Capital Budget

Capital budget or capital investment decisions require the evaluation of cash inflow and outflows over several years to determine the acceptability of the project. These are usually described as long-term decisions and they focus on specific projects or programs. In these decisions managers must decide whether they should undertake a particular capital investment project. In such a decision, the required funds are available or readily obtainable, and management must decide whether the project is worthwhile.

Capital Budget

Types of capital investment decisions

Two types of capital budgeting projects will be considered: independent projects and mutually exclusive projects.

1. Independent projects are projects that, if accepted or rejected, do not affect the cash flows of other projects. For example, a decisions by McDonald to develop a restaurant in Jordan is not affected by its decision to build a new restaurant in Iraq. These are independent capital investment decisions.

Mutually exclusive projects are those projects that, if accepted, prevent the acceptance of all other competing projects. For example, some equipment uses traditional technology , while other options offer advanced technology for energy efficiency. Once one type of equipment is chosen the other type is excluded; they are mutually exclusive.

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Capital Budget

The capital budget process

Five stages of the capital budget process can be identified:

Stage 1: Identify Projects

Identify potential capital investments that agree with the organization's strategy.

Stage 2: Obtain Information:

Gather information about benefit and cost of investment projects. these information may be quantitative and qualitative.

Stage 3: Make Decisions by Choosing Among Alternatives

Determine which investment yields the greatest benefit and the least cost to the organization.

Stage 4: Obtain funding:

Sources of funding include internally generated cash flow as well as equity and debt securities sold in capital markets.

Stage 5: Implement the Decision, Evaluate Performance.

As the cash outflows and inflows begin to accumulate, managers can verify whether the predictions made in stage 3 agree with the actual flows of cash from the project.

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Capital Budget

Determining initial cost of investment

Initial cost of investment is cash outflows at beginning the life of investment project. generally, it includes the following items.

1. Purchase price of new assets. These cash outflow, made for purchasing plant and equipment, occur at the beginning of the project's life.

2. Expenditure before use. These expenditures include cash outflows for transporting and installing the equipment. These expenditure must be added to initial investments.

3. Additional investment in working capital. working capital is current assets, such as accounts receivable and inventories, minus current liabilities, such as accounts payable. Initial investment in plant and equipment are usually accompanied by additional investment in working capital. These additional investment in working capital must be added to initial cost of investment.

4. cash flow from current disposal of old machine. Any cash received from disposal of the old machine is a cash inflow (in year 0). this cash inflow must be deducted from the initial cost of investment.

5. tax on profit of sale or disposal of old machine must be deducted from disposal value.

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Capital Budget

Example

A company has an old machines. The historical cost of these machines is $25000000 and their book value is $5000000. These machines can be sold at $10000000.

Management of the company plans to replace old machines with new machines which their purchase price is $50000000. The new machines need the following cost:

Transportation $1500000

Customs fees $2000000

Installing $2500000

New machines have high production capacity, so they require additional investment in working capital as following

Increase raw material inventory for $2000000

Increase finished goods inventory for $6000000

Increase balance of accounts receivable for $2000000

Purchasing spare part for new machines for $2000000

These additional investment will be kept until the end of machines' life. The profits of the company are subjected to income tax at %40.

Required: calculate initial cost of investment

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Cost of investment	
50000000	Price of new machines
6000000	+ expenditure before the use (1500000 + 2000000 + 2500000)
56000000	Cost of new machine
12000000	+ additional investment in working capital (raw material 2000000 + finished goods inventory 6000000 + increase accounts receivable 2000000 + spare part 2000000)
8000000	- After tax disposal value for old machine (Disposal value 10000000 - income tax 2000000)
60000000	Cost of investment (cash outflow)

Profit of disposal the old machine = market value 10000000 – book value 5000000 = 5000000

Income tax on profit of disposal the old machine = 5000000 x %40 = 2000000

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Determining Cash returns (cash inflow)

1. cash inflow may be generated from producing and selling additional goods by means of investment in new machines have a capacity more than old machines.

2. cash inflow may be resulted from saving in costs, so this reduction in costs is considered cash return. for example:
   A) buying a new advanced machine leads to reduce number of workers. Therefore, saving in wages of workers is cash return for this investment.
   B) buying a new machine lead to reduce the cost of maintenance. this saving in cost is cash return.

3. Income tax is considered annual cash outflow which is paid from the profit of the project. therefore, income tax must be deducted from cash return.

Capital Budget

Example

A company wants to buy a new machine for $6000000. This machine will produce a product which is sold at $500 per unit. Variable production cost is $200 per unit and annually fixed cash production cost is $100000. Estimated sales quantity, which is produced by this machine, is 12500 units.

New machine generates saving in maintenance cost for $350000 and it has disposal value $800000 at the end of 8 years (the production life of new machine). Income tax rate is %40. The book value of old machine is zero and its disposal value is zero.

Required:

1. Calculate cash return (cash inflows).
2. Draw diagram of annual cash inflows

6250000	Sales revenues (12500 units x $500)
2500000	- Variable cost (12500 units x $200)
3750000	= contribution margin
350000	+ saving in maintenance cost
4100000	Total cash returns
100000	- Fixed cash cost
4000000	Cash return before tax
650000	Depreciation (6000000 – 800000) ÷ 8
3350000	Net income before tax
1340000	Income tax(3350000 x %40)
2010000	Net income after tax
650000	+ depreciation
2660000	= net cash return (cash inflow) after tax

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Diagram of annual cash inflows

8	7	6	5	4	3	2	1	0	Years
2660000 + 800000	2660000	2660000	2660000	2660000	2660000	2660000	2660000	6000000	Annual cash outflow /inflow

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Discounted cash flows approach

Discounted cash flow (DCF) approach measures all expected future cash inflows and outflows of a project discounted back to the present point in time. The key feature of DCF approach is the time value of money, which means that a dollar received today is worth more than a dollar received at any future time. The reason is that $1 received today can be invested at, say, 10% per year so that it grows to $1.10 at the end of one year. To explain discounted cash flows approach, we need to know concepts of future value and present value.

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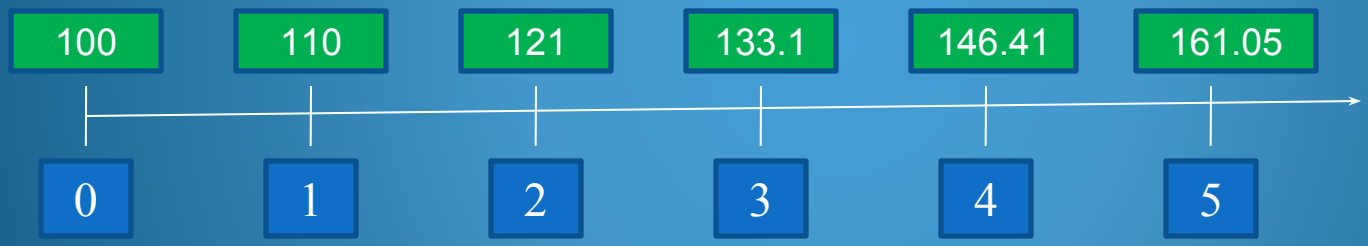
Future value also is called compound value. It means an amount of money that has accumulated over a period of time based on an assumed certain interest rate. For example, you invest $100 at interest rate %10 for 5 years.

The figure shows that $100 after 5 years will become $161.05 which is referred as future value and it is calculated as following



$Fv = P (1 + r)^n$

$Fv = 100 (1 + 0.1)^5$

$Fv = 100 (1.6105)$

$Fv = 161.05$

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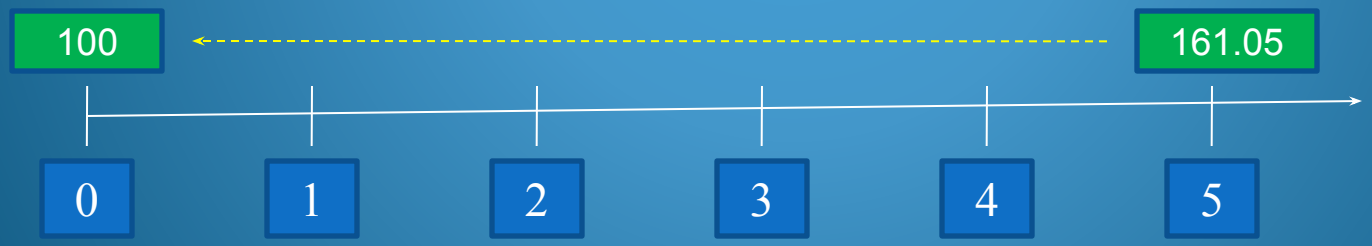
Present value, also known as discounted value, aims to measure a future amount of money in today's dollars according to an interest rate. In other words, it aims to know value of future money that will be received in the moment of investment.

Example : you will received $161.05 after 5 years

Required: calculate the present value for the above amount. If you know that interest rate is %10.



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We can determine the present value as follows

$$P = \frac{F}{(1 + r)^n}$$

$$P = \frac{161.05}{(1 + 0.1)^5}$$

$$P = \frac{161.05}{1.6105}$$

$$P = \$100$$

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Discounted cash flows approach

1. Net present value (NPV) method

The net present value (NPV) method calculates the expected monetary gain or loss from a project by discounting all expected future cash inflows and outflows back to the present point in time using the required rate of return.

NPV = present value for annual cash return – cost of investment

= (cash return x discount factor) – cost of investment

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Example (1)

Arab company have two alternatives investment projects. The following information are related to two projects:

Second project	First project	Details
3200000	3200000	Initial investment
Cash inflows:		
1800000	1000000	First year
1200000	1000000	Second year
1000000	1000000	Third year
500000	1000000	Fourth year
500000	1000000	Fifth year

If you know that interest rate is %12.

Required: evaluate the two investment projects by using net present value (NPV) method

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First project **(uniform series Cash Flows)**

NPV = present value for annual cash return – cost of investment

= (cash return x discount factor) – cost of investment

= (1000000 x 3.605) - 3200000

= 3605000 - 3200000

= 405000

OR

Present value	Discount factors	Cash inflows	Year
893000	0.893	1000000	1
797000	0.797	1000000	2
712000	0.712	1000000	3
636000	0.636	1000000	4
567000	0.567	1000000	5
3605000	Present value for cash inflows		
3200000	- Present value for cash outflows (cost of investment)		
405000	= Net present value		

Capital Budget

Second project (uneven series cash flows)

Present value	Discount factors	Cash inflows	year
1607400	0.893	1800000	1
956400	0.797	1200000	2
712000	0.712	1000000	3
318000	0.636	500000	4
283500	0.567	500000	5
3877300	Present value for cash inflows		
3200000	- Present value for cash outflows (cost of investment)		
677300	= Net present value		

The two projects are acceptable, but the second project is the better because it owns positive net present value more than the first project.

Example (2)The same information in the example (1) and assume that the first project and the second project have disposal value for $400000 and $200000 respectively at the end of their life.

First project **(uniform series Cash Flows)**

NPV = present value for annual cash return – cost of investment

= (cash return x discount factor) + (disposal value x discount factor) – cost of investment

= (1000000 x 3.605) + (400000 x 0.567) - 3200000

= 3831800 - 3200000

= 631800

OR

Present value	Discount factors	Cash inflows	Year
893000	0.893	1000000	1
797000	0.797	1000000	2
712000	0.712	1000000	3
636000	0.636	1000000	4
567000	0.567	1000000	5
226800	0.567	400000	5
3831800	Present value for cash inflows		
3200000	- Present value for cash outflows (cost of investment)		
631800	= Net present value		

Capital Budget

Second project **(uneven series Cash Flows)**

Present value	Discount factors	Cash inflows	year
1607400	0.893	1800000	1
956400	0.797	1200000	2
712000	0.712	1000000	3
318000	0.636	500000	4
283500	0.567	500000	5
113400	0.567	200000	5
3990700	Present value for cash inflows		
3200000	- Present value for cash outflows (cost of investment)		
790700	= Net present value		

The two projects are acceptable, but the second project is the better because it owns positive net present value more than the first project.

Capital Budget

Discounted cash flows approach

2. Internal rate-of- return (IRR) method

The internal rate-of-return (IRR) method calculates the discount rate at which an investment's present value of all expected cash inflows equals the present value of its expected cash outflows. That is, the IRR is the discount rate that makes NPV $ zero.

Example:

Initial cost of an investment project is $379100 and it generates annual cash inflow as follows:

Cash inflow	Year
100000	1
100000	2
100000	3
100000	4
100000	5

Required: evaluate the investment project by using internal rate-of- return (IRR). If you know that required rate of return (RRR) is %8.

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$$\text{Discount factor} = \frac{\text{Initial cost of investment}}{\text{Annual cash return (cash inflow)}}$$

$$\text{Discount factor} = \frac{379100}{100000} = 3.791$$

Discount factor (3.791) is the factor that makes net present value zero. calculating of net present value can confirm that.

NPV = present value for annual cash return – cost of investment

= (100000 x 3.791) – 379100 = zero

On the five-period line of present's value table, find the discount factor (3.791). It is under column of %10, so Internal rate-of- return (IRR) is %10.

Decision: A project is accepted only if IRR equals or exceeds required rate of return (RRR). In this example, the project is acceptable because the internal rate-of- return (IRR) (%10) is greater than required rate (%8).

Capital Budget

Example:

Initial cost of an investment project is $379100 and it generates annual cash inflow as follows:

Cash inflow	Year
130000	1
130000	2
130000	3
130000	4
130000	5

Required: evaluate the investment project by using internal rate-of- rate (IRR). If you know that required rate of return (RRR) is %18.

$$\text{Discount factor} = \frac{379100}{130000} = 2.916$$

On the five-period line of present's value table, find the discount factor (2.916). It is between column of %20 and column %22, so we need to use the following formula to determine the internal rate-of- return

Discount factor	Details
2.991	Interest rate %20
2.864	Interest rate %22
0.127	Difference

Discount factor	Details
2.991	Interest rate %20
2.916	IRR
0.075	Difference

$$\text{IRR} = \text{lower interest rate} + \left\{ \text{difference between the two interest rate} + \frac{\text{the difference between discount factor of the lower interest rate and discount factor of IRR}}{\text{the difference between discount factor of the lower interest rate and discount factor of the higher interest rate}} \right\}$$

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$$\text{IRR} = \%20 + \%2 \times \frac{0.075}{0.127} = \%21.2$$

Decision: the project is acceptable because the internal rate-of- return (IRR) (%21.2) is greater than required rate (%18).

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Example:

Initial cost of an investment project is $51000 and it generates the following cash inflows during the five years of it's life.

Cash inflow	Year
5000	1
10000	2
15000	3
20000	4
30000	5

Required: evaluate the investment project by using internal rate-of- rate (IRR). If you know that required rate of return (RRR) is %12.

In situation of uneven cash flows, we use trial and error method to determine IRR as follows:

First step: we have to find a interest rate that make the present value zero. let's try %12.

Present value	Discount factors	Cash inflows	Year
4465	0.893	5000	1
7970	0.797	10000	2
10680	0.712	15000	3
12720	0.636	20000	4
17010	0.567	30000	5
52845	Present value for cash inflows		
51000	- Present value for cash outflows (cost of investment)		
1845	= Net present value		

Second step: Because the net present value (NPV) at %12 interest rate is positive, we need to increase the interest rate. Therefore, let's try %14.

Present value	Discount factors	Cash inflows	Year
4385	0.877	5000	1
7690	0.769	10000	2
10125	0.675	15000	3
11840	0.592	20000	4
15570	0.519	30000	5
49610	Present value for cash inflows		
51000	- Present value for cash outflows (cost of investment)		
(1390)	= Net present value		

NPV at %12 interest rate is 1845 (positive) and it at %14 interest rate is -1390 (negative). This means that IRR will be between %12 and %14 as follows:

$$\text{IRR} = \text{lower interest rate} + \left[\text{difference between the two interest rate} + \frac{\text{The net present value (NPV) of the lower interest rate}}{\text{The absolute total of the two present values}} \right]$$

$$\text{IRR} = \%12 + \left(\%2 \times \frac{1845}{3235} \right) = \%13.14$$

Decision: the project is acceptable because the internal rate-of- return (IRR) (%13.14) is greater than required rate (%12).

Non discounted approach

Non discounting approach ignores the time value of money. The use of discounting models has increased over the years, and few companies use only one approach. Indeed, companies seem to use both types of approaches. This refers that both approaches supply useful information to managers in order to make capital investment decisions.

Non discounted methods

1- Payback Period

The payback period is the time required for a company to recover its original investment.

Example

A company has $60000 and want to invest this amount in a project. the management of the company studies two projects which are A and B. The following is cash flows for both of projects.

Project (B)	Project (A)	Year
16000	20000	1
14000	20000	2
20000	20000	3
20000	20000	4
40000	20000	5

Required: differentiate between the two projects by using payback period method.

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Project (A): **(uniform series Cash Flows)**

$$\text{Payback period} = \frac{\text{Cost of investment}}{\text{Annual cash return}}$$

$$\text{Payback period} = \frac{60000}{20000}$$

Payback period = 3 years

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Project (B): (uneven series Cash Flows)

cumulative cash return	Annual cash return	Year
16000	16000	1
30000	14000	2
50000	20000	3
70000	20000	4
110000	40000	5

payback period is between the third year and the fourth year because the cost of the investment is between the cumulative cash flows of the third year and the cumulative cash return of the forth year.

$$\text{Payback period} = 3 \text{ year} + \frac{10000}{20000}$$

Payback period = 3.5 years (three years and six months)

Non discounted methods

2- Accounting-Rate-of-Return Method

The accounting-rate-of-return method focuses on the accounting income that results from a project. Accounting income is based on accrual accounting procedures. Revenue is recognized during the period of sale, not necessarily when the cash is received; expenses are recognized during the period they are incurred, not necessarily when they are paid in cash. The following formula is used to compute the accounting rate of return on an investment project.

$$\text{Accounting rate-of- return (ARR)} = \frac{\text{Accounting net income}}{\text{Cost of investment}}$$

many companies calculate ARR using an average of investment. This alternative procedure recognizes that the book value of the investment declines over time. average investment is calculated as the arithmetic mean of the net initial investment at beginning life of project and disposal value (salvage value) at ending life of project.

$$\text{Accounting rate-of- return (ARR)} = \frac{\text{Accounting net income}}{\text{Average cost of investment}}$$

$$\text{Average cost of investment} = \frac{\text{Cost of investment + disposal value}}{2}$$

Example: A company has $500000 and want to invest this amount in a project. the management of the company studies two projects . The following is cash flows for both of projects.

Second project	First project	Details
500000	500000	Cost of investment
		Cash inflow:
300000	100000	Year 1
250000	100000	Year 2
150000	100000	Year 3
100000	100000	Year 4
-	100000	Year 5
-	100000	Year 6
-	100000	Year 7
-	100000	Year 8

Required: evaluate the two project using (1) ARR (based on cost of investment). (2) ARR (based on average cost of investment). If you know that company uses straight line method in computing depreciation.

First project: (uniform series Cash Flows)

Depreciation = cost ÷ production life

= 500000 ÷ 8

= $62500

Net income = annual cash inflow – depreciation

= 100000 – 62500

= $37500

$$\text{Accounting rate-of- return (ARR)} = \frac{37500}{500000} = \%7.5$$

$$\text{Accounting rate-of- return (ARR)} = \frac{37500}{\frac{500000 + \text{zero}}{2}} = \%15$$

Second project: (uneven series Cash Flows)

Depreciation = cost ÷ production life

= 500000 ÷ 4

= $125000

Average of cash inflows = total of cash inflow during production life ÷ production life

= 800000 ÷ 4 = $200000

Net income = average cash inflow – depreciation

= 200000 – 125000

= $75000

$$\text{Accounting rate-of- return (ARR)} = \frac{75000}{500000} = \%15$$

$$\text{Accounting rate-of- return (ARR)} = \frac{75000}{\frac{500000 + \text{zero}}{2}} = \%30$$