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Capital Budgeting

Definition of Capital Budgeting

Capital budgeting is the process of determining and selecting the most profitable long-term projects.

Long-term asset purchase planning process.

Example:

The company wants to determine whether to undertake a project to purchase a new machine for.

How to decide?

Will the machine be profitable?

Will the company get a high return on investment?

Project Types

1 *Mutually Exclusive*

Only one project will be accepted, others rejected

2 *Independent Project*

Projects are not interconnected so they can be selected or rejected

Project Classifications

Replacement Decision

To maintain business, there is no need to do detailed analysis
For cost reduction, more detailed analysis is needed

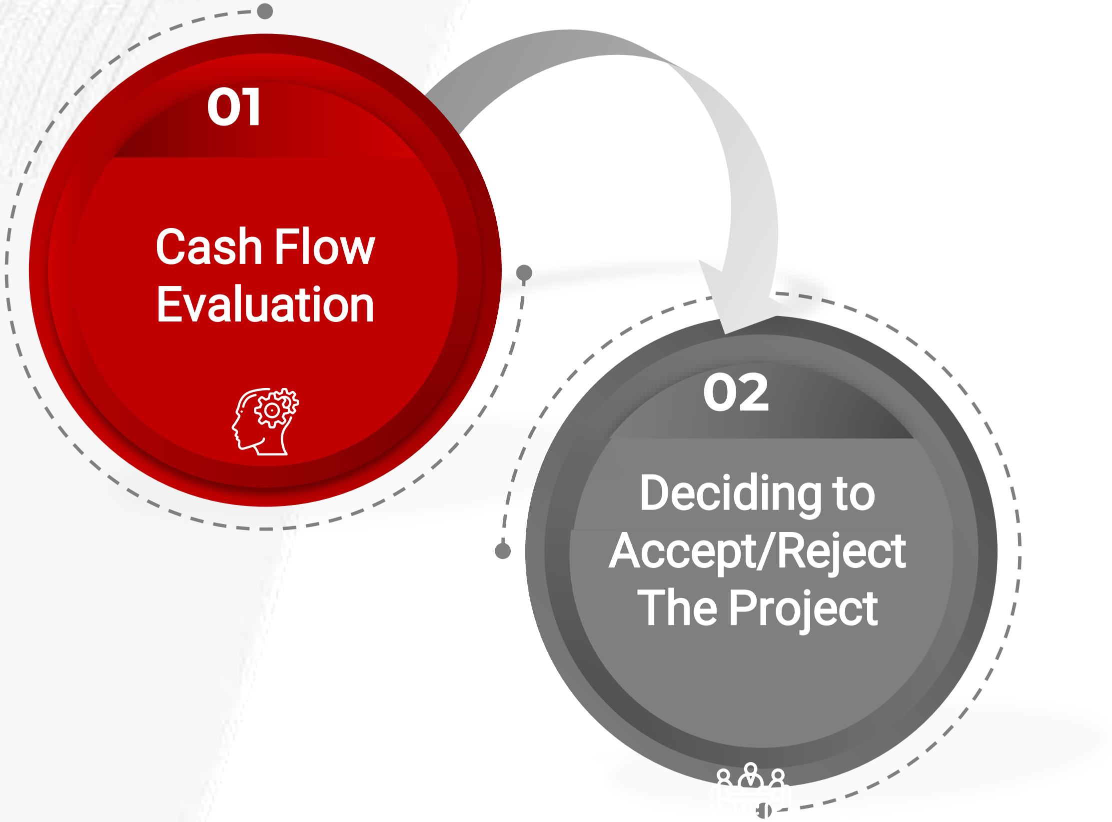
Expansion

Into existing products or markets, detailed analysis is needed
New products or markets. Complex, requires detailed analysis

Security and/or environmental projects

That usually accompany new investments or projects

Capital Budgeting Stages



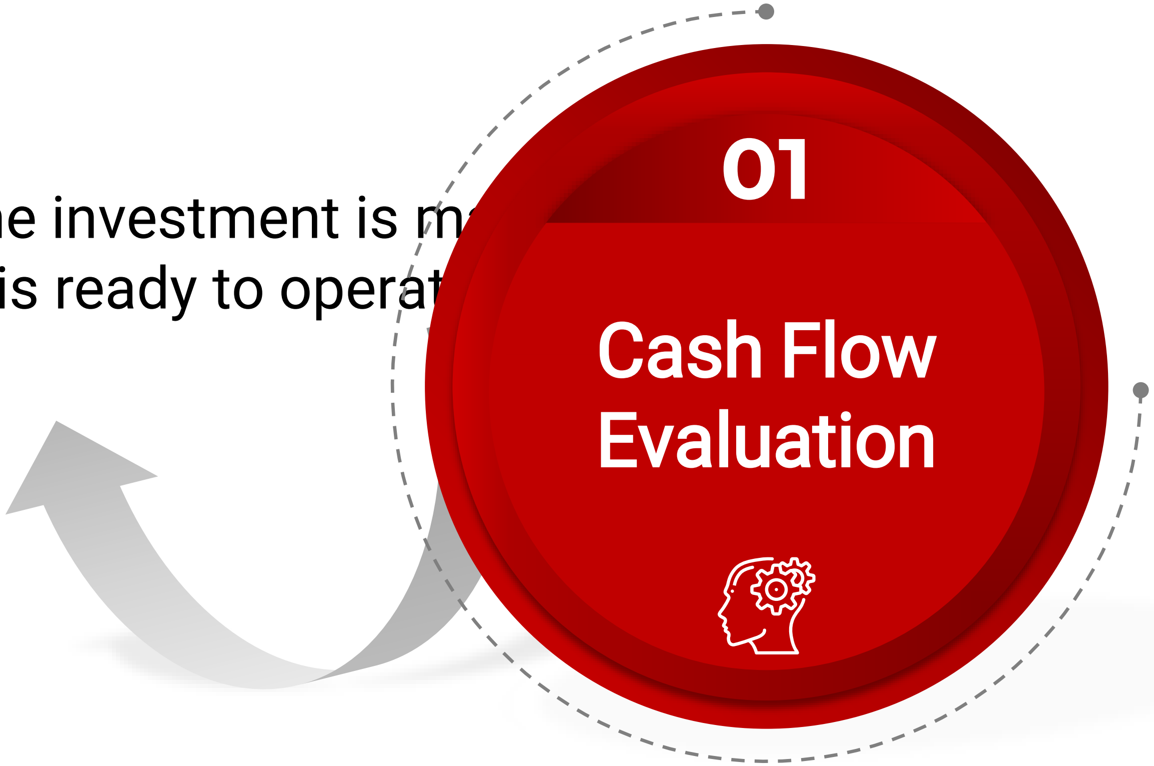
Capital Budgeting Stages

a) Initial Cashflow

What is the cash flow at “time 0?”

Represents the cash flow that occurs when the investment is m
cost of building a new installation unit until it is ready to operat

- Pre-construction costs
- Purchase of materials and equipment
- Construction
- Start-up
- Working capital



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Capital Budgeting Stages

b) Operational Cash Flows

Represents cash flow generated from project operations.

In operating cash flow is taken into account:

- Cash inflow from product sales
- Cash outflow for cash operating expenses and depreciation.

If the funds for investment come from their own capital

Operating Cash Flow = EAT + Depreciation

If the funds for investment come partly from loans:

Operating Cash Flow = EAT + Depreciation + Interest (1 – T)

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Cash Flow Evaluation

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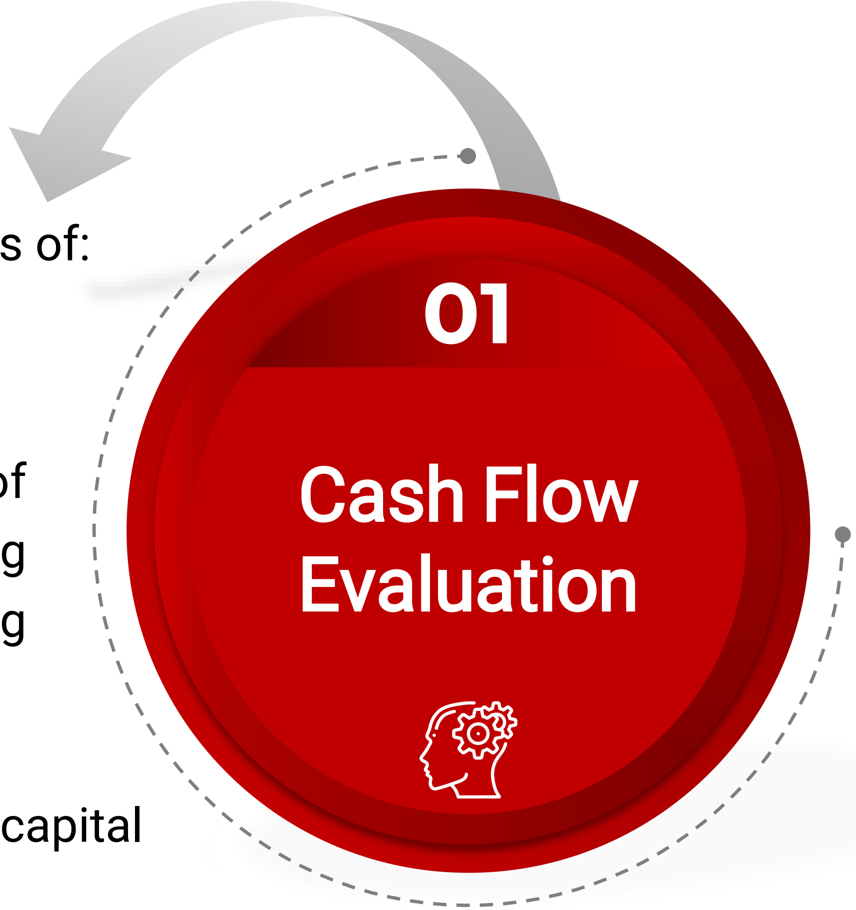
Capital Budgeting Stages

c) Terminal Cash Flow

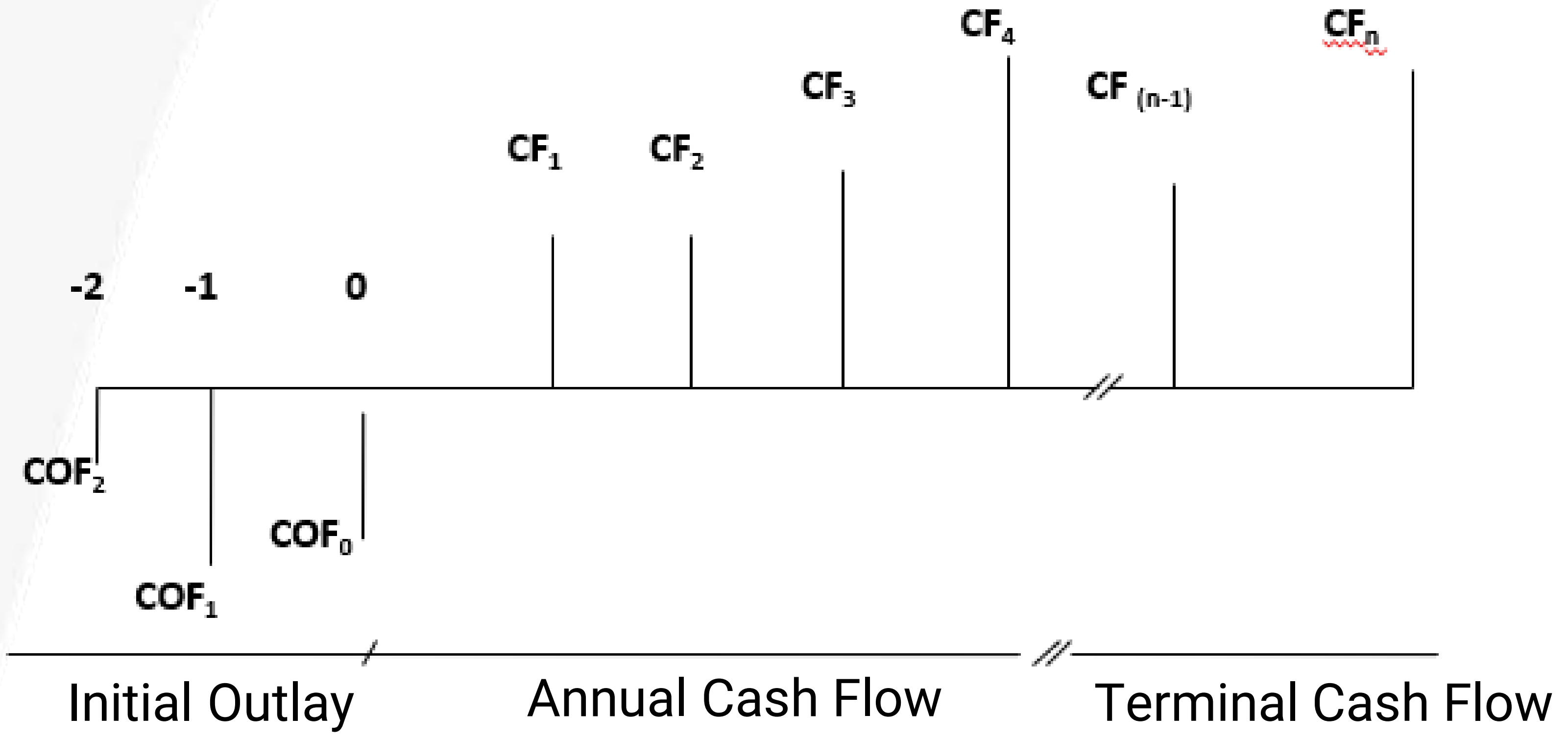
- How much cash flow at the end of the project?
- Is the cash flow that occurs at the end of the project, which consists of:
  - **Salvage Value** , the estimated selling price of fixed assets at the end of the project life.
  - **Working Capital Recovery (Capital Recovery)**, the return of working capital needed at the beginning of the project or during the life of the project because when the project ends the working capital is no longer needed.

Formula :

1. Salvage value
2. +/- Tax impact on capital gain/loss
3. + Return of net working capital
4. Cash Flow Terminals



Capital Budgeting Diagram



CO = Cash Out Flow CF = Cash Flow

Capital Budgeting Stages

Initial Cash Flow

a. Purchase of new assets
b. Capitalized expenses (transportation, insurance, etc.)
c. Working capital

d. Total Initial Cash Flow (a + b + c)

Operational Cash Flow

e. Income
f. Operating Expenses
g. Depreciation
h. EBIT (e –f –g)
i. Interest
j. EBT (h – i)
k. Tax
l. EAT (j – k)
m. Depreciation
n. Interest (1-T)

o. Total Operational Cash Flow (l + m + n)

Terminal Cash Flow

p. Salvage value
q. Tax on Salvage Value
r. Working Capital Recovery

s. Total Terminal Cash Flow (p – q + r)

Net Cash Flow (d + o + s)

Capital Budgeting Stages

Example :

1. Expenditures for working capital are made when the investment will start and the source of capital comes from own capital.

2. Expenditures for working capital are carried out during the life of the project and the source of capital comes from own capital and loans from banks

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Expenditures for working capital are made when the investment will start and the source of capital comes from own capital.

Description	0	1	2	3	4	5	6
Initial Cash Flow :							
Machine Purchase Price	860						
B. Transportation & Installation	40						
Working capital	60						
Total Initial Cash Flow	960						
Operating Cash Flow:							
Income		480	500	530	550	580	610
Operating Expenses :							
- Cash		250	260	270	280	300	310
- Depreciation Expense		150	150	150	150	150	150
Total Operating Cost		400	410	420	430	450	460
Operating Profit (EBIT)		80	90	110	120	130	150
Interest		0	0	0	0	0	0
EBT		80	90	110	120	130	150
Tax (25%)		20	22,5	27,5	30	32,5	37,5
Net Profit (EAT)		60	67,5	82,5	90	97,5	112,5
Depreciation Expense		150	150	150	150	150	150
Total Operating Cash Flow		210	217,5	232,5	240	247,5	262,5
Terminal Cash Flow :							
Salvage value							72
Tax (25%)							18
Salvage Value After Tax							54
Working Capital Recovery							60
Terminal Cash Flow Total							114
NET CASH FLOW	(960)	210	217,5	232,5	240	247,5	376,5

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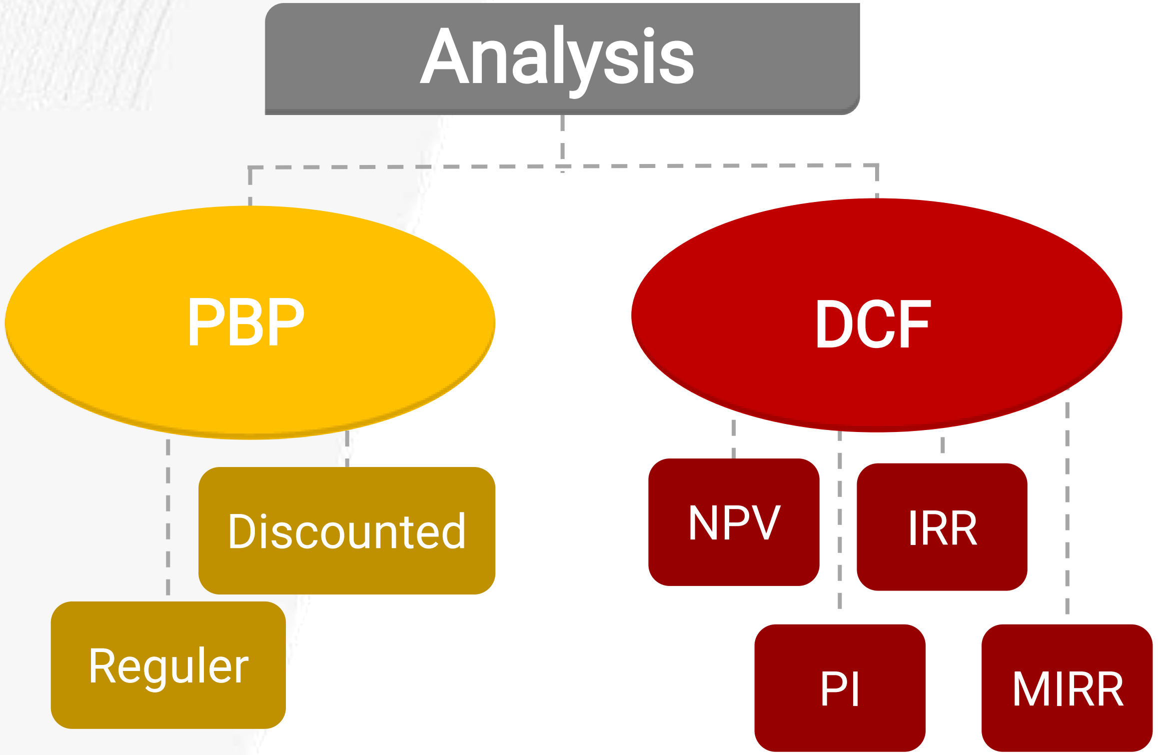
2 Expenditures for working capital are carried out during the life of the project and the source of capital comes from own capital and loans from banks

Description	0	1	2	3	4	5
Initial Cash Flow :						
Machine Purchase Price	350.000					
Operating Cash Flow:						
Income		500.000	550.000	605.000	665.500	732.050
Operating Expenses :						
- Cash		325.000	350.000	377.500	407.750	441.025
Depreciation Expense		70.000	70.000	70.000	70.000	70.000
Total Operating Cost		395.000	420.000	447.500	477.750	511.025
Operating Profit (EBIT)		105.000	130.000	157.500	187.750	221.025
Interest		10.000	8.362	6.559	4.557	2.396
EBT		95.000	121.638	150.941	183.193	218.629
Tax (25%)		23.750	30.410	37.735	45.798	54.657
Net Profit (EAT)		71.250	91.228	113.206	137.395	163.972
Depreciation Expense		70.000	70.000	70.000	70.000	70.000
Interest (1- 25%)		7.500	6.272	4.919	3.412	1.797
Working capital		- 20.000	-5.000	-8.000	-10.000	-15.000
Total Operating Cash Flow		128.750	162.500	180.125	200.807	220.769
Terminal Cash Flow :						
Salvage value						150.000
Tax (25%)						37.500
Salvage Value After Tax						112.500
Working Capital Recovery						58.000
Terminal Cash Flow Total						170.500
NET CASH FLOW	(350.000)	128.750	162.500	180.125	200.807	391.269

Capital Budgeting Decision Method



Capital Budgeting Decision Method

Example:

A manufacturer considers a proposed investment of $10,000 with no salvage value that can generate annual cash flows of $2000, $3000, $4000 and $5000 over 4 years, respectively. Assuming the required rate of return (cost of capital) is 10%.

By using capital budgeting methods, is the project accepted or rejected?

Year	After-tax FCF
0	(10.000)
1	2.000
2	3.000
3	4.000
4	5.000

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Capital Budgeting Decision Method

Reguler PayBack Period

DEFINITION

The number of years required to recover the initial investment cost

DECISION RULE

The shorter the payback period, the better

To determine which project to choose, the company must have a benchmark.

If
Payback ≤ Payback Benchmark

The project is **accepted**

If
Payback > Payback Benchmark

The project is **rejected**

Capital Budgeting Decision Method

Reguler PayBack Period

Year	After-tax FCF	Cumulative Inflow
0	(10.000) (b)	0
1	2.000	2.000
2	3.000	5.000
3 (a)	4.000	9.000 (c)
4	5.000 (d)	14.000

$$PBP = a + \frac{(b-c)}{d}$$

$$PBP = 3 + \frac{(10.000 - 9000)}{5000}$$

$$= 3{,}4\ year$$

If the Benchmark, which the company expects to be 4 years, is the project accepted or rejected? **YES**

Because Payback Payback ≤ benchmark, the project is **accepted**

Capital Budgeting Decision Method

Discounted PayBack Period

- Improvement of the payback period method
- Discount the estimated cash flow using the company's cost of capital

Capital Budgeting Decision Method

Discounted PayBack Period

Year	After-tax FCF	$PVIF_{10\%,n}$	Discounted FCF	Cumulative Disc. FCF
0	(10.000) (b)			
1	2.000	0.909	1.818	1.818
2	3.000	0.826	2.478	4.296
3 (a)	4.000	0.751	3.004	7.300 (c)
4	5.000	0.683	3.415 (d)	10.715

$$PBP = a + \frac{(b-c)}{d}$$

$$PBP = 3 + \frac{(10.000 - 7.300)}{3.415}$$

$$= 3{,}79\ year$$

If the Benchmark, which the company expects to be 4 years, is the project accepted or rejected? **YES**

Payback ≤ benchmark → ***Accept the project***

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Capital Budgeting Decision Method

Net Present Value NPV

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

FCF	=	the annual cash flow in time period t
k	=	the appropriate discount rate or cost of capital
IO	=	initial cash outlay (initial cashflow)
n	=	the project's expected life

Criterion

If $NPV \geq 0$	If $NPV < 0$
Accept the project	Reject the project

Capital Budgeting Decision Method

Net Present Value - NPV

Year	After-tax FCF	$PVIF_{10\%,n}$	Discounted FCF	Cumulative Disc. FCF
0	(10.000)			
1	2.000	0.909	1.818	1.818
2	3.000	0.826	2.478	4.296
3	4.000	0.751	3.004	7.300
4	5.000	0.683	3.415	10.715

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

NPV = 10.715 – 10.000
= 715

NPV ≥ 0 → *Accept the project*

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Capital Budgeting Decision Method

Profitability Index - PI

$$PI = \frac{\sum_{t=1}^{n} \frac{FCF_t}{(1+k)^t}}{IO}$$

PI	=	profitability index
FCF	=	free cash flow
k	=	discount rate
IO	=	initial cash outlay (initial cashflow)

Criterion

If $PI \geq 1{,}0$	If $PI < 1{,}0$
Accept the project	Reject the project

Capital Budgeting Decision Method

Profitability Index - PI

Year	After-tax FCF	$PVIF_{10\%,n}$	Discounted FCF	Cumulative Disc. FCF
0	(10.000)			
1	2.000	0.909	1.818	1.818
2	3.000	0.826	2.478	4.296
3	4.000	0.751	3.004	7.300
4	5.000	0.683	3.415	10.715

$$PI = \frac{\sum_{t=1}^{n} \frac{FCF_t}{(1+k)^t}}{IO}$$

$$PI = \frac{10.715}{10.000} = 1{,}07$$

PI ≥ 1,0 → *Accept the project*

Capital Budgeting Decision Method

Internal Rate of Return - IRR

$$IO = \sum_{t=1}^{n} \frac{FCF_t}{(1+IRR)^t}$$

FCF	=	Free cash flow
IO	=	Initial outlay (Initial cashflow)
IRR	=	Internal rate of return

Criterion

If $IRR \geq k$	If $IRR < k$
Accept the project	Reject the project

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Capital Budgeting Decision Method

Internal Rate of Return - IRR

Year	After-tax FCF
0	(10.000)
1	2.000
2	3.000
3	4.000
4	5.000

$$IO = \sum_{t=1}^{n} \frac{FCF_t}{(1+IRR)^t}$$

$$10.000 = \sum_{t=1}^{4} \frac{FCF_t}{(1+IRR)^t}$$

IRR ? By Interpolation

Capital Budgeting Decision Method

Internal Rate of Return – 3 simple step

1. At 10% discount rate, PV of cash inflow = $10.715. So, 10% will be our lower limit.
2. To make PV < Initial Outlay, the discount rate must be higher than 10%, say 15%. Then, calculate the PV of cash inflow at 15% discount rate.
3. Then estimate the IRR by **interpolating** the data

Discount rate	PV of cash inflow
10%	10.715
IRR = ?	10.000
15%	9.500

Capital Budgeting Decision Method

Internal Rate of Return – 3 simple step

Discount rate	PV of cash inflow
10%	10.715
IRR = ?	10.000
15%	9.500

X (difference between 10% and IRR); 5% (difference between 10% and 15%)

715 (difference between 10.715 and 10.000); 1.215 (difference between 10.715 and 9.500)

$$\frac{X}{5\%} = \frac{715}{1.215}$$

$$1.215\,X = 715\,(5\%)$$

$$X = \frac{35{,}75}{1.215} = 2{,}94\%$$

$$IRR = 10\% + 2{,}94\% = 12{,}94\%$$

IRR (12,94%) > k (10%) → Accept the project

Capital Budgeting Decision Method

Modified Internal Rate of Return- MIRR

$$PV_{outflow} = PV_{\inf low}$$

$$\sum_{t=0}^{n} \frac{ACOF_t}{(1+k)^t} = \frac{\sum_{t=0}^{n} ACIF_t (1+k)^{n-t}}{(1+MIRR)^n}$$

ACOF = annual cash outflow in period t

ACIF = annual cash inflow in period t

TV = terminal value of ACIF

n = project's expected life

k = required rate of return or discount rate

Criterion

If MIRR ≥ required rate of return	If MIRR < required rate of return
Accept the project	Reject the project

Capital Budgeting Decision Method

Modified Internal Rate of Return- MIRR

Year	After-tax FCF
0	(10.000)
1	2.000
2	3.000
3	4.000
4	5.000

$$PV_{outflow} = PV_{\inf low} \longrightarrow \sum_{t=0}^{n} \frac{ACOF_t}{(1+k)^t} = \frac{\sum_{t=0}^{n} ACIF_t (1+k)^{n-t}}{(1+MIRR)^n}$$

$$\frac{10000}{(1+0,1)^0} = \frac{2000\,(1+0,1)^3 + 3000\,(1+0,1)^2 + 4000\,(1+0,1)^1 + 5000\,(1+0,1)^0)}{(1+MIRR)^4}$$

$$10.000 = \frac{2662 + 3630 + 4400 + 5000}{(1+MIRR)^4} = \frac{15692}{(1+MIRR)^4}$$

$$(1+MIRR)^4 = \frac{15692}{10.000}$$

$$(1+MIRR) = \sqrt[4]{\frac{15692}{10.000}}$$

$$(1+MIRR) = 1{,}12$$

MIRR = 1,12 -1 = 0,12 = **12 %**

MIRR **(12%)** ≥ required rate of return **(10%)**
→ Accept the project