

Problem 11

Tax Matters

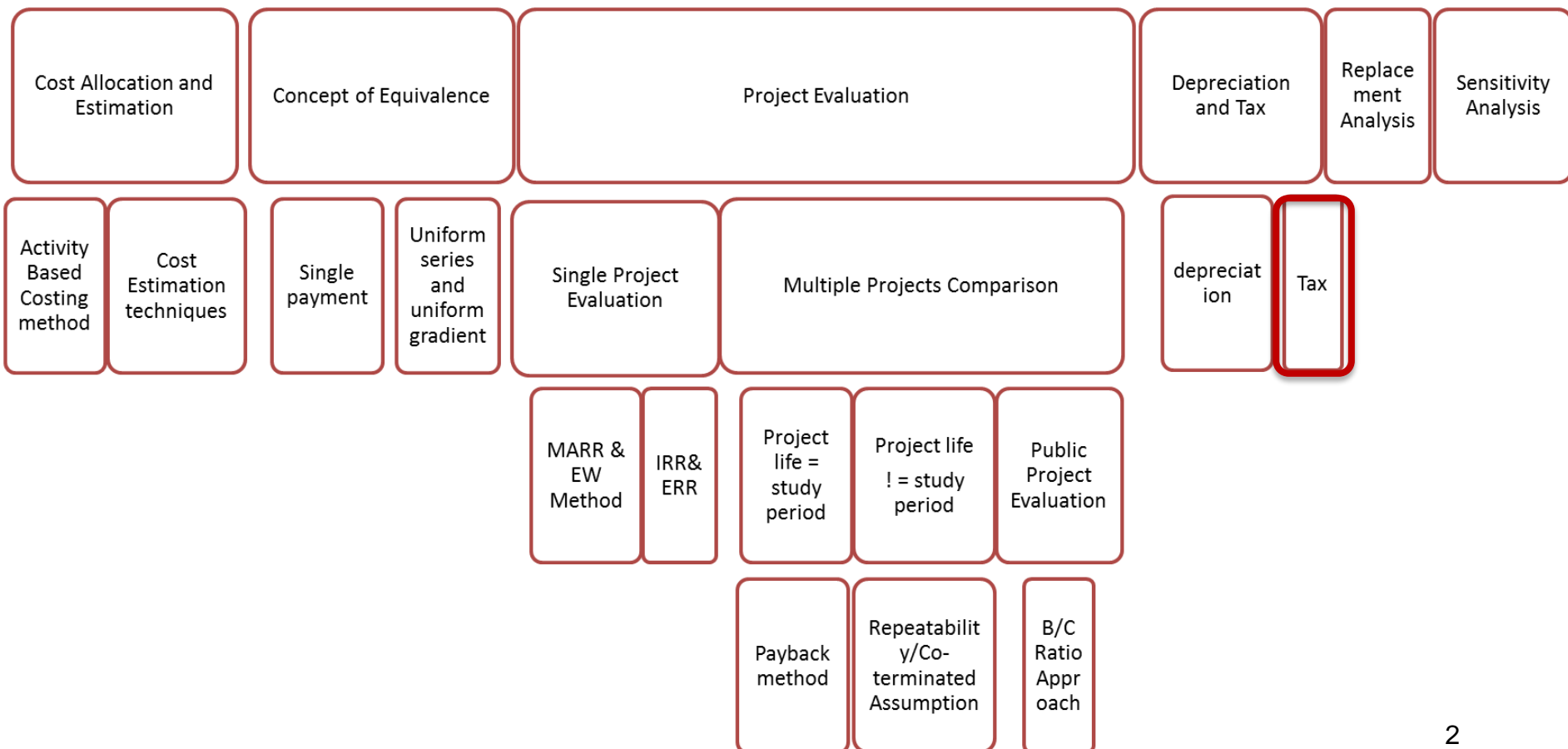
E213 – Engineering Cost Decisions

SCHOOL OF
ENGINEERING

Module Coverage: Topic Tree



E213 – Engineering Cost Decisions



Income Taxes



- So far, there has been no consideration of **income taxes** in the previous problems.
- There is a wide variety of capital investment cases where income taxes do **affect the choice** among alternatives.
- Income taxes associated with a proposed project may represent a **major cash outflow**.
- In the assessment of the overall economic **profitability** of that project, one should consider income taxes together with other cash inflows and outflows.
- **After-tax studies** are essential in helping one understand **how** income taxes affect a project's estimated cash flows.

Types of Taxes



- **Property tax**
 - Property tax is imposed on owners of properties based on the expected rental values of the properties.
- **Motor Vehicle Taxes**
 - These are taxes, other than import duties, that are imposed on motor vehicles. These taxes are imposed to curb car ownership and road congestion.
- **Goods & Services Tax (GST)**
 - GST is a tax on consumption. The tax is paid when money is spent on goods or services, including imports.
- **Income tax**
 - Income tax is chargeable on income of individuals and companies.
 - **Most important in engineering cost decisions.**

Terminology



- **Gross Income**
 - Total of all income before taxes
- **Capital expenditures**
 - Either depreciable (e.g. Equipment) or non depreciable assets (e.g. Land)
- **Taxable Income**
 - Income on which taxes are paid
 - ***Taxable income = Gross income – All expenditures except capital expenditures – Depreciation and depletion charges***
- **Capital Gains and Losses**
 - known as balancing allowance/ charge in Singapore
 - When an asset is disposed off for more (less) than its book value (BV), the resulting gain (loss) is taxed
 - Depreciation recapture and capital gains (losses) are taxed as ordinary income
 - ***Capital Gain (or Loss) = MV – BV***
 - When $MV < BV$, it is termed a capital loss, and taxes on the loss represent tax credit (rebate)

Effects of Taxes



- Tax paid by a company is a form of business cost.
- Taxes are important since they represent a major cash flow thereby affecting the viability of an investment.
- Taxes are based on a company's chargeable income.
- Hence, an after-tax analysis will reflect a more accurate measure of investment potential.

General Rules for Claiming Allowable Business Expenses



- Expenses must be incurred
- Expenses must be related to your business.
- Expenses that are capital in nature (e.g. purchase of fixed assets such as plant and machinery) are not allowable business expenses. However, depreciation of fixed assets may be claimed as **capital allowances**.
- Expenses should be supported by proper and complete source documents that should be kept for at least five years to substantiate any claims.

Capital Allowances



- Depreciation of fixed assets may be claimed as **capital allowances**.
- Capital allowances are deductions you can claim for wear and tear of qualifying fixed assets bought and used in business.
- Qualifying fixed assets include carpets, machinery and office equipment.
- Claiming capital allowance over a period of time is also known as “writing off the asset”.

Comparing Alternatives with Taxes



- Analysis is similar to **Before Tax** analysis
- After-tax cash flow (ATCF) are used in place of before-tax cash flow (BTCF) by **including expenses (or savings) due to income taxes**
- Equivalent worth measures are computed using an after-tax MARR:

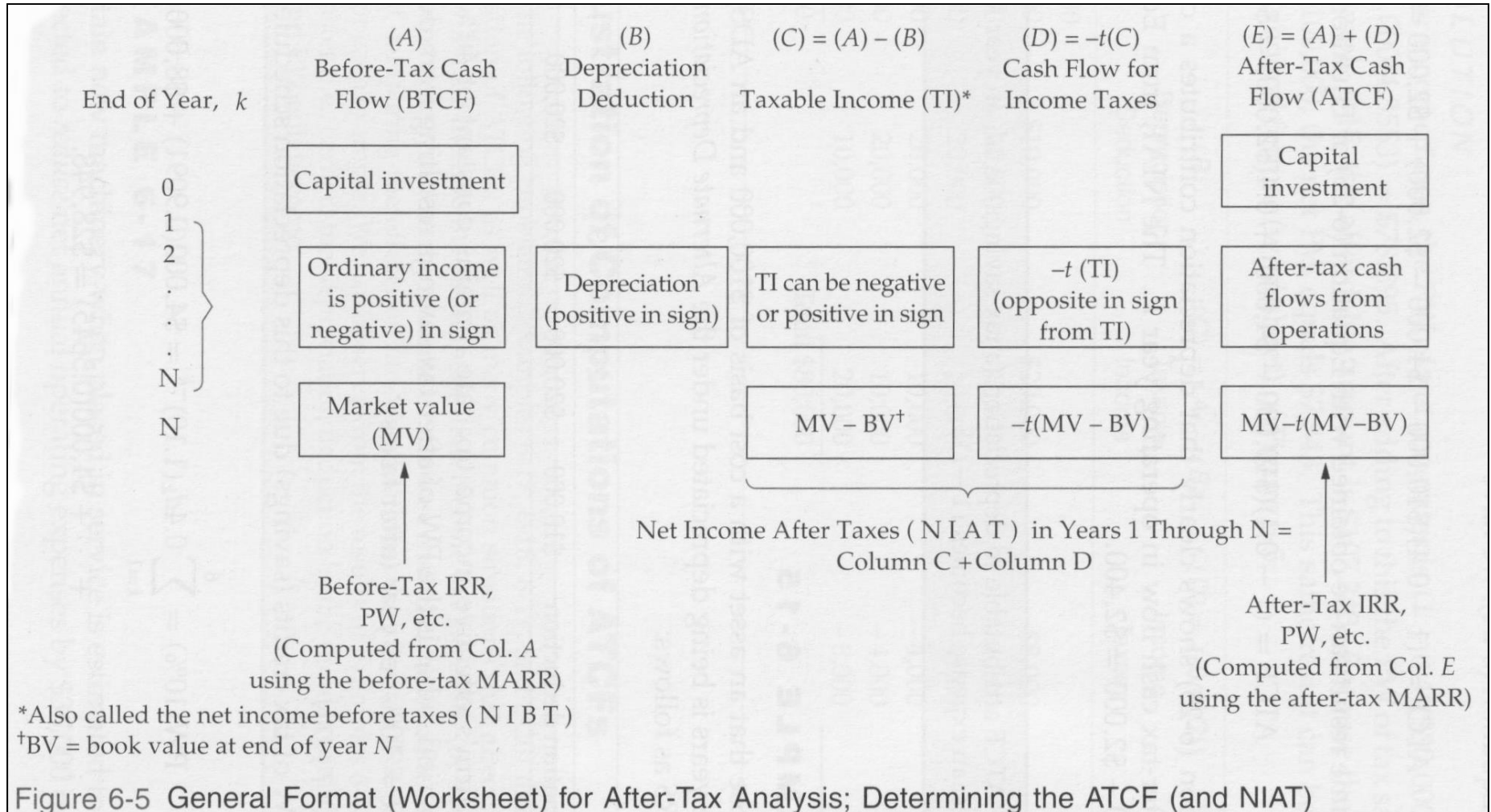
$$\text{Before tax } MARR \sim \frac{\text{After - tax } MARR}{(1 - \text{effective income tax rate})}$$

Example

Suppose the before-tax MARR = 20%, and effective income tax rate, $t = 40\%$, what is the approximate after-tax MARR?

$$\text{After-tax } MARR = (1 - 0.4) \times 20\% = 12\%$$

Procedure for After-Tax Economic Analysis



Example 1



Example

AP Manufacturing bought a CNC machine for \$60,000 and will use it for 5 years. At the end of 5 years, it has a salvage value of \$10,000. The company annual revenue is \$50,000 and annual expense is \$20,000. Assume straight line depreciation deduction method is used, find out the annual tax amount and the MARR (after income tax).

Step 1: Calculate the depreciation deduction amount each year:

$$(\$60,000 - \$10,000) / 5 = \$10,000$$

The depreciation each year is \$10,000

Step 2: Identify the taxable income each year:

$$\begin{aligned} \text{Annual Taxable income} &= \text{annual revenue} - \text{annual expense} - \text{depreciation deduction} \\ &= \$50,000 - \$20,000 - \$10,000 = \$20,000 \end{aligned}$$

Step 3: With income tax rate at 16%, determine the annual tax amount:

$$\text{Annual Tax amount} = \$20,000 * 16\% = \$3,200$$

Step 4: Calculate the annual after tax cash flow:

$$\text{After tax cash flow (net income)} = \$30,000 - \$3,200 = \text{\textcolor{blue}{\$26,800}}$$

Calculate the after-tax MARR at the income tax of 16%:

$$\text{MARR (after income tax)} = 20\% * (1 - 16\%) = \text{\textcolor{blue}{16.8\%}}$$

Example 2



Example

An asset has a cost basis of \$100,000. The depreciation deductions for a six-year period are:

| Year | 1 | 2 | 3 | 4 | 5 | 6 |
|-------|----------|----------|----------|----------|----------|----------|
| d_k | \$10,000 | \$20,000 | \$20,000 | \$20,000 | \$20,000 | \$10,000 |

Effective income tax rate is $t = 40\%$. After tax MARR = 10%

Net cash revenue = \$30,000 per year for six years

SV = 0

How much can the company afford to spend for this asset and still earn the MARR?

| EOY | (A) | (B) | ©=(A)-(B) | (D)= -0.4© | (E)=(A)+(D) |
|-------|----------|------------------------|----------------|--------------|---------------------------|
| | BTCF | Depreciation deduction | Taxable income | Income taxes | ATCF |
| 0 | -100,000 | | | | -100,000 |
| 1 | 30,000 | 10,000 | 20,000 | -8,000 | 22,000 |
| 2 | 30,000 | 20,000 | 10,000 | -4,000 | 26,000 |
| 3 | 30,000 | 20,000 | 10,000 | -4,000 | 26,000 |
| 4 | 30,000 | 20,000 | 10,000 | -4,000 | 26,000 |
| 5 | 30,000 | 20,000 | 10,000 | -4,000 | 26,000 |
| 6 | 30,000 | 10,000 | 20,000 | -8,000 | 22,000 |
| Total | 80,000 | | 80,000 | | PW(10%) of ATCF = \$7,343 |

The affordable amount = \$7,343.

An e-learning video is available for procedure on after tax economic analysis in the following link:

https://youtu.be/jHMqb46B_r0

Singapore's Income Tax



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Taxable income

= Income received in/derived from Singapore –
Allowable deductions (expenses)

For Singapore tax purposes, taxable income refers to:

- gains or profits from any trade or business;
- income from investment such as dividends, interest and rental;
- royalties, premiums and any other profits from property; and
- other gains that is revenue in nature.

<https://www.iras.gov.sg/irashome/Businesses/Companies/Working-out-Corporate-Income-Taxes/Taxable-and-Non-taxable-Income/>

Singapore's Income Tax



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Tax rates & tax exemption

With effect from Year of Assessment 2010, a company is taxed at a flat rate of 17% on its chargeable income regardless of whether it is a local or foreign company.

<https://www.iras.gov.sg/irashome/web/pages/destination.aspx?id=3800&cmsMode=Preview&langtype=1033#title2>



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Writing-Down Allowances for Intellectual Property Rights (IPR)

With effect from YA 2017, a company will be allowed to claim the writing-down allowances over a 5, 10 or 15-year period (on a straight line basis) on capital expenditure incurred in acquiring the IPR.

<https://www.iras.gov.sg/irashome/Businesses/Companies/Working-out-Corporate-Income-Taxes/Claiming-Allowances/Writing-Down-Allowances-for-Intellectual-Property-Rights/>

Singapore's Income Tax



Capital Allowances (expenses)

Capital allowances are deductions you can claim for wear and tear of qualifying fixed assets bought and used in your trade or business.



<https://www.iras.gov.sg/irashome/Businesses/Companies/Working-out-Corporate-Income-Taxes/Claiming-Allowances/Capital-Allowances/>

Calculating Capital Allowances

You may write off the cost of an asset over one year, three years or over the prescribed working life of the asset.

<https://www.iras.gov.sg/irashome/Businesses/Companies/Working-out-Corporate-Income-Taxes/Claiming-Allowances/Capital-Allowances/Calculating-Capital-Allowances/#title4>

P11 Suggested Solution



Problem Statement



- Hardy Motorcycles wants to know if it's feasible to invest in the manufacturing of motorcycles in the region.
- Selling price and manufacturing cost:

| Year | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|-----------------------------------|---------|---------|---------|---------|---------|---------|
| Motorcycles demand | 8,000 | 12,000 | 18,000 | 13,000 | 7,200 | 5,600 |
| Selling price per motorcycle | \$7,000 | \$6,700 | \$6,500 | \$6,200 | \$6,000 | \$5,800 |
| Manufacturing cost per motorcycle | \$5,000 | \$5,000 | \$5,000 | \$5,000 | \$5,000 | \$5,000 |

- Patent cost: \$1million
- Initial setup cost: \$30million
- Other cost : Annual cost of sales and marketing is \$2million
- Before-tax MARR: 25%
- After-tax MARR (Singapore): $(1-0.17) \times 25\% = 20.75\%$
- Study period: 6 years

After Tax Cash Flows (ATCF)



Refer to slide 20

| | (A) | (B) | (C) = (B)-(A) | (D) | (E)= (C) - (D) | (F) =-t(E) | (G) = (C) + (F) | (H) |
|-----|--------------|---------------|----------------|-----------------------|----------------|-----------------|-----------------|-------------------|
| EOY | Expenses | Gross Income | BTCF | Write-Down Allowances | Taxable Income | Income Tax @17% | ATCF | PW (25%) |
| 0 | \$31,000,000 | \$0 | (\$31,000,000) | \$0 | \$0 | \$0 | (\$31,000,000) | (\$31,000,000.00) |
| 1 | \$42,000,000 | \$56,000,000 | \$14,000,000 | \$10,200,000 | \$3,800,000 | (\$646,000) | \$13,354,000 | \$11,059,213.25 |
| 2 | \$62,000,000 | \$80,400,000 | \$18,400,000 | \$10,200,000 | \$8,200,000 | (\$1,394,000) | \$17,006,000 | \$11,663,473.20 |
| 3 | \$92,000,000 | \$117,000,000 | \$25,000,000 | \$10,200,000 | \$14,800,000 | (\$2,516,000) | \$22,484,000 | \$12,770,625.18 |
| 4 | \$67,000,000 | \$80,600,000 | \$13,600,000 | \$200,000 | \$13,400,000 | (\$2,278,000) | \$11,322,000 | \$5,325,674.18 |
| 5 | \$38,000,000 | \$43,200,000 | \$5,200,000 | \$200,000 | \$5,000,000 | (\$850,000) | \$4,350,000 | \$1,694,546.77 |
| 6 | \$30,000,000 | \$32,480,000 | \$2,480,000 | \$0 | \$2,480,000 | (\$421,600) | \$2,058,400 | \$664,059.41 |

Present Worth

\$12,177,591.99

- (A) Expenses :
 - Year 0: Patent cost + Equipment/Machine cost
 - Year 1-6: No. of Motorcycles * Manufacturing Cost per motorcycle
- (B) Gross Income : No. of Motorcycles* Sales Price per motorcycle
- (C) Before Tax Cash Flow (BTCF) : Gross Income – Expenses
- (D) Write Down Allowance, (Depreciation Deduction, Slide 20)
- (E) Taxable Income : BTCF – Write Down Allowances
- (F) Income Tax : Taxable Income * Tax Rate (17%)
- (G) ATCF : BTCF – Income Tax
- (H) Present Worth (PW): ATCF*(P/F, MARR, N)

Investment is economically feasible as PW > 0

Write Down Allowance (Depreciation Deduction)



- ❖ Write-down allowance for intellectual property rights (Singapore Income Tax Act Section 19B)
 - = 20% each year for a period of 5 years
 - = $\$1,000,000 * 20\%$
 - = $\$200,000$
- ❖ Write-down allowances over 3 years for machinery and plant (Singapore Income Tax Act Section 19A)
 - Year 1 : $1/3 * 30,000,000 = \$10,000,000$
 - Year 2 : $1/3 * 30,000,000 = \$10,000,000$
 - Year 3 : $1/3 * 30,000,000 = \$10,000,000$

Cash Flow Diagram



- Cash flow from sales and manufacturing costs:

$$\begin{aligned}\text{Sales: } & \$7,000 * 5,000 \\ & = \$ 56,000,000\end{aligned}$$

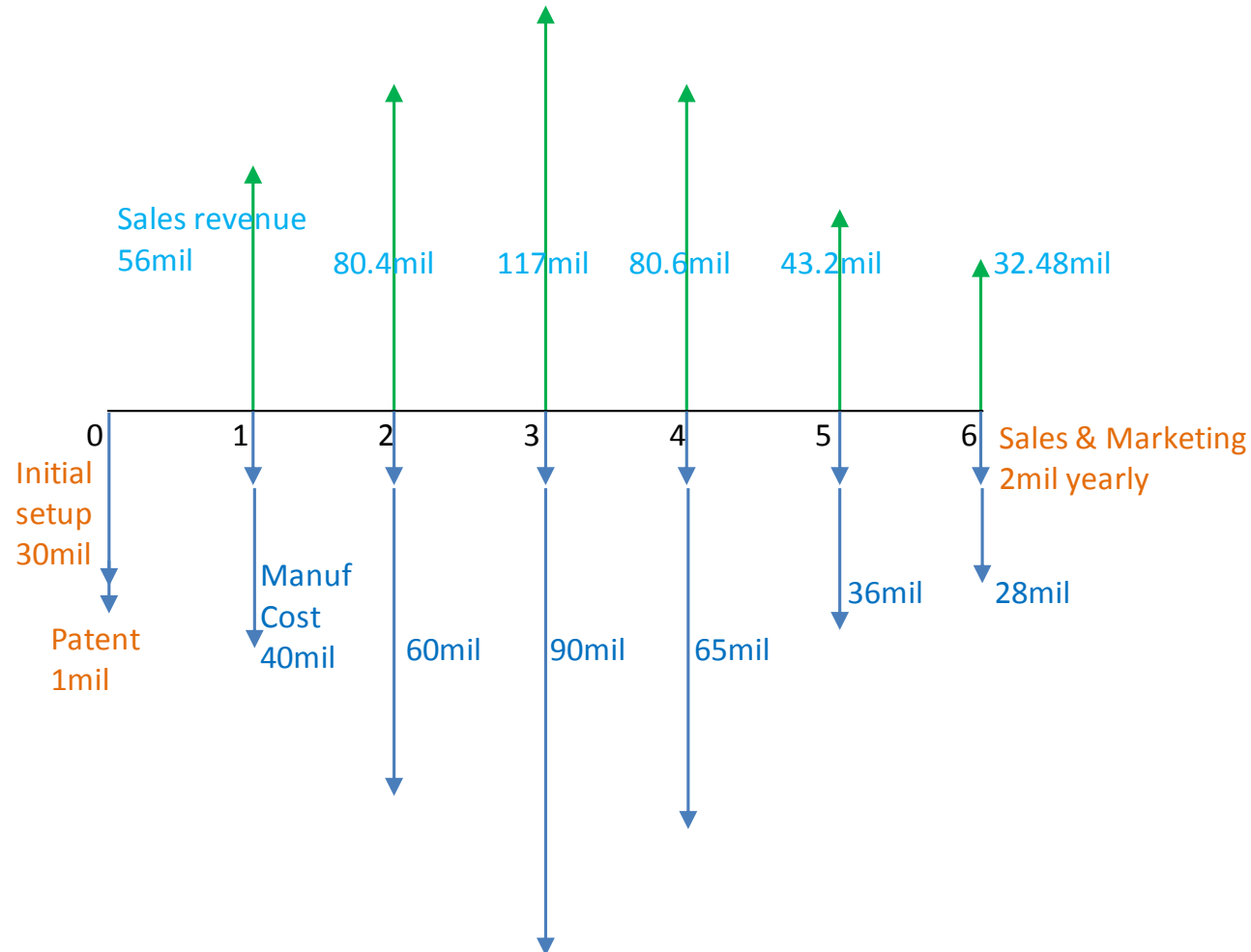
| Year | EOY | No. of Motorcycles | Price per unit | Cost per unit | Sales | Manufacturing Cost |
|------|-----|--------------------|----------------|---------------|---------------|--------------------|
| 2018 | 0 | | | | | |
| 2019 | 1 | 8,000 | \$7,000 | \$5,000 | \$56,000,000 | \$40,000,000 |
| 2020 | 2 | 12,000 | \$6,700 | \$5,000 | \$80,400,000 | \$60,000,000 |
| 2021 | 3 | 18,000 | \$6,500 | \$5,000 | \$117,000,000 | \$90,000,000 |
| 2022 | 4 | 13,000 | \$6,200 | \$5,000 | \$80,600,000 | \$65,000,000 |
| 2023 | 5 | 7,200 | \$6,000 | \$5,000 | \$43,200,000 | \$36,000,000 |
| 2024 | 6 | 5,600 | \$5,800 | \$5,000 | \$32,480,000 | \$28,000,000 |

$$\begin{aligned}\text{Manufacturing Cost:} \\ & \$5,000 * 5,800 \\ & = \$ 28,000,000\end{aligned}$$

Cash Flow Diagram (BTCF)



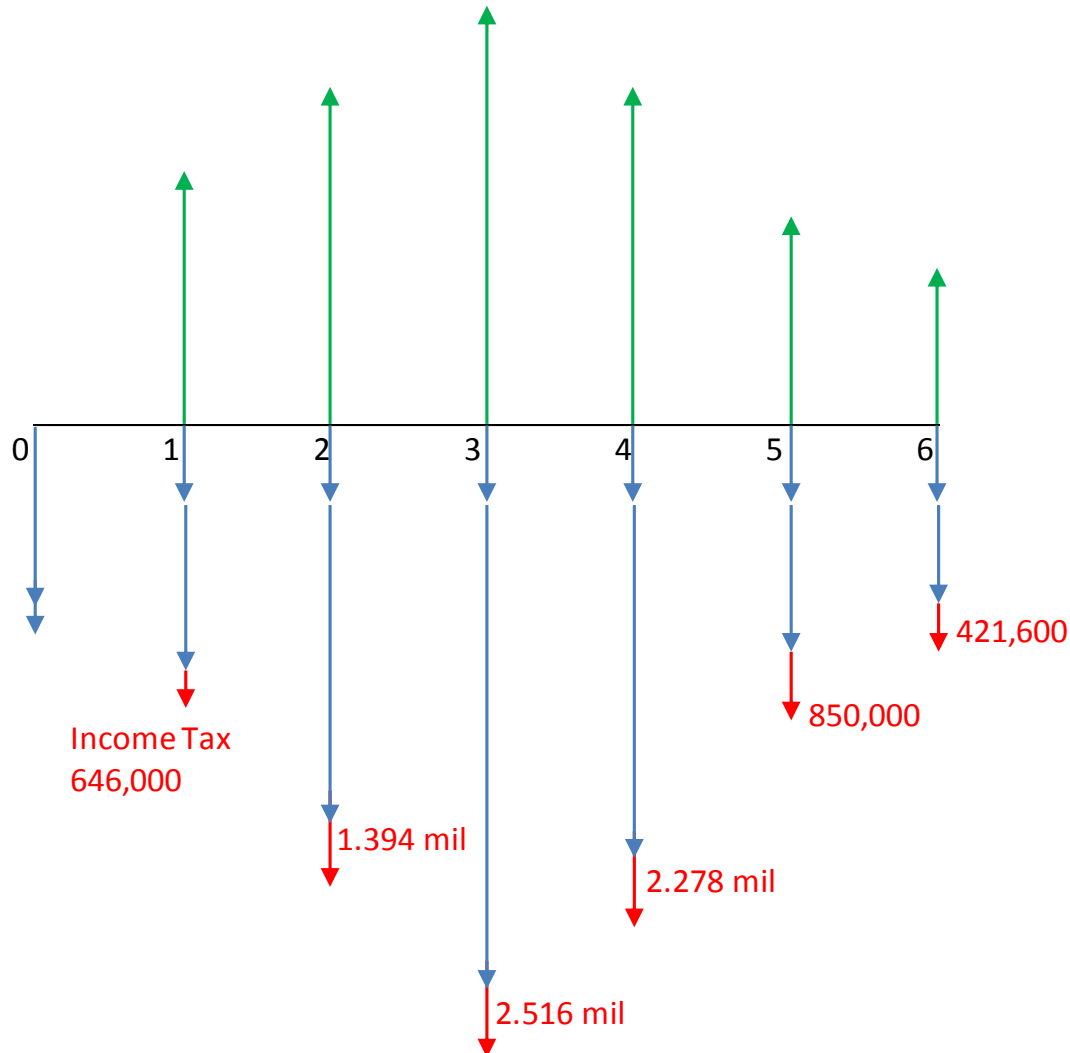
- Before-Tax-Cash-Flow Cash flow diagram:



Cash Flow Diagram (ATCF)



- After-Tax-Cash-Flow Cash flow diagram



Learning Objectives



- Review
 - The terminology and effect of tax
 - The company tax structure in Singapore
- List the types of taxes
- Perform after-tax economic analysis
- Assess investment opportunity with consideration of tax

E213 Engineering Cost Decisions (Topic Flow)

