The Investment Decision: Part 2

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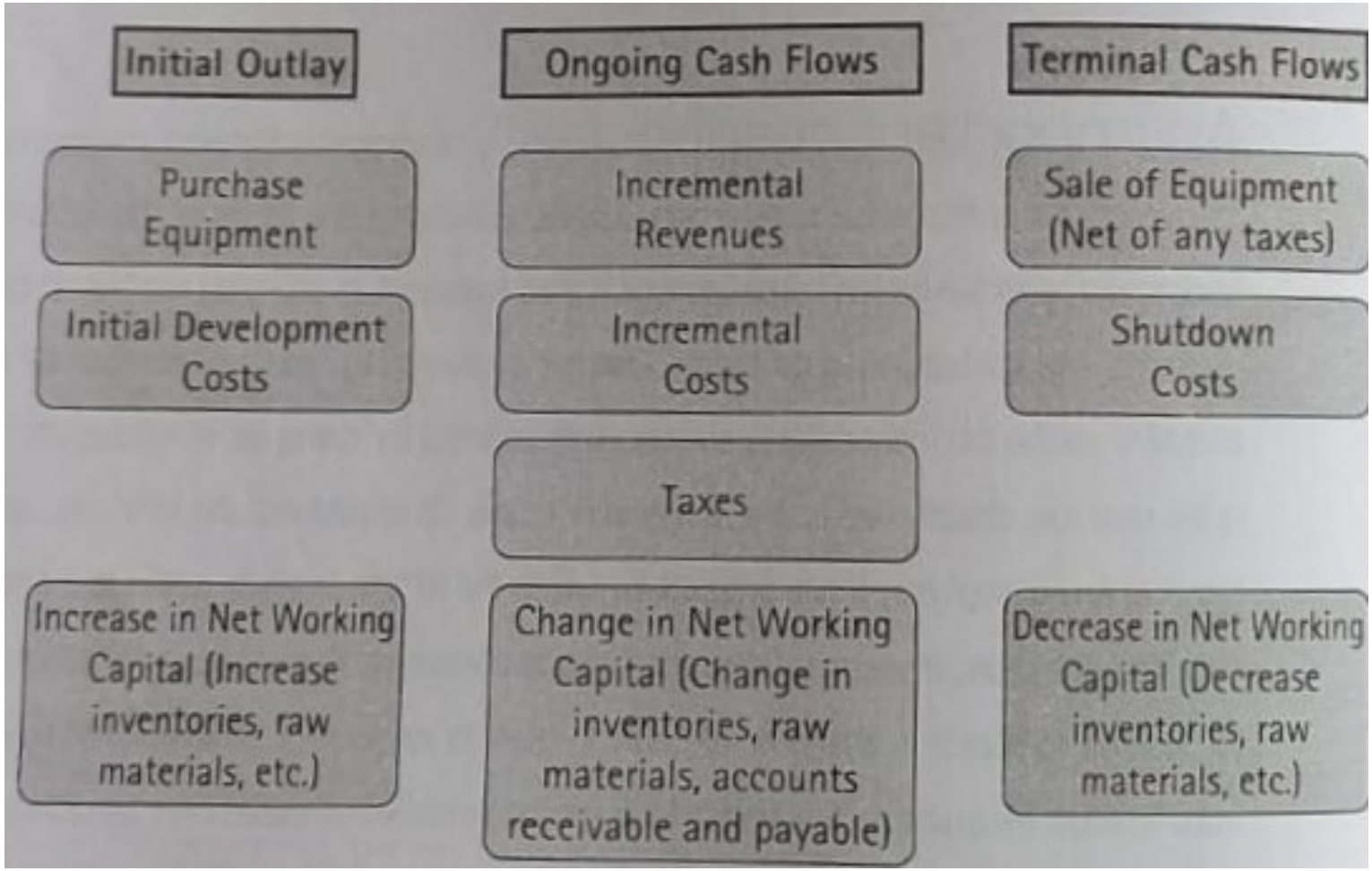
What do we cover in this discussion?

1. Types of Capital Budgeting Projects
2. Principles of capital budgeting/cash flow projections
3. Expansion and Replacement Projects

Types of Capital Budgeting Projects

- Classifying Investment Projects
  - Projects Generated by Growth Opportunities
  - Projects Generated by Cost Reduction Opportunities
  - Projects Generated to Meet Legal Requirements and Health and Safety Standards
- Project Size and the Decision-Making Process
  - Typically decentralized

Cash Flows in a typical project



Principles of capital budgeting/cash flow projections

- **Only cash flow is relevant.**
  - When calculating NPV of a project, state capital expenditures and disposal when they occur, not when they show up as depreciation. To go from accounting income to cash flow, please add back depreciation (which is not a cash outflow) and subtract capital expenditure (which is a cash outflow).
  - You must consider the working capital requirements for the project. For the calculation of NPV, please consider **the change in working capital** during the life of the project. The working capital is recovered at the end of the project.
  - Net Working Capital= Current Assets (mainly Bills Receivable and Inventories)-Current liabilities (mainly Bills Payable)
  - Change in Net working capital (ΔNWC) is used for calculations.

Principles of capital budgeting/cash flow projections

- **Always estimate cash flows on incremental basis.**
  - Remember to include taxes.
  - Do not confuse Average with Incremental Payoffs
  - Include all incidental effects
  - Forecast sales today and recognise after-sales cash flows to come later
  - Include Opportunity Costs
  - Forget Sunk Costs
  - Beware of Allocated Overhead Costs
  - Remember Salvage Value

Incremental Revenue and Cost Estimates

- A new product typically has lower sales initially, as customers gradually become aware of the product. Sales will then accelerate, plateau, and ultimately decline as the product nears obsolescene or faces increased competition.
- The average selling price of the product and its cost of production will generally change over time. Prices and costs tend to rise with the general level of inflation in the economy. The price of technology products, however, often fall over time as newer, superior technologies emerge and production costs decline.
- For most industries, competition tends to reduce profit margins over time.
- We are evaluating how the project will **change** the cash flows of the firm. Hence, we focus on **incremental** revenues and costs.

Forecasting Incremental Earnings

1	Year	0	1	2	3	4	5
2	Operating Expenses (Plant Redesign)	−$50,000					
3	Depreciation (New Equipment)		−$204,000	−$204,000	−$204,000	−$204,000	−$204,000

1	Year	0	1	2	3	4	5
2	Incremental Revenues		500	500	500	500	500
3	Incremental Costs	−50	−150	−150	−150	−150	−150
4	Depreciation		−204	−204	−204	−204	−204

1	Year	0	1	2	3	4	5
2	Incremental Revenues		500	500	500	500	500
3	Incremental Costs	−50	−150	−150	−150	−150	−150
4	Depreciation		−204	−204	−204	−204	−204
5	**EBIT**	−50	146	146	146	146	146
6	Income Tax at 40%	20	−58.4	−58.4	−58.4	−58.4	−58.4
7	**Incremental Earnings**	**−30**	**87.6**	**87.6**	**87.6**	**87.6**	**87.6**

Another Example

- Linksys is considering the development of a wireless home networking appliance called Homenet.
- The sales forecast for Homenet is 50000 units per year. Linksys expects the product will have a four-year life and an expected wholesale price of $260. Actual production will be outsourced at a cost of $110 per unit.
- Lab space will be rented for testing purposes with total SGA costs of $2.8 million per year but Linksys will need to purchase $7.5 million of new equipment.
- The equipment will be depreciated using the straight line method over a five year life. Linksys's marginal tax rate is 40%. The lab will be operational at the end of one year.
- Forecast the incremental earnings from the Homenet Project.

Another Example

1	Year	0	1	2	3	4	5
2	Revenues		13,000	13,000	13,000	13,000	–
3	Cost of Goods Sold		−5,500	−5,500	−5,500	−5,500	–
4	**Gross Profit**		7,500	7,500	7,500	7,500	–
5	Selling, General, and Administrative		−2,800	−2,800	−2,800	−2,800	–
6	Depreciation		−1,500	−1,500	−1,500	−1,500	−1,500
7	**EBIT**		3,200	3,200	3,200	3,200	−1,500
8	Income Tax at 40%		−1,280	−1,280	−1,280	−1,280	600
9	**Incremental Earnings**		**1,920**	**1,920**	**1,920**	**1,920**	**−900**

1	Year	0	1	2	3	4	5
2	Revenues		13,000	13,000	13,000	13,000	–
3	Cost of Goods Sold		−5,500	−5,500	−5,500	−5,500	–
4	**Gross Profit**		7,500	7,500	7,500	7,500	–
5	Selling, General, and Administrative		−2,800	−2,800	−2,800	−2,800	–
6	Depreciation		−1,500	−1,500	−1,500	−1,500	−1,500
7	**EBIT**		3,200	3,200	3,200	3,200	−1,500
8	Income Tax at 40%		−1,280	−1,280	−1,280	−1,280	600
9	**Incremental Earnings**		1,920	1,920	1,920	1,920	−900
10	Add Back Depreciation		1,500	1,500	1,500	1,500	1,500
11	Purchase of Equipment	−7,500					
12	**Incremental Free Cash Flows**	**−7,500**	**3,420**	**3,420**	**3,420**	**3,420**	**600**

Incorporating Changes in Net Working Capital

- Suppose the Homenet will have no incremental cash or inventory requirements. However, receivables related to Homenet are expected to account for 15% of annual sales and payables are expected to be 15% of the COGS. 15% of $13 million sales is $1.95 million and 15% of $5.5 million COGS is $825,000. Calculate Homenet's net working capital requirements.

1	Year	0	1	2	3	4	5
2	**Net Working Capital Forecast ($000s)**						
3	Cash Requirements	0	0	0	0	0	0
4	Inventory	0	0	0	0	0	0
5	Receivables (15% of Sales)	0	1,950	1,950	1,950	1,950	0
6	Payables (15% of COGS)	0	−825	−825	−825	−825	0
7	**Net Working Capital**	**0**	**1,125**	**1,125**	**1,125**	**1,125**	**0**

1	Year	0	1	2	3	4	5
2	Net Working Capital	0	1,125	1,125	1,125	1,125	0
3	Change in NWC		+1,125	0	0	0	−1,125
4	Cash Flow Effect		−1,125	0	0	0	+1,125

Incremental Free Cash Flows

1	Year	0	1	2	3	4	5
2	Revenues		13,000	13,000	13,000	13,000	0
3	Costs of Goods Sold		−5,500	−5,500	−5,500	−5,500	0
4	**Gross Profit**		7,500	7,500	7,500	7,500	0
5	Selling, General, and Administrative		−2,800	−2,800	−2,800	−2,800	0
6	Depreciation		−1,500	−1,500	−1,500	−1,500	−1,500
7	**EBIT**		3,200	3,200	3,200	3,200	−1,500
8	Income Tax at 40%		−1,280	−1,280	−1,280	−1,280	600
9	**Incremental Earnings**		1,920	1,920	1,920	1,920	−900
10	Add Back Depreciation		1,500	1,500	1,500	1,500	1,500
11	Purchase of Equipment	−7,500					
12	Subtract Changes in NWC		−1,125	0	0	0	1,125
13	**Incremental Free Cash Flows**	**−7,500**	**2,295**	**3,420**	**3,420**	**3,420**	**1,725**

Free Cash Flow

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \text{Tax Rate})}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \text{Change in } NWC$$

NPV from Incremental Free Cash Flows

1	Year	0	1	2	3	4	5
2	Incremental Free Cash Flows	−7,500	2,295	3,420	3,420	3,420	1,725

To compute the NPV, we sum the present values of all of the cash flows, noting that the year 0 cash outflow is already a present value.

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Using Eq. 9.8,

$$NPV = -7500 + \frac{2295}{(1.12)^1} + \frac{3420}{(1.12)^2} + \frac{3420}{(1.12)^3} + \frac{3420}{(1.12)^4} + \frac{1725}{(1.12)^5} = 2862$$

Principles of capital budgeting/cash flow projections

- **Be consistent with your treatment of inflation.**
  - Be consistent in how you handle inflation!!
  - Use nominal interest rates to discount nominal cash flows.
  - Use real interest rates to discount real cash flows.
  - You will get the same results, whether you use nominal or real figures.
- You invest in a project that will produce real cash flows of -$100 in year zero and then $35, $50, and $30 in the three respective years. If the nominal discount rate is 15% and the inflation rate is 10%, what is the NPV of the project?

$$\text{Real discount rate} = \frac{1 + \text{nominal discount rate}}{1 + \text{inflation rate}} - 1$$

Solution.....Contd.

Year	Cash Flow	PV @ 15%
0	-100	-100
1	$35 \times 1.10 = 38.5$	$\frac{38.5}{1.15} = 33.48$
2	$50 \times 1.10^2 = 60.5$	$\frac{60.5}{1.15^2} = 45.75$
3	$30 \times 1.10^3 = 39.9$	$\frac{39.9}{1.15^3} = 26.23$
		$5.5

$$\text{Real discount rate} = \frac{1 + \text{nominal discount rate}}{1 + \text{inflation rate}} - 1$$

$$= \frac{1.15}{1.10} - 1 = .045$$

Solution.....Contd.

Year	Cash Flow		PV@4.50%
0	−100		−100
1	35	$\frac{35}{1.045} = -33.49$	
2	50	$\frac{50}{1.045^2} = 45.79$	
3	30	$\frac{30}{1.045^3} = 26.29$	
			$= \$5.5$

Modified Accelerated Cost Recovery System (MACRS)

Tax Depreciation Schedules by Recovery-Period Class							
	Year(s)	3-year	5-year	7-year	10-year	15-year	20-year
1	1	33.33	20.00	14.29	10.00	5.00	3.75
2	2	44.45	32.00	24.49	18.00	9.50	7.22
3	3	14.81	19.20	17.49	14.40	8.55	6.68
4	4	7.41	11.52	12.49	11.52	7.70	6.18
5	5		11.52	8.93	9.22	6.93	5.71
6	6		5.76	8.92	7.37	6.23	5.28
7	7			8.93	6.55	5.90	4.89
8	8			4.46	6.55	5.90	4.52
9	9				6.56	5.91	4.46
10	10				6.55	5.90	4.46
11	11				3.28	5.91	4.46
12	12					5.90	4.46
13	13					5.91	4.46
14	14					5.90	4.46
15	15					5.91	4.46
16	16					2.95	4.46
17	17-20						4.46
18	21						2.23

Principles of capital budgeting/cash flow projections

- **Separate investment and financing decisions**
  - **Question:** How should you treat the proceeds from the debt issue and the interest and principal payments on the debt?
  - **Answer:** You should neither subtract the debt proceeds from the required investment nor recognize the interest and principal payments on the debt as cash outflows
- **The Investment Timing Decision**
  - Should you invest now or wait and think about it again next year? Here today's investment is competing with future investments.
  - Some projects are more valuable if undertaken in the future, rather than today.
  - Net present value of investment if undertaken at date t= (net future value at date t)/$(1 + r)^t$

Problem and Solution

- You own a large tract of inaccessible timber. To harvest it, you have to invest a substantial amount in access roads and other facilities. The longer you wait, the higher the investment required. On the other hand, lumber prices will rise as you wait, and the trees will keep growing, although at a gradually decreasing rate. Given the following data and a 10% discount rate, when should you harvest?

	Year of Harvest					
	0	1	2	3	4	5
Net *future* value ($ thousands)	50	64.4	77.5	89.4	100	109.4
Change in value from previous year (%)		+28.8	+20.3	+15.4	+11.9	+9.4

	Year of Harvest					
	0	1	2	3	4	5
Net present value ($ thousands)	50	58.5	64.0	67.2	68.3	67.9

Asset Expansion Projects

- A project that requires to invest funds in additional assets in order to increase sales (or reduce costs) is called an **asset expansion project**.
- **Net Investment:** The net investment in an expansion project is defined as the project's initial net cash outlay at the time period 0. It is calculated using the following steps:
  - The new project cost plus any installation and shipping costs associated with acquiring the asset and putting it into service PLUS
  - any increase in net working capital initially required as a result of the new investment

Asset Expansion Projects.....An example

- **Example:** TLC Yogurt Company has decided to capitalize on the exercise fad and plans to open an exercise facility in conjunction with its main yogurt and health foods store.
- Equipment will cost $50,000. Shipping and installation charges for the equipment are expected to total $5,000.
- Equipment will be depreciated on a straight-line basis over its 5-year economic life to an estimated salvage value of $0.
- $7,000 increase in net working capital at the beginning of the project.

Asset Expansion Projects.....Contd.

- Total revenues will increase by $50,000 above the level that would have prevailed in year 1, $60,000 in year 2, $75,000 in year 3, decline to $60,000 in year 4, and decline again to $45,000 during the fifth and final year of the project's life.
- Incremental operating costs to increase by $25,000 during the first year and increase at a rate of 6 percent per year over the 5-year project.
- Depreciation will be $11,000 per year.
- Marginal tax rate is 40 percent.
- Net working capital will increase by $5,000 per year in years 1, 2, and 3 and by $0 in years 4 and 5. At the end of the project, the total accumulated net working capital required by the project will be recovered.

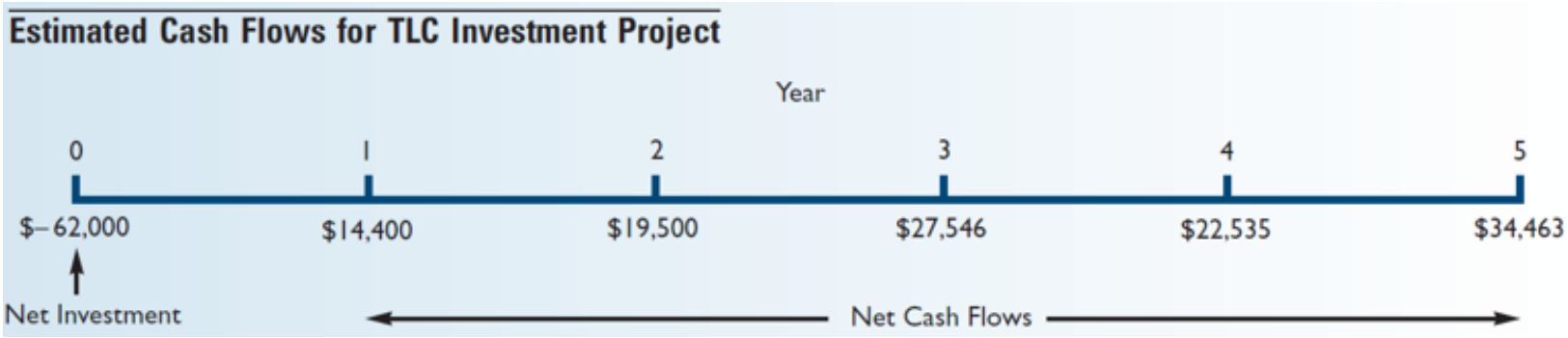
Asset Expansion Project.....Solution

Purchase price of exercise equipment	$50,000
Plus Shipping and installation	5,000
Plus Initial net working capital required	7,000
Equals Net investment (NINV)	$62,000

Calculation of Annual Net Cash Flows for TLC Exercise Facility

	Year 1	Year 2	Year 3	Year 4	Year 5
Change in revenues (ΔR)	$50,000	$60,000	$75,000	$60,000	$45,000
Minus: Change in operating costs (ΔO)	25,000	26,500	28,090	29,775	31,562
Minus: Change in depreciation (ΔDep)	11,000	11,000	11,000	11,000	11,000
Equals: Change in operating earnings before tax (ΔOEBT)	$14,000	$22,500	$35,910	$19,225	$2,438
Minus: Change in taxes (40%) (T)	5,600	9,000	14,364	7,690	975
Equals: Change in operating earnings after tax (ΔOEAT)	$8,400	$13,500	$21,546	$11,535	$1,463
Plus: Change in depreciation (ΔDep)	11,000	11,000	11,000	11,000	11,000
Minus: Change in net working capital (ΔNWC)	5,000	5,000	5,000	0	−22,000
Plus: After-tax salvage	—	—	—	—	0
Equals: Net cash flow (NCF)	$14,400	$19,500	$27,546	$22,535	$34,463

Asset Expansion Project.....Solution

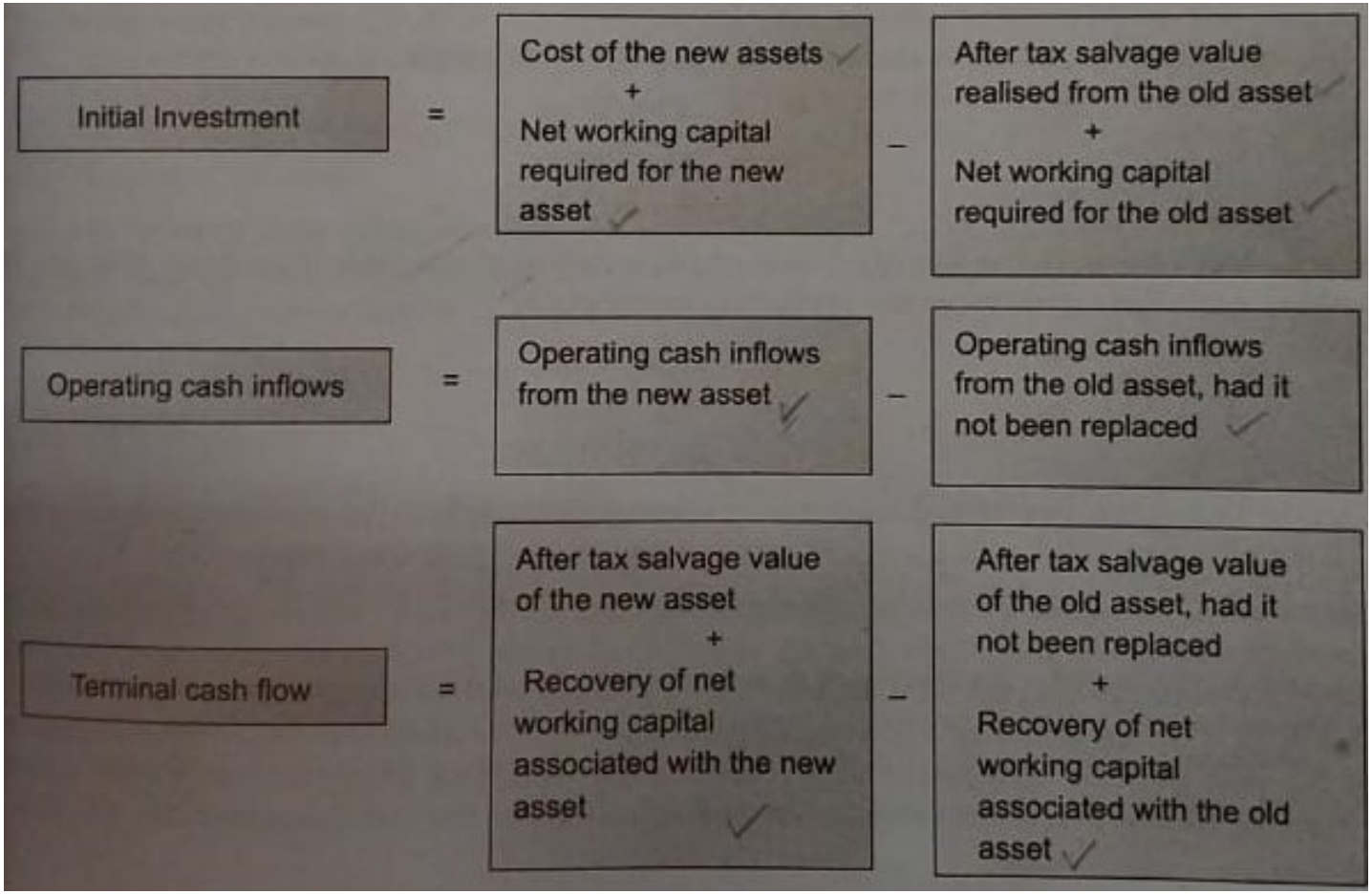


- If the opportunity cost of capital is 18%, what would be the NPV of the expansion project?

Replacement Project

- It involves retiring one asset and replacing it with a more efficient asset.
- **Net Investment:** The net investment in a replacement project is defined as the project's initial net cash outlay at the time period 0. It is calculated using the following steps:
  - The new project cost plus any installation and shipping costs associated with acquiring the asset and putting it into service PLUS
  - any increase in net working capital initially required as a result of the new investment MINUS
  - The net proceeds from the sale of existing assets when the investment is a replacement decision PLUS OR MINUS
  - The taxes associated with the sale of existing assets and/or the purchase of new assets EQUALS
  - The net investment

Cash flows for a Replacement Project



An example of a replacement project

- **Example:** Ojus Enterprises is evaluating a replacement project. The old machine has a book value of Rs 400,000 and a post tax salvage value of Rs 500,000. It has a remaining life of 5 years after which its net salvage value is expected to be Rs 160,000. Depreciation is 15% under the WDV method. The NWC required for the old machine is Rs 400,000.
- The new machine costs Rs 1,600,000 and will fetch a net salvage value of Rs 800,000 after 5 years. The depreciation is 15% under the WDV method. The NWC required for the new machine is Rs 500,000. The new machine is expected to bring a saving of Rs 257,143 annually in manufacturing costs (other than depreciation). The tax rate applicable to the firm is 30%. Please calculate the after tax cash flow associated with the replacement project.

Solution

	Year					(Rs. in '000)
	0	1	2	3	4	5
I. Investment Outlay						
1. Cost of New Asset	– 1600					
2. Salvage Value of Old Asset	500					
3. Increase in Net Working Capital	– 100					
4. Total Net Investment	– 1200					
II. Operating Inflows Over the Project Life						
5. After-Tax Savings in Manufacturing Costs		180.00	180.00	180.00	180.00	180.00
6. Depreciation on New Machine		240.00	204.00	173.40	147.39	125.28
7. Depreciation on Old Machine		60.00	51.00	43.35	36.85	31.32
8. Incremental Depreciation (6–7)		180.00	153.00	130.05	110.54	93.96
9. Tax Savings on Incremental Depreciation		54.00	45.90	39.02	33.16	28.19
10. Net Operating Cash Inflow (5+9)		234.00	225.90	219.02	213.16	208.19
III. Terminal Cash Inflow						
11. Net Terminal Value of New Machine						800.00
12. Net Terminal Value of Old Machine						160.00
13. Recovery of Incremental Net Working Capital						100.00
14. Total Terminal Cash Inflow (11–12+13)						740.00
IV. Net Cash Flow (4+10+14)	–1200.00	234.00	225.90	219.02	213.16	948.19

Another example of a replacement project

- **Example:** An automated drill press was purchased 10 years ago that had an estimated economic life of 20 years. The drill press originally cost $150,000 and has been fully depreciated. The market value of this drill press is $40,000.
- The company is considering replacing the drill press with a new one costing $190,000. Shipping and installation will add an additional $10,000 to the cost. The new machine would be depreciated to zero on a straight-line basis and is expected to have a 10-year economic life. The new machine's estimated salvage value at the end of the 10-year period is $25,000.
- The firm's current marginal tax rate is 40%.

Another example of a replacement project...Contd.

- The firm expects annual revenues during the project's first year to increase from $70,000 to $85,000 if the new drill press is purchased. After the first year, revenues from the new project are expected to increase at a rate of $2,000 a year for the remainder of the project life.
- Annual operating costs will fall from $40,000 to $20,000 during the project's first year
- After the first year, annual operating costs of the new drill press are expected to increase by $1,000 a year over the remaining life of the project. The company's net working capital does not change as a result of replacing the drill press.

Solution

Net Investment Calculation for Briggs & Stratton

Cost of new drill press	$190,000
Plus: Shipping and installation charges	10,000
Equals: Installed cost	$200,000
Plus: Increase in initial net working capital	0
Minus: Proceeds from sale of old drill press	40,000
Equals: Net investment before taxes	$160,000
Plus: Tax on gain from sale of old drill press (40% $\times$ $40,000)	16,000
Equals: Net investment (NINV)	$176,000

Solution....Contd.

Annual Net Cash Flow Worksheet for the Briggs & Stratton Drill Press Acquisition

	Year									
	1	2	3	4	5	6	7	8	9	10
Change in revenues ($R_W - R_{WO}$)*	$15,000	$17,000	$19,000	$21,000	$23,000	$25,000	$27,000	$29,000	$31,000	$33,000
Minus: Change in operating costs ($O_W - O_{WO}$)**	−20,000	−19,000	−18,000	−17,000	−16,000	−15,000	−14,000	−13,000	−12,000	−11,000
Minus: Change in depreciation ($Dep_W - Dep_{WO}$)***	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Equals: Change in operating earnings before taxes (ΔOEBT)	$15,000	$16,000	$17,000	$18,000	$19,000	$20,000	$21,000	$22,000	$23,000	$24,000
Minus: Tax (40%)	6,000	6,400	6,800	7,200	7,600	8,000	8,400	8,800	9,200	9,600
Equals: Change in operating earnings after taxes (ΔOEAT)	$ 9,000	$ 9,600	$10,200	$10,800	$11,400	$12,000	$12,600	$13,200	$13,800	$14,400
Plus: Change in depreciation ($Dep_W - Dep_{WO}$)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Minus: Change in net working capital (ΔNWC)	0	0	0	0	0	0	0	0	0	0
Equals: Net cash flow before Salvage	$29,000	$29,600	$30,200	$30,800	$31,400	$32,000	$32,600	$33,200	$33,800	$34,400
Plus: Salvage	0	0	0	0	0	00	0	0	0	25,000
Minus: Tax on salvage (0.4 × salvage)	0	0	0	0	0	0	0	0	0	10,000
Equals: Net cash flow	$29,000	$29,600	$30,200	$30,800	$31,400	$32,000	$32,600	$33,200	$33,800	$49,400

Solution....Contd.

Summary Project Cash Flows for Briggs & Stratton

Year	Net Investment and Net Cash Flows
0	–$176,000
1	29,000
2	29,600
3	30,200
4	30,800
5	31,400
6	32,000
7	32,600
8	33,200
9	33,800
10	49,400