MANGISTAU
BEKET-ATA NEFTE COMPLEX

COST CALCULATION DATA

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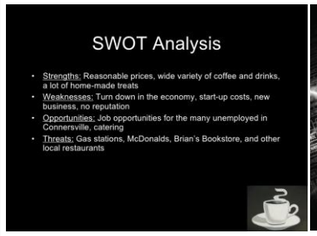
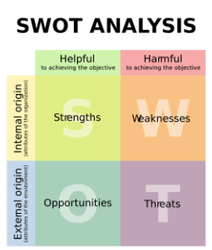
FLAGS ARE IN ALPHABETICAL ORDER





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ASIA MINERAL RESOURCE

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BEKET ATA ECONOMIC EVALUATION

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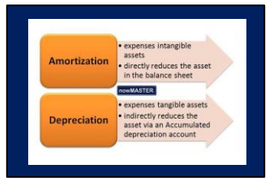
Economic Evaluation

Economic evaluations are generally carried out to determine if a proposed investment meets the profitability criteria of the company or to evaluate alternatives. There are a number of methods of evaluation and a good summary of the advantages and disadvantages of each is given in ***Perry's Chemical Engineers' Hand- book.*** *Most companies do not rely upon one method alone but utilize several to obtain a more objective viewpoint.*

As this is primarily concerned with cost estimation procedures, there will be no attempt to go into the theory of economics, but equations will be presented which are used for the economic evaluation calculations. There is a certain amount of basic information needed to undertake the calculations for an economic evaluation of a project.

DEFINITIONS

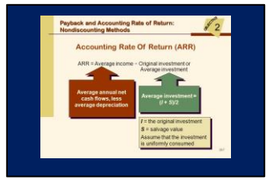


DEPRECIATIONS

Depreciation arises from two causes: deterioration and obsolescence. These two causes do not necessarily operate at the same rate, and the one having the faster rate determines the economic life of the project. Depreciation is an expense and there are several permissible ways of allocating it. For engineering purposes depreciation is usually calculated by the straight-line method for the economic life of the project. Frequently economic lives of 10 years or less are assumed for projects of less than $250,000.

WORKING CAPITAL

The working capital (WC) consists of feed and product inventories, cash for wages and materials, accounts receivable, and spare parts. A reasonable figure is the sum of the above items for a 30-day period.



$$ROI = \frac{\text{Average yearly profit}}{\text{Original fixed investment}} \frac{100}{\text{working capital}}$$

RETURN ON ORIGINAL INVESTMENT

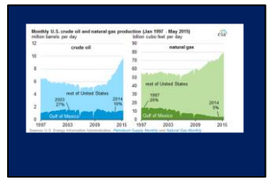
This method is also known as the engineer's method, du Pont method, or the capitalized earning rate. It does not take into account the time value of money, but, because of this, offers a more realistic comparison of returns during the latter years of the investment. The return on original investment is defined as:The return on investment should be reported to two significant figures.

ANNUAL CASH FLOW

The annual cash flow (ACF) is the sum of the earnings after taxes and the depreciation for a one-year period.

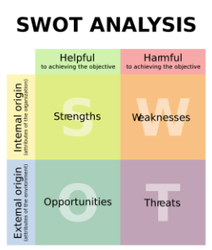
SENSITIVITY ANALYSIS

Uncertainties in the cost of equipment, labor, operation, and raw materials as well as in future prices received for products can have a major effect on the evaluation of investments. It is important in appraising the risks involved to know how the outcome would be affected by errors in estimation, and a sensitivity analysis is made to show the changes in the rate of return due to errors of estimation of investment costs and raw material and product prices. These will be affected by the type of cost analysis performed (rough estimate or detailed analysis), stability of the raw material and product markets, and the economic life of the project. Each company will have its own bases for sensitivity analyses but when investment costs are derived from the installed-cost figures in this book, the following values are reasonable:



RAW MATERIAL AND PRODUCT COST ESTIMATION

It is very important that price estimation and projections for raw materials and products be as realistic as possible. Current posted prices may not be representative of future conditions, or even of the present value to be received from an addition to the quantities available on the market. A more realistic method is to use the average of the published low over the past several months.



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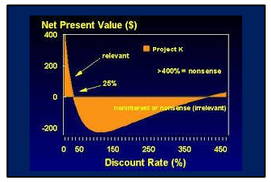
DEFINITIONS

PAY OUT TIME

The payout time is also referred to as the cash recovery period or years to pay out. It is calculated by the following formula and is expressed to the nearest one-tenth year:

$$\text{Payout time} \quad \frac{\text{Original depreciable fixed investment}}{\text{Annual cash flow}}$$

If the annual cash flow varies, the payout time can be calculated by adding the cash income after income taxes for consecutive years until the sum is equal to the total investment. The results can be reported to a fractional year by indicating at what point during the year the cash flow will completely offset the depreciable investment.



DISCOUNTED CASH FLOW RATE OF RETURN

This method is called the investors' return on investment, internal rate of return, profitability index, and interest rate of return as well as discounted cash flow. A trial-and-error solution is necessary to calculate the average rate of interest earned on the company's outstanding investment in the project. It can also be considered as the maximum interest rate at which funds could be borrowed for investment in the project with the project breaking even at the end of its expected life.

The discounted cash flow is basically the ratio of the average annual profit during construction and\ earning life to the sum of the average fixed investment, working capital, and the interest charged on the fixed and working capital that reflects the time value of money. This ratio is expressed as a percentage rather than a fraction. Discounted cash flow is discussed in detail, with an example of its use, in Appendix E.

In order to compare investments having different lives or with variations in return during their operating lives, it is necessary to convert rates of return to a common time basis for comparison. While any time may be taken for this comparison, the plant startup time is usually taken as the most satisfactory.

Expenditures prior to startup and income and expenditures after startup are converted to their worth at startup. The discussion to follow is based upon the predicted startup time being the basis of calculation.

EXPENDITURE PRIOR TO STARTUP

The expenditures prior to startup can be placed in two categories: those that occur uniformly over the period of time before startup and lump-sum payments that occur in-an-instant at some point before the startup time. Construction costs are generally assumed to be disbursed uniformly between the start of construction and the startup time, although equivalent results can be obtained if they are

considered to be a lump-sum disbursement taking place halfway between the start of construction and startup.

The present worth of construction costs that are as- sumed to occur uniformly over a period of years, T, prior to startup can be calculated using either continuous interest compounding or discrete (annual) interest compounding.

Continuous interest compounding:

$$P_0 = \left(\frac{CC}{T}\right)\left(\frac{e^{iT} - 1}{i}\right)$$

Discrete (annual) interest compounding:

$$P_0 = \left(\frac{CC}{T}\right)\left(\frac{\ln[1/(1+i)]}{[1/(1+i)]^T - [1/(1+i)]^{(t-1)}}\right)$$

where

P = worth at startup time
CC = total construction cost
T = length of construction period in years before startup
i = annual interest rate.

Continuous interest

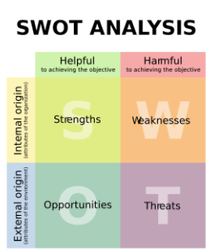
$$P_0 = (LC)e^{iT}$$

Discrete (annual) interest compounding:

$$P_0 = (LC)(1+i)^T$$

where

LC = land cost
T = years before startup time that payment was made
i = annual interest rate.



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