

# PROFITABILITY ANALYSIS

Ekonomi Teknik Kimia  
By Dr. Istadi  
2007

## Schedule

- Time Value of Money (Interest Rate) & Cash Flow
- Depreciation & Salvage Value
- **Profitability Analysis**
- Selection of Alternatif Investment of Chemical Plant Equipment
- Sensitivity/Break Even Analysis
- Tax Principals (Dasar-Dasar Perpajakan)
- Selection of Plant Location
- Ujian Modul

## Corporate/Plant Objectives

- Maximize the return on investment
- Maximize the return on stockholder's equity
- Maximize aggregate earning
- Maximize common stock prices
- Find outlets for a maximum of additional investment at returns greater than the minimum acceptable rate of return
- Increase marker share
- Increase the economic value added
- Increase earnings per share of stock
- Increase the market value added

## Project Classification

- Necessity Project (reduction of operating expenses)
- Product improvement project
- Process improvement project
- Expansion project (to meet increased sales demand)
- New ventures (require capital expenditures to introduce new products to the market)

## Minimum Acceptable Rate of Return

- Pihak manajemen mungkin akan menaikkan rate yang diperlukan untuk mengantisipasi resiko projek atau jika budget terbatas
- Manajemen selanjutnya menentukan rate of return minimum untuk suatu projek.
- Yang perlu diperhatikan adalah Modal, dari mana dipinjam.
- Perusahaan harus berusaha agar pendapatan lebih besar daripada biaya angsuran, dan harus untung (profitable)
- Higher the risk, higher the required return
- Today's economy → ROI after tax minimum : 25-35 %, and Payout Time maximum: 3 years

## Factors Affecting Minimum Acceptable Rate of Return

- Cost of Capital
- Availability of Capital (health of economy)
- Competing Investments
- Difference in Risks of investment
- Difference in time to recover capital



## Profitability Measures

- **Quantitative Measures**
  - Interest Rate based (ROI, IRR/DCFROR)
  - Money/Cash based (NPV, NFV)
  - Time Based (POT/Payback Period)
- **Qualitative Measures**
  - Employee morale
  - Employee safety
  - Environmental Constraints
  - Legal Constraints



## Return on Investment (ROI)

- Merupakan besarnya laju pengembalian modal suatu investasi
- Biasanya digunakan analisis proyek dengan pendapatan rata-rata per tahun
- Persamaan: 
$$ROI = \frac{\text{Annual net profit (Earnings after taxes)}}{\text{Total Capital Investment}} \times 100$$
- ROI can be calculated before or after taxes
- Denominator could be Fixed Capital Investment or Fixed + Working Capital
- Profit = income - expenses

## Disadvantage of "Return on Investment (ROI)"

- The time value of money is ignored
- The project will last the estimated life and this is often not true
- Equal weight is given all income for all years and that is not always true. The averaging of profits permits laxity in forecasting
- It does not consider timing of cash flows
- It does not consider capital recovery

## Return on Average Investment (ROAI)

- Method for measuring the profitability of investments utilizing accounting data and based on averaging method
- Equation:
$$\text{ROAI} = \frac{\text{Annual net profit (Earnings after taxes)}}{\text{Land} + \text{Working Capital} + \text{FCI}/2} \times 100$$
- Why FCI/2 ??
  - At the beginning of a project the return is earned against the full investment, and at the end of a project the investment has been fully depreciated and the capital has been recovered.
  - Therefore, on the average over the life of the investment, half the FCI is involved.
- Kelemahan ? *Sama dengan ROI*

## Payback Period/Payout Time (POT)

- Other terms: Payback Period, Payout Time.
- To calculate the amount of time that will be required to recover the depreciable FCI from the accrued cash flow of a project.
- Equation:

$$\text{POP} = \frac{\text{Depreciable Fixed Capital Investment}}{\text{After-tax Cash Flow}}$$

- The denominator may be the averaged annual cash flow or the individual yearly cash flows. This could be after or before tax.
- Disadvantages:
  - No consideration to cash flow or time value of money
  - The method makes no provision for including land or working capital

## Payout Period with Interest (POPI)

- Takes into account the time value of money (discounted).
- Equations:

$$\text{POP}_i = \frac{\text{after-tax cash flow}_i}{\text{fixed capital investment}_i}$$

- Where:
  - (after tax cash flow)<sub>i</sub> = cash flow discounted to time zero at interest rate i.
  - (fixed capital invest.)<sub>i</sub> = FCI compounded to time zero at an interest rate i

## Example (ROI & POT)

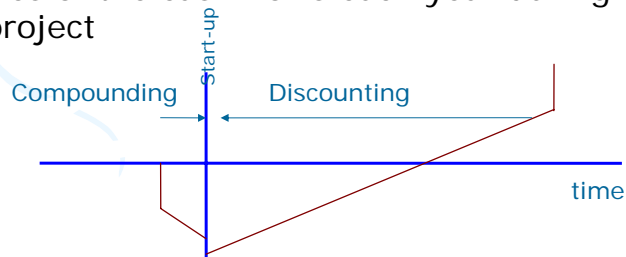
- **Problem:** A proposed chemical plant will require a fixed-capital investment of \$10 million. It is estimated that the working capital will amount to 25 percent of the total investment, and annual depreciation costs are estimated to be 10 % of the FCI. If the annual profit will be \$3 million, determine the standard % ROI and the minimum payback period.
- **Solution:**
  - Annual Profit = \$3,000,000
  - Fixed capital investment = \$10,000,000
  - Working Capital = (25%)(10,000,000)=\$2,500,000
  - Rate of Return on Investment =  $\frac{3,000,000}{10,000,000 + 2,500,000} \times 100\% = 16\%$

## Example ....

- Payout Time = depreciable FCI / (avg. profit/yr + avg. depreciation/yr)
- Depreciation = (10%)(10,000,000)=\$1,000,000
- Payout Time =  $\frac{10,000,000}{3,000,000 + 1,000,000} = 3.23 \text{ year}$
- *Salvage Value = Fixed Capital Investment - Depreciation*

## Net Present Worth (NPW)

- Other terms: Net Present Value (NPV)
- The NPW is the one most companies use since it has none of the disadvantages of other methods and treats the time value of money and its effect on project profitability properly
- The NPW is the algebraic sum of the discounted values of the cash flows each year during the life of project



## ... NPW

- The Net Present Worth (NPW) is the difference between the present worth of all cash inflow [income] and the present worth of all investment items:

$$\text{NPW or NPV} = \text{Present Worth of all cash inflow [income]} - \text{Present Worth of all investment items}$$

- Project with high NPW will produce a greater future worth to a company.





## Advantages and Disadvantages of NPW

- **Advantages:**

- Timing of all cash flows and capital recovery at the end of a project are considered

- **Disadvantages:**

- Capital investment is hidden in the calculation and need to be stated clearly in any report of the results



## Net Present Worth Index (NPWI)

- Also known as Profitability Index
- The NPWI is the ratio of the present value of the after-tax cash inflows to the present value of the cash outflows or capital items
- $NPWI > 1 \rightarrow$  greater than discount rate

## Internal Rate of Return (IRR)

- IRR or DCFROR is the interest or discount rate for which the Net Present Value of the project is equal to zero
- IRR is usually used for analyze the project in which the revenue of the project is not uniform yearly ==> cash flow
- It is discount rate that results when the NPW is equal to zero.
- Also known as: DISCOUNTED CASH FLOW RATE OF RETURN (DCFROR)
- The technique is similar with NPW method
- IRR is the interest rate that will produce an NPW of zero.

## DCFROR Calculation of A Project

- DCFROR can be calculated from the Cash Flow and Fixed Capital Investment which forward to present value:

$$FCI - WC = CASH FLOW \cdot P/A, i, n - WC - SV \cdot \frac{1}{1+i^n}$$

$$FCI - WC = CASH FLOW \cdot \frac{1-i^{-n}}{i-1} - WC - SV \cdot \frac{1}{1+i^n}$$

- WC and Salvage Value are recoverable

## Limitations of IRR Method

- **Multiple rates for return:** Unusual cash flow forecasts can lead to more than one answer for the IRR
- **Reinvestment Rate:** Inherent in the IRR calculation is the assumption that funds received during the project can immediately be reinvested at the same interest rate as the IRR. This is not always possible.
- **Comparison of two or more projects:** When comparing two or more mutually exclusive projects will not necessarily lead to the correct choice.
- **Size of the investment:** The IRR cannot differentiate between differences in the size of the investment.
- **Timing of cash flows:** Because of uncertainty in forecast, there is the possibility that the discounted value of the net cash flows can equal to zero at more than one interest rate.

## Net Rate of Return (NRR)

- Equation:

$$\text{NRR} = \left\{ \frac{\text{Net Present Worth}}{\text{Discounted Investment} \times \text{Project Life}} \right\} \times 100$$

- The cost of capital has been taken care of in the NPW calculation so that the NRR is then a true net return rate



## Capitalized Costs

- Capitalized Cost (K) is useful for comparing alternatives which exist as possible investment choices within a single overall project.
- Capitalized cost related to investment represents the amount of money that must be available initially to purchase the equipment and simultaneously provide sufficient funds for interest accumulation to permit perpetual replacement of the equipment



## Capitalized cost....

- Equation:

$$K = C_v + \frac{C_R}{1+i} + \frac{C_R}{(1+i)^2} + \dots + \frac{C_R}{(1+i)^n} + V_s$$

- K : capitalized cost
- $C_v$  : original cost of equipment
- $C_R$  : replacement cost
- $V_s$  : salvage value at end of estimated useful life
- n : useful life
- i : interest rate
- $(1+i)^n / ((1+i)^n - 1)$  = capitalized-cost factor



## Personal Assignment (1 week)

- **Problem:** Sebuah perusahaan ingin berinvestasi di bidang pabrik kimia. Berikut ini adalah data-data untuk analisis ekonomi:
  - Fixed Capital Investment: \$3,600,000
  - Kapasitas pabrik: 5,000,000 lb/year
  - Periode Konstruksi : 1 tahun
  - Land : \$100,000
  - Working Capital : \$300,000
  - Project life (umur pabrik): 10 years
  - Depreciation: Straight-line method
  - Potential Sales: 4,000,000 lb/year, dan meningkat 10% tiap tahun hingga akhir project
  - Selling price: &0.80/lb dalam 2 tahun pertama setelah masa konstruksi, dan meningkat 5% per tahun untuk tahun-tahun berikutnya
  - Cash operating expenses: \$0.25/lb pada tahun pertama setelah masa konstruksi dan meningkat 3% per tahun untuk tahun-tahun berikutnya.
  - Income tax rate : 35%



## Lanjutan Tugas

- Soal/Pertanyaan:
  - Buatlah Cumulative Cash Flow untuk Project di atas mulai tahun ke-0 (masa konstruksi) hingga akhir project.
  - Hitunglah Payout Time (dalam tahun)
  - Hitunglah Rate of Return on Investment (ROI)
  - Hitunglah Discounted Cash Flow Rate of Return (DCFROR)