After studying this unite, you should be able to:

1. Discuss the capital budgeting evaluation process and explain what inputs are used in capital budgeting.

2. Describe the cash payback technique. فترة الاسترداد.

3. Describe the annual rate of return method. معدل العائد المحاسبي(السنوي).

4. Explain the net present value method. صافي القيمة الحالية.

5. Describe the profitability index. مؤشر الربحية.

6. Explain the internal rate of return method. معدل العائد الداخلي.

Capital budgeting: refers to the process we use to make decisions concerning investments in the long-term assets of the firm. The general idea is that the capital, or long-term funds, raised by the firms are used to invest in assets that will enable the firm to generate revenues several years into the future.
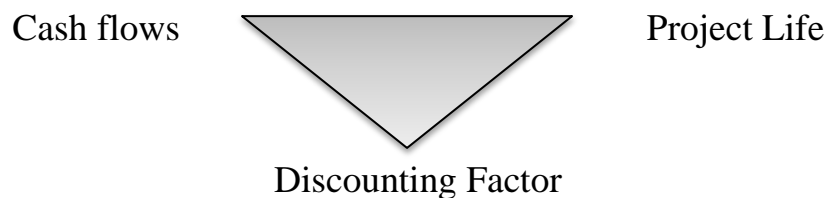
Typical Capital Budgeting Decisions

Any decision that involves an outlay now in order to obtain a future return is a capital budgeting decision. Typical capital budgeting decisions include:

1. Cost reduction decisions قرارات تخفيض التكاليف. Should new equipment be purchased to reduce costs?

2. Expansion decisions قرارات التوسعة. Should a new plant, warehouse, or other facility be acquired to

increase capacity and sales?

3. Equipment selection decisions قرارات اختيار معدات. Which of several available machines should be purchased?

4. Lease or buy decisions قرارات عقود الاستئجار طويلة الاجل. Should new equipment be leased or purchased?

5. Equipment replacement decisions قرارات استبدال المعدات. Should old equipment be replaced now or later?

Capital budgeting decisions fall into two broad categories— *screening decisions* and *preference decisions.* **Screening decisions**قرارات تفحص مدى مقبولية المقترحات relate to whether a proposed project is acceptable—whether it passes a set of difficulties. For example, a company may have a policy of accepting projects only if they promise a return of 20% on the investment. The required rate of return is the minimum rate of return a project must yield to be acceptable.

Preference decisions,قرارات التفضيل by contrast, relate to selecting from among several acceptable alternatives. To illustrate, a company may be considering several different machines to replace an existing machine on the assembly line. The choice of which machine to purchase is a preference decision.

Any investment decision depends upon the decision rule that is applied under circumstances. However, the decision rule itself considers following inputs:

Cash flows   Project Life

Discounting Factor

The effectiveness of the decision rule depends on how these three factors have been properly assessed.

Capital budgeting techniques:

A number of capital budgeting techniques are used in practice. They may be grouped in the following two categories: -

I. Capital budgeting techniques under certainty; and

II. Capital budgeting techniques under uncertainty

Capital budgeting techniques under certainty:

Capital budgeting techniques (Investment appraisal criteria) under certainty can also be divided into following two groups:

1) Non-Discounted Cash Flow Criteria: -

(a) Pay Back Period (PBP)

(b) Accounting Rate Of Return (ARR)

2) Discounted Cash Flow Criteria: -

(a) Net Present Value (NPV)

(b) Internal Rate of Return (IRR)

(c) Profitability Index (PI)

Non-Discounted Cash Flow Criteria:

These are also known as traditional techniques:

Pay Back Period (PBP) فترة الاسترداد:

The pay back period (PBP) is the traditional method of capital budgeting. It is the simplest and perhaps, the most widely used quantitative method for appraising capital expenditure decision.

Meaning:

It is the number of years required to recover لاسترداد the original cash outlay الانفاق النقدي الاصلي invested in a project.

Methods to compute PBP:

There are two methods of calculating the PBP.

(a) The first method can be applied when the CF is uniform. In such a situation the initial cost of the investment is divided by the constant annual cash flow: For example, if an investment of $ 100000 in a machine is expected to generate cash inflow of $ 20,000 for 10 years. Its PBP will be calculated using following formula:

$$PBP = \text{Initial Investment} \div \text{Constant Annual Cash flow}$$
$$= 100000 \div 20000$$
$$= 5 \text{ years.}$$

(b) The second method is used when a project's CF are not equal. In such a situation PBP is calculated by the process of cumulating CF till the time when cumulative cash flow becomes equal to the original investment outlays.

For example, A firm requires an initial cash outflow of $ 20,000 and the annual cash inflows for 5 years are:

Year	Cash flow
1	6000
2	8000
3	5000
4	4000
5	4000

Calculate PBP. Here, When we cumulate the cash flows for the first three years, $ 19,000 is recovered. In the fourth year $ 4000 cash flow is generated by the project but we need to recover only $1000 so the time required recovering $ 1000 will be ($1000/$4000)× 12 months = 3 months. Thus, the PBP is 3 years and 3 months (3.25 years).

Decision Rule:

The PBP can be used as a decision criterion to select investment proposal.

- ✓ If the PBP is less than the maximum acceptable payback period, accept the project.
- ✓ If the PBP is greater than the maximum acceptable payback period, reject the project.

This technique can be used to compare actual pay back with a standard pay back set up by the management in terms of the maximum period during which the initial investment must be recovered. The standard PBP is determined by management subjectively on the basis of a number of factors such as the type of project, the perceived risk of the project etc. PBP can be even used for ranking mutually exclusive projects. The projects may be ranked according to the length of PBP and the project with the shortest PBP will be selected.

QUICK CHECK:

Major Corporation is considering the purchase of a new machine for $5,000. The machine has an estimated useful life of 5 years and no salvage value. The machine will increase Major's cash flows by $2,000 annually for 5 years. Major uses straight-line depreciation. The company's required rate of return is 10%. What is the payback period for the machine?

A) 5.00 years   C) 7.58 years

B) 2.50 years   D) 8.34 years

Accounting Rate Of Return (ARR)معدل العائد المحاسبي

The **accounting rate of return technique** is based on accrual accounting data. It indicates the **profitability of a capital expenditure**.

- The formula is:

  expected annual net income ÷ average investment = accounting(annual) rate of return

- The **annual rate of return** is compared to management's **required minimum rate of return** for investments of similar risk.

A project is acceptable under this method if the **annual rate of return is greater than the required rate of return**.

- Assume that Reno Company is considering an investment of $130,000 in new equipment. The new equipment is expected to last 5 years and have zero salvage value. The straight-line depreciation method is used for accounting purposes. The expected annual revenues and costs of the new product that will be produced from the investment are:

Sales		$200,000
Less: Cost and expenses		
Manufacturing costs	$132,000	
Depreciation expense ($130,000 ، 5)	26,000	
Selling and administrative expenses	22,000	180,000
Income before income taxes		20,000
Income tax expense		7,000
Net income		$ 13,000

- Average investment is computed as follows:

Average investment = (Original investment + Investment at end of useful life)/2

- The investment at the end of the useful life is equal to the asset's salvage value.

- For Reno, average investment is $65,000 [($130,000 + $0)÷ 2].

- The expected annual rate of return for Reno's investment is therefore 20%, computed as follows:

$$\$13,000 \div \ \$65,000 = 20\%$$

Annual Rate of Return: Advantages & Disadvantages

- The principal advantages of this method are the simplicity of its calculation and management's familiarity with the accounting terms it uses.

A major limitation is that it does not consider the time value of money. Also, this method relies on accrual accounting numbers instead of actual cash flows.

QUICK CHECK:

Pearson Co. is considering the purchase of a $200,000 machine that is expected to reduce operating cash expenses by $65,000 per year. This machine, which has no salvage value, has an estimated useful life of 5 years and will be depreciated on a straight-line basis. For this machine, the simple rate of return would be:

A) 10%   C) 20%

B) 12.5%   D) 32.5%

Discounted Cash Flow Criteria:

These are also known as modern or time adjusted techniques because all these techniques take into consideration time value of money.

Net Present Value (NPV):صافي القيمة الحالية

The net present value is one of the discounted cash flow or time-adjusted technique. It recognizes that cash flow streams at different time period differs in value and can be computed only when they are expressed in terms of common denominator i.e. present value.

Meaning:

The NPV is the difference between the present value of future cash inflows and the present value of the initial outlay, discounted at the firm's cost of capital.

- Under the **net present value** (**NPV**) **method**, cash inflows are discounted to their present value and then compared with the capital outlay required by the investment.

- The difference between these two amounts is referred to as the **net present value**.

- The interest rate to be used in discounting the future cash flows is the **required minimum rate of return**.

- **A proposal is acceptable when the NPV is zero or positive**.

- The higher the NPV, the more attractive the investment.

EXAMPLE:

Stewart Soup Company is considering an investment of $130,000 in new equipment. The new equipment is expected to last 10 years and have a zero salvage value at the end of its useful life. The annual cash inflows are $200,000, and the annual net cash outflows are $176,000.

Equal Annual Cash Flows Example

- Stewart's annual cash inflows are $24,000. If we assume this amount is uniform over the asset's useful life, the present value of its annual cash flows can be computed as shown:

	PV at 12%
Discount factor for annuity of $1 for 10 periods	**5.65022**
Present value of cash flows: $24,000 x 5.65022	**$135,605**

Therefore, the analysis of the proposal by the NPV method is:

	12%
Present value of cash flows:	**$135,605**
Capital investment	**130,000**
Net present value	**$ 5,605**

The proposed capital expenditure is **acceptable** at the 12% required rate of return because the NPV is positive.

Unequal Cash Flows Example

When annual cash flows are **unequal**, it is not possible to use annuity tables to calculate their PV. Instead tables showing the PV of a single amount must be applied to **each** annual cash flow. Assume Stewart Soup expects the same aggregate cash flows ($240,000), but a declining market demand for the new product over the life of the equipment.

The PV of the annual cash flows is calculated below:

Year	Assumed Annual Cash Flows (1)	Discount Factor PV at 12% (2)	PV at 12% (1 x 2)
1	$ 34,000	.89286	$ 30,357
2	30,000	.79719	23,916
3	27,000	.71178	19,218
4	25,000	.63552	15,888
5	24,000	.56743	13,618
6	22,000	.50663	11,146
7	21,000	.45235	9,499
8	20,000	.40388	8,078
9	19,000	.36061	6,852
10	18,000	.32197	5,795
	$240,000		144,367

Therefore, the analysis of the proposal by the NPV method is:

	12%
Present value of cash flows:	$144,367
Capital investment	130,000
Net present value	$ 14,367

The proposed capital expenditure is **acceptable** at the 12% required rate of return because the NPV is positive.

Choosing a Discount Rate

▪ In most cases, a company uses a **discount rate** (also known as **hurdle rate**, **cutoff rate**, or **required rate of return**) that is equal to its **cost of capital**, which is the rate it must pay to obtain funds from creditors and stockholders.

▪ The **cost of capital** is a weighted average of the rates paid on borrowed funds and funds from investors in the company's stock.

▪ A **discount rate** has two elements:

  – a cost of capital element, and

  – a risk element.

▪ Companies often assume the risk element is zero.

Using an incorrect discount rate can lead to incorrect capital budgeting decisions.

Suppose Stewart Soup's 12% discount rate did not take into account the fact that this project is riskier than most of the company's investments. Given the risk, a 15% discount rate would have been more appropriate.

As shown below, a 15% discount rate would cause Stewart to **reject** the project because of its negative NPV.

	12%	15%
Discount factor for annuity for 10 periods	5.65022	5.01877
Present value of cash flows:		
$24,000 x factor	$135,605	$120,450
Capital investment	130,000	130,000
Positive (negative) NP	$ 5,605	$ (9,550)

Profitability Index مؤشر الربحية

One relatively simple method of comparing alternative projects that takes into account both the size of the original investment and the discounted cash flows is the **profitability index**.

Profitability Index (PI) or Benefit-cost ratio (B/C) is similar to the NPV approach. PI approach measures the present value of returns per rupee invested. It is observed in shortcoming of NPV that, being an absolute measure, it is not a reliable method to evaluate projects requiring different initial investments. The PI method provides solution to this kind of problem.

The profitability index is computed with the following formula:

Present value of cash flows ÷ Initial investment = Profitability Index

Profitability Index Example

Data for the two projects is shown below in a slightly altered form

	Project A	Project B
Initial investment	$40,000	$90,000
Net annual cash inflows	10,000	19,000
Salvage value	5,000	10,000
Present value of cash flows:		
($10,000 x 5.65022) + ($5,000 x .32197)	58,112	
($19,000 x 5.65022) + ($10,000 x .32197)		110,574

Project A	Project B
$58,112 ÷ $40000 = 1.45	$110,574 ÷ $90000 = 1.23

Project A is more desirable because it has the higher **profitability index**.

Risk Analysis

- A simplifying assumption made by many financial analysts is that the projected results are known with certainty. In reality, this is seldom true.

- One approach for dealing with uncertainty is **sensitivity analysis**, which uses a number of outcome estimates to get a sense of the variability among potential returns.

- The earlier example of comparing NPVs using different discount rates was a form of sensitivity analysis.

QUICK CHECK:

Brown Company is considering several investment proposals, as shown below:

	Investment Proposal			
	A	*B*	*C*	*D*
Investment required	$ 95,000	$120,000	$90,000	150,000
Present value of future net cash flows	$107,000	$130,000	$105,000	$180,000

If the project profitability index is used, the ranking of the projects would be:

A) D C A B   C) B A C D

B) D B A C   D) D A B C

Internal Rate of Return Method معدل العائد الداخلي

This technique is also known as yield on investment, marginal productivity of capital, marginal efficiency of capital, rate of return, and time-adjusted rate of return and so on. It also considers the time value of money by discounting the cash flow streams, like

NPV. The **internal rate of return method** results in finding the **interest yield of the potential investment**.

- The **internal rate of return** is the interest rate that will cause the present value of the proposed capital expenditure to equal the present value of the expected annual cash inflows (i.e., a NPV of zero).

Determining the **internal rate of return** involves three steps: (These steps assume that annual cash flows are equal; an alternative method of computing the internal rate of return must be used when cash flows are unequal.)

- Tampa Company will be used as an example. Tampa Company is considering a new project with an 8-year estimated life, an initial cost of $249,000, and a net annual cash inflow of $45,000.

- **Step 1:** Compute the **internal rate of return factor** using the following formula:

capital investment ÷ net annual cash inflow = internal rate of return

Using the Tampa Company data, the internal rate of return factor is computed as follows:

$249000 ÷ $45000 = 5.5333

- **Step 2:** Use the factor and the present value of an annuity of 1 table to find the **internal rate of return**.

- **For Tampa, the net annual cash inflow is expected to continue for 8 years. Thus, it is necessary to read across the period-8 row in the present value of an annuity table to find the discount factor that is closest to the internal rate of return factor.**

Period	5%	6%	8%	9%	10%	11%	12%	15%
8	6.46321	6.20979	5.74664	5.53482	5.33493	5.14612	4.96764	4.8732

- The closest discount factor to 5.53333 is 5.53482, which represents an interest rate of approximately 9%.

- **Step 3**: Compare the internal rate of return to management's required rate of return.

- **The decision rule is**: Accept the project when the internal rate of return is equal to or greater than the required rate of return, and reject the project when the internal rate of return is less than the required rate. Assuming the **minimum required rate of return is 8% for Tampa Company, the project is** accepted because the 9% internal rate of return is greater than the required rate.