CAPITAL BUDGETING / INVESTMENT DECISIONS.

This involves commitment of funds in long term projects which will generate benefits in the future.

Characteristics of Capital budgeting projects

1. They are long term projects
2. Requires huge initial Capital Commitment.
3. Benefits are expected to be realized in the future.
4. They are irrevocable projects: Once the project is undertaken, it will be difficult to abandon.
5. They are highly risky - Since it requires huge Capital commitment and benefits are realized in future which is uncertain.

Types of Capital Budgeting projects

1. **Mutually Exclusive projects**
   They are projects which are alternate of each other. i.e they compete against each other. Therefore they are substitute of each other. and hence if one project is undertaken, the other project is automatically rejected.
2. **Independent projects.**
   They are projects which serves different purposes i.e they don't compete against each other. The happening of one project does not affect the other project. They can be undertaken simultaneously.
3. **Dependent projects / Complementary / contigent projects.**
   They are projects which depends on each other and therefore, if one project is undertaken, the other project also will be undertaken.
4. **Divisible project**
   Is a project which can start generating incomes even before they are completed.
5. **Indivisible projects**
   Is a project which must be fully completed before they start generating inflows.
6. **Replacement projects**
   This involves replacing an old and inefficient asset with a new and more efficient asset.
7. **Acquisition projects**
   This involves buying a completely new asset where none existed before

Projects Evaluation Techniques.

This involves cost-benefit analysis in order to determine which projects to accept or reject.
There are 2 techniques used.

(a) Non-discounting techniques / Traditional techniques
(b) Discounting techniques.

(a) Non-Discounting Techniques.

This technique ignores the concept of time value for money.
They include:

1. Payback period (PBP)
2. Accounting Rate of Return (ARR)

1. PayBack Period. (PBP)

PBP refers to the length of time taken to recover the initial capital invested in a project.

→ The shorter the PBP, the better and less risky the project is.

Illustration 1

Consider a 5 year project whose initial investment is sh 100,000 and the project is expected to generate the following cash-inflows

Year	1	2	3	4	5
Cashflows	35,000	30,000	35,000	25000	20,000

Required: Calculate the payback period of the project.

Solution

Period	Cashflows	Accumulated Cashflows
1	35000	35000
2	30,000	65000
3	35,000	100,000 → payback period
4	25,000	125,000
5	20000	145,000

PBP = 3 years.

Illustration 2

Assuming the above cashflows but with initial capital of ksh 120,000.
Compute PBP

Period	Cashflows	Accumulated Cashflow
1	35000	35000
2	30,000	65000
3	35000	100,000 → ksh 120,000
4	25000	125,000
5	20,000	145,000

$$PBP = 3\text{yrs} + \left[\frac{\text{Capital} - \text{lower limit}}{\text{upper limit} - \text{lower limit}} \times 12\right]$$

$$= 3\text{yrs} + \left[\frac{120{,}000 - 100{,}000}{125{,}000 - 100{,}000} \times 12\right] = 3 \text{ years } 10 \text{ months}$$

Incase of Annuity cashflow

The following formular is applied where the cashflows are annuities

$$PBP = \frac{\text{Initial Capital Investment}}{\text{Annuity}}$$

Advantages of payback period method

1. Its easier to compute and understand.
2. It uses cashflows to evaluate projects instead of accounting profits.
3. Its normally used by managers who fears risks
4. It emphasizes on liquidity cost by considering projects with shorter payback period.

Disadvantages

1. It ignores the concept of time value of money.
2. It ignores the cashflows of the project after PBP.
3. It penalizes the projects which generates higher returns infuture.
4. It does not give a decision incase of one project.
5. It does not use all cashflows when evaluating the project.

2 Accounting Rate of Return (ARR)

This method uses accounting profit to evaluate projects. It is computed as follows.

$$ARR = \frac{\text{Average Account profit (EAT)}}{\text{Average Investment}} \times 100\%$$

$$\text{Average Investment} = \frac{\text{Initial Investment} + \text{salvage value}}{2}$$

Illustration 1

Consider a 4 year project whose initial investment is sh 150,000 with a salvage value of Ksh 50,000. The project is expected to generate the following accounting profits.

Year	1	2	3	4
EAT	40,000	30,000	20,000	10,000

Solution.

Average EAT = $(40+30+20+10) \div 4 = 25{,}000$

Average Investment $(150+50) \div 2 = 100{,}000$

$$ARR = \frac{25{,}000}{100{,}000} \times 100\% = 25\%$$

Decision Criteria

1. Incase of mutually exclusive project, select the project with higher ARR

Adv of ARR

1. Its easier to compute and understand.
2. It uses accounting profit which is readily available in financial statement
3. It uses all accounting profit when evaluating the project
4. It requires no adjustments to the profit unlike other methods

Disadvantages

1. It does not take into account time value of money.
2. It ignores fluctuations of profits during the economic life.
3. In case of one project, it does not give a decision.

(b) Discounting Techniques

They are techniques which takes into account time value of money by computing present value of all expected cashflows of the project.

→ This method is consistence with the shareholders wealth maximization goal. They include:

1. Discounted payback period. (DPBP)
2. Modified Internal Rate of Return. (MIRR)
3. Net present value (NPV)
4. Profitability index (PI)
5. Internal Rate of Return (IRR)

Features of an ideal Investment Appraisal Method.

1. It should consider all cashflows
2. It should use cashflows rather than accounting profits
3. It should take into account time value of money.
4. It should give a clear decision on whether to either accept or reject.
5. It should help in ranking the projects.

1. Discounted payback period.

Illustration I

Consider a 5 year project with initial investment of Ksh 100,000 and the project is expected to generate the following cashflows.

Year	1	2	3	4	5
Cashflow	35000	30,000	35000	25000	20,000

Assuming the cost of capital of 10%. Determine DPBP

Solution.

Period	Cashflows	Df @ 10%	PV	Accumulated PV
1	35000	0.9091	31818.5	31818.5
2	30,000	0.8264	24792	56610.5
3	35000	0.7513	26295.5	82906.
4	25000	0.6830	17075	99981 → 100,000
5	20,000	0.6209	12418	112399

$$PBP = 4 \text{ year} + \left[\frac{100,000 - 99981}{112399 - 99981} \times 12\right] = 4 \text{ yrs}$$

Assign Nov 2018 Q26

2. Modified Internal Rate of Return. (MIRR)

Under this techniques, it assumes that the cashflows generated can be re-invested to earn more returns. It is computed as follows:

$$MIRR = \sqrt[n]{\frac{\text{Future value of cashflows}}{\text{Initial investment (PVCOF)}}} - 1$$

May 2019 Q 5d)

Period	Cashflows	FVIF $(4\%)^n$		FV
1	460000	1.14^3	= 1.4815	207416
2	120000	1.14^2	= 1.2996	155952
3	80000	1.14^1	= 1.14	91200
4	60000	1.14^0	= 1	60000
				514568

$$MIRR = \sqrt[n]{\frac{FV \text{ of cashflows}}{PVCOF}} - 1$$

$$MIRR = \sqrt[4]{\frac{514568}{300000}} - 1 = 14.44\%$$

Decision criteria

1. Accept the project if MIRR > cost of capital
2. Reject the project if MIRR < cost of capital.

3 Net present value (NPV)

This is the difference between present value of cash inflow (PVCIF) and present value of cash outflows (PVCOF)

$$NPV = PVCIF - PVCOF$$

Decision criteria

1. If NPV is positive, Accept the project
2. If NPV is negative, Reject the project
3. If NPV = 0, then the investor is indifferent.

Dec 2007 Q 16

Mapeni Ltd is considering either of the following mutually exclusive project to invest in. Each project will generate cashflows over a 3 year period.

project	cost	year 1	2	3
M	10m	5m	5m	5m
N	10m	0	0	17.28m.

The cost of capital for each project is 10%. Ignore taxation.

Required:

Determine which project to undertake using i) NPV (5 mks)
ii) IRR (5 mks)

Solution

NPV = PVCIF − PVCOF

Project M

PVCIF = $5m \times PVIFA^{3}_{10\%}$

$5m \times 2.4869 = 12.43445$ PVCIF

(10) PVCOF

2.43445 NPV

Project N

PVCIF = $17.28 \times PVIF^{3}_{10\%}$

$17.28 \times 0.7513 = 12.982$ PVCIF

(10) PVCOF

2.982 NPV

Comment: Both project have +ve, NPV but they are mutually exclusive, so undertake project N since it has higher NPV.

May 2016 Q 16

(1) Cashflow statement

Year	1 $k000	2 $k000	3 $k000	4 $k000	5 $k000
Sales revenue (8×600)	4800	4200	4200	3000	1800
Variable cost (8×200)	(1920)	(1680)	(1680)	(1200)	(720)
Fixed cost	(600)	(600)	(600)	(600)	(600)
EBDT	2280	1920	1920	1200	480
less: Dep (6−1.5)÷5	(900)	(900)	(900)	(900)	(900)
EBT	1380	1020	1020	300	(420)
less tax (30%)	(414)	(306)	(306)	(90)	(0)
EAT	966	714	714	210	(420)
add back depreciation	900	900	900	900	900
Cashflows	1866	1614	1614	1110	480
add: Salvage value	—	—	—	—	1500
	1866	1614	1614	1110	1980
$PVIF^{n}_{10\%}$	0.9091	0.8264	0.7513	0.6830	0.6209
present value	1696	1334	1213	758	1229

	$k000
Total present value	6230
less PVCOF	(6000)
NPV	230

Accept the project since NPV is positive.

Assig June 2006 Q16

Changes in working capital items

- Working capital refers to current asset – current liabilities
- working capital is treated as an outflow at the initial stage and an ~~outflow~~ inflow at the end of economic life

June 2008 Q3b

Baraka Ltd is considering investing in a new processing machine costing Sh 25 million. The machine would be used for five years and thereafter be disposed of for Sh 5 million at the end of 5th year.

Additional information:

1. Additional raw material amounting to Sh 5 million would be required at the beginning of the five-year period. This would increase account payables by Sh 2 million. These changes in working capital would reverse at the end of 5th year.
2. The new machine would increase the Company's annual gross profit from Sh 12 million to 24 million.
3. Incremental fixed cost would amount to Sh 2.2 million per annum.
4. Additional machine operator would be employed at a cost of Sh 1,600,000 per annum.
5. The new machine would be depreciated on a straight line basis.
6. The cost of capital is 12%.
7. The corporation tax is 30%.

Required.

Using NPV, advice the Company on whether to invest in the new machine (10 Mks)

Solution.

NPV = PVCOF − PVCOF

PVCOF

Initial cost	25
Working Capital (5−2)	3
	28

Cashflow statement

Incremental gross profit (24−12)	12
Incremental fixed cost	(2.2)
Machine operator cost	(1.6)
EBT	8.2
tax. EAT.	2.46
add: Dep tax shield Benefit (25−5) ÷ 5 = 4 × 30%	5.74
Annual Cashflows	1.2
PVIFA 12% 5	6.94
PV of annuity	3.6048
	25.017

Terminal Benefits

Salvage value	5
working capital	3
	8

PV of terminal benefit = $8 \times PVIF_{12\%}^{5}$

$8 \times 0.5674 = 4.54$

Total present value = Annuity 25.017 +

Terminal Benefit 4.54

PVCF 29.557

PVOF (28)

NPV 1.557 M.

Comment: Accept the project since NPV is positive.

Adv of NPV technique

1. It takes into account time value of money.
2. It gives a clear decision on whether to accept or reject a project
3. It uses cashflow in evaluation of projects
4. It uses all cashflows.
5. It is consistent with shareholders goal of wealth maximization.

Disadvantages

1. Cashflows used in evaluation of project are usually estimates.
2. It assumes that the cost of capital will remain ~~cost~~ constant during the period under analysis.
3. In some cases it gives conflicting results with IRR

4 Profitability Index (PI)

This is a relative measure of risk. It indicates the returns for every shilling invested in the project.

-> Its mostly applicable when there exist capital Rationing for viable project

-> Its calculated as follows:

$$PI = \frac{PVCF}{PVOF}$$

Decision Criteria

1. If PI > 1 (+), accept the project
2. If PI < 1 , reject the project
3. If PI = 1 , the investor is indifference.

- NPV is the absolute measure of risk while PI is the relative measure of risk. Both NPV and PI will give the same decision when evaluating the project and therefore the advantages and disadvantages of NPV will be the same with that of PI.

- The only difference is that PI is used when the company is experiencing capital rationing to undertake all viable projects.

Capital Rationing

This is the scarcity of the investment funds. There are 2 types of Capital Rationing:

(a) Soft / Internally generated Capital Rationing:

This occurs when the shortage of the investment funds is as a result of action of the management. It may occur due to:

1. When the management have set a limit on budget for the funds to be invested.
2. Where the project can only be invested using internally generated funds
3. Where the mgnt refuses to raise additional capital through issue of shares to avoid dilution.
4. Where the mgnt refuses to borrow to avoid commitment of heavy payment of interest or principle.

(b) Hard / Externally generated Capital Rationing

This is the shortage of investment funds due to factors not within the control of the management. It may arise due to the following:

1. When the capital market is depressed thereby making it impossible to raise finances.
2. High demand of fund by well established firms
3. Lack of collateral security incase of borrowing.
4. High issue cost of the debt therefore affecting borrowing.

NB:

1. Either Soft or Hard Capital rationing can persist for a period less than one accounting year, this is known as Single period Capital Rationing
2. However if the scarcity of funds persist for more than one year, it is known as Multi-period capital rationing

May 2012 Q 4b

ABC ltd has the following proposed independent projects for the year ended 31 Dec 2012. Shs '000'

project	cash outlay	present value of future net cashflows
A	500	1000
B	1000	2500
C	400	300
D	300	400
E	200	300

Required

i) Assuming there is no capital rationing, indicate which projects to select

(ii) Total NPV of the selected projects

(iii) Assuming a single period internal Capital Constraint of Sh 1,700,000 is imposed, indicate which projects should be selected (6mks)

Solution:

i) Accept only if NPV is positive

NPV = PVCIF − PVCOF

		comment
A	1000 − 500 = 500	select
B	2500 − 1000 = 1500	select
C	300 − 400 = (100)	
D	400 − 300 = 100	select
E	300 − 200 = 100	select

(ii) Total NPV

500 + 1500 + 100 + 100 = 2200

(iii) Capital Rationing of 1700

PI = PVCIF / PVCOF

projects	PVCIF ÷ PVCOF = PI	Ranking
A	1000 ÷ 500 = 2	2
B	2500 ÷ 1000 = 2.5	1
D	400 ÷ 300 = 1.33	4
E	300 ÷ 200 = 1.5	3

Capital Balance	1700
Project B	(1000)
	700
Project A	(500)
	200
Project E	(200)
	0

Projects to undertake = B, A & E

May 2017 Q 3b

Dep = 50 ÷ 5 = 10

Solution

project A

EBDT	42
less: Dep	(10)
EBT	32
tax	(9.6)
EAT	22.4
add back dep	10
Annuity	32.4
PVIFA 5, 12%	3.6048
PVCIF	116.796

PI = PVCIF / PVCOF = 116.796 / 50 = 2.34

Project B.

	1	2	3	4	5
EBDIT	62	32	22	52	52
Depreciation	(10)	(10)	(10)	(10)	(10)
EBT	52	22	12	42	42
tax 30%	(15.6)	(6.6)	(3.6)	(12.6)	12.6
EAT	36.4	15.4	8.4	29.4	29.4
add back dep	10	10	10	10	10
Cashflows	46.4	25.4	18.4	39.4	39.4
PVF 12%	0.8929	0.7972	0.7118	0.6355	0.5674
Present value	41.43	20.25	13.1	25.04	22.36

PI = Total PVCIF / PVCOF = 122.18 / 50 = 2.444

Comment:- Acceptance Project B since it has higher PI than A

Assign May 2016 Q 4(d)
Nov 2015 Q 3b

May 2018 Q 4 C

Simple period Capital Rationing for Indivisible projects

May 2018 Q4C

Solution

Project Combination	Total outflow	Surplus funding	Interest NPV	External NPV	Total NPV
A+B	30+45=75	15	20+15=35	6	41
A+C	30+60=90	0	20+40=60	0	(60)
A+D	30+40=70	20	20+30=50	8	58
B+D	45+40=85	5	15+30=45	2	47

Working for External NPV

Return on Investment (ROI) (A+B)

14% x 15 = 2.1

PVCIF = A/r = 2.1 ÷ 0.1 = 21

PVCOF (15)

NPV 6

Optimal Project Combination A + C

A+D

ROI = 14% x 20 = 2.8

PVCIF = 2.8 ÷ 0.1 = 28

PVCOF (20)

NPV 8

B+D

ROI = 14% x 5 = 0.7

PVCIF = 0.7 ÷ 0.1 = 7

PVCOF (5)

NPV 2

5. Internal Rate of Return. (IRR)

is the rate of return where NPV is zero (0).

Decision Criteria

1. If IRR > cost of capital --- accept the project
2. If IRR < cost of capital --- Reject the project.
3. If IRR = cost of capital -- point of indifference

IRR can be computed depending with the nature of cashflows as follows:

1. Incase of Annuity until infinity

$$IRR = \frac{A}{PVIOF} \times 100\%$$

Illustration 1

Consider a project whose initial investment is sh 250 million. The project is expected to generate annual cash inflows of Ksh 45 million per annum to perpetuity.
Required: Determine IRR of the project

Solution

$$IRR = \frac{A}{PVIOF} \times 100\% \Rightarrow \frac{45}{250} \times 100\% = 18\%$$

2. Incase of one year project

$$IRR = \frac{FV}{PVIOF} - 1$$

Illustration 1

Consider a one year project whose initial investment is sh 12 million. The project is expected to generate sh 15 million at the end of the year. Determine IRR of the project.

Soln

$$IRR = \frac{15}{12} - 1 = 0.25 \simeq 25\%$$

3 Incase of single future cashflows in period "n"

$$IRR = \sqrt[n]{\frac{FV}{PVIOF}} - 1$$

Dec 2007 Q1 previous copied quiz

Project N

$$IRR \simeq \sqrt[3]{\frac{17.28}{10}} - 1 = 0.2 \simeq 20\%$$

4 Incase of annuity for specific period of time.

$$IRR = \frac{PVCOF}{A}$$

Dec 2007 Q1 previously quiz

Project M.

$IRR = \frac{10}{5} = 2$ → inside due table (3 year)

20 → 2.1065
IRR → 2
24 → 1.9813

$$\Rightarrow \frac{IRR - \text{lower limit}}{\text{upper limit} - \text{lower limit}}$$

$$\frac{IRR-20}{24-20} = \frac{2-2.1065}{1.9813-2.1065}$$

$$\frac{IRR-20}{4} = 0.8506.$$

$IRR - 20 = 3.4$

$IRR = 23.4\%$

Nov 2015 Q 3b

(i) $IRR = \frac{PVCOF}{A} = \frac{65000,000}{21000,000} = 3.0952$ (5)

18% - 3.1272
IRR - 3.0952
20% - 2.9906.

$$\frac{IRR-18}{20-18} = \frac{3.0952-3.1272}{2.9906-3.1272}$$

$$\frac{IRR-18}{2} = 0.234$$

$IRR - 18 = 0.47$

$IRR = 18.47\%$

(ii) $PI = \frac{PVCIF}{PVCOF}$

$PVCIF = 21 \times PVIFA^{5}_{12\%} \Rightarrow$

$21 \times 3.6048 = 75.7$ P

$PI = \frac{75.7}{65} = 1.16$

Assig: Handout Quiz

5. Incase of unequal cashflows

In this case IRR is calculated using trial and error method. The following steps are followed.

1. Compute the NPV using cost of capital given.
2. (a) If the NPV obtained in step I is positive, Re-discount using a higher discounting rate which will give negative NPV.
   (b) If the NPV obtained in step I is negative, Re-discount using a lower discounting rate which will give positive NPV
3. Compute IRR using the following formular.

$$IRR = LDR + \left[\frac{NPV_{LDR}}{NPV_{LDR} - NPV_{HDR}}\right][HDR - LDR]$$

where LDR -> lower Discounting Rate
HDR -> Higher Discounting Rate

May 2014 Q1. previously copied

NPV = wcas 230

Rediscount using higher rate

period	cashflows	PVIF 20%	PV.
1	1866	0.8333	1555
2	1614	0.6944	1121
3	1614	0.5787	934
4	1110	0.4823	535
5	1980	0.4019	796.
		PVCF	4941
		INOF	(6000)
		NPV	(1059)

$$IRR = 10 + \left(\frac{230}{230 - -1059}\right)(20-10) = 11.8\%$$

Illustration 2

Consider a 3 year project with initial investment of sh 100,000. The project is expected to generate the following cashflows.

year	1	2	3
cashflows	50,000	55000	35000

If the cost of capital is 12%, determine IRR of the project

Solution

Period	Cashflow	$PVIF^{n}_{12\%}$	PV
1	50,000	0.8929	44645
2	55000	0.7972	43846
3	35000	0.7118	24913
		PVCIF	113404
		PVCOF	(100000)
		NPV	13404

Since NPV is +ve, rediscount using higher rate

Period	Cashflows	$PVIF^{n}_{20\%}$	PV
1	50,000	0.8333	41665
2	55000	0.6944	38192
3	35000	0.5087	17805
		PVCIF	97662
		PVCOF	(100000)
		NPV	(2338)

$$IRR = 12 + \left[\frac{13404}{13404 - -2338}\right](20-12) = 18.81\%$$

AdV of IRR
Disadv of IRR } same as NPV.

Differences between IRR & ARR

IRR	ARR
1 Its a discounting technique	Non-discounting technique
2 It uses cashflows to evaluate project	It uses accounting profit (EAT)
3 It uses all cashflows of the project in evaluation	It uses the average accounting profit to evaluate.
4. It gives a decision on whether to accept or reject single project	It does not give a decision on whether to accept or reject single project

Causes of Conflict between NPV & IRR

The conflict between NPV and IRR may arise due to the following circumstances.

1. Incase of difference in sizes of mutually exclusive projects
2. Incase of difference in Economic lives of mutually exclusive projects
3. Incase of cashflows timing of mutually exclusive projects.
4. Incase of non-conventional cashflows i.e cashflows that are +ve at one point and -ve at another point.

NB: Incase of conflict btw NPV and IRR, NPV always prevails