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VIRTUAL COACHING CLASSES
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INTERMEDIATE LEVEL
PAPER 8A : FINANCIAL MANAGEMENT

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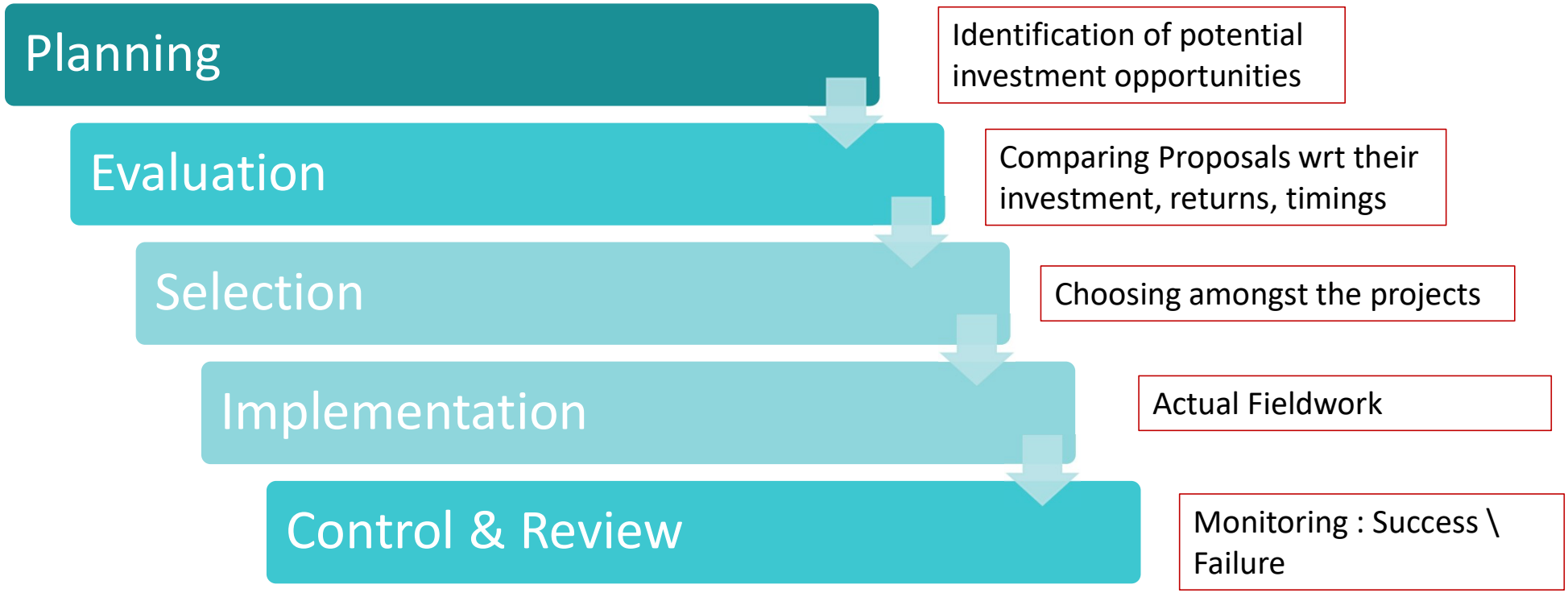
Investment Decisions

- It is concerned with **optimum utilization of funds** to maximize the wealth of the organization
- Since each rupee of capital raised by an entity bears some cost (cost of capital) it becomes of paramount importance that each rupee raised is to be invested in a very prudent manner
- Requires proper planning & budgeting known as **Capital Budgeting, involves below steps** :-
  - Identification of investment projects that are strategic to business' overall objectives;
  - Estimating and evaluating post-tax incremental cash flows for each of the investment proposals; and
  - Selection of an investment proposal that maximizes the return to the investors
  - Control & Review
- Capital Budgeting is very important because:
  - It involves huge financial resources that are scarce
  - It involves long term hence will impact any business for long term
  - Irreversible – after upfront payments, contractual obligations etc one can't reverse
  - Complexity in assessment of future events (cash flows)

Capital Budgeting Process



Types of Capital Budgeting Decisions

Basis of Firm's Existence

- Replacement (economic life) & Modernization (technological obsolescence)
- Expansion (add capacity)
- Diversification (new product lines / markets)

Basis of Decision Situation

- Mutually Exclusive Decisions (acceptance of one proposal will exclude acceptance of other alternatives)
- Accept-Reject Decisions (independent evaluation, can compare with minimum return on required investment)
- Contingent Decisions (Dependable – one proposal may require further investment)

Project Cash Flows

- Only incremental cash flows are considered (as timing of cash flows doesn't match accounting profits and investment decisions require initial investment)
- **Factors to be considered**
  - Depreciation – non cash, but gives tax shield (as per Income Tax Act : block of assets, i.e. in terminal year gain or loss on sale only if that's the only asset in the block)
  - Opportunity Cost – any foregone benefit to be taken into account
  - Sunk Cost – Costs already incurred do not impact (eg: cost of existing machinery)
  - Working Capital – to be considered initially and at the end, could also be incremental during tenure. There can be either addition or reduction in WC initially and accordingly vice versa towards end
  - Allocated overheads – only incremental need to be considered
  - Operational savings or Costs reduced to be taken net of tax
  - Additional investment at any stage to be taken into account

  * Financing costs (interest & dividends) to be excluded as same is reflected in discounting factor (WACC), thus add back Interest net of tax to PAT or reduce tax from EBIT

Stages of Cash Flows

INITIAL CASH FLOWS

- Initial investment – Cost of new asset & its installation
- Investment in Working Capital / Savings in Working Capital
- Sale proceeds of old asset (net of any tax saving or liability)

INTERIM CASH FLOWS

- New Project : PAT + Non Cash Expenses
- Replacement : Incremental Revenue or Savings in Expenses (Net of Tax)
- Any additional Working Capital

TERMINAL YEAR CASH FLOWS

- Interim cash flow of last year
- Salvage value of asset (net of any tax impact on gain / loss)
- Release of working capital

Calculation of Cash Inflow Net of Tax

Sl. No.	PARTICULARS	
1.	Total Sales Units	**xxx**
2.	Selling Price per unit	**xxx**
3.	Total Sales [1 × 2]	**xxx**
4.	Less: Variable Cost	**xxx**
5.	Contribution [3-4]	**xxx**
6.	Less: Fixed Cost	
	(a) Fixed Cash Cost	**xxx**
	(b) Depreciation	**xxx**
7.	Earning Before Tax [5-6]	**xxx**
8.	Less: Tax	**xxx**
9.	Earning After Tax [7-8]	**xxx**
10.	Add: Depreciation	**xxx**
11.	**Cash Inflow After Tax (CFAT) [9 +10]**	**xxx**

Depreciation Tax Shield

Method 1

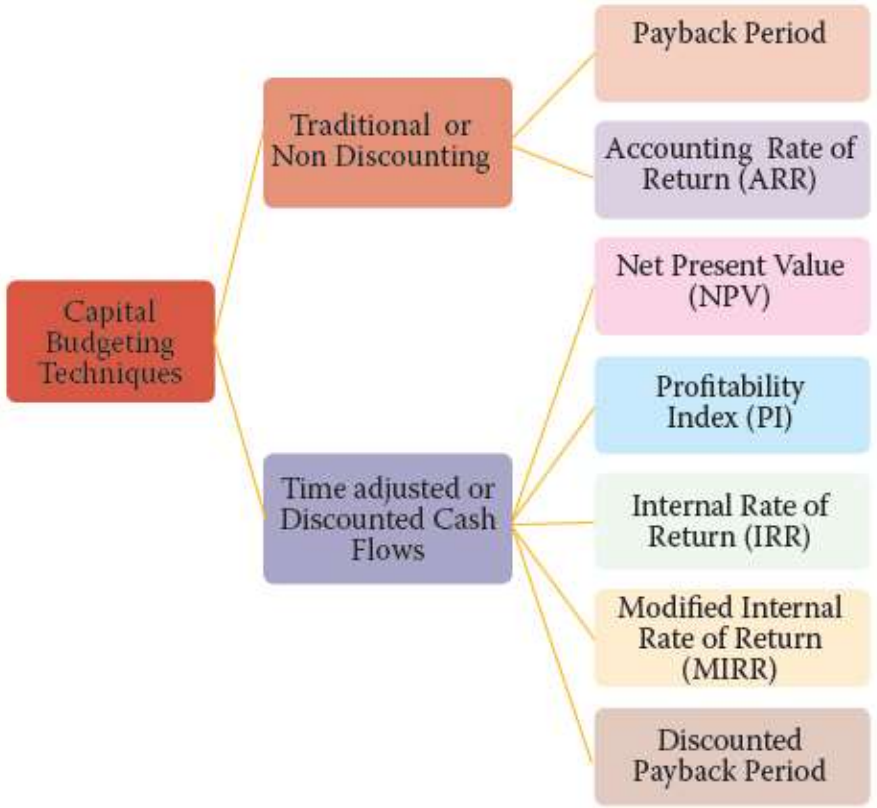
	Amount
Earnings before tax & depreciation	50,000
Less: Depreciation	(20,000)
Earnings before tax	30,000
Less: Tax @ 30%	(9,000)
Profit after Tax	21,000
Add: Depreciation	20,000
Net Cash Flow	41,000

Method 2

	Amount
Earnings before tax & depreciation	50,000
Less: Tax @ 30%	(15,000)
Cash Profits	35,000
Add: Depreciation tax shield (20,000 x 30%)	6,000
Net Cash Flow	41,000

Capital Budgeting Techniques

- To maximise the return to the shareholders of a company, it is important that the best or most profitable investment projects are selected.
- Results of making a bad long-term investment decision can be devastating in both financial and strategic terms.



Non-Discounting Techniques

Payback Period

- The payback period of an investment is the length of time required for the cumulative total net cash flows from the investment to equal the total initial cash outlays.
- Thus, 2 factors needed : Initial Capital Investment & Annual after tax cash flows

Payback Reciprocal - Reciprocal of payback time giving close approximation of Internal rate of return on an investment (when project life > twice the payback period & project generates uniform cash flows.

A. Uniform Cash Flows

Payback Period = Initial Investment / Annual after tax cash flow

Example – A project costs 10,00,000 and yields annually a profit of 3,00,000 after depreciation @ 20% (straight line method) but before tax 50%.

Solution – After Tax Cash Flows: PAT 3,00,000 (1-0.50) = 1,50,000 Add depreciation 2,00,000 = 3,50,000

Thus, Payback period = 10,00,000 / 3,50,000 = 2.86 Years

Non-Discounting Techniques

B. Uneven Cash Flows

Need to calculate Cumulative Cash after tax cash flows & payback period is when it covers the initial capital outflow (may also be fraction of a year)

Example – A project costs 2,00,000 and yields the following after cash flows

Year	After Tax Cash Flows	Cumulative
1	100,000	100,000
2	80,000	180,000
3	60,000	240,000
4	40,000	280,000

Payback period is in 3rd Year

= 2 + (200,000 – 180,000) / 60,000

= 2.33 Years

Advantage: Easy to understand, simple to compute & gives a high level estimate of risk in terms of length of the project

Disadvantage: Ignores time value of money, Ignores profitability (cash flows after pay-back) and Ignores long term projects

Non-Discounting Techniques

Accounting / Average Rate of Return (ARR) -

- Average Annual Net Income / Investment
- Numerator is Average Annual Net Income generated by the project over its useful life
- Investment can be measured in multiple ways : Entire initial investment or average investment over useful life or ARR can be calculated for each year and then averaged
- If additional working capital is needed during the project in addition to initial, then Average investment shall be : ½(Initial Investment – Salvage Value) + Salvage Value+ Additional Working Capital

Example: Suppose Cisco Ltd. is going to invest in a project a sum of ₹ 3,00,000 having a life span of 3 years. Salvage value of machine is ₹ 90,000. The profit before dep every year is ₹ 1,50,000. Tax 30%.

Solution: Depr (SLM) = (300,000-90,000)/3 = 70,000 Annual Net Income = (150,000 – 70,000) – 30% = 56,000. Thus, ARR (basis initial investment) = 56,000 / 300,000 = 18.67%

Alternative: Avg inv over life = ½(300000-90000) + 90000 = 195,000 Thus, ARR = 56,000/195,000 = 28.72%

Another alternative can be average of ARR for all the years

Non-Discounting Techniques

Year	Net Income	Op Investment (after depr)	Annual ARR	Average ARR
1	56,000	300,000	56/300 = 18.67%	(18.67+24.35+35) / 3
2	56,000	230,000	56/230 = 24.35%	= 26 % approx.
3	56,000	160,000	56/160 = 35%	

* Income is uniform here, in case uneven returns, we need to calculate Average Annual Income

Advantages – Ready Data (from Financial Statements), Evaluates Management Performance, Covers entire life of project

Disadvantages – Ignores time value of money, Net Income can vary basis different accounting policies and lastly it ignores cash flow and focus on net income (may not coincide)

Discounting Techniques

- Considers time value of money by discounting the cash flows to their present value using an appropriate discount rate which is generally WACC

Net Present Value (NPV) Technique

Net Present Value = Present Value of (net) Cash Inflows – Present Value of Outflows (or initial investment)

$$NPV = \left(\frac{C_1}{(1+k)} + \frac{C_2}{(1+k)^2} + \frac{C_3}{(1+k)^3} + ... + \frac{C_n}{(1+k)^n} \right) - I$$

$$NPV = \sum_{t=1}^{n} \frac{C_t}{(1+k)^t} - I$$

Where, C = Cash flow for various years K = discount rate

N=Life of the project I = Initial Investment

Discounting Techniques

Steps to Calculate NPV

- Determine the net cash inflow in each year of the investment
- Select the desired rate of return or discounting rate or Weighted Average Cost of Capital.
- Find the discount factor for each year based on the desired rate of return selected. (1/(1+k)^n)
- Determine the present values of the cash flows by multiplying them by respective discount factors of respective period called [Present Value (PV) of Cash flows]
- Total the amounts of all PVs of Cash Flows

Decision Rule: If NPV > 0, Accept the Project and If NPV < 0 Reject the project

* In case of multiple projects, we may choose those having the highest NPVs (within budget)

Illustration: Compute the NPV for a project with a net investment of ₹ 1,20,000 and net cash flows for the three years are ₹ 80,000; ₹ 70,000 and ₹ 20,000 respectively. Further, the company's cost of capital is 10%. [PVF @ 10% for three years are 0.909, 0.826 and 0.751] Provide recommendation.

Discounting Techniques

Solution:

Year	Net Cash Flow	PVF @ 10%	Discounted CF
0	(1,20,000)	1	(1,20,000)
1	80,000	0.909	72,720
2	70,000	0.826	57,820
3	20,000	0.751	15,020
NPV			25,560

Since the project has a positive NPV, the project may be accepted.

Advantages: Time value of money is considered, Entire life of project (i.e. all cash flows) are considered, facilitates the projects comparison and, in line with financial objective of wealth maximization

Disadvantages: Difficult calculations, Its an absolute measure – ignores difference in initial outlays amongst various projects, Accuracy depends on estimation of cash flows & discount rate

Practice Question

MTR Limited is considering buying a new machine which would have a useful economic life of five years, at a cost of ₹25,00,000 and a scrap value of ₹3,00,000, with 80 per cent of the cost being payable at the start of the project and 20 per cent at the end of the first year. The machine would produce 75,000 units per annum of a new product with an estimated selling price of ₹300 per unit. Direct costs would be ₹285 per unit and annual fixed costs, including depreciation calculated on a straight- line basis, would be ₹8,40,000 per annum.

In the first year and the second year, special sales promotion expenditure, not included in the above costs, would be incurred, amounting to ₹1,00,000 and ₹1,50,000 respectively.

Evaluate the project using NPV method assuming cost of capital as 14%.
Ignore tax for this illustration.

Discounting Techniques

Profitability Index (PI) (Desirability Factor or PV Index)

Profitability Index = PV of Cash Inflows / PV of Cash Outflows (or Initial Investment)

- Useful for comparing a number of proposals each involving different amounts of cash inflows.
- Decision: If PI > 1 , accept and If PI < 1, reject. Also, for mutually exclusive projects, project with higher PI shall be selected

Example: - 2 projects with discounted cash O/F as 100,000 and 120,000 and discounted cash I/F as 150,000 and 190,000 respectively. PI for Project 1 = 150,000 / 100,000 = 1.50 and PI for project 2 shall be 190,000 / 120,000 = 1.58. Thus, 2nd project should be preferred.

Advantages: Time value of money is considered, better than NPV as it's a relative measure

Disadvantages: Doesn't help in Capital Rationing and It may result in rejecting a project with lower PI but having significant absolute returns. Also, it may ignore smaller projects which may have higher combined NPV.

NavJeevani hospital is considering to purchase a machine for medical projectional radiography which is priced at ₹ 2,00,000. The projected life of the machine is 8 years and has an expected salvage value of ₹ 18,000 at the end of 8th year. The annual operating cost of the machine is ₹ 22,500. It is expected to generate revenues of ₹ 1,20,000 per year for eight years. Presently, the hospital is outsourcing the radiography work to its neighbour Test Center and is earning commission income of ₹ 36,000 per annum, net of taxes.

Required:

ANALYSE whether it would be profitable for the hospital to purchase the machine? Give your recommendation under:

(i) Net Present Value method

(ii) Profitability Index method.

Consider tax @30%. PV factors at 10% are given below:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467

Discounting Techniques

Internal Rate of Return (IRR) Method

- Internal rate of return for an investment proposal is the discount rate at which the present value of the expected cash inflows equals the initial cash outflow or present value of cash outflows
- Compared with organization's desired rate of return for evaluating capital investments

Calculation of IRR – Uniform Cash Flows

At IRR, PV of Cash Inflow = PV of Cash Outflow or Initial Investment

Annuity Factor x Annual Cash Inflow = PV of Cash Outflow or Initial Investment

i.e. Annuity Factor = PV of Cash Outflow / Annual Cash Inflow

IRR shall be the rate that corresponds to the Annuity factor as in the annuity table along the row for the number of periods of the useful life of the investment.

However, if it doesn't match and falls between two rates for that period, then IRR shall be –

$$LR + \frac{\text{NPV at LR}}{\text{NPV at LR- NPV at HR}} \times (HR\text{-}LR)$$

Where LR is lower rate and HR is higher rate

Discounting Techniques

Illustration: Zebra Ltd. is evaluating a project involving an outlay of ₹ 10,00,000 resulting in an annual cash inflow of ₹2,50,000 for 6 years. Assuming scrap value of the project is nil; determine the IRR of the project.

Solution: Annuity Factor = 10,00,000 / 2,50,000 = 4

Looking at 4 in annuity table for 6 years, we see that it lies between 2 values

4.111 & 3.998 which is at 12% (LR) and 13% (HR) respectively – closer to 13%

NPV @ 12 % = 2,50,000 x 4.111 - 10,00,000 = 27,750

NPV @ 13 % = 2,50,000 x 3.998 - 10,00,000 = - 500

Thus, IRR = 12 + [27,750 / 27,750 – (-500)] x (13-12) = 12.98%

Period	11%	12%	13%
1	0.901	0.893	0.885
2	1.713	1.690	1.668
3	2.444	2.402	2.361
4	3.102	3.037	2.974
5	3.696	3.605	3.517
6	4.231	4.111	3.998

Discounting Techniques

Calculation of IRR – Uneven Cash Flows

- This will involve discounting the cash flows with any random rate like 10/15/20/30 %. If the result is positive NPV then discount cash flows at a higher rate to get negative NPV and If the result is negative then discount cash flows at a lower rate to get positive NPV.
- Then use the same formula for NPV at LR & HR to find the IRR lying in middle.

Acceptance Rule with IRR

If IRR > WACC / Cut-off Rate, accept the project (at WACC, NPV shall be positive)

If IRR < WACC / Cut-off Rate, reject the project (at WACC, NPV shall be negative)

IRR - Illustration

A company proposes to install machine involving a capital cost of ₹ 3,60,000. The life of the machine is 5 years and its salvage value at the end of the life is nil. The machine will produce the net operating income after depreciation of ₹ 68,000 per annum. The company's tax rate is 45%.

The Net Present Value factors for 5 years are as under:

Discounting rate	*14*	*15*	*16*	*17*	*18*
Cumulative factor	*3.43*	*3.35*	*3.27*	*3.20*	*3.13*

You are required to COMPUTE the internal rate of return of the proposal.

Step 1 – Computation of Annual Cash Inflows

Net operating income per annum	68,000
Less: Tax @ 45%	(30,600)
Profit after tax	37,400
Add: Depreciation (₹ 3,60,000 / 5 years)	72,000
Cash inflow	1,09,400

IRR - Illustration

Step 2 – Computation of IRR (PV of Cash IF = Initial Investment)

109,400 X PVAF = 360,000 i.e. PVAF = 360,000 / 109,400 = 3.29 .. Check for 5 years in annuity table

Discounting Rate	*15%*	*16%*
Cumulative factor	3.35	3.27
PV of Inflows	3,66,490 (₹ 1,09,400×3.35)	3,57,738 (₹ 1,09,400×3.27)
Initial outlay (₹)	3,60,000	3,60,000
NPV (₹)	6,490	(2,262)

$$\text{IRR} = 15 + \left[\frac{6,490}{6,490 + 2,262}\right] \times (16 - 15) = 15 + 0.74 = 15.74\%.$$

IRR – Brain Storming

Question :- Which of the following events would decrease the internal rate of return of a proposed asset purchased ?

a) Decrease Tax Credits on the asset

b) Decrease related working capital requirements

c) Shorten the payback period

d) Use written down value method instead of straight line for depreciation

Discounting Techniques

Issues with IRR

1) Mutually exclusive projects can create problems with the IRR technique because IRR is expressed as a percentage and does not take into account the scale of investment or the quantum of money earned in absolute terms. A project with a larger fund commitment but lower IRR contributes more in terms of absolute NPV and increases the shareholders' wealth. In such situation decisions based only on IRR criterion may not be correct.

2) Where project cash flows change signs or reverse during the life of a project e.g. an initial cash outflow is followed by cash inflows and subsequently followed by a major cash outflow, there may be more than one IRR in that case. Then decision would be easy only if cost of capital is less than both IRRs.

Reinvestment Assumption : NPV & IRR Methods

- NPV assumes all cash flows are reinvested at the discount rate used to calculate NPV which is logical
- IRR assumes that all cash flows are reinvested at the projects' IRR which would favour only those projects that have heavy cash flows in earlier years (whereas other projects may be better for long run)

Discounting Techniques

Advantage: Time value of money is considered, Considers wealth maximization by comparing with WACC

Disadvantage*: Calculation is complex, assumes reinvestment at IRR, Creates issues in Mutually exclusive projects, not a good method to compare projects with different inflow and outflow patterns

Discounted Payback Period Method

- It's a better version of Payback period method as it discounts the cash flows to their present value
- Calculation shall be similar to the Cumulative approach cumulative discounted cash flows will represent an year where the initial investment is recovered and that shall be the discounted payback period
- It will always be a longer period than non-discounted payback as discounted cash flows shall always be lower amount

Discounting Techniques

Modified Internal Rate of Return (MIRR) / Terminal Value Method

- It eliminates some limitations attached with conventional IRR like Multiple IRRs by addressing the reinvestment rate issue & provides results consistent with NPV technique.
- It compounds all the cash flows (whether inflow or outflow) apart from the Initial Investment to the terminal value (i.e. towards end of the project) using appropriate discount rate (WACC)
- The MIRR is obtained by assuming a single outflow in the zeroth year (initial) and single stream of terminal cash inflow. MIRR is the discount rate which equates the present value of the terminal cash inflow to the zeroth year outflow.

Decision Criteria: If MIRR > Required Rate of Return, Accept the project else reject the same.

Illustration - An investment of ₹ 1,36,000 yields the cash inflows (profits before depreciation but after tax) of 30,000 , 40,000, 60,000, 30,000 and 20,000 in 5 years respectively. Determine MIRR considering 8% as cost of capital.

Discounting Techniques

Solution:

Year	Cash Flows	@ 8% Reinvestment Factor	Compounded Value
1	30,000	(1.08)^4 = 1.3605	40,815
2	40,000	(1.08)^3 = 1.2597	50,388
3	60,000	(1.08)^2 = 1.1664	69,984
4	30,000	(1.08)^1 = 1.0800	32,400
5	20,000	1.0000	20,000
			2,13,587

MIRR shall be the discounting rate that will discount 2,13,587 from year 5 to 1,36,000 in year 0.

Hence: 2,13,587 x PV Factor = 1,36,000. Thus PV factor for 5 years = 1,36,000 / 2,13,587 = 0.6367 which comes to approx. 9% looking from Annuity tables

Brain Teasers

Q1. A capital budgeting technique which does not require the computation of cost of capital for decision making purposes is:

a. Net Present Value method

b. Internal Rate of Return method

c. Modified Internal Rate of Return method

d. Pay back

Q2. In case a company considers a discounting factor higher than the cost of capital for arriving at present values, the present values of cash inflows will be

a. Less than those computed on the basis of cost of capital

b. More than those computed on the basis of cost of capital

c. Equal to those computed on the basis of the cost of capital

d. None of the above

NPV & IRR – Conflicting Conclusions

1. **Scale or Size Disparity:** Being IRR a relative measure and NPV an absolute measure in case of disparity in scale or size both may give contradicting ranking.

	Year 0	Year 1	IRR	NPV (10%)
Project A	(₹ 1,00,000)	₹1,50,000	50%	₹ 36,360
Project B	(₹ 5,00,000)	₹ 6,25,000	25%	₹ 68,180

2. **Time Disparity in Cash Flows:** It might be possible that overall cash flows may be more or less same in the projects but there may be disparity in their flows i.e. larger part of cash inflows may be occurred in the beginning or end of the project. In such situation there may be difference in the ranking of projects as per two methods.

Year	0	1	2	3	NPV (10%)	IRR (%)
Project X	(2,50,000)	2,00,000	1,00,000	50,000	51,950	24.87
Project Y	(3,00,000)	50,000	1,00,000	3,00,000	53,350	17.60

NPV & IRR – Conflicting Conclusions

3. **Projects with Unequal Lives:** Projects having disparity in lives may also have different conclusions with these two methods

Year	0	1	2	3	NPV (12%)	IRR (%)
Project X	(5,00,000)	7,50,000	-	-	1,69,750	50.00
Project Y	(5,00,000)	2,00,000	2,00,000	7,00,000	3,36,400	43.07

Although the decision making for such projects can be done with other techniques like Replacement chain method or Equivalent Annualized criteria (covered in subsequent slides)

Special Cases

Capital Budgeting under Capital Rationing

- General Rule: projects having positive NPV should be accepted (aiming wealth maximization)
- Where capital is constraint (limited), a firm may have to select only some projects amongst various projects, all having positive NPVs

Independent Projects also divisible in nature (I.e. part project also possible) > Projects should be ranked on basis of "NPV per rupee of Capital" method

Projects that are not divisible in nature > Projects shall be ranked on the basis of absolute NPV and should be mixed up to the point of maximum possible NPV and available resources are exhausted

Illustration - Parvati Ltd. is planning its capital investment programme for next year. It has five projects all having a positive NPV at the company cut-off rate of 15%, the investment outflows and present values being as follows (all numbers in '000). The company is limited to a capital spending of ₹ 1,20,000.

Special Cases

You are required to illustrate the returns from a package of projects within the capital spending limit. The projects are independent of each other and are divisible (i.e., part- project is possible).

Project	A	B	C	D	E
Investment	(50)	(40)	(25)	(30)	(35)
NPV @ 15%	15.40	18.70	10.10	11.20	19.30
Ranking (Abs NPV)	3	2	5	4	1
NPV per ₹ 1 Inv	0.31	0.47	0.40	0.37	0.55
Ranking (NPV ₹ Inv)	5	2	3	4	1
Investment Decision	Reject	40	25	20*	35

* With only 20,000 funds remaining after allocating to top 3 projects, only 2/3 of project D can be taken

Also , if the projects were not divisible, then project ranking as per absolute NPV shall be considered and a combination with maximum NPV shall be selected

- Not enough funds for E, B & A (125). E, B & D (105) shall give total NPV of 49.20 and shall be selected. Based on ranking next combination of E, B & C (100) shall give lesser NPV of 48.10 & hence not relevant.

Test Yourselves

Q. A company has ₹ 1,00,000 available for investment and has identified below four projects:

Project	A	B	C	D
Investment (₹)	40,000	1,00,000	50,000	60,000
NPV	20,000	35,000	24,000	18,000

You are required to optimize the returns from a combination of projects within the available funding assuming: A. Projects are independent and divisible and B. Projects are not divisible.

Project	A	B	C	D
NPV Ranking	3	1	2	4
NPV per ₹ 1	0.50	0.35	0.48	0.30
New Ranking	1	3	2	4

A. Divisible Projects – Project A & C (ranks 1 & 2) consume ₹ 90,000 and 10% of project B (3rd rank)

B. Non-Divisible Projects – Combination seems to yield more NPV than only project B (Example: Projects A & C : NPV 44,000 and A& D: NPV 38,000. Thus, projects A & C are advisable

Special Cases

Projects with Unequal Lives

- While evaluating the proposal for projects with unequal lives, firms may be faced with issues like:
  - Retaining an old asset or replace it with new one.
  - Choosing one proposal among two proposals (Mutually Exclusive)
- Such issues can be solved by either Replacement Chain method or Equivalent Annualized criteria

Replacement Chain Method: Involves repeating shorter projects multiple times until they reach the lifetime of the longest project. Thus, applicable where size of one project is in multiple (like double or triple) of others, so that with repetition – sizes can be equalized. Now, project with highest revised NPV can be selected.

Equivalent Annualized criteria: Involves dividing the NPV of the projects with unequal lives by their respective Present Value Annuity Factor (PVAF) used for discounting each of them, it will give equivalent annualized (annuity) criteria. Project with the highest value can be selected.

Special Cases

Illustration: Dhoom plc is considering modernizing its production facilities and it has two proposals under consideration. The expected cash flows (in '000) associated with these projects and their NPV as per discounting rate of 12% (in '000) and IRR is as follows. Identify which project can be accepted.

Year	0	1	2	3	4	5	6	NPV(12%)	IRR (%)
Project A	(4,000)	800	1,400	1,300	1,200	1,100	1,000	649	17.47
Project B	(2,000)	700	1,300	1,200	0	0	0	515	25.20
B Repeated	(2000)	700	1,300	1,200 – 2,000	700	1,300	1200	882	25.20

Initially NPV (project A) & IRR (project B) gave conflicting decisions. With replacement chain (project B being repeated), consensus can be reached to select B.

What if, the projects couldn't be repeated (if their lives were not in multiples of one another) – need to use Equivalent Annualized criteria then.

	Project A	Project B
NPV @ 12%	₹ 6,49,094	₹5,15,488
PVAF @12%	4.112	2.402
Equivalent Annualized Criterion	₹1,57,854	₹2,14,608

Special Cases

Replacement of Existing Machinery

- Whether an existing asset should be replaced by a newer version of the same machine or even a different type of machine having similar/advanced functionality
- Factors that can be considered : Cost of new machine, Sale Value / Exchange Value of existing machine, operating cash flows generated by existing & new machine, salvage value of new machine, tax impact on sale of existing machine (with or without block of assets) etc

Step I. Net cash outflow (assumed at current time /[Present value of cost]):

a. (Book value of old equipment - market value of old equipment) × Tax Rate = Tax payable/savings from sale

b. Cost of new equipment – [Tax payable/savings from sale + market value of old equipment] = Net cash outflow

Step II. Estimate change in cash flow per year, if replacement decision is implemented.

Change in cash flow = [(Change in sales ± Change in operating costs) - Change in depreciation] (1 - tax rate) + Change in depreciation

Step III. Present value of benefits = Present value of yearly cash flows + Present value of estimated salvage of new system

Step IV. Net present value = Present value of benefits - Present value of costs

Step V. Decision rule:

Accept when present value of benefits > present value of costs.

Xavly Ltd. has a machine which has been in operation for 3 years. The machine has a remaining estimated useful life of 5 years with no salvage value in the end. Its current market value is ₹ 2,00,000. The company is considering a proposal to purchase a new model of machine to replace the existing machine. The relevant information is as follows:

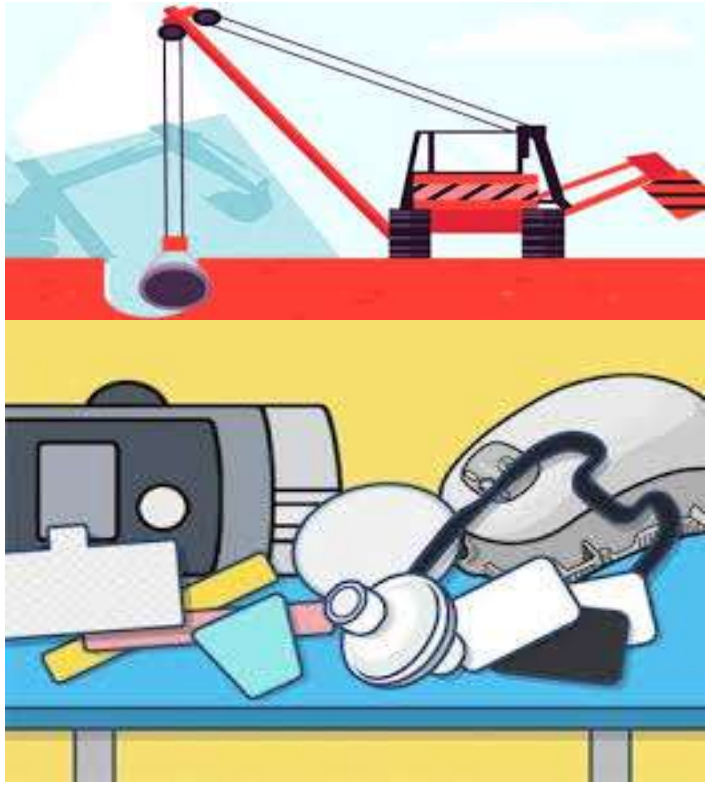
	Existing Machine	New Machine
Cost of machine	₹ 3,30,000	₹ 10,00,000
Estimated life	8 years	5 years
Salvage value	Nil	₹ 40,000
Annual output	30,000 units	75,000 units
Selling price per unit	₹ 15	₹ 15
Annual operating hours	3,000	3,000
Material cost per unit	₹ 4	₹ 4
Labour cost per hour	₹ 40	₹ 70
Indirect cash cost per annum	₹ 50,000	₹ 65,000

The company uses written down value of depreciation @ 20% and it has several other machines in the block of assets. The Income tax rate is 30 per cent and Xavly Ltd. does not make any investment, if it yields less than 12 per cent.

Advise Xavly Ltd. whether the existing machine should be replaced or not.

PV factors @12%:

Year	1	2	3	4	5
PVF	0.893	0.797	0.712	0.636	0.567



Solution

Question. HMR Ltd. is considering replacing a manually operated old machine with a fully automatic new machine. The old machine had been fully depreciated for tax purpose but has a book value of ₹ 2,40,000 on 31st March 2021. The machine has begun causing problems with breakdowns and it cannot fetch more than ₹ 30,000 if sold in the market at present. After 10 years, it will be sold for ₹ 9,000. The company has been offered ₹ 1,00,000 for the old machine as a trade in on the new machine which has a price (before allowance for trade in) of ₹ 4,50,000. The expected life of new machine is 10 years with a salvage value of ₹ 35,000. The company had been using the old machine to produce a special component to use as a raw material in production of its main product.

Further, the company follows straight line depreciation method but for tax purpose, written down depreciation @ 7.5% is allowed taking that this is the only machine in the block of assets.

Given below are the expected sales and costs from both old and new machine:

	Old machine (`)	New machine (`)
Sales	8,10,000	8,10,000
Material cost	1,80,000	1,26,250
Labour cost	1,35,000	1,10,000
Variable overhead	56,250	47,500
Fixed overhead	90,000	97,500
Depreciation	24,000	41,500
PBT	3,24,750	3,87,250
Tax @ 30%	97,425	1,16,175
PAT	2,27,325	2,71,075

From the above information, ANALYSE whether the old machine should be replaced or not if required rate of return is 10%?

PDF

Solution

SUMMARY OF DECISION CRITERIA OF CAPITAL BUDGETING TECHNIQUES

Techniques		For Independent Project	For Mutually Exclusive Projects
Non-Discounted	Pay Back	(i) When Payback period ≤ Maximum Acceptable Payback period: Accepted (ii) When Payback period ≥ Maximum Acceptable Payback period: Rejected	Project with least Payback period should be selected
	Accounting Rate of Return (ARR)	(i) When ARR ≥ Minimum Acceptable Rate of Return: Accepted (ii) When ARR ≤ Minimum Acceptable Rate of Return: Rejected	Project with the maximum ARR should be selected.
Discounted	Net Present Value (NPV)	(i) When NPV > 0: Accepted (ii) When NPV < 0: Rejected	Project with the highest positive NPV should be selected
	Profitability Index(PI)	(i) When PI > 1: Accepted (ii) When PI < 1: Rejected	When Net Present Value is same, project with Highest PI should be selected
	Internal Rate of Return (IRR)	(i) When IRR > K: Accepted (ii) When IRR < K: Rejected	Project with the maximum IRR should be selected

Brain Teasers

Q1. While evaluating investments, the release of working capital at the end of the projects life should be considered as:

(a) Cash in flow

(b) Cash out flow

(c) Having no effect upon the capital budgeting decision

(d) None of the above.

Q2. Multiple IRRs are obtained when

(a) Cash flows in the early stages of the project exceed cash flows during the later stages.

(b) Cash flows reverse their signs during the project

(c) Cash flows are uneven

(d) None of the above.

Comprehensive Question

Question. Gama Company is considering the following investment projects :

	Cash Flows (₹)			
Projects	C_0	C_1	C_2	C_3
A	-10,000	+10,000		
B	-10,000	+7,500	+7,500	
C	-10,000	+2,000	+4,000	+12,000
D	-10,000	+10,000	+3,000	+3,000

(a) Rank the projects according to each of the following methods: (i) Payback, (ii) ARR, (iii) IRR and (iv) NPV, assuming discount rates of 10 and 30 per cent.

(b) Identify the best project when : 1) Projects are independent and 2) Projects are mutually exclusive.

Practice Questions

Q1. Unlock Limited wants to replace its old machine with a new automatic machine. Two models A and B are available at the same cost of ₹ 5 lakhs each. Salvage value of the old machine is ₹ 1 lakh. The utilities of the existing machine can be used if the company purchases A. Additional cost of utilities to be purchased in that case are ₹ 1 lakh. If the company purchases B then all the existing utilities will have to be replaced with new utilities costing ₹ 2 lakhs. The salvage value of the old utilities will be ₹ 0.20 lakhs. The earnings after taxation are expected to be:

Year	(cash in-flows of)		
	A ₹	B ₹	P.V. Factor @ 15%
1	1,00,000	2,00,000	0.87
2	1,50,000	2,10,000	0.76
3	1,80,000	1,80,000	0.66
4	2,00,000	1,70,000	0.57
5	1,70,000	40,000	0.50
Salvage Value at the end of Year 5	50,000	60,000	

The target return on capital is 15%. You are required to compute for the two machines separately: a) NPV b) Discounted Payback Period and c) Desirability Factor. Also advise which of the two machines should be selected.

Practice Questions

Q2. Bajrangi Chimney Company is evaluating three investment situations: (1) produce a new line of aluminium chimneys, (2) expand its existing line to include several new variants, and (3) develop a new, higher-quality line of exhausts. If only one project is undertaken, then its stand-alone expected present value and the amount of investment is here below for all three projects:

Project	Investment Required (₹)	PV of Future Cash Flows (₹)
1	2,00,000	2,90,000
2	1,15,000	1,85,000
3	2,70,000	4,00,000

* If projects 1 and 2 are jointly undertaken, there will be no savings; the investments required and present values will simply be individual totals.

With projects 1 and 3, economies are possible in investment because one of the machines acquired can be used in both production processes. The total investment required for projects 1 and 3 combined is ₹ 4,40,000. If projects 2 and 3 are undertaken, there are economies to be achieved in marketing and producing the products but not in investment. The expected present value of future cash flow for projects 2 & 3 shall be ₹ 6,20,000. If all three projects are undertaken simultaneously, the economies noted will still hold. However, a ₹ 1,25,000 extension on the plant will be necessary, as space is not available for all three projects. Advise on what combination shall be the best.

Q3. A&R Ltd. has undertaken a project which has an initial investment of Rs.2,000 lakhs in plant & machinery and Rs.800 lakhs for working capital. The plant & machinery would have a salvage value of Rs. 474.61 lakhs at the end of the fifth year. The plant & machinery would depreciate at the rate of 25% p.a. on WDV method. The other details of the project for the five year period are as follows:

Sales	10,00,000 units p.a.
Selling price per unit	Rs.500
Variable cost	50% of selling price
Fixed overheads (excluding depreciation)	Rs.300 lakh p.a.
Corporate tax rate	35%
Rate of interest on bank loan	12%
After tax required rate of return	15%

Required:

(i) CACULATE net present value (NPV) of the project and DETERMINE the viability of the project.

(ii) DETERMINE the sensitivity of project's NPV under each of the following condition:

a. Decrease in selling price by 10%;

b. Increase in cost of plant & machinery by 10%.

PV factor	Year-1	Year-2	Year-3	Year-4	Year-5
12%	0.892	0.797	0.711	0.635	0.567
15%	0.869	0.756	0.657	0.571	0.497

Q4.

Shiv Limited is thinking of replacing its existing machine by a new machine which would cost ₹ 60 lakhs. The company's current production is 80,000 units, and is expected to increase to 1,00,000 units, if the new machine is bought. The selling price of the product would remain unchanged at ₹ 200 per unit. The following is the cost of producing one unit of product using both the existing and new machine:

			Unit cost (₹)
	Existing Machine (80,000 units)	**New Machine (1,00,000 units)**	**Difference**
Materials	75.0	63.75	(11.25)
Wages & Salaries	51.25	37.50	(13.75)
Supervision	20.0	25.0	5.0
Repairs and Maintenance	11.25	7.50	(3.75)
Power and Fuel	15.50	14.25	(1.25)
Depreciation	0.25	5.0	4.75
Allocated Corporate Overheads	10.0	12.50	2.50
	183.25	165.50	(17.75)

The existing machine has an accounting book value of ₹ 1,00,000, and it has been fully depreciated for tax purpose. It is estimated that machine will be useful for 5 years. The supplier of the new machine has offered to accept the old machine for ₹ 2,50,000. However, the market price of old machine today is ₹ 1,50,000 and it is expected to be ₹ 35,000 after 5 years. The new machine has a life of 5 years and a salvage value of ₹ 2,50,000 at the end of its economic life. Assume corporate Income tax rate at 40%, and depreciation is charged on straight line basis for Income-tax purposes. Further assume that book profit is treated as ordinary income for tax purpose. The opportunity cost of capital of the Company is 15%.

Required:

(i) ESTIMATE net present value of the replacement decision.

(ii) CALCULATE the internal rate of return of the replacement decision.

(iii) Should Company go ahead with the replacement decision? ANALYSE.

Year (t)	**1**	**2**	**3**	**4**	**5**
$PVIF_{0.15,t}$	0.8696	0.7561	0.6575	0.5718	0.4972
$PVIF_{0.20,t}$	0.8333	0.6944	0.5787	0.4823	0.4019
$PVIF_{0.25,t}$	0.80	0.64	0.512	0.4096	0.3277
$PVIF_{0.30,t}$	0.7692	0.5917	0.4552	0.3501	0.2693
$PVIF_{0.35,t}$	0.7407	0.5487	0.4064	0.3011	0.2230

Q5. The General Manager of Merry Ltd. is considering the replacement of five-year-old equipment. The company has to incur excessive maintenance cost of the equipment. The equipment has zero written down value. It can be modernized at a cost of ₹ 1,40,000 enhancing its economic life to 5 years. The equipment could be sold for ₹ 30,000 after 5 years. The modernization would help in material handling and in reducing labour, maintenance & repairs costs.

The company has another alternative to buy a new machine at a cost of ₹ 3,50,000 with an economic life of 5 years and salvage value of ₹ 60,000. The new machine is expected to be more efficient in reducing costs of material handling, labour, maintenance & repairs, etc.

The annual cost are as follows:

	Existing Equipment (₹)	Modernization (₹)	New Machine (₹)
Wages & Salaries	45,000	35,500	15,000
Supervision	20,000	10,000	7,000
Maintenance	25,000	5,000	2,500
Power	30,000	20,000	15,000
	1,20,000	70,500	39,500

Assuming tax rate of 50% and required rate of return of 10%, should the company modernize the equipment or buy a new machine?

Q6. City Clap Ltd. is in the business of providing housekeeping services. There is a proposal before the company to purchase a mechanized cleaning system for a sum of Rs. 40 lakhs. The present system of the company is to use manual labour for the cleaning job. You are provided with the following information:

<u>Proposed Mechanized System:</u>	
Cost of the machine	Rs. 40 lakhs
Life of the machine	7 years
Depreciation (on straight line basis)	15%
Operating cost of mechanized system	Rs. 20 lakhs per annum
<u>Present system (Manual):</u>	
Manual labour	350 persons
Cost of manual labour	Rs. 15,000 per person per annum

The company has an after-tax cost of fund at 10% per annum.

The applicable tax rate is 50%.

PV factor for 7 years at 10% are as follows:

Years	1	2	3	4	5	6	7
P.V. factor	0.909	0.826	0.751	0.683	0.621	0.564	0.513

You are required to DETERMINE whether it is advisable to purchase the mechanized cleaning system.

Q7. A large profit making company is considering the installation of a machine to process the waste produced by one of its existing manufacturing process to be converted into a marketable product. At present, the waste is removed by a contractor for disposal on payment by the company of ₹ 150 lakh per annum for the next four years. The contract can be terminated upon installation of the aforesaid machine on payment of a compensation of ₹ 90 lakh before the processing operation starts. This compensation is not allowed as deduction for tax purposes.

The machine required for carrying out the processing will cost ₹ 600 lakh to be financed by a loan repayable in 4 equal instalments commencing from end of the year- 1. The interest rate is 14% per annum. At the end of the 4th year, the machine can be sold for ₹ 60 lakh and the cost of dismantling and removal will be ₹ 45 lakh.

Sales and direct costs of the product emerging from waste processing for 4 years are estimated as under:

Year	1	2	3	4
Sales	966	966	1,254	1,254
Material consumption	90	120	255	255
Wages	225	225	255	300
Other expenses	120	135	162	210
Factory overheads	165	180	330	435
Depreciation (as per income tax rules)	150	114	84	63

Initial stock of materials required before commencement of the processing operations is ₹ 60 lakh at the start of year 1. The stock levels of materials to be maintained at the end of year 1, 2 and 3 will be ₹ 165 lakh and the stocks at the end of year 4 will be nil. The storage of materials will utilise space which would otherwise have been rented out for ₹ 30 lakh per annum. Labour costs include wages of 40 workers, whose transfer to this process will reduce idle time payments of ₹ 45 lakh in the year- 1 and ₹ 30 lakh in the year- 2. Factory overheads include apportionment of general factory overheads except to the extent of insurance charges of ₹ 90 lakh per annum payable on this venture. The company's tax rate is 30%.

Present value factors for four years are as under:

Year	1	2	3	4
PV factors @14%	0.877	0.769	0.674	0.592

ADVISE the management on the desirability of installing the machine for processing the waste. All calculations should form part of the answer.

THANK YOU