value of outflows. Profitability index is used for capital rationing because NPV does not give the right insight if Projects require different initial outlays. This method is also known as the Benefit cost ratio because the numerator measures the benefits and the denominator measures the cost.

Accept Reject Criterion

A Project will qualify for acceptance if the profitability index exceeds one. When profitability is equal to one, the firm is indifferent to the project.

Suppose the Initial cash out flow of a project is Rs 1000000 and it can generate cash inflow of Rs 400000, Rs 300000, Rs 500000 and Rs 200000 in years 1to 4. If the discount rate is 10%, then calculate Profitability Index.

Present value of cash flows need to be calculated first and here it is equal to 1123500.

$$PI = \frac{1123500}{1000000} = 1.12$$

The project with PI greater than 1 will be accepted.

3. Summary

The capital budgeting Proposals needs a carful analysis which can be done through the various discounted and non discounted techniques. These techniques have their own advantages and disadvantages. The discounted techniques are superior to non discounted techniques as they take into consideration the time value of money and the benefits occurring in the toatal life of the project.