
6 Financial Evaluation

6.1 INTRODUCTION

Investment in a project is normally done with the expectation that any cash outlay now will result in extra cash (or benefits) in the future. Financial evaluation methods try to estimate whether the cash returns from the investment will be enough to justify the initial investment.

The following commonly used methods will be discussed in this chapter:

- Payback period;
- Return on investment (ROI);
- Net present value (NPV);
- Internal rate of return (IRR);
- Cost/benefit analysis (CBA).

6.2 YEARLY CASH FLOWS

For any project, estimates of initial cash inflows and outflows are necessary for understanding the pattern of cash expenses on certain items of the project. (The word 'cash' includes coins and notes as well as cheques, drafts and other banking instruments.) The fundamental concept of the topic is discussed in this section for the understanding of the financial evaluation techniques that follow. Typically, fixed assets such as buildings equipment, vehicles and raw material. are to be acquired at the beginning of the project. These would need an initial cash outflow. Depending on the necessity, additional working capital outflows may also be incurred at a later year during the duration of the project. Other cash outflows include operating (wages and raw materials) and maintenance costs. As the project is completed, the working capital is released, which is turned into cash inflow. In cash flow computation, the inflows (benefits) are treated as positive and the outflows (costs) as negative.

The main cash inflow in a project is from sales revenue, after deducting operating and maintenance costs. For easy understanding, the effect of inflation is ignored.

A typical computation of cash flow is shown in Table 6.1.

6.3 TIME VALUE OF MONEY (TVM)

Time value of money (TVM) is the concept that money has potential earning capacity (i.e., certain 'interest'), and therefore, money available at the present time (present value) is worth more than the same amount in a future time (future value). Future values of money are computed by using the concept of compound interest. Thus, if \$10 is invested at 10% per annum and is left to accumulate interest, Table 6.2 shows how the capital grows in 3 years.

TABLE 6.1
Typical Cash Flow Computation over the Lifetime of a Project

Year	Annual Cash Flow (\$)		Net Cash Flow (\$)	Cumulative Cash Flow (\$)
	Inflow	Outflow		
0	NIL	-13,000	-13,000	-13,000
1	NIL	-23,000	-23,000	-36,000
2	NIL	-16,000	-16,000	-52,000
3	+18,000	-5,000	+13,000	-39,000
4	+21,000	-2,000	+19,000	-20,000
5	+26,000	-5,000	+21,000	+1,000
6	+32,000	-6,000	+26,000	+27,000
7	+28,000	-2,000	+26,000	+53,000
8	+15,000	-2,000	+13,000	+66,000
9	---	-1,000	-1,000	+65,000

TABLE 6.2
Future Value of \$10 at Compound Interest of 10%

Year	Future Value (\$)
0	10.00
1	11.00
2	12.10
3	13.31

In short, compounding is the method of moving cash flows forward in time. Similarly, cash flows can be moved back in time also. In this case, money received or paid at a future time is to be treated as less value than the same amount received or paid today.

6.4 PAYBACK PERIOD

Payback period is generally used as an initial yardstick for reviewing and screening of any project option in terms of period of time that it takes to pay back an initial cash investment. Cash flows are accumulated annually and payback period is considered to have been reached when the cumulative cash flow reaches zero. In the cash flow, when there is initial outlay, the term 'Year 0' is used to signify the start of the project.

It should be noted that payback period uses cash flows only and not the net income. Also, it does not take care of the profitability of the project. It simply computes how fast the investment is recovered. Other parameters being equal, shorter payback periods are preferable to longer payback periods. Payback period is normally expressed in years. Table 6.3 illustrates a typical example of computation of payback period.

TABLE 6.3
Computation of Payback Period

Year	Annual Cash Flow (\$)	Cumulative Cash Flow (\$)
0	-40,000	-40,000
1	+12,000	-28,000
2	+14,000	-14,000
3	+8,000	-6,000
4	+8,000	+2,000

In this example, the payback period is between 3 and 4 years, and *the cumulative cash flow becomes positive in the 4th year*. In practice, the year in which the cumulative cash flow becomes positive is designated as the payback year.

6.4.1 ADVANTAGES

The basic advantages of payback period method are briefly stated below:

- Payback period is easy to comprehend and calculate. This is a ‘rule of thumb’ method for appraisal of projects of minor nature that come across frequently for investment decisions. Primary aim is to get the money back as early as possible so that it can be re-invested in other projects. Thus, it is a useful capital budgeting method for cash-starved business organizations;
- It tries to take care of the risk factor in an investment. In cases where risk is anticipated from political, economic or any other direction, the shortest payback period should be the best option as the shortest time period reduces the risk of unforeseen happenings.

6.4.2 DISADVANTAGES

In spite of its simplicity to calculate, the payback period method has some inherent disadvantages. These are briefly discussed below:

- Payback period does not take into account the TVM and consequently does not present the true financial scenario while evaluating the cash flows of different options of a project. The issues related to TVM (e.g., NPV, IRR and discounted cash flow) will be discussed in later sections;
- Payback period is an arbitrary period without any rationale for selecting a particular project. It provides primary emphasis on the shortest period of time for returning the investment and ignores cash inflows after the payback period. Thus, the method is likely to reject an alternative and perhaps a better investment proposal simply because it does not meet an arbitrary payback period target. This, certainly, is not a sound financial decision. The weakness is illustrated by an example. Two investment options are compared, viz., Project A and Project B, each requiring an investment of \$ 40,000. The expected cash flows are shown in Table 6.4.

TABLE 6.4
Comparison of Investment Options

Year	Project A		Project B	
	Annual Cash Flow (\$)	Cumulative Cash Flow (\$)	Annual Cash Flow (\$)	Cumulative Cash Flow (\$)
0	-40,000	-40,000	-40,000	-40,000
1	+12,000	-28,000	+4,000	-36,000
2	+14,000	-14,000	+6,000	-30,000
3	+8,000	-6,000	+10,000	-20,000
4	+8,000	+2,000	+12,000	-8,000
5	+2,000	+4,000	+12,000	+4,000
6			+10,000	+14,000
7			+10,000	+24,000

In this example, as per payback period method, Project A takes lesser period for recouping the initial investment and should be accepted. However, this would mean rejection of a more profitable option, viz., Project B, which continues to give revenues for more years after the payback period of the alternative option (Project A);

- Payback period method ignores the timing and the quantum of the cash flows within the payback period. In Table 6.5, two identical investment proposals, both having the same payback period, are compared. Cash inflow in case of Project C is more in the first two years compared to that in the case of Project D, and consequently, Project C has an advantage over Project D. But at the same time, it has to be considered that cash inflows after the payback period are much higher in the case of Project D. This aspect is required to be considered during selection process.

TABLE 6.5
Comparison of Investment Options

Year	Project C		Project D	
	Annual Cash Flow (\$)	Cumulative Cash Flow (\$)	Annual Cash Flow (\$)	Cumulative Cash Flow (\$)
0	-60,000	-60,000	-60,000	-60,000
1	+20,000	-40,000	+10,000	-50,000
2	+20,000	-20,000	+10,000	-40,000
3	+10,000	-10,000	+20,000	-20,000
4	+10,000	NIL	+20,000	NIL
5 (Onwards)	+10,000	+10,000	+20,000	+20,000

6.5 RETURN ON INVESTMENT (ROI)

This method is also known in a number of titles, of which accounting rate of return (ARR) and return on capital employed (ROCE) are some of the most commonly used titles. In this method, an average rate of return is calculated by expressing average annual profit as a percentage of average capital investment in the project. Thus,

$$\text{ROI} = \frac{\text{Estimated average annual profit}}{\text{Average capital invested}} \times 100$$

This can be illustrated by an example.

Rs. 1,70,000/- is invested in a project, and the estimated annual profits are as follows:

Year 1: Rs. 10,000/-

Year 2: Rs. 20,000/-

Year 3: Rs. 20,000/-

Year 4: Rs. 10,000/-

Total profit = Rs. 60,000/-

$$\text{Average annual profit} = \frac{\text{Rs. } 60,000}{4} = \text{Rs. } 15,000$$

$$\text{Average capital invested} = \frac{\text{Rs. } 1,70,000}{2} = \text{Rs. } 85,000$$

$$\begin{aligned} \text{Therefore, ROI} &= \frac{\text{Rs. } 15,000}{\text{Rs. } 85,000} \times 100 \\ &= 17.65\% \end{aligned}$$

6.6 NET PRESENT VALUE (NPV)

In this method, all future costs and benefits related to a project are brought together into a single value by applying the traditional 'present-value' concept on a base date corresponding to the initial costs. The inflows (benefits) are treated as positive and outflows costs as negative, and the summation gives the NPV.

Thus:

$$\text{NPV} = \sum_{t=1}^{\text{ton}} \frac{(b - c)}{(1 + r)^t}$$

where

b = Benefits

c = Costs

r = Selected discount rate per annum expressed in decimal

t = Time in years when the future cost is incurred

n = Number of years considered in the analysis (life of the project)

The following example will make the matter clear:

A discount rate of 10% is assumed for a project with an initial outlay of \$10,000 in year 'one'. In year 'two', the net income is \$7,000 and again \$6,000 in year 'three'.

The NPV will be calculated as follows:

$$\begin{aligned} \text{NPV} &= -10,000 + \frac{7,000}{1.10} + \frac{6,000}{(1.10)^2} \\ &= +1,322 \end{aligned}$$

A positive NPV implies that estimated total benefits exceed total costs. While comparing alternative proposals, the project with higher NPV is to be preferred, other factors being equal.

6.7 INTERNAL RATE OF RETURN (IRR)

The IRR of a project is the rate of return (discount rate) which equates the discounted net benefits to discounted capital costs, and can be obtained by solving for r in the following equation:

$$C_0 = \sum_{t=1 \text{ to } n} \frac{(b-c)}{(1+r)^t}$$

where

C_0 = Initial outlay

b = Benefits

c = Costs

r = Selected discount rate per annum expressed in decimal

t = Time in years when the future cost is incurred

n = Number of years considered in the analysis (life of the project)

As an illustration of computation of IRR, consider that the initial outlay for a project is \$10,000 and the subsequent annual returns are \$3,000, \$4,000 and \$6,000 in years one, two and three at a return rate of r . This can be represented by the following equation:

$$10,000 = \frac{3,000}{(1+r)^1} + \frac{4,000}{(1+r)^2} + \frac{6,000}{(1+r)^3}$$

Solving the above equation for IRR of a project is rather tedious and needs a trial-and-error method if done manually. This can be solved easily by using a computer.

If the IRR calculated from the above formula exceeds the rate of interest obtained by investing capital in the open market, the scheme may be considered acceptable.

6.8 COMPARISON BETWEEN NPV AND IRR METHODS

In NPV method, the discount rate is assumed first and the NPV is calculated accordingly. However, in the IRR method, the present value is set to be equal to zero, and then the 'rate' (IRR) that satisfies this condition is determined. Essentially, IRR does not produce any new information compared to NPV. It indicates the same information in a different manner.

6.9 BENEFIT/COST RATIO (BCR)

In this method, all benefits and costs are discounted to their present value, and the ratio of the benefits to costs is calculated. As in the previous cases, benefits and costs are considered as positive and negative values, respectively.

Thus:

$$\text{BCR} = \frac{\text{Discounted benefits}}{\text{Discounted costs}} = \frac{\text{NPV}}{C_0}$$

where the symbols are as before.

A project with a BCR greater than one is worth undertaking. Also, for comparing purpose, higher the value of BCR for an alternative, the higher will be its ranking.

6.10 DRAWBACKS OF BCR

BCR method is a popular method used by the analysts. However, it suffers from a few drawbacks. The major drawback is that the discount rate needs to be assumed. This rate is related to the opportunity cost of capital, which is not easy to ascertain.

6.11 CONCLUDING REMARKS

The methods discussed in this chapter are extensively used for financial evaluation of projects. These involve four basic parameters, viz., initial costs, future costs, predicted time frame and the discount rate. While initial costs can be reasonably estimated, there are some misgivings about the accuracy in forecasting the other parameters. Although these perceived difficulties are real to varying degrees, the method is often utilized as a very useful qualitative tool for decision making. It addresses the future costs in proper perspective and offers an informed and rational way of evaluation of alternative solutions. It also brings to focus that the future costs are required to be given due importance in the early stage of the project itself and that the concerned stakeholders should be aware of the consequences of their present actions. To make it more effective, reliable inputs such as database of future costs, service life, as well as appropriate discount rates in respect of different alternatives, are to be made available in the early stage of the project cycle.

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