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CAPITAL BUDGETING

Learning Objectives

After completing this chapter, you should be able to understand

- the concept and significance of capital budgeting
- kinds of capital budgeting decisions
- estimation of cash inflows and cash outflows
- evaluation of investment proposals under
  - (a) payback method
  - (b) accounting rate of return method
  - (c) internal rate of return method
  - (d) net present value method
  - (e) profitability Index
- limitations of capital budgeting process.

INTRODUCTION

Every organisation, irrespective of its nature (profit-making or otherwise) or size (big or small), in the course of its functioning, usually acquires, upgrades, replaces the assets such as land and buildings, plant and machinery and so on. For each of these, there exist two or more alternatives, which need to be carefully evaluated on the basis of their costs and revenues. To improve the quality of our decisions, an understanding of the principles and practices of capital budgeting is essential.

NATURE OF CAPITAL BUDGETING

Charles T Horngren defines capital budgeting as 'the long-term planning to make and finance proposed capital outlays.' The capital budgeting decisions involve long-term planning for selection and also financing the investment proposals. Capital budgeting is the process of evaluating the relative worth of long-term investment proposals on the basis of their respective profitability.

Capital budgets are different from operating budgets from time frame point of view. Operating budgets (such as sales budget, purchase budget or overheads budget) show the firm's planned operations or resource allocation for a given period in future, normally one year. On the other hand, capital budgets are made for long-term period say three years or beyond.

Long-term investment proposals involve larger cash outlays. This requires a careful analysis of cash outflows and inflows associated with each of these proposals. While evaluating capital budgeting proposals, the following steps are considered:

- Generating investment proposals
- Estimating cash flows for the proposals
- Evaluating cash flows
- Selection of projects based on an acceptance criterion
- Monitoring and re-evaluating, on a continuous basis, the investment projects, once they are accepted.

SIGNIFICANCE OF CAPITAL BUDGETING

Capital budgeting decisions assume special significance for the following reasons:

1. **Substantial capital outlays** Capital budgeting decisions involve substantial capital outlays.
2. **Long-term implications** Capital budgeting proposals are of longer duration and hence have long-term implications. For instance, the cash flows for next 5 to 15 years have to be forecast.
3. **Strategic in nature** Capital budgeting decision can affect the future of the company significantly as it constitutes the strategic determinant for the success of a company. A right investment decision is the secret of the success of many business enterprises.
4. **Irreversible** Once the funds are committed to a particular project, we cannot take back the decision. If the decision is to be reversed, we may have to lose a significant portion of the funds already committed. It may involve loss of time and efforts. In other words, the capital budgeting decisions are irreversible or may not be easily reversible.

Complications Underlying Capital Budgeting Decisions

Capital Budgeting decisions are complex because of the following:

- **Varying cash flows at different points of time** Cash flows occur at different points of time in future. The future cash flows, both inflows and outflows, are to be estimated now to take decide whether to commit substantial funds in a project under consideration or not. Since the future is uncertain, the process of estimating future cash flows needs to be a specialised task.
- **Time value factor** Cash inflows occurring at different points of time have to be compared with the corresponding cash outflows using the concept of 'time value' of money.

WHY IS CAPITAL BUDGETING NECESSARY

It is necessary to reduce costs or increase revenues to maximise profits. The company is said to be efficient in its operations when it can maximise profits. In other words, capital budgeting decisions are made to keep the business vibrant, competitive, profitable and thus efficient. Capital budgeting decisions can be classified into the following types:

- Projects that reduce costs
- Projects that increase revenues

Of these two, the capital budgeting decisions that reduce costs are relatively easier to be handled as full information about their present costs and revenues is available. What is to be decided here is: how to reduce the costs further before a capital budgeting proposal is selected.

Regarding the projects which increase the revenues, it may be difficult to select one from the given alternatives. It is so because the available data about the future cash flows has its own limitations, such as uncertainty in future, inaccurate estimate of life of the asset and so on.

CAPITAL BUDGETING DECISIONS

The following are examples of certain investment or capital budgeting decisions:

- Construction of a new building, or renovation of existing old buildings
- Interior decoration of a given building
- Purchase of technology from a foreign country
- Building a production facility
- Buying a new delivery truck
- Sponsoring a local football or cricket team for one or more number of years
- Building a bridge
- Buying an airline
- Making a new product
- Starting a new business
- Expansion decisions of existing plant and equipment
- Replacement decisions for replacing worn out or damaged equipment as well as replacing obsolete equipment
- Decision to expand into new products or markets such as R& D
- Advertising for the product or service or undertaking market survey
- Safety and/or environmental protection investment decisions necessary to comply with government directives
- Labour agreements and so on.

METHODS OF CAPITAL BUDGETING

Capital budgeting decisions are made under different criteria. How are these criteria determined. These criteria differ in concepts. Some use thumb rules and some use logic and scientific approach. So, based on these criteria, the methods of capital budgeting can be classified as

(a) Traditional methods
  (i) Payback period
  (ii) Accounting rate of return method

(b) Discounted cash flow methods.
  (i) Internal rate of return (IRR) method
  (ii) Net present value (NPV) method.

Let us discuss these methods in detail.

Payback Method

Under payback method, the decision to accept or reject a proposal is based on its payback period. *Payback period* refers to the period within which the original cost of the project is recovered. It is calculated by dividing the cost of the project by the annual cash inflows.

$$\text{Payback period} = \frac{\text{Cost of the project}}{\text{Annual cash inflows}}$$

The shorter the length of the payback period, the better is the project in terms of paying back the original investment. Particularly where the future is uncertain, the companies favour this method. The earlier the original investment is recovered, the better it is, in terms of safety and liquidity. Where the cashflows are uniform throughout, they are said to even. Consider this example.

Where the cash inflows are even

Advantages

1. *Easy to calculate and understand* Calculation of payback period does not involve any complicated formulae. It is easy to calculate and understand.
2. *Liquidity is emphasised* It emphasises on the earlier cash flows which are more likely to be accurate than later cash flow. In other words, a short payback period also reduces the risk. (The more the risk, it is more likely that a part or whole of the investment will be lost).
3. *Reliable technique in volatile business conditions* It is a reliable technique for project appraisal particularly in the areas of volatile business conditions such as change in technology, changing fashions or customer's tastes/preferences.

Disadvantages

1. *Post-payback earnings ignored* This method ignores the earnings after the payback period. It ignores the total life of the project and the total profitability of the investment.
2. *Timing of cash flows ignored* This method does not consider the timing of cash flows. All the cash flows are given equal weightage.
3. *Liquidity is over-emphasised* The liquidity of the proposal is over-emphasised by choosing only cash inflows. Other factors such as cost of proposal or cost of capital are ignored.

Despite the above limitations, the pay back method continues to be very popular and widely put to use particularly where there is a high degree of uncertainty.

Accounting Rate of Return (ARR) Method

Accounting rate of return refers to the ratio of annual profits after taxes to the average investment. The average investment is equal to half of the original investment. Accounting rate of return is also called average rate of return.

$$\text{ARR} = \frac{\text{Average annual profits after taxes}}{\text{Average investment}}$$

Where average investment is half of the capital outlay (that is, Capital outlay divided by 2). Average capital employed is calculated to the usual accounting convention that the original investment gets exhausted steadily to zero over the life of the project.

It is assumed that the asset is depreciated as per straight line method. Usually it is expressed in terms of percentage. The *higher the ARR is, the better is the profitability* and hence the projects with higher accounting rate of return are short-listed for implementation.

The above formula can be changed as per the needs of the appraisal. Average profits can be considered before or after depreciation, interest or taxes. At times, ARR is determined considering the original cost of the project as the denominator.

Table 17.4 Present Value of Re. 1.

Years	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%	22%	24%	25%	28%	30%
1	0.952	0.913	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833	0.820	0.806	0.800	0.781	0.769
2	0.907	0.890	0.857	0.826	0.797	0.769	0.756	0.743	0.718	0.694	0.672	0.650	0.640	0.610	0.592
3	0.864	0.840	0.794	0.751	0.712	().675	0.658	0.641	0.609	0.579	0.551	0.524	0.512	0.477	0.450
4	0.823	0.792	0.735	0.683	0.636	0.592	0.572	0.552	0.516	0.482	0.451	0.423	0.410	0.373	0.350
5	0.784	0.747	0.681	0.621	0.567	0.519	0.497	0.476	0.437	0.402	0.370	0.341	0.328	0.291	0.269
6	0.746	0.705	0.630	0.564	0.507	0.456	0.432	0.410	0.370	0.335	0.303	0.275	0.262	0.227	0.207
7	0.711	0.665	0.583	0.513	0.452	0.400	0.376	0.354	0.314	0.279	0.249	0.222	0.210	0.170	0.159
8	0.677	0.627	0.540	0.467	0.404	0.351	0.327	0.305	0.266	0.233	0.204	0.179	0.118	0.139	0.123
9	0.645	0.592	0.500	0.424	0.361	0.308	0.284	0.263	0.225	0.193	0.167	0.144	0.134	0 108	0.094
10	0.614	0.558	0.463	0.386	0.322	0.270	0.247	0.227	0.191	0.162	0.137	0.116	0.107	0.085	0.073
11	0.585	0.527	0.429	0.350	0.287	0.237	0.215	0.195	0.162	0.135	0.112	0.094	0.087	0.066	0.056
12	0.557	0.497	0.397	0.319	0.257	0.208	0.187	0.168	0.137	0.112	0.092	0.076	0.069	0.032	0.043
13	0.530	0.469	0.368	0.290	0.229	0.182	0.163	0.145	0.116	0.093	0.075	0.061	0.055	0.040	0.033
14	0.505	0.442	0.340	0.263	0.205	0.160	0.141	0.125	0.099	0.078	0.062	0.049	0.044	0.032	0.025
15	0.481	0.417	0.315	0.239	0.183	0.140	0.123	0.108	0.084	0.065	0.051	0.040	0.035	0.025	0.020
16	0.458	0.394	0.292	0.218	0.163	0.123	0.107	0.093	0.071	0.054	0.042	0.032	0.028	0.019	0.015
17	0.436	0.371	0.270	0.198	0.146	0.108	0.093	0.80	0.060	0.045	0.034	0.026	0.023	0.015	0.012
18	0.416	0.350	0.250	0.180	0.130	0.095	0.081	0.069	0.051	0.038	0.028	0.021	0.018	0.012	0.009
19	0.396	0.331	0.232	0.164	0.116	0.83	0.070	0.060	0.043	0.031	0.023	0.017	0.014	0.009	0.007
20	0.377	0.312	0.215	0.149	0.104	0.073	0.061	0.051	0.037	0.026	0.019	0.014	0.012	0.007	0.005

Given scrap value and working capital particulars, then the present value of the given series of cash inflows will be determined as given below:

$$PV = \sum_{t=1}^{n} \frac{CF_t}{(1+K)^t} + \frac{S_n}{(1+K)^n} + \frac{W_n}{(1+K)^n}$$

Table 17.5 Present Value of Re. 1 Received Annually for N. Years.

Years	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%	22%	24%	25%	28%	30%
1	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833	0.820	0.806	0.800	0.781	0.769
2	1.859	1.833	1.783	1.736	1.690	1.647	1.646	1.605	1.566	1.528	1.492	1.457	1.440	1.392	1.361
3	2.723	2.676	2.577	2.487	2.402	2.322	2.283	2.246	2.174	2.016	2.042	1.981	1.952	1.868	1.816
4	3.546	3.465	3.312	3.170	3.037	2.914	2.855	2.798	2.690	2.589	2.494	2.404	2.362	2.241	2.166
5	4.330	4.212	3.993	3.791	3.605	3.433	3.352	3.274	3.127	2.991	2.864	2.745	2.689	2.532	2.346
6	5.076	4.917	4.623	4.335	4.111	3.889	3.784	3.685	3.498	3.326	3.167	3.020	2.951	2.759	2.643
7	5.786	5.582	5.206	4.868	4.564	4.288	4.160	4.039	3.812	3.605	3.416	3.242	3.161	2.937	2.802
8	6.463	6.210	5.747	5.335	4.968	4.639	4.487	4.344	4.078	3.837	3.619	4.421	3.329	3.076	2.925
9	7.109	6.802	6.247	5.759	5.328	4.946	4.772	4.607	4.303	4.031	3.786	3.566	3.463	3.184	3.019
10	7.722	7.360	6.710	6.145	5.650	4.216	5.019	4.833	5.494	4.192	3.923	3.682	3.571	5.269	3.092
11	8.306	7.887	7.139	6.495	5.937	5.453	5.234	5.029	4.656	4.327	4.035	3.776	3.656	3.335	3.147
12	8.863	8.384	7.536	6.814	6.194	5.660	5.421	5.197	4.793	4.439	4.127	3.851	3.725	3.387	3.190
13	9.394	8.853	7.904	7.103	6.424	5.842	5.583	5.342	4.910	4.533	4.203	3.912	3.780	3.427	3.223
14	9.899	9.295	8.244	7.367	6.628	6.002	.5.724	5.468	5.008	4.611	4.265	3.962	3.824	3.459	3.249
15	10.380	9.712	8.559	7.606	6.811	6.142	5.847	5.575	5.092	4.675	4.315	4.001	3.859	3.483	3.268
16	10.838	10.106	8.851	7.824	6.974	6.265	5.954	5.669	5.162	4.730	4.357	4.033	3.887	3.503	3.283
17	11.274	10.477	9.122	8.022	7.120	6.373	6.047	5.749	5.222	4.775	4.391	4.059	3.910	3.518	3.295
18	11.690	10.828	9.372	8.201	7.250	6.467	5.128	5.818	4.273	4.812	4.419	4.080	3.928	3.529	3.304
19	12.085	11.158	9.614	8.365	7.366	6.550	6.198	5.877	5.316	4.844	4.442	4.097	3.442	3.539	3.311
20	12.462	11.470	9.818	8.514	7.469	6.623	6.259	5.929	5.353	4.870	4.660	4.110	3.954	3.546	3.316

Where S_n is scrap value, W_n is the working capital and *n* refers to the last period.

Let us apply this principle to the cash inflows of a project.

Internal Rate of Return (IRR) Method

Internal rate of return is that rate of return at which the present value of expected cash flows of a project exactly equals the original investment. In other words, it equates the present value of a given project with its outlay. This is the cut-off point at which the income equals the expenditure or the investment breaks even.

At IRR, the net present value of a project is zero. The net present value refers to the excess of the present value of future cash flows over and above the original investment. IRR is denoted by 'r'. It is computed as shown below:

$$C = \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} \cdots \frac{CF_n}{(1+r)^n}$$

Where C is the capital outlay, r is the internal rate of return and CF_n is the cash inflow at different time periods.

If we have scrap value and working capital adjustments, the above formula will change to:

This shows that IRR is that rate at which the difference between the present value of cash inflows and the original cost is equal to zero.

[illegible] If the IRR is more than the cost of [illegible] different IRRs.

Advantages

1. IRR is based on time value of money.
2. It is based on the earnings of all the years of the project.
3. It is a valuable tool to compare the projects with different cash inflows and different life span.
4. It is independent of cost of capital.
5. Such projects with higher IRR are recommended. Hence it directly contributes to the 'wealth maximisation goal' of the finance manager.

Disadvantages

1. It is difficult to understand and tedious to calculate IRR by even trial and error.
2. It is based on certain assumptions, one of which is that the intermediate cash inflows are reinvested at IRR. Where the company has more than one project with different IRRs, this assumption may not hold good.
3. There could be cases of non-conventional projects with multiple IRRs, which are difficult to understand.
4. There are cases where higher IRR does not necessarily contribute to wealth maximisation (particularly in the case of mutually exclusive projects where NPV method is better).

Net Present Value Method

Net present value refers to the *excess* of present value of future cash inflows over and above the cost of original investment.

NPV = (PV_{CFAT}) minus (PVc)

Where PV_{CFAT} refers to the present value of future cash inflows after taxes

PVc refers to present value of original investment or capital

The concept of NPV is a logical extension to the concept of present value. Here the decision is based on the size of net present value. The projects with higher NPVs are selected. If the NPV is negative, that means the project is not profitable. In other words, the NPV should always be positive and should be maximum. The present value factor tables are used here to determine the present value of the future cash inflows.

positive cash flows will be only.

PROFITABILITY INDEX

This is the ratio between the present value of cash inflows and the present value of cash outflows. It is used to indicate the profitability at a glance.

Where the projects differ in their duration and the cash flows, these can be compared based on their profitability index.

$$\text{Profitability Index} = \frac{\text{Sum of present value of cash inflows}}{\text{Sum of present value of cash outflows}}$$

Interpretation

The profitability index is more than one for the profitable projects.

If the profitability index is less than one, reject the proposal.

If the profitability index is equal to one, the proposal is just break even.

If the profitability index is more than one, accept the proposal.

The higher the index, the more profitable the proposal is.

Example 15 Profitability index