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Module 4

4



Developed by  
Industrial Promotion and Technology Branch (UNIDO)  
in cooperation with the Inter-Regional Centre for Entrepreneurship  
and Investment Training (EDII, Ahmedabad)

# Financial Analysis



UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION

**INVESTMENT PROJECT PREPARATION AND APPRAISAL**

**IPPA Teaching Materials**

**Financial Analysis**

**Module 4**

**Developed by**

Industrial Promotion and Technology Branch (UNIDO)

in cooperation with

The Inter-Regional Centre for Entrepreneurship and Investment Training  
(EDII, Ahmedabad)



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION  
Vienna, 2005

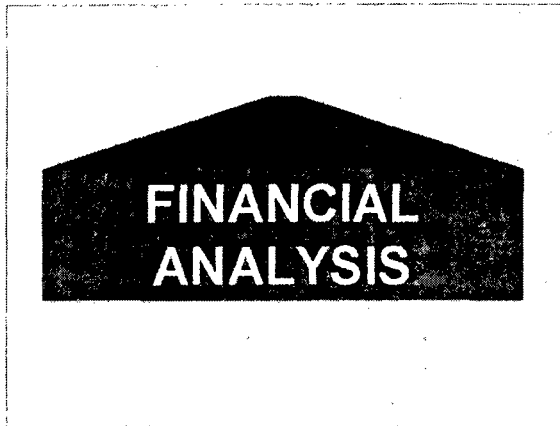
# MODULE 4 – FINANCIAL ANALYSIS

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# INTRODUCTION

## FINANCIAL ANALYSIS



Financial analysis of an investment project provides the "bottom line" for investors, a prediction of what the project holds in store in terms of financial benefits and costs. It is linked to the analysis of markets that provide an idea of revenues (benefits) that can be generated, and to technical analysis that provides an idea of the necessary investment and operating costs.

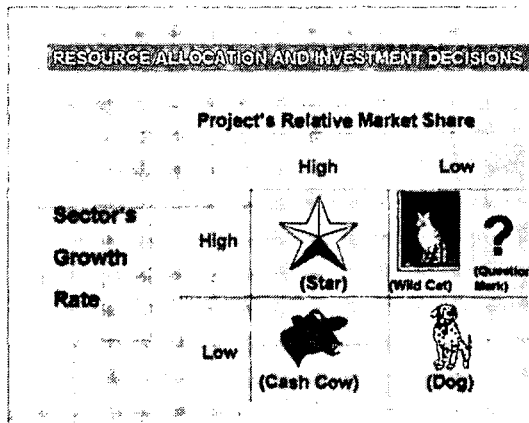
An investment project normally has more than one stake holder. Most important among them are financial investors who invest in a project with expectations of financial/economic rewards. They develop criteria that need to be fulfilled by the financial performance of the project they choose to invest in. They generally feel interested in more earnings, with risks they can afford. They also consider it favourable to fully recover their initial investment within an acceptable time frame.

Other participants in the project are also concerned with the financial results of the project. Bankers want to be assured that their loans along with its regular servicing will be repaid in time from the surplus; guarantors that they will not have to cover non-performance and defaults commitments; licensors that resources committed to the project are optimally utilized justifying allocation of resources.

Thus all stakeholders have interest in the surplus generating capacity of the project. But they also have concerns about the reliability of the accrual of the surpluses projected based on which they have taken the investment decision. Financial analysis of the project provides answers to these considerations of the stakeholders and helps them to take suitable investment decisions.

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## RESOURCE ALLOCATION AND INVESTMENT DECISIONS



The resource allocation framework shapes, guides and circumscribes individual project decisions and elementary investment strategies. To guide the process of strategic project planning and resource allocation, the BCG (Boston Consulting Group) product portfolio matrix can be used. This system analyzes the investment in production on the basis of a) relative market share of the product and b) growth rate of the sector. It is assumed that growth of the sector and relative strength of the product

as measured by its market share are strong signals indicating sources of value or wealth. The sector's growth and the existing relative market share are separated into 'high' and 'low' areas.

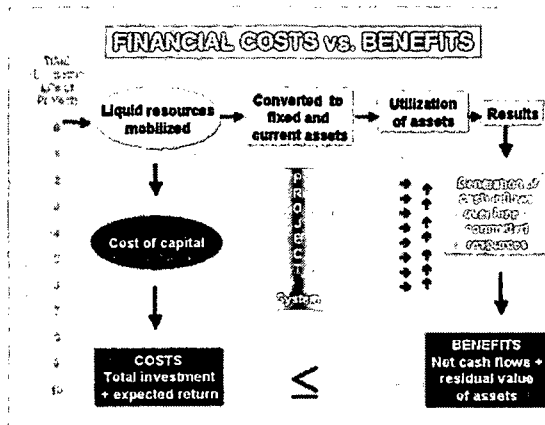
**Wild cat:** This category pertains to a project in a high growth sector, with a relatively small market share, that easily attracts investment. What the future brings is dependent on how efficiently the enterprise responds to the opportunities presented by a rapidly growing market - how it takes advantage of experience and how quickly it acquires the keys to survival and growth. The organization might set up new capacity for the first time in this category.

**Star category:** A project in a high growth rate sector that has both a relatively large percentage of market share (perhaps through expansion) and that also has a growth rate higher than competitors is in the 'star' category. This category pertains to an organizations whose product is already established in the market and has the benefit of experience in the field.

**Cash cow:** With maturity phase of the product's life cycle approaching, the sector starts becoming less lucrative and consequently less attractive for growth oriented investment. The position is characterized by high market share in a low growth sector. The position is called "cash cow" because the free cash flow is high because there is little or no need for new investment in this sector. The organization would take up such a project as a diversification measure.

**Dog:** The dog signifies an enterprise in a low growth sector with relatively low market share. There would be very little interest for an enterprise to undertake a new project in this sector.

## FINANCIAL COSTS VS. BENEFITS



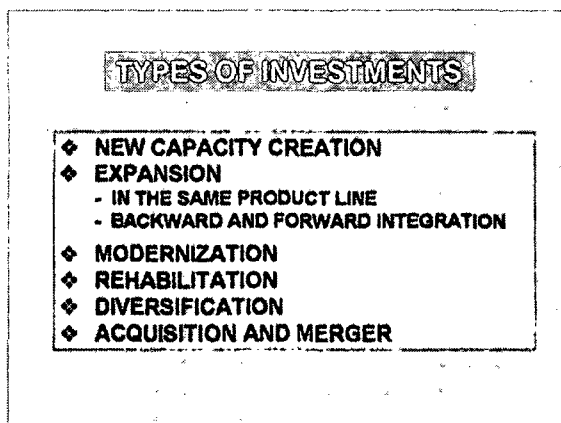
During planning and construction phases the project mobilizes capital in liquid form, which is then converted to fixed and current assets. These assets are utilized to generate net cash flows (the difference between revenues and costs) over time representing the benefits accruing to investors.

The owners of capital have the expectation of return, both recovery of the initial investment plus a rate of return (capital recovery plus a rental cost).

The total net benefits accumulated should cover the initial capital investment and the expected service rate. A surplus (a return higher than the expectation) would be regarded favorably as the wealth of investors would increase.

The project should remain in operation so long as the marginal benefits are higher than the marginal costs.

## TYPES OF INVESTMENTS



**New capacity creation:** New production capacity is added in a sector. This could represent production of existing or innovative products. Normally such capacity is added when justified by sustainable growth.

**Expansion:** Capacity may be added by an enterprise in an existing product line. Expansion offers several advantages: familiarity with technology, production methods, and market conditions; lower capital costs; reduction in operating costs.

The degree of market saturation should be a consideration in and expansion decision.

**Vertical integration:** An enterprise may undertake backward or forward integration. Backward integration involves manufacture of raw materials and components required for the existing operations (upstream). Forward integration involves the manufacture of products that would otherwise be end products of downstream producers.

**Modernization:** Modernization involves upgrading the technology or process of production for existing product line. Such an investment can result in higher volume, lower costs, better quality or product differentiation. The objective is to provide a competitive advantage.

**Rehabilitation:** This involves capital investment needed to upgrade an existing production facility to restore production levels and to reduce operating costs to normal.

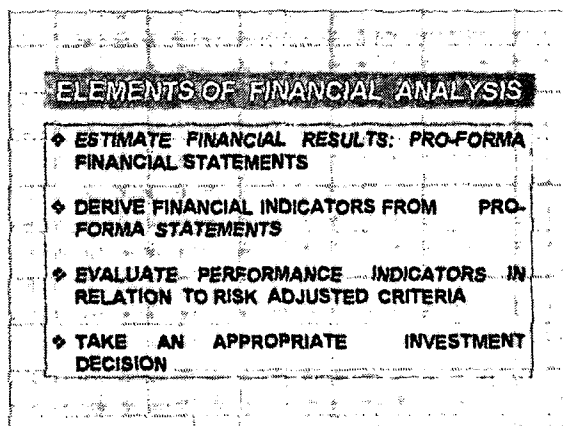
**Diversification:** Diversification involves adding new one or more new product lines in related or unrelated area. Concentric diversification is investment in related product lines, which can result in lower production costs, more efficient use of existing distribution facilities, and benefits from the goodwill of existing brands.

Conglomerate diversification pertains expansion into unrelated product lines. It is undertaken as a means of overcoming limited growth opportunities in the existing product line and as a means of reducing risk.

**Acquisition and merger:** An enterprise may find favourable opportunities by acquiring or merging with another entity. The basis for a merger or acquisition decision would be the relative advantage of utilizing the facilities and capabilities of another enterprise as compared with new investment in the sector. There may be synergies in processes, operations and products. Historically, mergers and acquisitions have shown more promise on paper than in fact.

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## ELEMENTS OF FINANCIAL ANALYSIS



Financial analysis is a process of evaluating an investment proposal. The financial indicators measuring should satisfy the criteria of participants. The analyst should also consider the set of assumptions developed during the project's formulation. Analysis provides information for decision makers, either to accept or reject the investment proposition or to modify it in such a way that it satisfies criteria. Financial analysis is comprised of the following elements:

**Estimate financial results - projected financial statements:** Estimates of project inputs and outputs expressed in monetary terms are assembled into standard financial statements (see the section on Financial Statements) describing the predicted financial status and performance to the planning horizon.

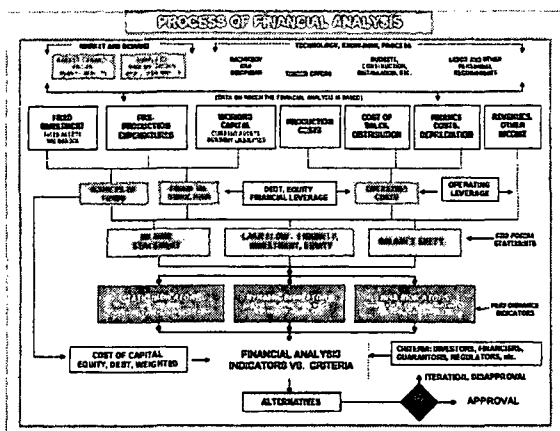
**Derive financial indicators:** Indicators of performance can be derived from one or more financial statements. The types of indicators can be static (at a point in time) or dynamic (time-dependent). They can focus on rates of return, leverage, turnover or other project parameters. Financial indicators are generally expressed numerically as ratios, percentages or another quantitative measure.

**Evaluate performance indicators in relation to risk adjusted criteria:** Indicators of predicted performance are compared with the criteria of investors and other interested parties. The criteria are developed independent of the financial analysis, generally based upon alternative uses of the investors' capital or on the aspirations of other interested parties. Criteria are generally adjusted to the level of risk associated with the project and the risk tolerance of the investor or other participant.



**Decide on investment:** The comparison of financial indicators with criteria is usually a major part of the appraisal process, upon which an investment decision is taken.

## PROCESS OF FINANCIAL ANALYSIS



This flow chart shows the general outline of financial analysis of an investment project. Although it appears in the diagram as a linear process, it is anything but linear. As information is gathered and refined, it is inevitable that prior stages will have to be revisited and revised. This presentation is intended only to illustrate the general flow of development.

**Background - market and technology:** Financial data derives from the analysis of market and technology that result in an

understanding of capital and operating inputs and outputs that can then be expressed in monetary terms.

**Investment and capital structure:** The total investment package, consisting of fixed assets, pre-production expenditures and working capital margin, are covered with financial capital structured in accordance with resources available to investors and the requirements of financiers and other interested parties. The essential issue is generally the degree of financial leveraging, the ratio of debt to equity. Operating leverage can also be estimated from the relationship of variable margin to operating profit.

**Operations:** Costs of production, sales, financing and capital depletion (depreciation) are combined with predicted revenues to determine the projected income for all operating periods to the planning horizon.

**Financial statements:** Capital requirements and operating estimates are combined to develop a series of pro-forma financial statements (income, 'cash' flows, balance sheet) that describe the expected financial conditions to the planning horizon.

**Performance indicators:** These are derived from financial statements - static to describe the state at a point in time, dynamic that are panoramic over time and risk that indicate the likelihood of an undesirable outcome.

**Financial appraisal - indicators vs. criteria:** Once the capital structure is defined, the opportunity cost of capital is ascertained for each individual source, equity and debt. These costs represent the criteria of the participants, the return on capital in its most favourable alternative use. There may be other financial criteria associated with risk.

A weighted cost of capital can be determined that serves as a benchmark for the financial performance of the project.

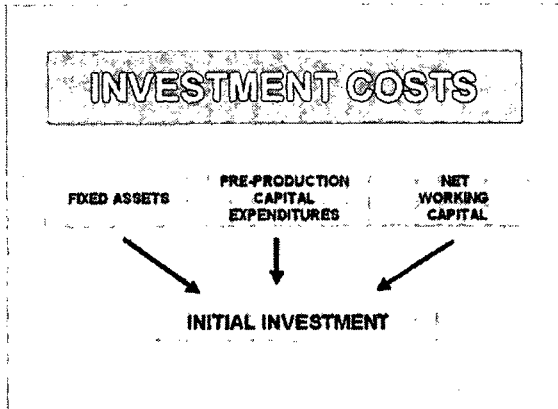
Projected performance as expressed by the indicators are compared with criteria. If the indicators match or exceed criteria the project is acceptable as a candidate for investment from the financial point of view.

**Alternatives:** The project can be considered in relation to alternative investments. When capital is scarce a rationing process based upon the generation of benefits per unit of capital investment can be employed to decide which of the alternatives should be selected.

**Approval, disapproval:** If the project is approved, further development and planning are undertaken. If disapproved, the concept may be revisited and perhaps revised to make it more attractive. In any case, the project should be shelved but not discarded as future external and internal developments may alter its appeal as an investment opportunity.

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# INVESTMENT COSTS

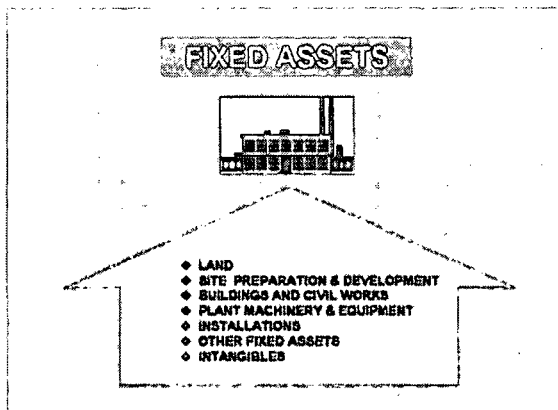


An investment project requires investment of capital, accumulated wealth in the form of resources that can be employed for the generation of future benefits for its owner. An investment project mobilizes capital, usually in monetary form, which is then used to acquire assets that are employed for generating goods and services. The assets are capital items owned or otherwise controlled by the project sponsors.

The *Initial Investment Package* represents the value of these assets that are initially committed to the project. Generally the procurement of these assets involve cash outlays, but sometimes they are provided by one or more of the investors 'in kind'.

The assets initially committed to the project generally fall into three categories: **Fixed assets, Pre-production expenditures and Working capital.** At the start of the project, when the assets are first mobilized, the initial investment cost represents the total amount of financial resources that must be raised to implement the project. As the project proceeds into the operation stage, the value of the initial investment will usually change due to deterioration, obsolescence or supply and demand factors. It may also change due to additional investments, either from commitments of new capital or from surplus generated by operations.

## FIXED ASSETS



Fixed assets are capital items with extended life committed for the duration of a project. The cost of fixed assets is generally covered with long term sources of finance.

Fixed assets remain in use for more than one year and sometimes for many years. However, their technological usefulness is finite as they are 'consumed' as a result of wear and tear, obsolescence and other factors. The value that they lose over the life of the project as a consequence of

being 'consumed' represents a cost to the project. Some of these assets may have to be replaced during the project life.

Two types of fixed assets, tangible and intangible, are differentiated to assure that all costs of the project are included in the investment estimate and because the rules for accounting for their costs (allowable methods of depreciation and/or amortization) differ in most countries.

## Tangible assets

Land: Most investment projects require acquisition of land for buildings and other facilities. Land is perhaps the only kind of fixed asset that is not consumed, except for mining and some types of agricultural projects.

Site preparation & development: Normally investment is required to prepare and develop the plant site.

Buildings: Projects need buildings to house manufacturing, stores, administration and other enterprise functions.

Plant machinery & equipment: The production of goods and services generally requires investment in machinery and equipment that usually represents a large proportion of the fixed assets committed to the project

Installations: In addition to machinery and equipment investment is required to cover the cost of their installation in the plant and other project facilities.

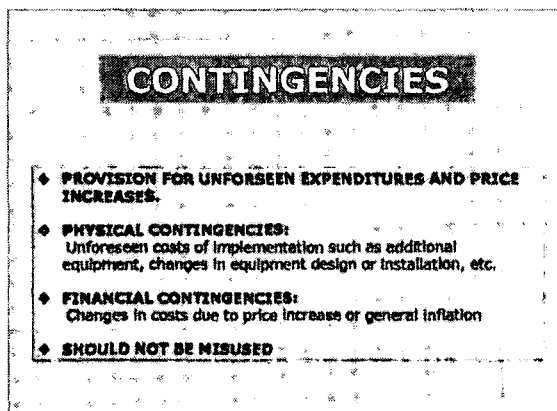
Other fixed assets: Ancillary equipment such as materials handling facilities, special tools, vehicles, refrigeration and air-conditioning equipment may be part of the fixed investment package.

## Intangibles assets

In addition to those assets that comprise the physical plant, i.e. that are material in nature, the project may have to invest in intangible assets that are not physical in nature. They may be 'incorporated' in the sense that they are embodied in the design of other assets, e.g. a license to use a patented machine in the project, payments for intellectual property rights or technical know-how or other proprietary knowledge, e.g. service fees, goodwill, copyrights, brand names, etc.

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## CONTINGENCIES



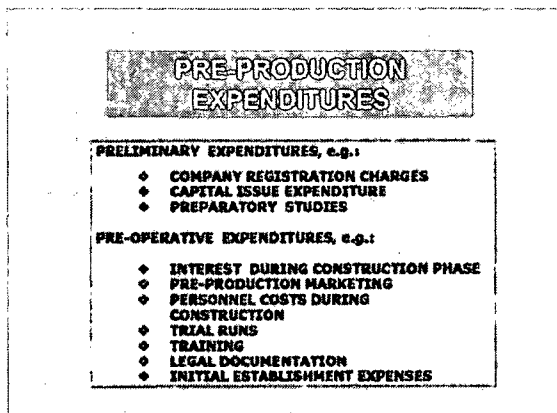
Provision for unforeseen expenditures and price increases: Contingencies are amounts added to the estimates of capital expenditures (fixed assets and pre-production expenditures). These contingencies are a method of risk-avoidance as they represent an overestimation of the needed investment to account for unforeseen over-runs. While costs can theoretically go up or down, the contingencies are always added, covering the pessimistic scenario. They fall into two categories.

**Physical contingencies:** Physical contingencies are intended to account for unforeseen physical requirements. A frequent phenomenon is the change in the design of some physical component, omission of a needed component or some additional area to be built for special machinery. These capital costs may not have been estimated.

**Financial contingencies:** Price contingencies are intended to account for likely increases in cost of assets during the construction phase. These increases can occur due to general inflation or escalation of prices for the particular item. As prices seem always to go in one direction (up), delays in implementation will usually entail increases investment costs. Local currency devaluation that occurs during the implementation phase will affect the cost of imports.

**Should not be misused:** Contingencies are, in a sense, factors of ignorance. It is one thing to be aware of what one does not know, but to blanket the project in a sea of ignorance does not solve anything and may well scuttle it. Every effort should be made to predict the most accurate costs of assets and then only the chances of contingencies examined.

## PRE-PRODUCTION EXPENDITURES



During the planning and implementation phase certain types of expenditures are generally required that do not fall into the category of fixed assets. They are part of the initial investment package and are financed with long-term sources of capital. These expenditures are involved primarily in the planning and organization of the project. The pre-production expenditures are comprised of preliminary and pre-operative expenditures, and are considered part of the assets of the enterprise. Their costs are generally

amortized over a period of years. The rules for amortization differ from country to country.

**Preliminary expenditures** occur in the early formative stages, prior to the implementation phase, but after the investment decision has been made.

- Company registration charges: Fees for incorporation and registration.
- Capital issue expenditure: Costs for issuing and underwriting initial capital instruments.
- Preparatory studies: Costs of various stages of project study.

**Pre-operative expenditures** occur during the implementation phase.

- Interest during construction phase: Interest on loans taken down during the implementation phase that may be capitalized.
- Pre-production marketing: Test marketing, setting up marketing organization and programme.
- Personnel costs during construction: Staff employed for implementation and operating personnel appointed in advance of the production phase.
- Trial runs: Performance tests on plant machinery, equipment and processes.
- Training: Pre-operations skills training for all classes of personnel.
- Legal documentation: For example, preparation of mortgage documents and registration fees.
- Initial establishment expenses: Insurance, rents, travel, inauguration expenses.

## NET WORKING CAPITAL

NET WORKING CAPITAL	
CURRENT ASSETS	
-	CURRENT LIABILITIES
<b>CURRENT ASSETS</b>	
Inventories:	
Materials and components	
Spare Parts	
Work-in-Progress	
Finished Goods	
+	Cash-in-hand
+	Account Receivable
<b>- CURRENT LIABILITIES</b>	
Accounts Payable	
+	Short-term finance
+	Current long-term finance
+	Advances received

In addition to the fixed assets and pre-production expenditures that comprise the physical plant and ancillary intangible investment items, there is also the need for short-term assets that are employed in the production process.

**Current assets:** These assets, current in the sense that their existence is ephemeral (almost without exception less than one year), have a cyclical nature: inventories of materials and components, work-in-progress, finished goods, spares,

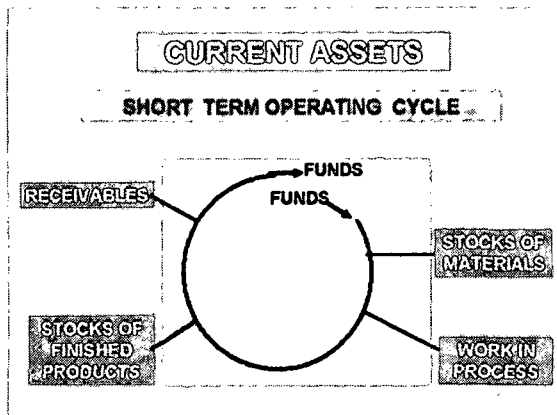
accounts receivable and cash-in-hand. Inventories of materials are converted through the production process into goods and services. These are sold, in some cases for cash and in other cases 'on account'. The latter become 'receivables' for the enterprise that will be liquidated at some future point in time. Since requirement of current assets facilitate the working of the project, they are also called working capital.

**Current liabilities:** One type of current liability is the debt corresponding to the cost of items delivered to the enterprise but not paid. They are carried on the books as 'payables' as the costs will eventually have to be covered. In a sense, this is a form of interest-free financing for the enterprise. Other current liabilities are the current portion of long-term debt and possibly advances against future deliveries of goods or services.

**Net Working capital:** The amount of financing required to cover the working capital is the difference between the values of current assets and current liabilities. Any increase in current assets represents a use or application of funds, while any increase in current liabilities represents a source of funds. As current assets are built up in the form of inventories and receivables, particularly in the early stages of operations, financing is required to cover these short term investments. Advances and other deposits (e.g. opening letters of credit) against purchases of project inputs may increase the amount of financing required.

In the initial investment package it is prudent to cover some portion of the working capital with long-term finance for security reasons (e.g. current liabilities may not be covered as the result of a decrease in value of current assets).

## CURRENT ASSETS: SHORT-TERM OPERATING CYCLE

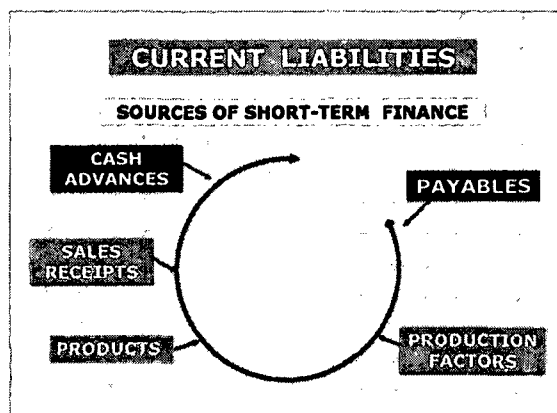


The cyclical nature of current assets is shown by moving clockwise in the diagram. Funds are used for the purchase of materials that become part of inventory. After entering the production process the consumed inputs such as labour, utilities and factory overheads become part of work-in-process inventory (another working capital component). Work-in-process eventually becomes finished product and, prior to sale, is part of finished product inventory. When finished product is sold, it may be

converted to a receivable if the cost of production is not covered immediately by a cash exchange. The receivable is another form of current asset that converts to cash when it is realized.

In whatever form, current assets require financing. This entails costs and reduces profitability. For this reason, it is increasingly the policy of most projects to reduce current assets to the lowest possible level without compromising the smoothness of operations. The JIT (just-in-time) system attempts to match delivery of materials and other production components with the production schedule so that little inventory is carried by the project. However, the possibility of a stock-out situation should also be kept in mind to avoid losses from non-availability of needed current assets when required.

## CURRENT LIABILITIES – SOURCE OF SHORT-TERM FINANCE



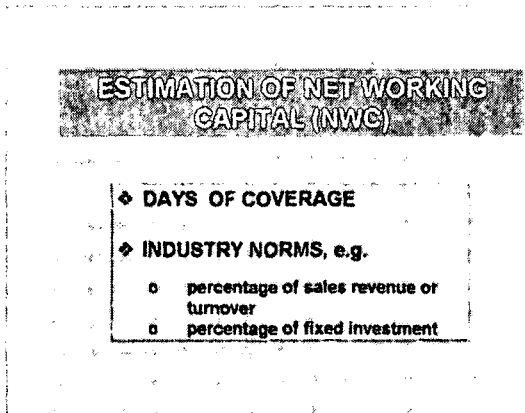
Current liabilities also have a cyclical nature.

There are two suppliers of cash: advances from clients for goods and services to be produced in the future and receipt of goods and services from suppliers on credit.

Advances and suppliers' trade credits are used to purchase production factors, which in turn are converted to products and then sold. Sales receipts are used

partly to cover advances and payables, precipitating a new cycle.

## ESTIMATION OF NET WORKING CAPITAL (NWC)



To determine the magnitude of the investment package and financing to cover increases in working capital it is necessary to estimate the amount of working capital during each project period.

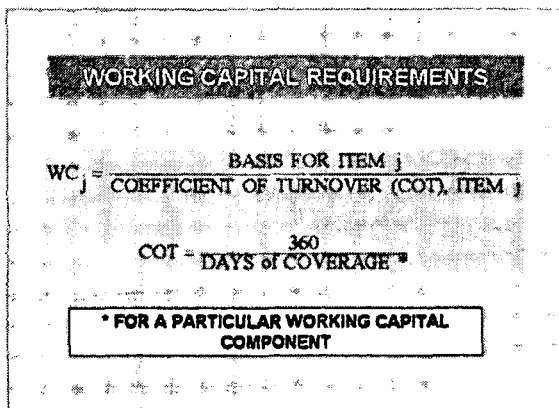
One approach is to estimate the value of each component of current assets and liabilities and the net financing required to cover them. Working capital margin should be covered with long-term funds and the balance with short-term loans.

Margin is a portion of working capital considered to require a more secure form of financing.

**Days of coverage:** Each component of the working capital requires an amount of 'coverage' that can be expressed in number of days. For example, a raw material has a certain rate of consumption during the production phase. Stock is maintained to cover a number of days of production requirement, determined by factors such as the nature of product, production and sales policy, process cycle time, the cost of holding inventory and the set-up or order costs. These issues are discussed in the Technical Module, Plant Capacity-Economic Size, Dynamic Inventory Analysis and Order Quantities. 'Days of Coverage' is a measure of the number of rotations (or cycles) of the asset or liability in a single year.

**Industry norms:** Another way of estimating the working capital is to use industry norms, e.g. a percentage of turnover or sales revenue. The estimate can also be based upon a percentage of the investment package. These factors can be obtained from studies of similar industries.

## WORKING CAPITAL REQUIREMENTS



If the 'days of coverage' method is used to estimate working capital, the basis for each item must be ascertained. In the formula shown, the basis is divided by the Coefficient of Turnover (COT) to determine the working capital required for the item. The COT is the number of days in the year (for simplicity taken as 360 days in this case) divided by the days of coverage of the particular working capital component. For example, 30 days coverage would result in a COT of 12.

Suppose it is estimated that the annual cost of coal for the project is \$36 million; this is the basis for estimating the working capital requirements for coal. Sufficient coal will be kept (on average) in inventory to cover 60 days of production (days of coverage). If there are (approx.) 360 days in a year, then the number of rotations



or cycles for the stock of coal would be 6 (360/60). This is the Coefficient of Turnover (COT) or number of rotations per year. The average value of the coal in inventory would be \$36 million/6 = \$6 million, the basis divided by the COT.

While purchase cost may be the basis for the value of a material such as coal, other components may have other bases depending on their stage of advancement in the operating cycle. For example, the basis for the amount of financing needed to cover work-in-process could be factory cost; for finished goods, it could be production cost. The basis for accounts receivable is not necessarily the sales price but could be the cost of its production plus marketing costs (cost of sales). This is the amount that would have to be invested in order to place the corresponding product in the hands of the customer.

The bases that are employed in the project analysis are at the judicious discretion of the analyst.

## BASES FOR REQUIREMENT OF WORKING CAPITAL

BASES FOR REQUIREMENTS OF WORKING CAPITAL*	
COMPONENT	BASIS
Materials:	Annual purchase cost
Work-in-Progress:	Annual Factory Cost
Finished Products :	Annual Factory Cost + Administrative Overheads
Accounts Receivable:	Annual Production cost + Marketing Cost - (Depreciation + Interest)
Cash-in-hand:	Annual Operating Cost - (materials + factory supplies)
Accounts Payable:	Annual cost of Materials + Factory Supplies + Spare Parts

\* Bases are suggestions only; analyst should apply judicious discretion

The bases presented for determining estimates for each component of working capital are suggestions only. The logic of each formula will be explained, but any project analyst may have different views that may be equally valid. The principle underlying these formulations is estimation of the effects of changes in working capital on cash flows to the most accurate extent.

The bases for requirement of current asset components are directly related to the amount of financing required for creating these assets. For current liabilities the bases represent the amount of liability incurred when the component is received but not paid (or advanced). For a definition of cost terms see the section on Production Costs, the cost system upon which the following are predicated.

**Materials:** Raw materials, semi-finished inputs, components and subsystems are valued at annual purchase cost. This is used for both material assets and liabilities.

**Work in progress:** The basis is factory cost, which is material cost plus labour, utilities, etc. and factory overhead costs.

**Finished Products:** A finished product is may be valued on the basis of factory cost + administrative overheads as this is the amount invested in its creation (profits are only realized upon sale).

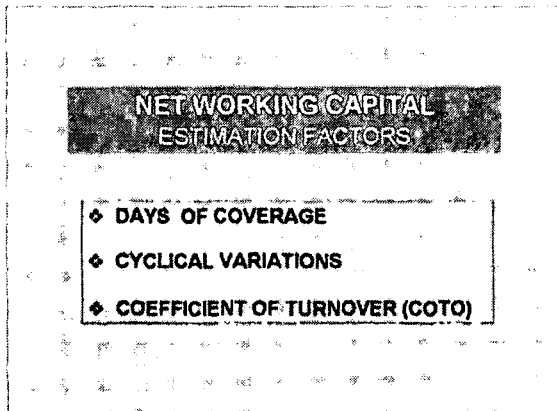
**Accounts Receivable:** Production cost + marketing cost - (depreciation + interest) is the basis for receivables. The assumption is that valuation of products that have been delivered should include the cost of sales and distribution. A caveat is that when the receivable is liquidated the cash inflow is the sales price.

**Cash-in-hand:** Cash-in-hand including liquid short-term financial instruments, used for smooth running of everyday operations, are estimated on the basis of operating cost minus material costs. The annual costs of materials, factory supplies and spares are excluded as they are adequately covered elsewhere.

**Accounts Payable:** The basis is the purchase cost of each respective material item.

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## NET WORKING CAPITAL - ESTIMATION FACTORS



Some elements of working capital estimation bear additional discussion. One reason for the emphasis is that working capital has proved to be one of the major stumbling blocks for new projects.

**Days of coverage:** Using the 'days coverage' approach in the calculation of the investment required for each item of working capital, it is necessary to assign a number of days that represents the rotational cycle for the item. But what is an appropriate number of days? If the

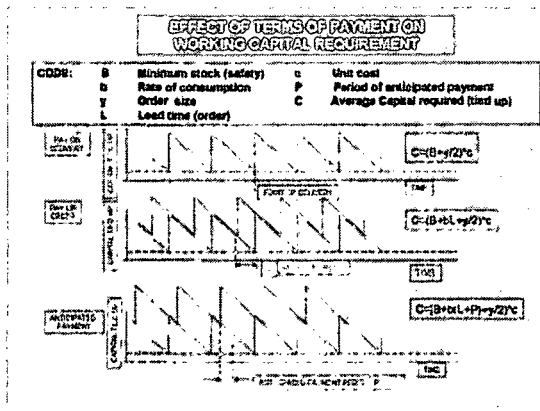
mean (or average) number of days is selected, then there will obviously be additional requirements for working capital when the quantity is above the mean. If the maximum number of days is used, then the financing required would be over-estimated (under-estimated if the minimum is used).

**Cyclical variations:** It should be recognized that if the mean number of 'days coverage' were used as the basis for the working capital estimate, then cyclical variations would require additional financing to cover the peaks. In other words, the working capital requirement calculated on the basis of the mean does not represent, in general, the maximum amount of working capital required. This can be a very important consideration in the financing arrangements for the project. It may indicate the need for more than one source of financing for working capital to cover both long-term and short-term components.

**Coefficient of Turnover (COT):** This coefficient is determined by dividing the number of days in the year by the days of coverage. Suppose, however, that there are only 300 days per year of operations, the remaining 65 days in shut-down state. If working capital is needed to cover 30 days of production, the coefficient would be 10 (300/30). A material with an annual consumption of \$10,000 with 10 rotations per year would be \$1,000. Some care should be exercised in determining the COT so that a reasonable estimate of working capital requirements is obtained.

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## EFFECT OF TERMS OF PAYMENT ON WORKING CAPITAL REQUIREMENT



The terms of payment for working capital items can significantly affect the financing requirements. In the illustration, the scenario at the top represents a situation in which there is a base level of stocks assumed and an order cycle in which payment for the order is made at the time the material is received. The maximum amount of capital tied up in this inventory item is therefore defined by the maximum value of the inventory (amounts tied up in base level inventory plus order quantity). The average capital tied-up is as shown in

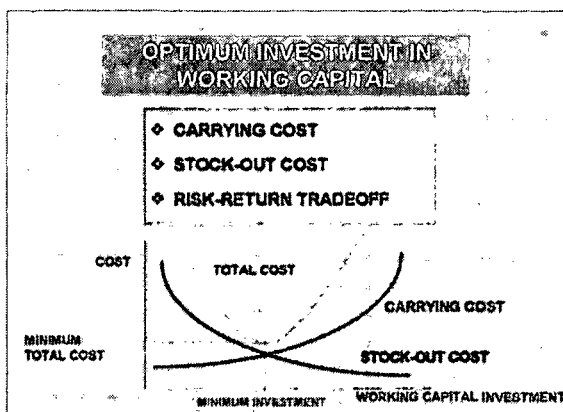
the formula, taking into account the average level of inventory.

In the second scenario it is assumed that payment is made at the time of order, i.e. the payment leads the delivery by the time required between order and delivery. In this case it can be seen that the maximum amount of short term capital tied up in this inventory item is higher than the first case because at the time the order value is paid there is still an inventory value above the base level.

In the last scenario it is assumed that scarcity of the items requires that payment be made in advance, even before the normal order point. The cyclical inventory level at this point is higher still than that of the case above, so that the short-term capital requirements will be increased further. One way that this situation arises is in the importation of raw materials. It is often necessary to open a letter of credit and to fully deposit the equivalent order value at the time of the order.

In each successive scenario not only the maximum is higher, but also the average. When using the 'days coverage' approach it is prudent to be careful to estimate the average days coverage required and also to include plans for financing the remaining cyclical portion of the working capital item.

## OPTIMUM INVESTMENT IN WORKING CAPITAL



In determining the amount to invest in working capital there is a trade-off between carrying costs and stock-out costs.

**Carrying cost:** Financing, shelf-life, obsolescence, pilferage.

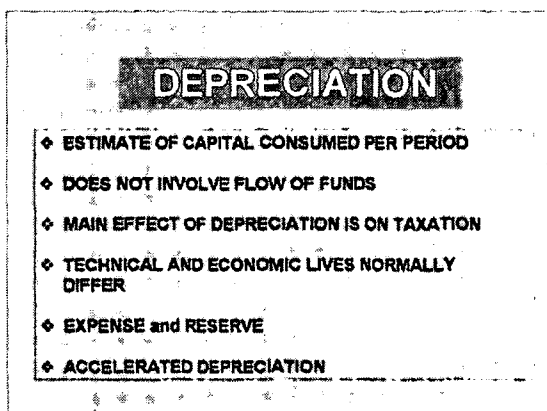
**Stock-out cost:** Losses in sales and profits.

**Risk-return tradeoff:** Risk of stock-out reduces with increased investment in working capital, but the increased investment lowers rate of return.

There is an optimum point where the total cost of investment in working capital is minimized. This is shown in the accompanying graph. The relationships of carrying cost and stock-out cost to working capital investment are shown. There is a level of investment for which total cost is minimized.

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## DEPRECIATION



**Estimate of capital consumed per period:** The idea behind depreciation is the consumption or depletion of capital assets committed to productive activities. The amount of depreciation allowed by taxing authorities is normally intended as a recognition of diminishing value as the capital asset is depleted.

**Does not involve flow of funds:** Depreciation does not involve a cash outflow. It is normally a tax-deductible expense to the income statement for the

portion of capital consumed during a period.

**Main effect of depreciation is on taxes:** The primary impact of depreciation as an expense item is tax savings.

**Technical and economic lives normally differ:** Economic life is defined as the period of time during which a capital asset can be employed economically. It is usually the basis upon which the depreciation rates are set by taxing authorities. The technological life may be different. At the end of its economic life an asset can still be technologically useful. In fact, the economic life is set for a class of assets, e.g. machinery, which does not really match the true economic life for all types of assets in the class.

**Expense and Reserves:** Two types of depreciation accounts can be maintained, one for the expense and another as reserve for depreciation, intended as a fund for replacing the asset at the end of its economic or technological life. In some countries setting up a reserve for depreciation is mandatory and is tied to the allowable depreciation or some multiple thereof.

**Accelerated depreciation:** Depreciation rates are sometimes set to encourage capital investment. When accelerated depreciation is permitted (depreciation charges at a rate greater than the asset's normal depletion), it is a way to increase after-tax cash flow (profit for these periods will appear to decrease). For the benefit of shareholders it may be necessary to adjust income statements with more realistic depreciation to determine profitability. However, astute investors will note the improvement in cash flow, which is really the important result.

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## DEPRECIATION METHODS

### DEPRECIATION METHODS

- ◆ STRAIGHT LINE (SL)
- ◆ STRAIGHT LINE TO SALVAGE VALUE (SLSV)
- ◆ DOUBLE DECLINING BALANCE (DDB)
- ◆ SUM OF THE YEARS' DIGIT (SYD)

Depreciation can be calculated by various methods, specified usually by taxation authorities in the country for a class of assets. The principal methods are (1) *straight-line to zero*, (2) *straight-line to salvage value*, (3) *double declining balance*, and (4) *sum of the years' digits*. Other methods are: depreciation fund, depletion per unit, and machine-hour rate.

The first four methods are described in detail subsequently.

The depreciation fund method is a sinking fund approach whereby an annual amount for a number of years (the economic life) is calculated at a specified rate of return so that the terminal amount matches the needed reinvestment in the asset. The depletion per unit method applies an estimate of the decrease in value of the asset per unit of production. The machine-hour rate method is a similar approach in which the asset is depleted for each hour of use based upon its expected life.

Usually the method to be applied is specified for the type of asset by taxing authorities. In some cases the enterprise is given a choice, but once selected the method usually has to be followed until the end of the asset's economic life.

The choice of depreciation method is usually not within the discretion of the enterprise, but when a choice is permitted generally the faster rates are selected considering the beneficial effects on cash flow if there are profits. Normally the applicable method depends on the type of the asset, its cost, estimated life, type of industry and the legal provisions on depreciation in the corporate laws prevailing in the country.

## STRAIGHT LINE TO ZERO METHOD

### STRAIGHT LINE TO ZERO METHOD

YEAR	ANNUAL DEPRECIATION EXPENSE	BOOK VALUE	ACCUMULATED DEPRECIATION BY END OF YEAR
0	0	1000	0
1	200	800	200
2	200	600	400
3	200	400	600
4	200	200	800
5	200	0	1000

$$\text{DEPRECIATION} = \frac{\text{Initial asset value} - 0}{\text{Depreciation period}}$$

The original cost of the machine is charged to depreciation at equal rates over the depreciation period of the asset. The value at the end of its depreciation is assumed to be zero (no salvage value). The depreciation expense per year is determined by dividing the initial cost of asset by the useful (economic) life of the asset. The accumulated depreciation conveys the provision for value loss in the asset, and helps to arrive at net of depreciation asset value at the end of a given period of time.

This method assumes that during the economic life, the value of the asset is fully consumed and it does not have any salvage value left thereafter.

In the example shown, the original value of the asset is \$ 1,000 and the useful life 5 years. The accumulated depreciation is the sum of depreciation up to and including the year 5.

$$\begin{aligned} \text{Annual depreciation} &= \frac{\text{Initial asset value} - 0}{\text{Depreciation period}} \\ &= \frac{\$ 1,000}{5} = \$ 200 \end{aligned}$$

## STRAIGHT LINE TO SALVAGE VALUE METHOD

STRAIGHT LINE TO SALVAGE VALUE METHOD			
ORIGINAL VALUE \$1,000, ECONOMIC LIFE 5 YEARS, SALVAGE VALUE \$200			
YEAR	ANNUAL DEPRECIATION EXPENSE	BOOK VALUE	ACCUMULATED DEPRECIATION BY END OF YEAR
0	0	1000	0
1	160	840	160
2	160	680	320
3	160	520	480
4	160	360	640
5	160	200	800

Annual depreciation =  $\frac{(\text{Initial asset value} - \text{salvage value})}{\text{Depreciation period}}$

The initial asset value is charged to depreciation at equal rates over the depreciation period of the asset. At the end of its depreciation period the asset is assumed to have some salvage value. Depreciation per year is allowed only on the difference between initial asset value and the expected salvage value; it is calculated by dividing the difference by the number of years of depreciation. The total accumulated depreciation is equal to the initial value of the asset minus its salvage value.

In the example shown, the initial value of the asset is \$1,000, the economic life is 5 years and the expected salvage value is \$ 200.

$$\begin{aligned} \text{Annual depreciation} &= \frac{(\text{Initial asset value} - \text{Salvage value})}{\text{Depreciation period}} \\ &= \frac{\$ 1,000 - \$ 200}{5} = \$ 160 \end{aligned}$$

## DOUBLE DECLINING BALANCE

DOUBLE DECLINING BALANCE				
ORIGINAL COST \$1,000, DEPRECIATION PERIOD 5 YEARS, SALVAGE \$0, DEPRECIATION RATE = SL RATE x 2 = 40%				
YEAR	DEPRECIATION EXPENSE	BOOK VALUE	ACCUMULATED DEPRECIATION	ACC. DEPR. SL
0	0	1000.00	0	0
1	400.00	600.00	400.00	200.00
2	240.00	360.00	640.00	400.00
3	144.00	216.00	784.00	600.00
4	86.40	129.60	870.40	800.00
5	51.84	77.76	922.24	1000.00
5	129.60	0.00	1000.00	1000.00

The rate of depreciation is determined for each year as by calculating the straight line to zero rate and then doubling it. This rate is then applied to the book value at the end of the previous period.

$$\text{Annual Depreciation Rate, \%} = (2) \left( \frac{1}{\text{Depreciation Period}} \right) (100)$$

$$= 2 \left( \frac{1}{5} \right) 100 = 40 \%$$

The amount of depreciation declines with time as the book value diminishes. This is an accelerated form of depreciation. Its advantage is the positive effect on cash flow (lower taxable profit in the early years). If there is a requirement to set up a depreciation reserve equivalent to the depreciation, in the early years the project may not generate sufficient profits to cover the higher amounts of depreciation. The method is justified in the sense that technical depreciation of assets is greater in the early years.

The book value theoretically will never be reduced to zero, so that depreciation could go on forever. To deal with this, usually the system is set up so that when the straight line accumulated depreciation exceeds the accumulated depreciation calculated on the basis of the double declining method the depreciation for that period is, as a maximum, the straight line depreciation. In the example shown, in year 5 the straight-line accumulated depreciation exceeds the corresponding value for the declining balance method; therefore, the straight line depreciation (as a maximum). In this case the available depreciation at the end of year 4 is \$129.60, so this is the amount of depreciation allowed in year 5, reducing the book value to zero (book value should not be reduced below zero).

### SUM OF YEARS' DIGITS

SUM OF YEARS' DIGITS			
ORIGINAL COST = 1,000.00 DEPRECIATION PERIOD = 5 YEARS SALVAGE = 0.00			
YEAR	DEPRECIATION EXPENSE	BOOK VALUE	ACCUMULATED DEPRECIATION
0	0	1000.00	0
1	333.33	666.67	333.33
2	266.67	400.00	600.00
3	200.00	200.00	800.00
4	133.33	66.67	933.33
5	66.67	0.00	1000.00

This is another form of accelerated depreciation. In each year the allowed depreciation is determined on the basis of the remaining life of the asset as a proportion of the total of the digits representing the years during the depreciation period. The formula is shown below.

The depreciation amount reduces each year, as in the double declining method. In this method the value of the asset does reach zero at the end of useful life.

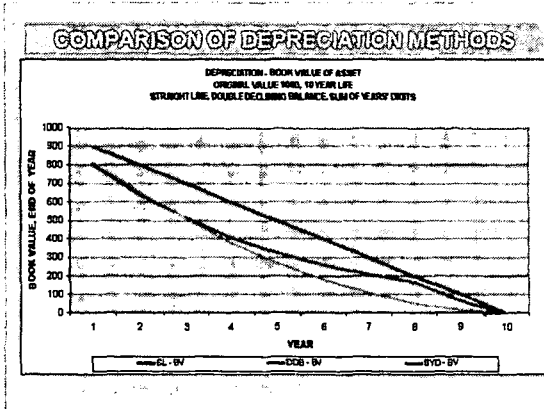
$$\text{Annual depr. rate, \%} = \left( \frac{\text{Remaining life of asset incl. current year}}{\text{Sum of year's digit}} \right)$$

$$\text{Annual depreciation} = \frac{\text{Annual depr. rate, \%}}{100} (\text{Original value})$$

$$\text{Depr. rate, year 2} = \frac{4}{15} (100) = 26.667 \%$$

$$\text{Annual depreciation} = \frac{26.667}{100} (1,000) = 266.67$$

## COMPARISON OF DEPRECIATION METHODS



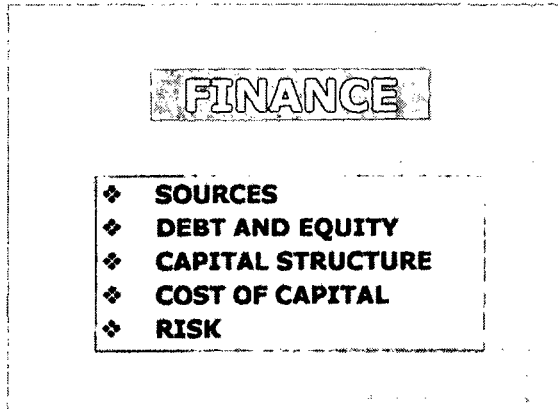
A comparison is shown of the book value of an asset with an original value of 1000 with a 10 year depreciation schedule. Straight line to zero (SL) with depreciation 10% of original value per annum, Double Declining Balance (DDB) with depreciation of 20% of book value at end of preceding period per annum, and Sum of Years' Digits (SYD) with depreciation according to the formula described above.

Although DDB shows the book value (as a result of the cumulative depreciation) declining most rapidly initially, the SYD method provides the greatest benefit over the life of the asset.

The DDB method switches to SL when the cumulative depreciation for DDB becomes lower than that of the SL method. In this case this occurs in year 9 so that the depreciation is 100 in year 9 and the balance of the book value in year 10 (less than 100).



# FINANCE



Any investment project requires financing. Financial assets, funds and perhaps other financial instruments that comprise the financial package, are primarily acquired in exchange for some expectation of return. The sources of finance (whether funds, securities or in-kind) can generally be classified as debt or equity.

The primary challenges to project sponsors are generating funds in the amount and at the time required and achieving maximum amount of coverage

for lender's risk. The issues for the financial designer of the project are (1) the sources of capital, the methods for acquiring debt and equity capital, (2) the capital structure, and (3) the cost of capital.

**Sources** of capital have to be identified by project sponsors, lenders, equity participants, grantors, suppliers and other institutions and individuals providing financial resources to cover capital expenditures. Debt and equity capital is acquired by the project when investors and lenders are identified and comply with their commitments according to their respective shares of the total project and the schedule of disbursements or contributions.

**Debt and equity:** Capital resources committed to an investment project must be covered by financial resources in the form of debt and equity. Debt financing involves borrowing and equity financing connotes ownership. The project incurs debt by borrowing from lenders who are willing to finance part of the project in exchange for future payments that consist of a rental price (interest) and the repayment of principal. Interest, including the effects of fees and discounts, constitutes the return to creditors.

The owners of the project contribute equity capital. There may be more than one class of equity; for each class there is an expectation of return usually defined in the articles of incorporation or in a partnership agreement. Ownership (equity) is secured by infusions of financial resources to the project in the expectation of dividends and other benefits in the form of financial surpluses accruing to them as owners of the assets that can fuel the growth of the enterprise or that can be used for other investment opportunities.

**Capital structure** deals with the types and proportions of financial capital used to cover assets committed to the project. This can involve common equity shares of one or more classes, each conferring certain rights and responsibilities to holders; preferred shares that are usually more a form of debt as holders have no direct claim of ownership of assets but usually stand first in line in case of liquidation; and debt in the form of short, medium and long term loans and other types of debt instruments such as bonds and debentures. The decision on the capital structure usually hinges on the cost (actual or opportunity) of debt and equity. Debt is usually preferred to the extent permitted by lenders when credit markets are soft (rates and terms favourable to borrowers). Equity is preferred when the real (inflation-

adjusted) cost of borrowing is high. Leveraging is the effect of employing debt to exercise control over assets and would usually be employed when conditions for doing so are favourable.

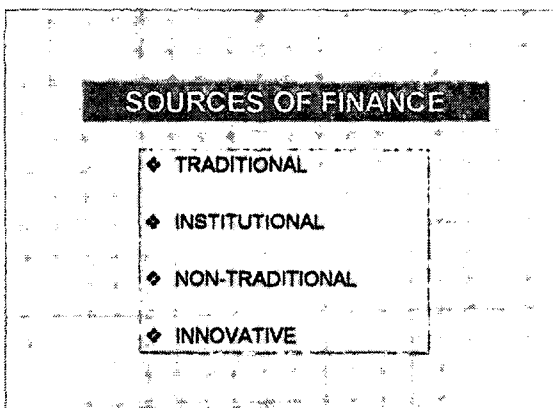
The selected proportion of debt and equity is a function of conditions imposed by lenders, the situation in capital markets and the type of project these sources are expected to finance. When the opportunity cost of equity capital is low (limited opportunities for investment) higher ratios of equity to debt will be favourable. Credit markets are affected by monetary and fiscal policy, so the cost of debt can fluctuate widely.

**Cost of capital** employed is a weighted composite of the costs of each individual source. The project should generate a return that is at least equal to the cost of capital employed. Capital cost is twofold, its "rental" price and its consumption cost. Capital is consumed as the covered assets depreciate in terms of utility and, consequently, value. There is also the cost of employment of capital, a rental charge by owners, who would profit by its employment in alternative uses.

**Risk:** Commitment of financial resources to a project is almost never without risk, which arises both from error and the vicissitudes of nature. The expectations of project financiers, whether lenders or owners, are strongly influenced by the level of participation (what is at risk), the degree of risk and their particular tolerance for risk. Available methods of risk immunization can help to alleviate what might otherwise prove to be insurmountable barriers (see Risk and Uncertainty).

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## SOURCES OF FINANCE



Project sponsors have a number of options for raising funds to complete a project. The path of least resistance dictates that traditional sources would be approached first. Failing that, sponsors may have to become somewhat more creative.

**Traditional:** Traditional sources of finance for projects are equity contributions from the sponsors and borrowing from banks and private lenders. The investment package can sometimes

be broken down into increments that can be financed from different traditional sources. One typical breakdown is to divide the project into long and short term requirements. Typically working capital, or a portion thereof, is financed by merchant banks, and long term financing is covered by commercial or development banks.

**Institutional:** Institutions controlling large pools of funds such as insurance companies and pension funds can be approached, but tend to be conservative in their portfolios.

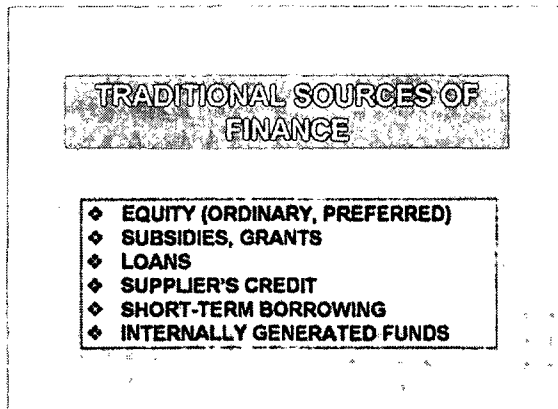
**Non-traditional:** Project sponsors may have to become creative and look toward non-traditional ways of funding their projects. One mechanism finding more favor is leasing, which precludes the necessity for raising large amounts of capital but

usually involves greater overall costs and lack of control over capital assets committed to the project.

**Innovative:** Some innovative approaches can be pursued that offer attractions to lenders such as floating rate instruments that transfer rate risk (usually tied to inflation) to the borrower.

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## TRADITIONAL SOURCES OF FINANCE



The financial structure of an investment package typically comprises both long-term and short-term sources. Investment projects are financed traditionally by a combination of equity and debt. The mechanism can be in the form of private placements or through capital markets.

**Equity:** Equity capital is that part of financing that confers ownership. The residual (or primary) class of capital is normally provided by the sponsors. Other classes of equity participation, with

specified rights to profit distributions, options and warrants, voting privileges, and other conditions, can be incorporated into the capital structure. Ordinary shares can be offered to other participants through private placements or capital markets.

Preferred shares provide a relatively secure return for conservative investors. Project sponsors would issue preferred shares to attract needed capital that might not be available otherwise. They would perhaps resort to this type of financing if conditions are favourable, i.e. at relatively low cost.

**Subsidies and Grants:** In addition to contributions of equity and borrowings from banking institutions, governments and other institutions interested in the economic growth of a country or region can provide financing in the form of grants or subsidies. Grants would ordinarily cover some portion of the fixed assets, and subsidies applied to production costs.

A few words of caution on subsidies and grants. They often are in the nature of equity contributions provided by governments and development institutions and their acceptance confers a degree of ownership. In some cases subsidies or grants are provided practically free of cost to the project and involve often complicated bureaucratic clearances, the commitment of subsidies and grants should not be relied upon. IN either case, provision for a bridge loan - funds that will bridge the gap between the funds required and the amount mobilized - or some provision for short term deposits should be planned well in advance to avoid project overruns due to postponement or cancellation of subsidies and grants.

**Debt:** Loans from investment and development banks are generally secured for covering the 'permanent' capital of the project. Investment bankers may also participate as equity participants. In general, collateral coverage is required as security for such loans. Development banks provide lower cost loans for preferred industries and rely less on collateral security; lower cost to the borrower and risk

are often covered by a greater degree of institutional monitoring.

Other forms of debt financing are possible. The project can issue bonds or debentures (collateralised debt instruments) through private placement or credit markets. The instruments would carry fixed or floating rates. The cost of capital would include underwriting or placement costs.

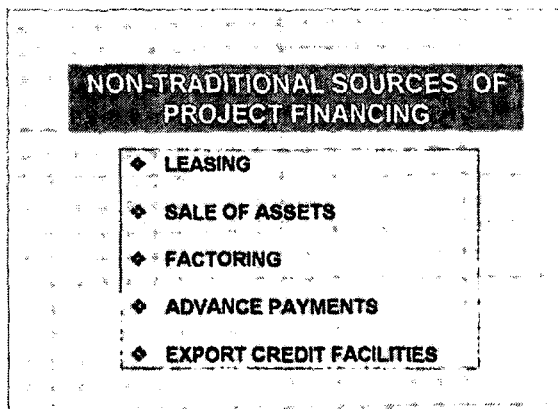
**Suppliers' credit:** Machinery and equipment, and even raw materials, can sometimes be financed with credit lines offered by the supplier. Such credit lines can be of long duration for capital items and of short duration for production. The provision of machinery and equipment by suppliers in exchange for a programme of future payments is another form of project financing. This is, in effect, a type of credit much like ordinary borrowing. Payment schedules are based upon the value of the equipment plus interest and other charges.

**Short term borrowings:** Short-term borrowings for 'working' capital (e.g. export credits) are provided by commercial or merchant banks in the form of short-term notes, credit lines, overdrafts or revolving credits. Overdrafts provide essentially credit on demand. Normally the credit line is limited to a balance specified by the lender and depends on the creditworthiness of the borrower. Revolving credits are similar, but are normally used for more cyclical requirements. A typical example would be export credit in which the bank finances production of the order, and is repaid upon delivery.

**Generated surplus:** Another major source of financing is internally generated surpluses. These surpluses are the cash and other liquid assets that accrue to the enterprise from operations. They can be used for financing the additional working capital required as production increases from start-up levels to full production, or for fixed investments (e.g. replacements or expansions).

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## NON-TRADITIONAL SOURCES OF PROJECT FINANCING



A number of financing options are available that reduce the amount of necessary capital mobilisation at the start of a project. When capital is scarce applying one or more of these options can influence the viability of the project.

**Leasing:** Leasing is a way of acquiring control of an asset without laying out the cost at the beginning of the project. When financial resources are scarce, this may be a viable option for acquiring at least some of the necessary plant and equipment.

Another incentive to lease is that it can have favourable tax consequences. Lease payments are deductible as expense. As lease payments are generally greater than the depreciation that would be allowed if the asset were owned by the project, they will tend to lower the tax burden.

Some of the benefits for the lessee:

- Leasing is roughly equivalent to 100% financing of a project asset and requires no initial capital outlay on the part of the lessee.
- Leasing fees are fixed over lease life and do not ordinarily change with inflation or price escalation.
- Risk obsolescence is shifted to the lessor who is the owner of the asset.
- There can be some positive affect on earnings ratios - e.g. for a given level of earnings the earnings:
- capitalization ratios may be higher than for the owned-assets situation.

Some disadvantages to lessee:

- The residual value of the asset at the end of the lease period reverts to the lessor.
- The lessee's flexibility in maintenance and servicing is reduced; servicing requirements may not correspond to the schedule preferred by the lessee.
- A lease is a senior fixed obligation and may interfere with the enterprise's ability to raise other financial resources.
- Prestige of ownership is lost. The assets can not be used to collateralise loans.
- Leasing is usually considerably more costly than borrowing on a present value basis.

**Sale of assets:** Funds can be raised by an existing enterprise through the sale of assets. The main issue is whether revenue from the sale that is invested in the new project yields more than the old operation. The assets may be under-performing or those that command a high price due to temporary demand. This option should be considered on the basis of the 'with' and 'without' situations. Without the sale the assets produce a certain yield which may be foreseen to deteriorate over time. If the assets are sold the existing operation ceases and the new project commences. It is the difference between these two scenarios that represents the net effect of the sale.

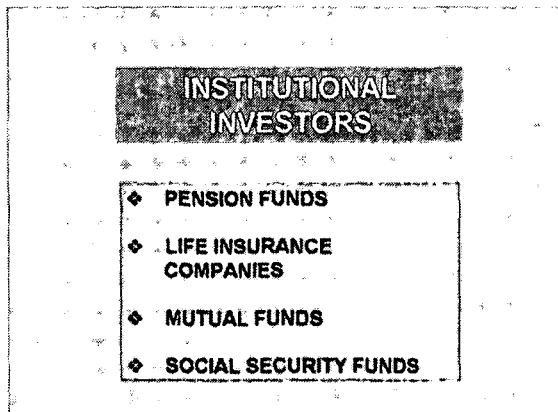
**Factoring:** Funds can be raised by an enterprise for other investments through the sale of its present or future receivables to the financial institution with which it does business. The agreement covers up to a fixed amount of receivables and up to a specified date. The bank assumes the credit risk. Other services may be provided: credit administration, accounting, and client selection. This option is not without its costs. Normally the receivables are discounted by the bank and adjusted for the possibility of bad debts, so that on a present value basis the arrangement is favourable from its point of view.

**Advanced payments:** A third party, (usually a user of project output) makes cash payments for assignment of a set share or right to purchase any part of the output.

**Export credit facilities:** Export/Import banks and other government export credit agencies extends low interest loans, guarantees or insurance against production for export. These agencies may also offer marketing services, trade information and technical assistance.

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## INSTITUTIONAL INVESTORS



Project sponsors may investigate institutional sources of financing when significant amounts of capital are required. These institutions would have to be approached with presentations that would not only explain business prospects but that would alleviate major risk concerns.

**Pension funds and life insurance companies:** These institutions control large pools of financial resources that must be invested to cover the benefits to

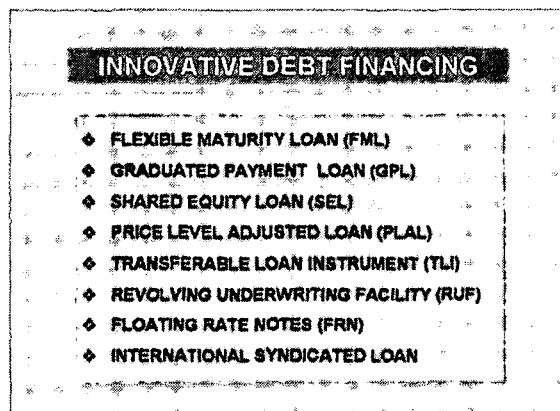
retirees and policyholders. These entities may place funds directly in investment projects, but generally seek rather secure opportunities with well-established companies for expansion and modernization projects. For this reason, such financing would generally not be available to fledgling projects/sectors with higher risk.

**Mutual funds:** Mutual funds are pools of capital resources that are securitised. The fund issues shares to raise financial resources that are then invested. The investments can be of various classes: aggressive, growth, growth and income, conservative. Some of the aggressive funds are used for venture capital, seeking promising high risk-high return projects in which to invest.

**Social security funds:** In some countries social security funds are managed by an entity that seeks to place these funds in relatively secure equity positions. These funds are generally not available to risky fledgling projects/sectors, and particularly highly leveraged projects. A typical placement would be a revenue-generating infrastructure project.

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## INNOVATIVE DEBT FINANCING



Project designers and sponsors may have to look toward non-traditional sources of finance when all else fails. Some of these mechanisms are intended to shed or share risk by financial institutions.

**Flexible maturity loan:** This type of loan is, in some ways, similar to an ordinary annuity type loan. The absolute level of debt service payments remains constant but there are periodic adjustments in the proportions of principal and interest covered by each payment as conditions

change in credit markets. When rates rise, amortization (principal) is reduced and debt maturity increases accordingly. With a sharp increase in rates, if payments do not cover interest on the existing principal, lenders add new principal to the loan balance. This eliminates the need for rescheduling the debt.

**Graduated payment loan:** In this scheme debt service payments vary according to the enterprise's revenue stream. It is possible to have negative amortisation during early phases, i.e. the principal balance increases as debt service payments do not cover both interest charges and principal. Most debt servicing occurs when the project is fully on stream with a normal revenues.

**Shared equity loan (profit sharing loan):** The lender provides below market rates in return for an equity share in the enterprise (equity sweetener or equity kicker). An additional inducement for the lender is direct participation in project management, especially in regard to recording and distributing profits. Foreign lenders need some risk security, such as protection against the possibility of nationalization that would preclude repatriation of profits or capital.

**Price level adjusted loan:** As a means of protecting against the risk of inflation the lender seeks to maintain the real value of the outstanding principal in relation to price index. The borrower wants to index on sales revenue or prices of project output as this will tend to maintain the real level of profit; the lender wants indexing on her/his home country Consumer Price Index (CPI) to maintain the real rate of return. An advantage to the lender in adopting the borrower's point of view is that if the adjustment is tied to sales revenue (to borrower's benefit) the loan is more likely to be serviced on schedule.

The arrangement normally calls for a spread over the real (inflation-adjusted) interest rate fixed by negotiations between parties.

**Transferable loan instruments (TLI):** TLIs standardise the system of transferring lending commitments from primary to secondary markets. It provides an option to international lending institutions to convert loan commitments to one or more transferable instruments, thus extending the range of their portfolio. The TLI has a single repayment date, usually aligned with one of the scheduled repayment dates.

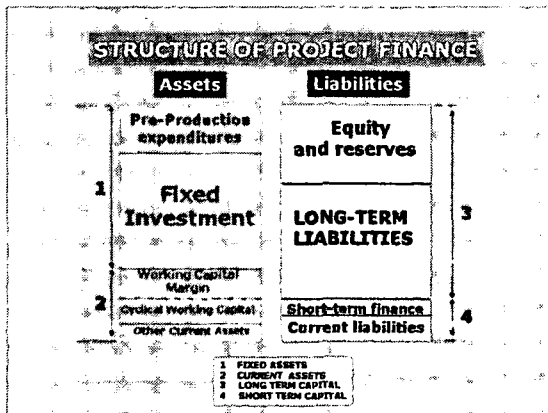
In the illustration (*see Related Documents*) the arrows represent the flow of funds. The red arrows represent the sale of TLI's to banks and the take-down of the loan by the project. The lender repays the TLI's basically with the loan repayments. Creditors have great flexibility in managing their assets. Buyers of TLI's (particularly second and third tier banks) are attracted by the short-term, small denomination, tradable paper.

**Revolving underwriting facility:** An underwriting syndicate, comprised of a number of lending institutions, extends a fixed sum for fixed period of time. The syndicate commits to providing funds for duration of facility. The borrower draws down the funds by selling, at buyer's option, three or six month notes. The notes are marketed by the syndicate, taking any unsold portion on its own books. The borrower has access to long term funds, but at a cost lower than the normal rate on long term instruments. The total cost to the borrower consists of the note discount, the spread in the note (lender's 'commission' consisting of the difference between the rate on the note and the rate to the borrower) and underwriting fees for the paper.

**Floating rate notes:** These are debt instruments that are issued by the borrower (e.g. the project). They carry a current coupon payment that is periodically adjusted to some standard such as LIBOR (London Inter Bank Offer Rate). FRN's place the rate risk upon the borrower. Lenders are thus inclined to accept lower rates.

**International syndicated loan:** For large projects funds can be provided by a syndicate consisting of a number of private banks. One or more banks acts as the lead manager of the syndicate. A proposal of the syndicate specifies the terms and conditions of the loan, which can be the basis for negotiations between the parties. Risk is spread among syndicate members.

## STRUCTURE OF PROJECT FINANCE



The project's financial designer has to determine an appropriate financial structure, the combination of equity and debt that will cover needed assets. A balance sheet, a financial snap-shot of a project at a point in time, describes the structure of assets and how they are covered by a combination of debt and equity.

**Fixed assets:** For the new venture fixed assets are committed plant and facilities. Pre-production expenditures, including

any interests accumulated and capitalised during the construction phase, are usually considered part of the investment package as there are otherwise no funds available to cover them before the revenue-generating phase.

**Current assets:** Current assets represent another part of the investment package.

**Long-term capital:** Equity and long-term financing generally are used to cover the cost of fixed assets and the working capital margin.

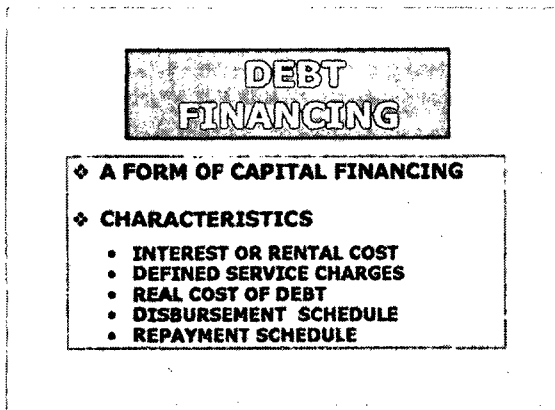
**Short-term capital:** Current liabilities and short-term financing are used to cover a part of current assets.

Working capital, the difference between current assets and current liabilities, has to be covered by long and short-term finance. A part of working capital, usually expressed as the working capital margin, is included as part of the long-term capital. The remaining part of working capital can be financed with a line of credit, perhaps an overdraft facility. However the cost of such a facility can be higher than long-term debt from development banks.

In the illustration the long-term capital covers fixed assets, pre-production expenditures and working capital margin. Short-term capital including short-term finance and current liabilities covers the balance of working capital.



## DEBT FINANCING



**A form of capital financing:** Investment projects are usually partially financed with debt capital. For any form of capital, the cost is at least twofold: the capital must be repaid and there is a charge for its rental. There may also be other charges and fees that increase the cost from the nominal rate. The rate of inflation in the designated and local currencies may play a part. A common advantage of the use of debt capital is that interest paid is a tax-deductible expense.

Leveraging capital with debt, or trading on equity, has its advantages so long as the project can earn more than its cost. However, excessive use of debt financing increases risk.

**Interest or rental costs:** The defined rental cost is interest, usually a percentage rate applied to the unpaid balance at the end of the period prior to that for which the interest is charged. Typically a rate is specified on an annual basis, with charges based on the equivalent monthly or quarterly rate.

**Defined service charges:** Fees and other charges are sometimes added to the cost. There may be placement fees or commitment fees. For example, if the nominal annual rate is 12 % the monthly rate charged is 1%. Premiums may be required for early redemption. In this way the actual percentage rate (APR) is higher than the nominal rate. These costs are often tax deductible.

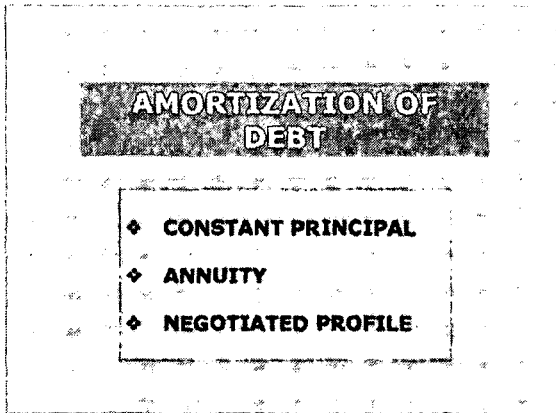
**Real cost of debt:** The real cost of debt can be approximated by comparing current values of receipts with current values of payments and adjusting for inflation. This is discussed further in the section on Cost of Capital. A simple approximate relationship that does account for interest but not for fees and other charges is to reduce the nominal interest by the average rate of inflation in the denominated currency.

**Disbursement schedule:** Term loans are usually taken down by the debtor, or disbursed by the lender, according to a disbursement schedule. In some cases the lender is willing to allow the borrower to take down the loan as needed, so long as interest is paid on the outstanding balance. The disbursement schedule is often predicated on conditions such as the requirement that all equity be committed to the project before disbursements of principal. Borrowers may have to secure regulatory approval or disbursements may be phased according to percentage of work completed.

**Repayment schedule:** Timing and amounts of principal and interest payments are usually prescribed by the lender. Typical schemes are (1) constant principal per period, (2) annuity type with fixed payment amounts and (3) a negotiated plan based upon the capacity of the borrower to repay.

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## AMORTIZATION OF DEBT



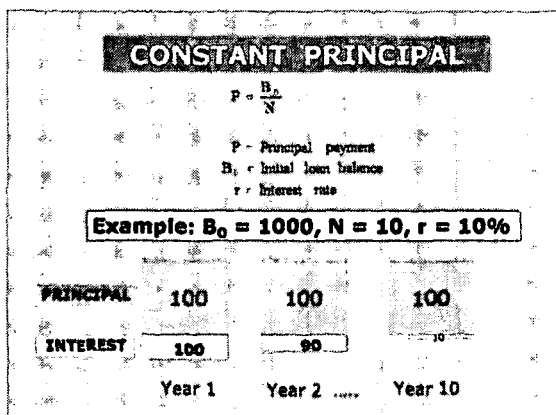
**Constant Principal:** The total debt is divided by the total number of periods or installments in which the debt is to be amortized. Interest is not considered for this purpose. The principal is repaid with interest payments based upon the unpaid balance at the end of period prior to the payment.

**Annuity:** The total debt and interest is repaid in equal installments. The interest component is built into the repayment installment. In the initial years as the

principal amount is high, the interest component in the annuity payment would be high. Gradually the principal component increases and the interest component reduces in the installment, while the total of principal and interest remains constant.

**Negotiated Profile:** This form of amortization of debt poses fewer problems for the borrower. The repayment schedule is negotiated with the lender according to the capacity of the borrower to repay. Cash flow accruals over the project life can be used in these negotiations. Repayments may or may not include the interest; however the interest accrues and, if not paid, is added to the principal balance. Generally borrowers and lenders discuss the cash flow statement in detail; after detailed negotiation, the repayment profile is fixed. One special type of profile loan is an agreement to pay a lump sum at the end of the loan period. Interest would ordinarily be due during the grace period.

## CONSTANT PRINCIPAL

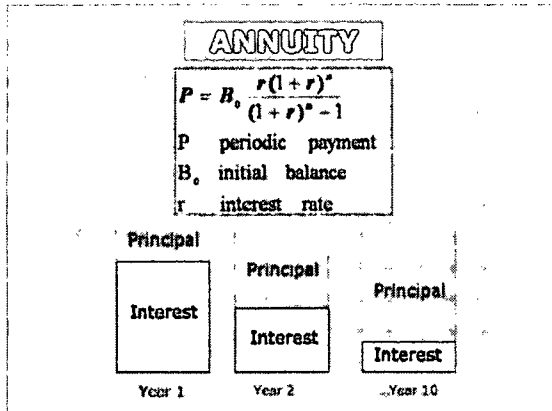


In this amortization scheme the total loan amount is divided by the number of installments on the loan to determine the periodic payment. Interest is generally paid on the outstanding balance at the end of the period preceding the payment. The repayment profile covers only principal repayments. For example, a loan amount of \$ 1,000 with repayment in 10 annual installments requires a repayment of principal of \$100 in each of the following ten years (unless a grace period is granted).

Interest payable on the unpaid balance, assuming the entire loan is taken down at the end of the year preceding year 1, is 10% of \$1,000 or \$100 for the first year, 10% of \$900 or \$90 for the second year, and so on. Interest not paid can, according to agreement, be added to the principal. In such a case interest would accrue on the principal balance plus the capitalized interest.

In some cases the borrower is granted a grace period, with principal repayments starting at a designated point in time. Usually the interest is payable, however.

## ANNUITY



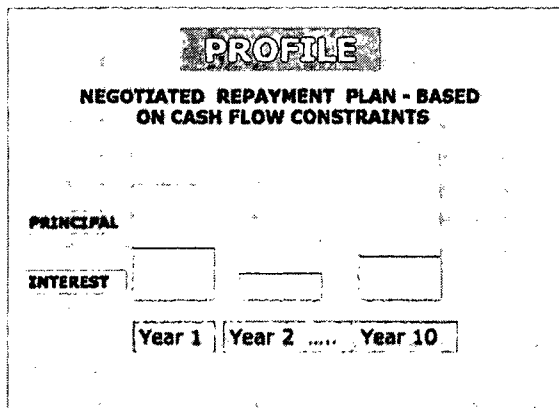
This method for repaying debt involves a repayment in each period that is constant, consisting of both a principal repayment and interest on the unpaid balance. The principal is adjusted so that the total payment is fixed.

The formula is developed for a finite number of periods based upon the initial balance, the interest rate and the number of periods, as shown. The proportions of principal and interest within each instalment vary. In the early periods the

amount of amortization is relatively small, while interest is high. The principal payments increase as the outstanding balance diminishes and the interest portion declines.

No provisions are made in this formula for charges other than interest.

## PROFILE



Lenders and borrowers are not well served when loans are in default. One way to avoid problems associated with early cash flow constraints (learning curve phenomena and market penetration) is to consider designing the repayment schedule in accordance with ability of the project to service its debt. In the negotiated profile the amortization schedule is fashioned in accordance with the amount of free cash flow generated by the project (cash flow after necessary capital investment requirements are

satisfied).

The amount of repayment should take interest payments into consideration. If payment of interest in the early project stages is precluded by the plan, perhaps it can be capitalized by adding to principal balance.

When conditions warrant, and to minimize early cash flow constraints, a grace period may be granted in which only interest payments are due.

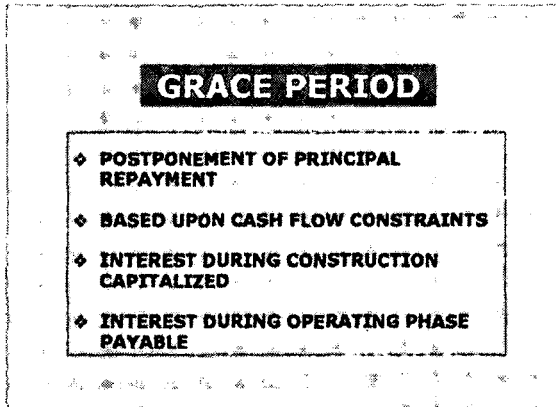
In the illustration the principal payments are designed around the cash flow plan. Interest is due and payable on the unpaid principal balance at the end of the period preceding the payment.

One type of profile loan is the lump sum payment. In this scheme the repayment of principal is at the end of the term of the loan. This is sometimes called a balloon payment, which may or may not include capitalized interest accumulated during the

time the loan is active. After the loan is taken down there is a one time repayment at the end of a designated interval. In some cases the agreement can call for small periodic principal and interest repayments during early periods with the major repayment at the end of the term of the loan. The advantage to the project is relief from heavy debt servicing requirements in the early stages when cash constraints are usually problematic.

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## GRACE PERIOD



To relieve the pressure on project sponsors in the early going, as production inefficiencies are gradually reduced and as markets increasing respond to the project's output, lenders may grant a period of grace, or a moratorium on repayments for a defined length of time.

**Postponement of principal repayment:** The start of principal payments is postponed for a designated number of periods. Usually the grace period defines the amount of time from the first

disbursement to the first repayment of principal. For example, for a project with a one year construction phase, if the loan is taken down initially at the start of the construction phase with a two year grace period, the first repayment would be due at the end of the first production year or the beginning of the second.

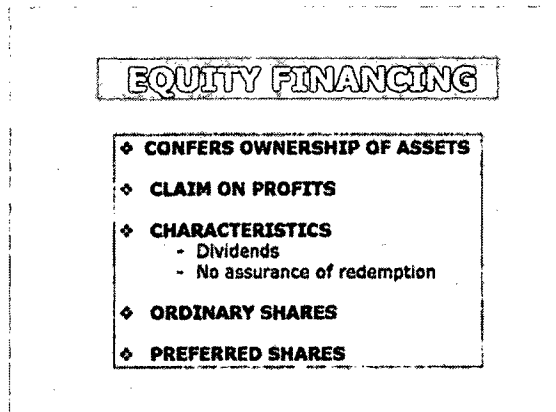
**Based upon cash flow constraints:** The length of postponement of principal payments is based upon the ability of the project to generate sufficient cash to service the debt. Without a moratorium on repayments a project would often lack the capacity to cover its internal cash requirements. Sponsors may then be required to expend scarce resources and energy seeking short term financing to cover cash needs.

**Interest during construction capitalized:** During the construction phase the project generates no cash inflows and usually has limited ability to pay even the interest on the loan. Financial institutions may be willing to capitalize any interest that is due during the construction phase, adding the amounts of interest to the principal as they become due. This compounds interest payments for the sponsors, but is often the only way to cover these expenditures. Such capitalized interest can usually be amortized for tax purposes after the commencement of production.

**Interest during operating phase payable:** Although principal repayments are waived during the period of grace, interest on the unpaid balance after commencement of production is usually payable.

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## EQUITY FINANCING



Equity is usually the part of capital financing brought into the project by the owners. Sometimes lenders swap debt for equity either as an investment promotion measure or because it seems to make good business sense. Equity finance has total claim to profits, but the last right over assets, i.e. the residual value after paying off all the creditors.

**Confers ownership of assets:** An equity position confers ownership of project or enterprise assets, other than those assets

that are leased. Equity usually involves the issuance of shares in the enterprise. How much ownership is conferred for a given amount of equity depends on agreement between all shareholders or partners.

**Claim on profits:** Equity represents a claim on the profits of the enterprise. In some cases any distributions from available funds are limited to the amount of profit for a given period or retained in previous periods. In some business environments there is no link between profits and distributions.

**Characteristics:** Dividends are returns to holders of equity from the cash generated by a project or enterprise. Ordinary dividends are not fixed; the amount and timing is usually the prerogative of a corporate board of directors, or in the case of partnerships by common agreement of the partners. Ordinary dividends are paid if sufficient funds are available. The entire profits earned by the firm are not generally declared as dividends; some amount is retained in the project as reserves for future investment or for other purposes. Shareholders' equity and wealth is thereby increased.

Unlike debt, there is usually no assurance of redemption of equity, unless by prior agreement between the owners. Development institutions sometimes participate as equity holders with the proviso that their stake will be retired at a future date. Shares of equity are normally traded in established markets or between individuals at mutually agreed prices between buyer and seller.

**Ordinary shares:** These shares confer ownership of assets and rights to profits. There may be more than one class of ordinary shares within a given enterprise, with the rights and benefits of ownership determined by agreement. In some cases shares are non-voting or carry differing dividend entitlements.

**Preferred shares:** Generally dividend payouts to preferred shareholders are a fixed amount per share that is set at the time of issue.

Preferred shares are more akin to debt than equity. Preferred equity has a right over profits and assets before ordinary common equity holders can exercise their rights. In case of bankruptcy preferred shareholders are first in line (after creditors) for redemption of the share value at the time of issue.

## DEBT vs. EQUITY

DEBT VS. EQUITY		
	DEBT	EQUITY
SERVICE RATE	FIXED	UNCERTAIN
SERVICE PREFERENCE	YES	NO
CLAIM ON PROFITS	NO	YES
REDEMPTION/REPAYMENT	MANDATORY	UNCERTAIN
LIQUIDATION PREFERENCE	YES	NO
CLAIM ON NET WORTH	NO	YES

The characteristics of debt and equity financing are summarily compared. The comparison can be helpful in deciding on financial leveraging - proportions of debt and equity used to finance the project. The major differences are as follows (only ordinary equity is considered):

**Service rate:** Debt is usually assigned a fixed service rate; floating rates are sometimes specified as a risk transfer or sharing device. There is usually not a fixed rate for equity; the return generally

depends upon profits and the policies of the project management.

**Service preference:** Creditors have preference in regard to debt service; their claims are usually satisfied before payment of dividends to equity holders.

**Claim on profits:** Creditors have no claim on profits, which accrue only to equity shareholders.

**Redemption/repayment:** The repayment of principal to creditors is mandatory; infusions of equity usually have no such claim to redemption. However, in the secondary markets equity can realize its investment at the prevailing prices to be paid by new investors.

**Liquidation preference:** In case of liquidation creditors stand in line before equity holders for repayment of loan balances and interest due. Equity holders have no such standing, with the exception of preference shareholders, whose demands are satisfied before ordinary shareholders.

**Claim on net worth:** Equity holders have claim to the accumulated wealth, or net worth, of the enterprise. Creditors have no such claim of ownership.

## FINANCING CONSIDERATIONS

FINANCING CONSIDERATIONS	
◆	THIRD PARTY GUARANTEES
◆	COMFORT LETTERS
◆	COVERAGE FOR LENDER'S RISK
◆	RISK SPREADING

Lending institutions tend to try to maintain conservative portfolios. They generally prefer to extend credit to secure clients or to clients who can obtain the backing of secure guarantors. Even development banks seek to minimize the risk of defaults on servicing of debt.

**Third party guarantees:** A common form of risk avoidance for lending institutions is the third party guarantee. The guarantor agrees to back up the

lender in case of default, in some cases with collateral. The guarantor may agree to act as the customer of last resort, taking control of unsold product inventory and maintaining the revenue stream so that debt can be serviced.

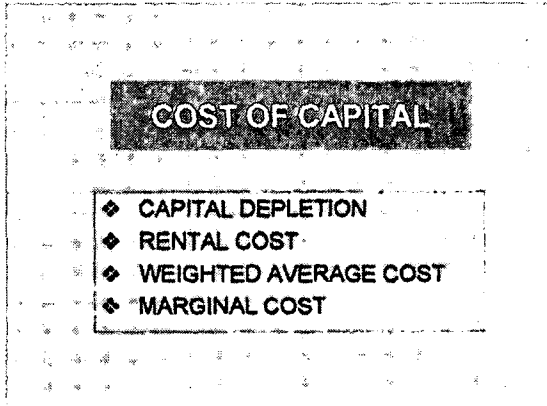
**Comfort letters:** Lenders will sometimes respond favourably to comfort letters, endorsements of the borrower by substantial entities with resources at their disposal that are far in excess of the amount of the loan, short of an ironclad guarantee, but implying that support will be offered as a last resort.

**Coverage for lender's risk:** The most common form of coverage is collateral, pledges by the borrower of assets that will come under the control of the lender in case of default. Sometimes the assets of the project can represent all or part of the collateral. A problem is that fledgling industries are seldom in control of many valuable assets. Sometimes borrowers have to pledge personal possessions, such as land, homes and other things of value.

**Risk spreading:** Risk avoidance is a priority of most financiers. Some risk-spreading devices have been discussed under innovative methods of financing. One method is to issue floating rate instruments, shifting some or all of the rate risk to the borrower. Syndicated loans spread the participation and risk among a number of financial institutions. Lenders can add premiums to riskier parts of the portfolio to compensate for some percentage of defaults. Insurance is available for some types of risk.

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# COST OF CAPITAL



To understand the concept of capital cost it is useful to think of capital in its economic sense - resources employed for the generation of future benefits. The project employs capital resources in the form of buildings, machinery and equipment, transportation and communications facilities. These are basically physical entities that must follow the laws of nature - with use they tend to deteriorate.

**Capital depletion:** The employment of capital, therefore, has a built-in cost of depletion or degradation. Eventually the buildings, machinery and equipment will lose their effectiveness to provide the function for which they were originally intended. Eventually they will have to be retired, dismantled or discarded. This is the justification for technological depreciation and its economic counterpart.

**Rental cost:** In addition to the depletion cost, capital usually has a rental cost. Owners of capital resources expect a reward for foregoing their use in favor of the project.

Capital transfers are usually executed through monetary exchanges. Sometimes an investor provides in-kind capital in the form of good or services. Normally funds are provided in the form of equity or debt and converted to capital resources by the project. The providers of equity and debt expect to be compensated for their capital contributions by the return of their capital plus the rental price. The project, in turn, expects to receive the monetary equivalent of the capital invested plus, at the very least, the rental price of that capital.

To be more precise, an investor placing funds at the disposal of the project does so with the expectation that the monetary capital will be fully returned and in addition the investor will be compensated with a rental amount, or rate of return. The expected rate of return is usually based upon the investor's opportunity cost - the return that could be realized, and that would have to be foregone, if the funds are invested in the project. This would ordinarily be the best alternative opportunity.

For an ongoing enterprise contemplating a new investment, the balance sheet provides the breakdown of the existing 'permanent' capital structure. This can consist of capital stock, retained earnings, reserves, and medium-long term debt. The cost of capital for the project, if it is to be internally financed, is the combined cost of all sources of finance, i.e. the weighted average cost of capital.

For the project to be viable it should generate a return (over and above depletion) at least equal to the (rental) cost of capital. Conventionally the 'cost of capital' is understood to be the rental cost. The challenge, or hurdle rate for the project is the cost of capital.

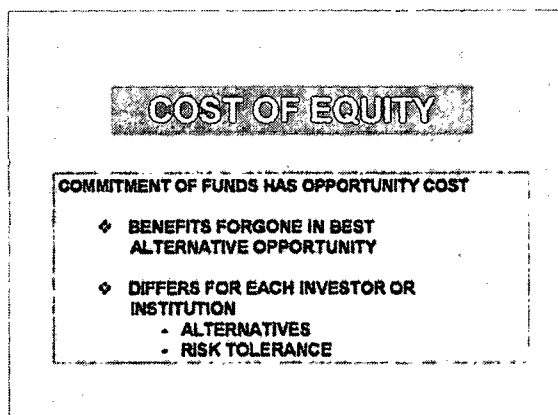


**Weighted average cost:** For a new project each investor (or class) has a particular expectation. Equity participants seek an adequate return on their equity and lenders an acceptable rate of interest. For each of these sources the project should have a rate of return at least equal to the provider's expectation. The cost of all sources can be combined in the form of a weighted average, which then becomes the hurdle or challenge rate of return for the project. It is acceptable for investment only if the project can generate return at least equal to the cost of capital.

**Marginal cost:** The weighted cost of capital for the enterprise might be considerably different from that of the current market. If it is heavily influenced by historical costs (large proportion of fixed interest loans) and the enterprise seeks outside financing when rates are changing, then it might be prudent use the marginal cost as the discount factor.

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## COST OF EQUITY



Equity funds committed by a project sponsor have a cost, both to the investor and to the project. Equity holders expect to be fully compensated by the portion of profits that they receive and the stake that they retain in the enterprise.

**Benefits forgone in the best alternative opportunity:** When an investor commits funds to the project, the opportunity to invest in an alternative is foregone. This is the opportunity cost of equity. As in any other commitment of

capital, the equity contributor would have expected full compensation for the original equity plus a reasonable rate of return based upon what is available in the best alternative investment.

**Differs for each investor or institution:** The opportunity cost differs for each person / institution because the available alternative opportunities and risk tolerance differ. Alternatives and risk tolerance are not necessarily independent. Each investment alternative has its particular types and levels of risk. Risk averse investors will forego opportunities for aggressive but risk-laden projects, or in some cases insist on a higher risk premium than a more aggressive investor. Their normal rate of return expectation is usually more modest than for aggressive investors.

From the enterprise point of view the cost of new equity capital for a project would be the portion of dividends, claim on generated surpluses and residuals accruing to the new investor (perhaps reflected in the market value of equity shares). The equity participant would expect that these accruals would match or exceed her/his particular opportunity cost of capital.

Preferred equity generally has a defined cost. The amount of dividend per share per time period is usually specified when such shares are issued.

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## COST OF DEBT

**COST OF DEBT**

$$K_d = \frac{I(1-T) + \frac{(F-P)}{n}}{P}$$

$K_d$	Cost of debt, % per annum
$I$	Annual interest payable
$T$	Income tax rate, %
$P$	Net amount from debt issue
$F$	Redemption amount
$n$	Number of periods

A cost is incurred by the project on issuing debt instruments to raise capital. The actual cost of debt is not necessarily the interest rate payable at regular intervals to the debt providers.

As explained further in Time Value the real return for the lender, and cost to the borrower, can best be determined using discounting methods, the discount rate that equates the present value of post tax interest and principal repayments (redemptions) with the net proceeds to

the project on issue of the debt. In other words, the future payments to the creditor must compensate the infusion of capital plus its rental price. If third parties are involved (commissions and fees) the borrowers rate and lenders rate are not necessarily the same.

An approximate formula for calculating the cost of debt in terms of a rate per annum is presented. The total cost for the project consists of interest and principal.  $I(1-T)$  is the post tax interest payable, where  $I$  is the interest payable per annum and  $T$  is the income tax rate (interest is normally deductible as an expense and thus the post-tax interest is relevant).  $P$  is the amount of proceeds realized by the project from the debt issue and  $F$  is the amount payable on debt redemption. In case of a bond issue normally the redemption price is equal to the issue price. On a callable bond the redemption may have a premium to compensate bond holders for the shorter (forced) maturity. The term in the denominator ( $n$  is the number of periods or years before the issue matures) is the average debt outstanding.

As a simple example, consider the case that the issue and redemption price is the same. This is typical of bonds that are held to maturity (the original term of the issue).  $P = F$  and the formula shows that the post-tax interest rate  $[I(1-T)]/P$  is the cost of capital. As the redemption price is reduced the cost of capital will also reduce.

## COMPONENTS OF COST OF DEBT

**COMPONENTS OF COST OF DEBT**

- ◆ INTEREST
- ◆ COMMISSIONS
- ◆ FEES
- ◆ DISCOUNTS
- ◆ REDEMPTION PREMIUM
- ◆ MATURITY PERIOD

When debt is incurred the borrower receives funds and then commits to making payments to the creditor. For a note covering the debt there would normally be interest payments and repayment of principal when the note comes due. There are a number of other charges and devices that affect the actual cost to the borrower.

**Interest:** This is the rental charge for the funds placed at the disposal of the borrower. The charge is paid usually at a defined time interval, by month, quarter, year or other time increment. It is usually expressed as a percentage of the outstanding debt balance at the end of the previous period. Normally payments are due at the end of the period.

**Commissions:** These are one time payments to the lender or to brokers or agents for services, usually for arranging the loan agreement or for underwriting a debt issue.

**Fees:** Special charges to the borrower that can be based upon commitment (portion of the loan dedicated to borrower's account but not disbursed) or for placement of the loan. Some of these fees can be in the form of "points" (one percent) of the total loan amount.

**Discounts:** Rather than receiving the full amount of principal, the lender sometimes discounts the loan by a percentage of the principal so that the borrower receives less than the principal. At maturity the full amount of the loan or note must be repaid. U.S. treasury bills, for example, are discounted to the bill purchasers who receive the full face value of the bill at the maturity date.

**Redemption premium:** This is the difference between the amount of the loan or note and the total payment at the time of maturity of the loan or note. The amount can be positive or negative. If positive it represents an additional cost to the borrower. Typically issuers of callable paper enhance the attractiveness by offering premiums over the par (issue) value. To enhance the attractiveness of publicly issued debt instruments the issuers (debtors) often have to sweeten the reward to lenders (purchasers) by offering discounts and /or redemption premiums.

**Maturity period:** Except for revolving credit lines, most debt instruments have maturity dates, a point in time when the principal must be redeemed or repaid to the lender. United States Treasury bills, for example, typically have maturities of 3, 6 and 12 months and notes 2, 5, 10 and 30 years.

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## WEIGHTED AVERAGE COST OF CAPITAL

### WEIGHTED AVERAGE COST OF CAPITAL

$$K_c = K_d(1 - T)W_d + K_e W_e$$

$K_c$  Weighted cost of capital, %  
 $K_d$  Cost of debt, %  
 $K_e$  Cost of equity, %  
 $T$  Tax rate, %/100  
 $W_d$  Weight of debt,  $0 \leq 1$   
 $W_e$  Weight of equity,  $0 \leq 1$   
 $W_d + W_e = 1$

The cost of capital is a benchmark for a project. If the project is able to generate benefits equal to or exceeding the cost of capital it is usually considered a good candidate for investment (see Criteria vs. Indicators). If there is more than one source of capital employed in financing a project the cost of capital is a composite of the costs of the individual sources. The formula shown is a way of combining the returns on each source to determine the weighted average cost (rental cost only).

The cost for each source is multiplied by their respective weights in the total capital of the project. If the cost of debt is tax-deductible its cost is commensurately adjusted for the after-tax situation. Otherwise the tax adjustment term would have to be excluded. The weighted average cost of

capital is the cost of debt (tax adjusted) multiplied by the weight of debt in the capital structure plus the cost of equity multiplied by the weight of equity in the capital structure.

There is not necessarily one cost each for debt and equity. If there were more than one source for either debt or equity, the best approach would be to add terms in the equation for each independent source. The sum of the weights would always have to equal one (1).

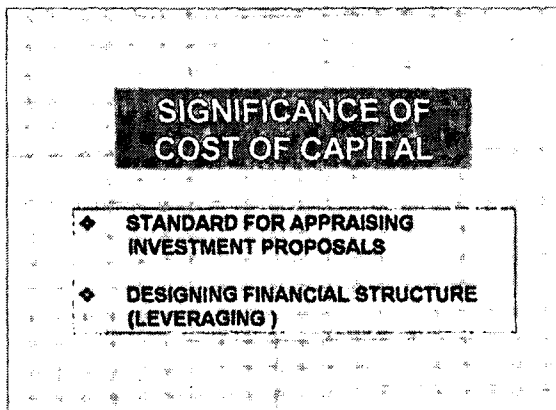
For an existing company the cost of equity is derived from the breakdown of Shareholders' Equity in the Balance Sheet. This may consist of a number of items: capital stock, preferred shares, retained earnings, reserves. The cost for each individual source should be ascertained. Either the actual cost (say, for preference shares) or the opportunity cost can be determined. If the project is to be financed with new equity the opportunity cost for the new investors would have to be considered. A similar situation may exist in regard to debt. The cost of each source (e.g. accounts payable, overdraft, loans, notes, bonds, debentures) would have to be ascertained and inserted into the formula.

Another factor to be considered is the assumption on weights. The traditional weighting system is based on book value (balance sheet amounts) but market value of the capital or the financing plan weights may also be considered. For example, the par (or book) value of common shares is often much different from the market value. In fact in securities markets the capitalization of an enterprise is usually calculated as the market value of common shares outstanding.

An example is provided in *Weighted Average Cost of Capital*, see Related Documents.

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## SIGNIFICANCE OF COST OF CAPITAL

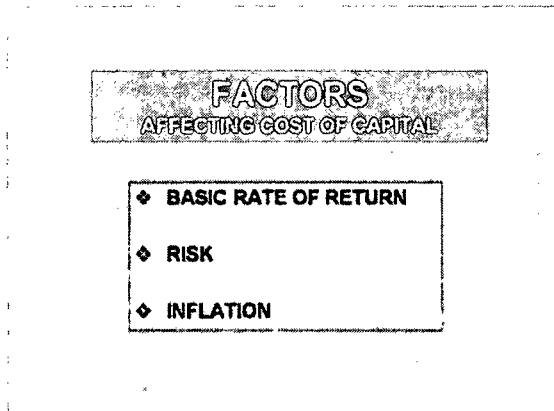


**Standard for appraising investment proposals:** The cost of capital is a benchmark (discount rate) for financial appraisal of investment projects. The rate of return on the investment can be compared with the cost of capital. A project can be considered favourably if the return on investment exceeds the cost of capital used in its financing. This is discussed further in Financial Criteria.

**Designing financial structure (leveraging):** The cost for each source of available capital can provide guidance on the most favourable capital structure for the project, i.e. the proportions of equity and debt to be included in the total investment package. Decisions on capital structure can be refined by considering the costs of the various capital sources: leveraging, or employing high proportions of debt to finance favourable investments considering their tax advantages, or reducing risk with higher proportions of equity capital.

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## FACTORS AFFECTING COST OF CAPITAL



Capital markets are often the reference for the cost of capital. For example, rates of return in credit markets are sometimes used as the basis for determining criteria for investors (see Financial Criteria).

The cost of capital in the marketplace is affected essentially by three factors:

**Basic rate of return:** In both credit and equity markets there is an expected rate of return on investment. Equity markets generally have higher expectation of

return. However, over the past centuries the nominal rate of return on industrial investment throughout the world has changed little. The average nominal price / earnings ratio (the inverse is the rate of return) over that period is about 10 or 12 with increases to 20 and decreases to 6 or 8 at times. The nature of investments is a factor. Investments can be classified basically as aggressive, growth or income, with respective decreasing expectations of return. In credit markets the nominal expectations, in terms of rates of return, are lower, mainly because there is lower risk (discussed below).

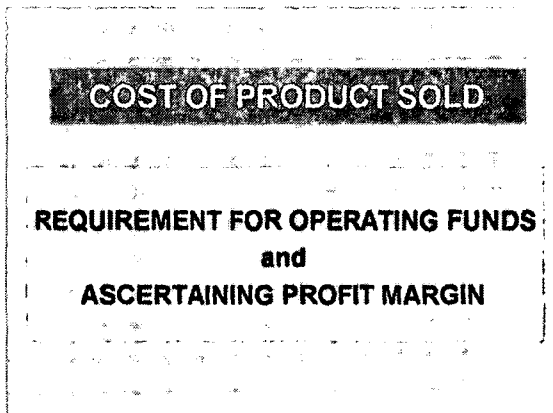
**Risk:** A second factor in the cost of capital is risk. If the environment of capital markets has high economic or political risk investors seek higher rates of return as a hedge against calamity. A risk premium is added to the nominal rate.

**Inflation:** Expected rates of return in capital markets is affected by inflation, which tends to erode the purchasing or economic power of future earnings. The result is that an inflation premium is also added to the nominal rate of return to compensate for the decrease.

To express this relationship, perhaps a bit too simplistically:  $C = B + R + I$

- **C** - nominal market cost
  - **B** - basic expected rate of return
  - **R** - risk premium
  - **I** - inflation rate
-

# COST OF PRODUCT SOLD

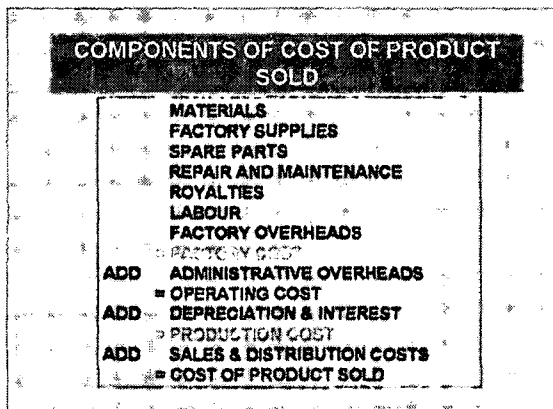


**Requirement for operating funds:** The application of cost of products sold in planning an investment project is to estimate the outflows associated with procurement of goods and services required for production and sales. It is also needed to estimate the requirement of working capital.

**Basis for determining profit margin:** An estimate the cost of product sold is necessary to complete the projected income statements that are used to

determine profitability and tax liability for each operating period to the planning horizon and acceptability of the post-tax profit to the stakeholders. For this purpose estimates of cost of product sold are inserted into projected income statements. The systems of accounting and the resulting taxation should be in accordance with the standards of the host country.

## COMPONENTS OF COST OF PRODUCT SOLD



For project planning purposes the production costs of goods and services produced and sold are estimated for each period. The effect on cash flow of changes in inventory (materials, work-in process and finished goods) are dealt with separately in the projected financial statements.

The following items generally enter into the estimates of cost of products sold (the designations of Factory Cost, Operating Cost, Production Cost and Cost of Product

Sold are based upon the structure in UNIDO Manual for the Preparation of Industrial Feasibility Studies, 1997, and can differ according to local accounting standards) :

**Material:** All direct material costs including the cost of procuring the direct material, e.g. cost of freight and handling.

**Factory Supplies:** Auxiliary materials used for producing the products such as chemicals, additives, oil, grease, etc. as well as utilities such as electricity, fuel, water, etc.

**Spare Parts:** Spares used to maintain and repair production machinery.

**Repairs and Maintenance:** Costs associated with keeping the plant and machinery in good operating condition - can include labour and materials costs needed for the repairs and maintenance.

**Royalties:** May be required if the project has acquired licenses to use patented or unpatented technical know-how, processes or any other assets.

**Labour:** All direct labor costs (labour that enters directly into production). Indirect labour costs are included generally in overheads.

**Factory overheads:** Costs not directly traceable to the product but incurred at the factory level, e.g. factory security systems, air conditioning and heating, salaries of supervisors.

**Factory cost:** The sum total of the above items can be designated as 'factory cost'

**Operating cost:** Administrative overheads, e.g. salaries of administrative staff, expenses related to business administration, are added to 'factory cost'. The total is designated as 'operating cost'.

**Production Cost:** Depreciation and finance charges (interest and fees) are added to 'Operating Cost'. The total is designated as 'production cost'.

**Cost of Product Sold:** Sales and distribution costs, e.g. advertising, sales commissions, maintenance of delivery vehicles, are added to 'production cost'. The total is designated as 'cost of product sold'.

The cost of products sold is comprised of the financial outflows in payment for acquiring resources utilized in creating the project's output as well as sales and distribution costs. In the conventional accounting system of an ongoing enterprise the cost of goods sold is determined by accounting for all of the related materials and services that are associated with production and then adjusting these outlays for changes in inventory (an increase in inventory is deducted from the total outlays to arrive at the resource utilized in producing the goods that were actually sold).

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## FIXED AND VARIABLE COSTS

**FIXED and VARIABLE COSTS**

- ◆ **FIXED COSTS ARE CONSTANT FOR ALL ACTIVITY LEVELS FOR A PERIOD OF TIME**
- ◆ **VARIABLE COSTS VARY WITH LEVEL OF ACTIVITY**
- ◆ **VARIABLE COSTS NOT NECESSARILY LINEAR – SEMI-VARIABLE COSTS**
- ◆ **DISTINCTION IMPORTANT FOR PROFIT ESTIMATES AND PROFIT SENSITIVITY TO CHANGES IN VOLUMES**

Identification of production costs as fixed or variable is necessary for profitability and breakeven analyses. Some items of costs are neither fixed nor variable, but a combination. Others have their own cost pattern with respect to activity level.

**Fixed costs are constant for all activity levels for period of time:** The term 'fixed' in this context signifies a cost that is independent of the level of activity. Examples of fixed cost are salaries paid to administrative staff, depreciation and

rent. They remain relatively unchanged over a significant time, perhaps to the planning horizon.

**Variable costs vary with level of activity:** These are costs that vary directly with the level of activity. 'Variable' implies linearity of cost, i.e. the cost increases proportional to the level of production. When there is zero production ideally a variable cost would also be zero. Examples of variable costs would be raw material cost, packing material cost and labour (in some situations).

**Variable costs not necessarily linear (semi-variable):** Some variable cost elements may be non-linear with respect to level of activity. The consumption efficiency may vary according to level of operations. An example is fuel used to fire a gas turbine. The consumption per kW output varies according to the load level, reaching its maximum efficiency near full load conditions.

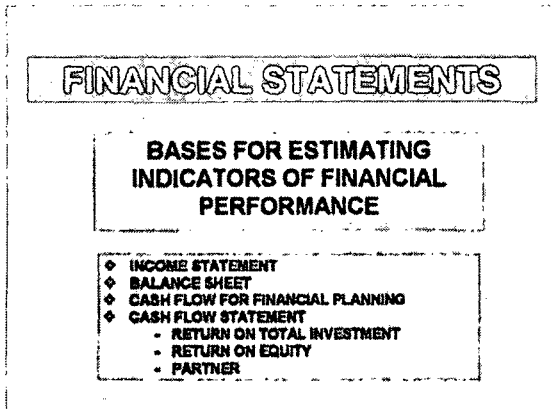
A fixed number of workers may be retained regardless of production level and additional workers taken on as production increases. Other examples of semi variable costs are electricity and telephone, where the cost remains fixed for certain consumption levels but varies with increase in consumption.

**Distinction important for profit estimates:** The exercise of identifying costs as fixed and variable is important for profit projections and sensitivity analysis. Marginal cost (the cost of producing one more unit of output) is important for decisions concerning optimal production plans.

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# FINANCIAL STATEMENTS



Information concerning the project's resource and financial flows are organized in the form of financial statements, which provide concise static (at a point in time) and dynamic (temporally panoramic) views of the projected status of the project. They describe the relationships of assets, liabilities and ownership, income and outlays. Projected indicators of financial performance can be derived from these statements that form an important part of the basis for the decision by sponsors on whether or not to go ahead

with the project.

**Income statement:** The income (profit or loss) statement provides a periodic (usually annual) view of results from operations and other sources versus the exploitation (production) costs. The difference is profit, the basis for determining taxes on income of the project. Another feature of the income statement, and what essentially justifies its employment, is that depreciation and amortization (of intangible assets) are included as costs of operation. While these do not represent real flows of resources or funds, they do affect taxable profit and tax liability, the salient information provided by the income statement. Consequently the income statement is essential for an accurate estimate of the flow of funds and resources, which is the primary means of assessing the viability of the project from the financial point of view.

**Balance sheet:** The projected balance sheet provides a projected snap-shot or static picture of the enterprise at points in time. Normally the balance sheet is developed on an annual basis, and states the status at the end of each fiscal year. It includes an estimate of fixed and current assets and how they are expected to be financed with debt and equity. In each year assets and liabilities are assigned their then estimated current values; assets, for example, the initial cost less any accumulated depreciation. Ownership, or net worth, at any point in time is the difference between the estimated values of assets and liabilities.

The **statements of funds (cash) and resource flows**, conventionally identified as **cash flow statements**, are of prime importance in project appraisal. They register the projected movements of cash and resources caused by the project. Normally, these statements involve inflows and outflows, the net determined as the difference between the totals of each provide a dynamic overview of the project that is most useful for assessment purposes.

These statements are related to the projected Income Statement and Balance Sheet so that they should be mutually consistent. For example, the projected net cash surplus in the Cash Flow for Financial Planning at a point in time should be identical to the value shown in the Balance Sheet. If not, there is an inconsistency in the accounting that should be corrected before proceeding to the appraisal stage.

**Cash Flow for Financial Planning** indicates for each period (construction, operation, decommissioning if applicable) the inflows and outflows of resources and funds in monetary terms. Its purpose is the financial design of the project. The plan is viable if sufficient liquidity is maintained so that there are funds available that are adequate to meet all financial obligations during each project period to the planning horizon.

The following statements concerning the flow of resources and funds, all expressed in monetary terms, are intended to assess the viability of the project in regard to return on investment. The results are discounted to determine Net Present Value and Internal Rate of Return, which are then compared with criteria of investors and other parties with a stake or other interest in the project.

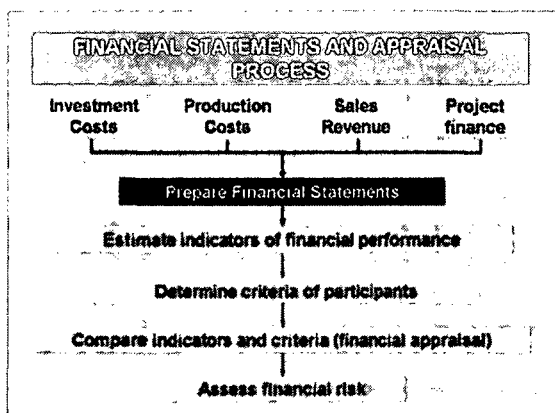
**Cash Flow Statement (to calculate return on total investment):** This statement shows the periodic commitment of resources and the generation of output, expressed in monetary terms. These are the flows related to productive operations (not financial flows). It is used to indicate how effectively the resources committed to the project are able to generate benefits in the form of real output. Its use is the dynamic equivalent of EBITDA (earnings before interest, taxes, depreciation and amortization), a static measure of performance used widely in investment appraisal. Whether or not income taxes (a financial flow) are included in the plan is a matter for discussion; in its most essential form they should be excluded.

**Cash Flow Statement (to calculate return on equity):** This statement shows the periodic flow of resources and funds, identical to the cash flow for financial planning in this respect, including the financial flows. The periodic net flows, expressed in monetary terms, are essentially the benefits (possibly negative) to be realized by the proprietors, or equity participants in general. Their cost is their equity contributions, shown as outflows in each period that they are to be committed. The purpose is to assess the efficacy of the project as an investment from the point of view of the equity participants.

**Cash Flow Statement (to calculate return for a partner):** Each partner to a joint venture has a particular stake and benefit pattern that emerges from the financial plan. The flow plan is similar to the return on equity, but includes only those elements of the total picture that are provided by, and accrue to, the particular partner.

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## FINANCIAL STATEMENTS AND THE APPRAISAL PROCESS



Financial appraisal is the ultimate purpose of preparing financial statements. The process begins with the preparation of pro-forma financial statements covering the entire life of the project to the planning horizon or any fixed number of years based on the requirements of financial institutions. These financial statements reflect the estimated financial performance of the project leading to identification of indicators of financial performance, which may be used to compare the expectations of the various

sources of finance.

Financial statements are organized compilations of estimates on the status and flow of resources and funds committed to and generated by the project. They are used to assess the status of the proposed project at points in time and over the entire temporal panorama of the planning horizon. Typically income statements, balance sheets and several types of cash flow tables are developed for project analysis.

Information for generating financial statements is derived from estimates of investment costs, production costs, sales revenue (and other sources) and project financing.

Financial statements provide (essentially) financial pictures of the proposed project, but perhaps more important are the means of developing indicators of performance that are used for financial appraisal of the project. Appraisal is the process of comparing the projected performance indicators with criteria of sponsors and other interested parties.

Financial statements are built around numerical estimates of values and flows expressed in monetary terms. The physical entities and phenomena behind the numbers are not quite so definitively known or understood as recording of values might imply. In fact, all processes, and particularly those that are to occur only in the future, are subject to uncertainty. When the financial statements are created it is incumbent upon the analyst to have an idea of the degree of uncertainty surrounding any and all of these predictions. This is essential for analysis of risk, the likelihood of an undesirable outcome. Each of the project's elements are independently subject to uncertainty, and considered conjointly provide a means of assessing the possible range and likelihood of outcomes that are of concern to investors.

Each of the financial statements focuses on elements of risk: the income statement and cash flow table for financial planning - on performance risk, the balance sheet showing investment in assets - on business risk and liabilities, and financing of the assets - on financial risk. Risk and uncertainty analysis is discussed in Risk and Uncertainty.

## INCOME STATEMENT

<b>INCOME STATEMENT</b>		
<b>Projected periodic results from operations</b>		
<b>September 2xxx</b>		
<b>TOTAL INCOME</b>		<b>336,000</b>
Sales		
Other Income		
<b>LESS VARIABLE COSTS</b>		
Materials	148,000	
Other variable costs	24,000	182,000
<b>VARIABLE MARGIN</b>		<b>154,000</b>
<b>LESS FIXED COSTS</b>		
Administration	82,000	
Other Fixed costs	18,000	
Depreciation	7,000	114,000
<b>OPERATING PROFIT</b>		<b>40,000</b>
<b>LESS COST OF FINANCE</b>		<b>6,000</b>
<b>GROSS PROFIT</b>		<b>34,000</b>
<b>LESS INCOME(CORPORATE) TAX</b>		<b>14,000</b>
<b>NET PROFIT</b>		<b>21,000</b>

For a new investment project the income statement presents the projected results of operations during a given period. An ongoing company might include sources of revenue and expenditures not connected with operations. The income statement is based upon projected revenues and expenses for the period.

One issue to be regarded is the method of accounting used in statement preparation, cash or accrual. In the cash method, the statement would reflect all cash inflows

and outflows for the period. The accrual method includes any income and expenses incurred, but not necessarily transacted financially, during the period. Which method is better for a particular project is a matter for the analyst. Certainly the accrual method reflects a more accurate picture of actual transactions and flows.

As the income statement includes non-flow items such as depreciation and amortization, and does not include flow items such as principal repayments, its principle utility for project analysis is in the determination of taxes payable. What is of greatest importance to prospective investors is the flow of resources and funds, as discussed in the section on Financial Indicators.

Income and its associated financial indicators are widely accepted in the investment community as measures of performance. In this respect it provides useful information to prospective investors for comparison against benchmarks for the industry. Financial appraisal depends greatly on the data provided by the income statement. One commonly regarded indicator based upon the income statement is break-even, the level of operations at which revenues just cover total expenses (fixed and variable). This is discussed further in Static Indicators.

*Some caveats in the preparation of the income statements (for each period of the production phase).* Revenues should be projected conservatively considering the nature of the industry and possibility of any cyclical fluctuations. Estimates of operating expenses should provide for escalations (relative price increases when constant pricing methods are employed - see Financial Criteria).

In the illustrated income statement the revenue from sales is reduced by operating expenses for the period to determine operating profit, which provides information regarding operating efficiency.

Of major significance in the income statement is the determination of taxes payable. Both depreciation and interest are normally deducted before taxes are determined. In the illustration all operating costs plus depreciation on the assets of the project are deducted to determine Operating Profit. The cost of finance (interest on debt and fees) for the period is then deducted from Operating Profit to arrive at earnings before taxes. Taxes are then estimated at this level and deducted to arrive at the net income.

In some countries there are restrictions on the payment of dividends based upon net income, while in others it is only the availability of funds and the discretion of

directors that determines dividend policy. In fact, it sometimes happens that enterprises pay dividends when there is both insufficient earnings and cash, by borrowing funds for the purpose. Income that is not distributed as dividends is added to reserves.

A distinction should be maintained between earnings, or profit, and cash flow, which is sometimes estimated by adding depreciation and amortization to net profit. With accrual accounting this may be an oversimplification. Free cash flow is a further refinement, with provisions for investment deducted.

## BALANCE SHEET

<b>BALANCE SHEET</b>	
<b>A financial snapshot at 31 December 2xxx</b>	
<b>ASSETS</b>	<b>LIABILITIES</b>
<b>CURRENT ASSETS</b>	<b>CURRENT LIABILITIES</b>
Cash/Bank 18,000	Short-term loans 28,000
Receivables 4,000	Payables 36,000
Inventories 72,000	
<b>FIXED ASSETS</b>	<b>LONG-TERM LIABILITIES</b>
Plant & Equip. 108,000	Long-term debt 20,000
Other Assets 5,000	<b>SHAREHOLDERS' EQUITY</b>
	Capital stock 90,000
	Retained earnings 83,000
<b>TOTAL ASSETS 237,000</b>	<b>TOTAL LIAB + SE 237,000</b>

The projected balance sheet is a statement of information on the financial position of the project at a point in time. It is typically generated at the end of the fiscal year. In project analysis it is useful to develop the balance sheet at end of the construction phase and for each of the operating periods.

The projected balance sheet provides financial information on the values of assets, liabilities and the net worth of the project. The balance is between the value

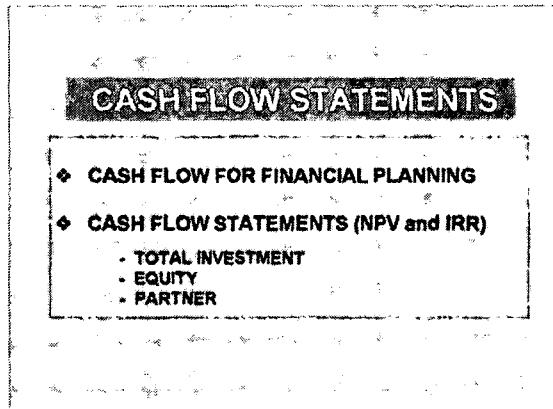
of all assets on the one hand, and their financing on the other. The net asset value is covered by a combination of liabilities (short, medium and long-term) and shareholders' equity or net worth.

The projected balance sheets provide information on the value created by the project for the equity holders, shareholders' equity or net worth, and also measures the quality of the assets. For example, the type of financing covering assets is a measure of stability - fixed assets covered with short-term borrowings is a sure sign of distress. A distinction can be drawn between shareholders' equity, essentially the book value of shareholders' ownership, and net worth, more likely a current or realistic valuation based upon the actual values of assets and liabilities. Book values often do not reflect replacement or market value. This distinction is not universally adopted.

By whatever name, the shareholders' stake in the enterprise is indicated by the difference in value between the assets and liabilities. The equity position can be comprised of capital stock (the value of shares as paid by the original shareholders), retained earnings (undistributed profits) and various reserves such as sinking funds and reserves for depreciation. In some countries the depreciation expense must be matched by a corresponding amount (or some derivative thereof) converted to depreciation reserve. Aside from the capital stock the designation and amounts of equity components is largely a bookkeeping exercise. No funds change hands when retained earnings are converted to reserves, and vice versa.

Book value, or shareholders' equity per common share, is of interest for sponsors when contemplating disposal of shares. Often market prices of shares are tied to this indicator.

## CASH FLOW STATEMENTS



These projected statements form the core of project financial analysis. They are the source of static and dynamic indicators that are essential for project appraisal. They include the flow of funds and 'real' resources. Real resources are goods and services used and generated by the project. In all cases the flows are expressed in monetary terms.

The cash flow statements are related to the other financial statements: Income Statement and Balance Sheet. The three

statements should therefore be mutually consistent. For example, the projected net cash surplus in the Cash Flow for Financial Planning at a point in time should be identical to the value shown in the Balance Sheet. If not, there is an inconsistency in the accounting that should be corrected before proceeding to the appraisal stage.

### Types of Cash-flow Statements:

**Cash Flow for Financial Planning:** All flows are included, real and financial. Real flows represent the values of resources used and generated. Financial flows are the capital inputs, repayment of debt and disbursement of dividends. The net cash flow for any period can be positive or negative. This statement provides information on project liquidity, i.e. whether enough funds are generated (internally or externally) to cover the financial needs of the project over its lifetime. For the project to be financially liquid the cumulative cash flow should be non-negative in all periods.

**Cash Flow Statement - Total Investment (NPV and IRR):** This statement includes only the operational cash flows (see OCF, Dynamic Indicators) caused by the productive operations of the project, e.g. investment outlays, operational costs (raw materials, labour, etc.), revenues from sales. It is used to indicate how effectively the resources committed to the project are able to generate benefits in the form of real output. Whether taxes should be included is a matter for discussion (see also Static Indicators, Debt Service Coverage Ratio). Flows induced by financing of the project (loan disbursements, repayments, interest, dividend, etc.) are omitted.

**Cash Flow Statement - Equity (NPV and IRR):** This statement includes both "operational cash flows" and flows caused by external financing - loan disbursements, repayments and interest. From the financial flows equity payments are deducted and dividends added back.

**Cash Flow Statement - Partner (NPV and IRR):** A statement can be prepared for each partner in which the relevant flows for that partner only are shown. These flows should include capital outlay of the partner (as an outflow), dividend payments, a share in post-dividend cash surplus or deficit for each period and a share of residual value as inflows.

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## CASH FLOW TABLE FOR FINANCIAL PLANNING

CASH FLOW FOR FINANCIAL PLANNING					
SOURCES OF CASH (INFLOW)	CONSTRUCTION		OPERATIONS		
	Year 0	Year 1	Year 2	Year 3	Year n
EQUITY	400	200	0	0	0
LOAN	740	520	0	0	0
SALES REVENUE	0	0	725	800	0
OTHER INCOME	0	0	80	75	0
RESIDUAL VALUE	0	0	0	0	200
<b>TOTAL INFLOW</b>	<b>1140</b>	<b>720</b>	<b>775</b>	<b>875</b>	<b>200</b>
<b>USES OF CASH (OUTFLOW)</b>					
INCREASE IN FIXED ASSETS	1027	683	0	0	0
INCREASE IN CURRENT ASSETS	0	47	29	19	0
OPERATING COSTS	0	0	378	400	0
MARKETING COSTS	0	0	30	30	0
INTEREST	60	120	181	191	0
INCOME TAX	0	0	20	30	0
LOAN REPAYMENT	0	0	60	80	0
DIVIDENDS	0	0	10	80	0
<b>TOTAL OUTFLOW</b>	<b>1140</b>	<b>850</b>	<b>726</b>	<b>721</b>	<b>0</b>
<b>NET FLOW (INFLOW - OUTFLOW)</b>	<b>0</b>	<b>-130</b>	<b>47</b>	<b>154</b>	<b>200</b>
<b>CUMULATIVE CASH FLOW</b>	<b>0</b>	<b>-130</b>	<b>-83</b>	<b>31</b>	<b>231</b>

In the example the sources and uses of funds are shown for each period. In this case the first two periods comprise the construction phase, building and commissioning the plant. Basically capital funds flow in and cover the outlays for capital facilities. Interest is payable during construction and usually is included in pre-production expenditures (part of the increase in fixed assets in this example).

In the operating periods sales revenues and other income appear as inflows.

Outflows include incremental current assets, operating and marketing costs, interest, taxes and payment of dividends. A surplus of 47 and 154 are generated in years 2 and 3 respectively. In the last period n, which might be the year beyond the planning horizon, provision is made for the residual value of all assets (minus outstanding liabilities). Although these assets and liabilities might not actually be liquidated, their values should be included for reasons related to determination of performance indicators as discussed in Dynamic Indicators.

The last line shows the cumulative buildup of financial surpluses. As discussed in Dynamic Indicators and Criteria vs. Indicators, the cumulative value is an indicator of financial liquidity.

## DISCOUNTED CASH FLOW TABLE - TOTAL INVESTMENT

DISCOUNTED CASH FLOW TABLE - TOTAL INVESTMENT					
SOURCES OF CASH (INFLOW)	CONSTRUCTION		OPERATIONS		
	Year 0	Year 1	Year 2	Year 3	Year n
EQUITY	400	200	0	0	0
LOAN	740	520	0	0	0
SALES REVENUE	0	0	725	800	0
OTHER INCOME	0	0	80	75	0
RESIDUAL VALUE	0	0	0	0	200
<b>TOTAL INFLOW</b>	<b>1140</b>	<b>720</b>	<b>775</b>	<b>875</b>	<b>200</b>
<b>USES OF CASH (OUTFLOW)</b>					
INCREASE IN FIXED ASSETS	1027	683	0	0	0
INCREASE IN CURRENT ASSETS	0	47	29	19	0
OPERATING COSTS	0	0	378	400	0
MARKETING COSTS	0	0	30	30	0
INTEREST	60	120	181	191	0
INCOME TAX	0	0	20	30	0
LOAN REPAYMENT	0	0	60	80	0
DIVIDENDS	0	0	10	80	0
<b>TOTAL OUTFLOW</b>	<b>1027</b>	<b>719</b>	<b>617</b>	<b>670</b>	<b>0</b>
<b>NET FLOW (INFLOW - OUTFLOW)</b>	<b>113</b>	<b>41</b>	<b>158</b>	<b>205</b>	<b>200</b>
<b>CUMULATIVE CASH FLOW</b>	<b>113</b>	<b>154</b>	<b>312</b>	<b>517</b>	<b>717</b>

The return on total investment, a measure of how effectively the resources committed to the project are employed, is determined by analyzing the resource flows. For this reason this type of analysis is quasi-economic. In the form shown, the flows are equivalent to the Operational Cash Flow (see Dynamic Indicators, OCF).

Although this analysis deals essentially with flows of real resources committed to the project (land, buildings, machinery and equipment) the values are expressed

in monetary terms. The values of resources used in production and the output generated are similarly expressed.

Comparing this example with the cash flow for financial planning, all of the financial flows are expunged - the inflow of capital funds, interest, loan repayments and dividends. Income tax is highlighted. Although these taxes remain part of the flow in the example, eliminating taxes would conform better to the idea behind EBITDA, the static equivalent used in financial markets to assess the efficiency of employment of capital resources. However, the OCF may be more appropriate for some indicators, for example the Debt Service Coverage Ratio described and further discussed in

Static Indicators. In all cases OCF as defined here is used to derive the dynamic indicators for return on total investment (see Dynamic Indicators - Return on Total Investment).

Another technicality is the inclusion of financial transactions such as changes in receivables and payables in the incremental working capital (current assets and current liabilities). Ideally this analysis would only include changes in physical inventories. From a practical point of view the financial increments usually do not much affect the analysis and are traditionally included.

When financial transactions are excluded the investment in assets appear as outflows. Positive values during the production phase represent the net benefits generated by the assets. Some production periods might show negative flows, which signify that the resources generated are less than those employed in production. This is (or should be) quite rare.

In regard to the last line, cumulative flow, the significance is the coverage of resources committed by resources generated or created. The point at which the value changes from negative to positive (generated resources match committed resources) is the payback period (see Static Indicators, Payback Period).

## DISCOUNTED CASH FLOW TABLE - EQUITY

DISCOUNTED CASH FLOW - EQUITY					
SOURCE OF CASH (INFLOW)	CONSTRUCTION		OPERATIONS		
	Year 0	Year 1	Year 2	Year 3	Year 4
EQUITY	400	200	0	0	0
LOAN	746	623	0	0	0
SALES REVENUE	0	0	723	800	0
OTHER INCOME	0	0	68	75	0
RESIDUAL VALUE	0	0	0	0	200
TOTAL INFLOW	746	623	773	875	200
USES OF CASH (OUTFLOW)					
INCREASE IN FIXED ASSETS	1087	643	0	0	0
INCREASE IN CURRENT ASSETS	0	47	68	58	0
OPERATING COSTS	0	0	378	400	0
MARKETING COSTS	0	0	30	30	0
INTEREST	59	123	181	188	0
INCOME TAX	0	0	25	30	0
LOAN REPAYMENT	0	0	50	50	0
DIVIDENDS	0	0	18	20	0
TOTAL OUTFLOW	1146	813	728	678	0
NET FLOW (INFLOW - OUTFLOW)	(400)	(200)	67	204	200
CUMULATIVE CASH FLOW	(400)	(600)	(543)	(339)	0

The concept of cash flow can be applied to analyze the perspective of investors. From the point of view of an equity participant (an owner) funds are fed into the project, which presumably commences to function financially according to plan. What is the plan? It is basically the cash flow for financial planning. This is presumably viable if it is adopted - it is this plan upon which the position of investors collectively can be analyzed. The costs and benefits that are described in this plan accrue to no one but the owners.

In the example, the cash flow for financial planning is the starting point. The numbers in the example are slightly modified to reflect the capital inflow as partly equity and partly the take-down of loan principal. To derive the position of the equity participants it is necessary to consider the equity contributions, from their point of view, as outflows. This is effected by deleting the values of equity input - equivalent to subtracting these values in each period from the net flow. Another slight modification is that dividends are also excluded, as the project should be 'credited' with having generated dividends. In any case the recipients of dividends are the owners, or equity holders.

Inflows and outflows are designated in this case as benefits and costs from the owner's perspective.

The net effect is that the contributed equity appear as outflows and all of the net flows of the project, with the exception of dividends, as inflows. Some of these values may be negative, signifying that for that period benefits did not match costs.



Similar to the return on total investment the cumulative value indicates the point in time at which benefits match costs.

One factor that bears mentioning at this point, and which will be expanded upon later, is that in the business environment there is a fundamental assumption that all available funds are destined for reinvestment and not for consumption. If this is not a valid assumption, special considerations must be employed in the assessment of the project.

## DISCOUNTED CASH FLOW - JV PARTNER

DISCOUNTED CASH FLOW - JV PARTNER					
SOURCES OF CASH (INFLOW)	CONSTRUCTION				
	Year 0	Year 1	Year 2	Year 3	Year n
NET FLOW (INFLOW - OUTFLOW)	0	0	47	154	200
JV PARTNER'S SHARE (60%)	0	0	28.2	92.4	120
JV PARTNER'S OF DIVIDENDS	0	0	0	25	0
INFLOW FOR JV PARTNER	0	0	33.2	117.4	120
JV PARTNER'S EQUITY	(240)	(120)	0	0	0
NET FLOW, JV PARTNER	(240)	(120)	33.2	117.4	120
CUMULATIVE FLOW, JV PARTNER	(240)	(360)	(326.8)	(209.4)	7

Each partner to a joint venture is party to an agreement on ownership and participation. A partner may contribute some proportion of total equity but be granted by agreement some other proportion of ownership or shares.

In any case, the partner's perspective can be analyzed in a manner similar to that for the combined equity participants. The partner is responsible, in effect, for a given percentage of the costs and the recipient of and agreed-upon percentage

of the benefits (usually the same percentage as costs).

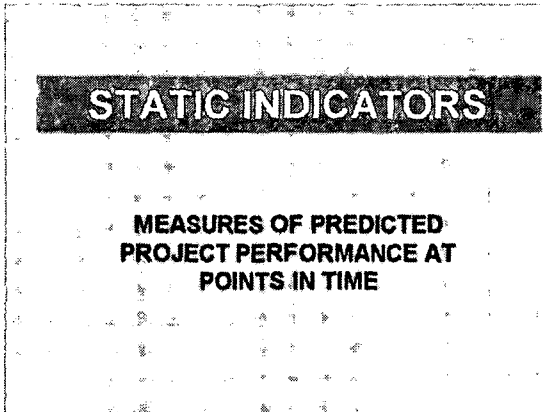
In the example the starting point is net flow from the cash flow for financial planning. The total equity contributions are 400 in the first year and 200 in the second. The JV1 is to contribute 60% of equity and will have 60% stake in the enterprise (60% of the ordinary shares), but by agreement will receive only 50% of the dividends.

The JV partner's position is then determined as follows:

Inflow: 60% of net flow (including salvage value) plus 50% of dividends.

Outflow: 60% of equity investment.

# STATIC INDICATORS



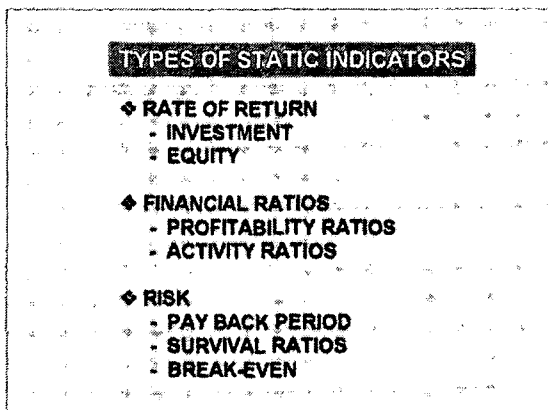
Indicators of predicted financial performance of an investment project are required to assess its financial viability. Indicators can be classified into two broad categories: static and dynamic. Static indicators are essentially financial snapshots, or measures of the predicted state of the project at discrete points in time. Dynamic indicators are temporally panoramic, taking into account in a single measure the predicted performance over the entire span of the project's life to the planning horizon.

Static indicators are more familiar to most investors as they are utilized widely in capital markets for appraising the value of financial instruments, both debt and equity.

These indicators are divided into three categories: rate of return, financial ratios and risk indicators. Indicators of existing enterprises are not always an appropriate benchmark for a new project. Markets have a way of swinging between extremes of pessimism and optimism, so that the ratios and other indicators can easily lose their significance. If such benchmarks are to be used, they should be averaged over an extended period (e.g. moving average) to remove cyclical extremes.

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## TYPES OF STATIC INDICATORS



In project analysis only a limited number of the many ratios utilized in the financial world are applicable. Most indicators of this type have the purpose of detailed analysis of an ongoing enterprise. Here the intent is to assess the viability of an investment proposal.

Investors are generally interested in expected returns and on the risks associated with realizing the expected returns. Static indicators can be derived from financial information dealing with

each of these concerns. They have the advantage of simplicity but the disadvantage of limited applicability for a new investment; the analyst is confronted with the issue of what point in time provides the most representative indicator.

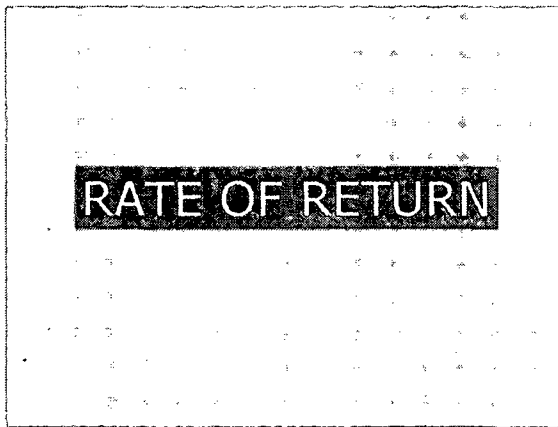
**Rate of return:** These are measures of the effectiveness of committing resources to the project. The return on investment deals with all of the committed assets; the return on equity is concerned only with the owners' capital contribution.

**Financial Ratios:** These ratios measure profitability with regard to sales revenues and turnover of inventories and receivables. Another measure looks at sales revenue in regard to assets, i.e. the effectiveness of assets in generating sales revenues.

**Risk-related:** Three types of indicators are used as risk assessment tools. The payback period indicates the length of time necessary to recover the investment; leverage and liquidity ratios are measures of the survivability of the enterprise in regard to meeting financial obligations; break-even is an indicator of the degree of safety of the operating level in regard to operating loss.

Break-even is not presented here as it is covered in some depth in the section on Risk and Uncertainty.

## RATE OF RETURN



These are measures of the effectiveness of committing resources to the project. The return on investment deals with all of the committed assets; the return on equity is concerned only with the owner's capital contribution.

## RETURN ON INVESTMENT

**RETURN ON INVESTMENT**

- ◆ RATIO OF ANNUAL NET PROFIT PLUS INTEREST TO TOTAL CAPITAL INVESTED
- ◆ BASED UPON OPERATIONS ACCOUNTS

**RETURN ON INVESTMENT (ROI)**

$$\text{RoI, \%} = 100 \left( \frac{\text{Net profit} + \text{Interest}^*}{\text{Total investment}} \right)$$

\* adjusted for tax ?

Return on Investment (RoI) is defined as the ratio of annual net profit to total capital invested. For appraisal purposes this ratio would be calculated for each year to the planning horizon. The total capital invested should include fixed assets, pre-production expenditures and working capital

The ratio is determined by dividing net profit after tax plus interest by the total invested capital. The rationale for adding back the interest is that the indicator is

supposed to be independent of financing considerations.

Whether or not interest should be adjusted for taxes by the factor (1-T), where T is the tax rate, is a matter of preference and practice extant in the country. Adding back the interest multiplied by (1-T) rather than the full amount of interest in each

period takes into account the reduction in taxes resulting from the deductible interest expense.

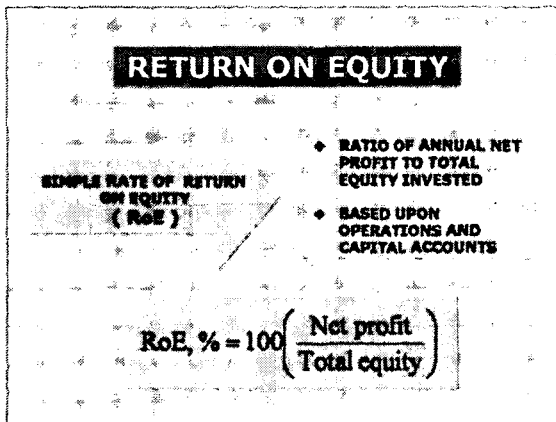
The data necessary for calculation of this indicator is found in the income statement (profit) and in the balance sheet (initial investment).

RoI can be used in comparing mutually exclusive projects competing for the same investment. For independent project appraisal RoI provides an indication of the project's capability to provide returns sufficient to meet the cost of capital invested in the project.

As it is a static indicator covering only one project period, the question of which period is representative has to be resolved. Usually a period is selected for which production has reached normal full production levels.

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## RETURN ON EQUITY



**RETURN ON EQUITY**

**SIMPLE RATE OF RETURN ON EQUITY (RoE)**

- ◆ RATIO OF ANNUAL NET PROFIT TO TOTAL EQUITY INVESTED
- ◆ BASED UPON OPERATIONS AND CAPITAL ACCOUNTS

$$\text{RoE, \%} = 100 \left( \frac{\text{Net profit}}{\text{Total equity}} \right)$$

Return on Equity (RoE) is defined as the ratio of the annual net profit for equity holders to the total equity invested in the project. The data for RoE is taken from the financial statements - profit from the income statement and equity from the balance sheet. RoE is based upon profits and not dividends. The planned distribution, and the rate of return based upon dividends, is another measure that may be of concern, particularly for preferred shareholders. The rate of return based upon dividends may be higher or

lower than RoE depending on the planned dividend policy.

RoE provides a basis for assessing the project in relation to the cost of capital of equity investors. As a static measure covering a single operating period, the same problem exists as with the RoI - which is the most appropriate planning period to select. One possibility would be to take an average, but perhaps a better approach is to select a representative period, one in which the planned level of production is at the full planned capacity.

A similar approach can be used for determining the RoE from the point of view of a partner. In this case the profit and equity would be the partner's share of each.

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## FINANCIAL RATIOS

### FINANCIAL RATIOS

Values of financial ratios are derived from data in the financial statements (Net Income Statement, balance Sheet and Cash Flow Statements). In financial analysis, it is usual to refer to several well-known ratios that facilitate the analysis of the project and comparison of alternative configurations and other projects.

The most frequently used ratios are discussed. The computation of these ratios alone would little serve the purpose of project appraisal, if their significance

were ignored. Ratio values have to be evaluated in the light of the characteristics of the corresponding industry, the type and scope of the project and the country of investment.

## PROFITABILITY RATIOS

### PROFITABILITY RATIOS

$$\text{GROSS PROFIT MARGIN} = \frac{\text{OPERATING PROFIT}}{\text{NET SALES}}$$

$$\text{OPERATING MARGIN} = \frac{\text{REVENUE} - \text{OPERATING COSTS}}{\text{NET SALES}}$$

$$\text{NET PROFIT MARGIN} = \frac{\text{NET INCOME (PROFIT AFTER TAX)}}{\text{NET SALES}}$$

Profitability ratios indicate the relationship of profits and sales. These ratios are used to assess the effectiveness of planned operations. They are particularly useful when compared with data from other enterprises in the same or similar businesses, as these margins vary among industries.

**Gross profit margin:** This is an indicator of the effectiveness of the production operations. The numerator is the operating (manufacturing) profit, which is

the margin of sales revenue over operating cost. Basically the indicator shows what proportion of sales revenue, after accounting for operating cost, is available to cover cost of finance and tax, and to provide profits.

**Net profit margin:** This indicator deals with after-tax profitability, so all costs are included. The numerator is profit after tax and the denominator is the sales revenue. As a measure to be compared with a benchmark for project assessment the net profit margin is a good indicator of profitability if a representative planning period is selected. It does not have a consistent relationship with the cost of capital for assessment purposes. Typical margins among industries vary widely. High quality, low volume products generally have higher margins while high volume products such as consumer staples generally work on smaller margins.

## ACTIVITY RATIOS

<b>ACTIVITY RATIOS</b>	
INVENTORY TURNOVER	$\frac{\text{Cost of goods sold}}{\text{Average Inventory}}$
ASSET TURNOVER	$\frac{\text{Sales Revenue}}{\text{Total assets}}$
ACCOUNTS RECEIVABLE TURNOVER	$\frac{\text{Sales Revenue}}{\text{Average Accounts Receivables}}$
RECEIVABLE COLLECTION PERIOD	$\frac{\text{Accounts Receivables}}{\text{Average daily sales}}$

Some ratios dealing with operations may be of interest to project designers. These activity ratios, or turnover ratios, are indicators of the relation of project variables and sales revenue (turnover).

Ratios that are perhaps of greatest interest at the design stage are the inventory and asset turnover.

**Inventory turnover:** This is an indicator of the rotation of inventories in relation to the costs embedded in products sold. The

ratio, sometimes called the stock turnover ratio, measures the rate at which inventory is converted into sales. Average inventory is the average of opening and closing inventory.

Using the cost of goods sold rather than sales revenue as the basis for the calculation gives a clearer picture of the number of inventory rotations per year. If this ratio is low it may indicate a need to look again at the inventory policy adopted in the project plan.

For an existing enterprise the inventory turnover ratio reflects the efficiency of inventory management of the firm and the velocity of working capital cycles. A high inventory turnover may mean that management is efficient. However, it is not always good to have a higher inventory turnover as chances of stock outs and attendant loss of sales and goodwill are increased. Among the activity ratios, this ratio has a significant role as it can influence many policy decisions, e.g. purchase, sales and credit policies and investment in storage facilities.

The inventory turnover should be the weighted average of the inventory COT's.

**Asset turnover ratio:** The asset turnover ratio indicates how efficiently the assets are employed to generate sales. A meaningful indicator is calculated by dividing the total sales (at full capacity) by initial value of assets. The higher the ratio the better utilization of the assets from this point of view. Comparing the total assets committed to the project with the sales revenue is useful mainly to compare with similar enterprises. As a stand alone indicator it is not very meaningful, as the value of assets compared with sales varies widely among industries. A higher ratio is more desirable as it indicates generation of greater sales revenue per unit of asset, i.e. more efficient use of assets.

For an existing enterprise the ratio may help in influencing decisions on investments in additional assets or perhaps increasing the number of production shifts.

The receivables turnover ratios are useful for designing the project's credit policy and also to estimate cash flows from receivables. They should reflect or confirm the policy or assumptions on receivables included in the project plan.

**Accounts receivable turnover:** This indicator measures the number of rotations of accounts receivable (debtors) during a year. A meaningful indicator is calculated by dividing total sales (at full capacity) by average receivables. Perhaps a more appropriate way to calculate this ratio is to use credit sales rather than total sales, if such data is available. A high turnover in receivables is desirable as it would reflect a short collection period and reduced need for short term financing.

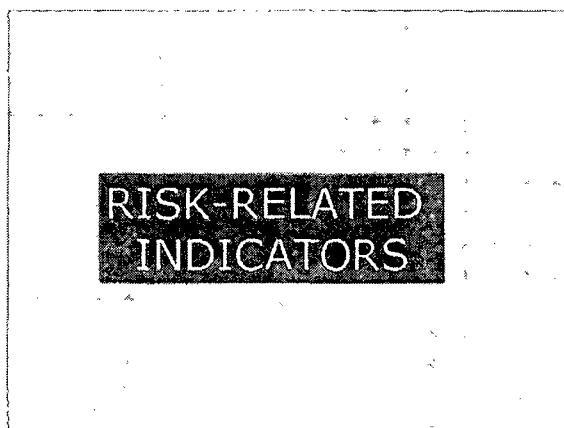
The accounts receivable turnover should be equal to receivables COT.

**Receivables collection period:** This indicates the average age of receivables, or the average number of days for collection. The total accounts receivable is divided by average daily sales or average daily credit sales (if available).

The receivables collection period and the accounts receivable turnover are related:

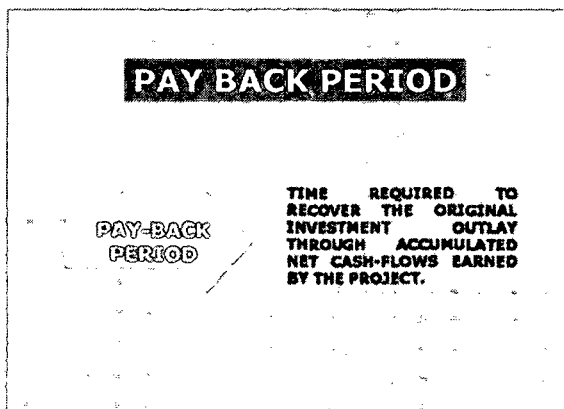
$$\text{Receivable Collection Period} = \frac{\text{Number of Days in Year}}{\text{Accounts Receivable Turnover}}$$

## RISK-RELATED INDICATORS



The pay back period indicates the length of time necessary to recover the investment. The leverage and liquidity ratios are measures of the survivability of the enterprise in regard to meeting financial obligations.

## PAY BACK PERIOD



Payback period is the time required to recover the original investment outlay through the annual cash flows. It is a measure of project risk. As the more distant future increases uncertainty, some investors seek to recover their investment in a relatively short period of time.

Payback period is easily understood. It is calculated by accumulating annual cash flows in each period until the full original investment outlay is covered.

Although it is a measure that is widely utilized, it does have a few shortcomings: (1) The method does not take into account cash flows generated after the payback period. (2) The magnitude and timing of cash flows are not considered. (3) Unless compared with payback of mutually exclusive projects, on an absolute basis it is

very difficult to determine what should be ideal payback period for a project; however, many investors have a maximum planning period beyond which the results are unimportant.

### EXAMPLE: PAY BACK PERIOD

**EXAMPLE - PAY BACK PERIOD**

YEAR	NET CASH FLOW	CUMULATIVE CASH FLOW
0	-100	-100
1	50	-50
2	30	-20
3	30	+10

PAYBACK PERIOD =  $2 + \frac{20}{30} = 2.67$  years

In this example the investment outlay in year zero is 100. During periods 1 to 3 there are positive net cash flows that can be used to offset the original investment. At the end of third year, as shown in the rightmost column, the cumulative cash flow becomes positive, indicating that the project has recovered its investment outlay. The payback period is then more accurately determined by extrapolation within the third year of operations.

It is important to note that net cash flow is used as the basis for determining payback.

### PAY BACK PERIOD - EQUITY INVESTMENT

**PAY BACK PERIOD - EQUITY INVESTMENT**

$$\sum_{t=0}^{t=p} -E_t + CF_{e,t} \geq 0$$

$E_t$  : Equity contribution, period  $t$   
 $CF_{e,t}$  : Net Cash flow (Equity), period  $t$   
 $p$  : Period that summation goes from negative to positive

The payback period can be determined from the point of view of the equity contributions. The relevant flows are determined from the Cash Flow for Financial Planning as adjusted to reflect the point of view of the equity participants (see the section on Financial Statements, Return on Equity and Return on Partner's Equity). Basically the payback period is that point in time when the equity investment is recovered by benefits generated during the operation phase, when the cumulative cash flows equal or

exceed the equity outlays.



## PAY BACK PERIOD – INVESTMENT

**PAY BACK PERIOD – TOTAL INVESTMENT**

1)  $A_0 + \sum_{t=1}^{t=p} [NP_t - (I_t(1-T) + D_t)] \geq 0$

$A_0$ : Investment outlay, period t  
 $NP_t$ : Net profit, period t  
 $I_t$ : Interest, period t  
 $T$ : Tax rate  
 $D_t$ : Depreciation and other amortization, period t  
 $p$ : Period in which summation goes from negative to positive

2)  $A_0 + \sum_{t=1}^{t=p} OCF_t \geq 0$

$OCF_t$ : Operating net cash flow  
 $p$ : Period in which summation goes from negative to positive

The payback period for the total investment is essentially the point in time at which the investment is recovered from the benefits generated during the operation phase of the project. The first formula is developed from the profits after tax for each period and adding back the interest and depreciation. Note that the investment is shown for each period, not only the initial investment but any other investments or replacements that might occur after the initial period. Interest, depreciation and other non-cash

amortizations in each period are added back to the after-tax profit. Interest is adjusted by the tax rate T to reflect what the taxes would have been in the absence of interest expense (interest is usually a tax-deductible expense). Whether or not this adjustment (1-T) should be included is a matter of choice. Ideally the flows relevant to payback on total investment would not include financial flows such as interest and taxes.

The payback period is the point in time that the cumulative flow changes from negative to positive, equivalent to the time needed to recover the initial investment by net flows generated in the operations phase.

The second formula is another way of determining payback that is equivalent to the first. Rather than focusing on the income statement, the financial statement Return on Total Investment (see the section on Financial Statements, Return on Total Investment) is used as the basis for the determination. This is the OCF or operational cash flow (see the section on Dynamic Indicators). The payback period is the point in time that the cumulative flow changes from negative to positive.

The payback period is, in a sense, a dynamic indicator as it is dependent upon time-related flows. It is included as a static indicator because it does not utilize time-dependent values, as in the other dynamic indicators.

## PAYBACK PERIOD LIMITATIONS

**PAYBACK PERIOD LIMITATIONS**

**NET CASH FLOW**

YEAR	0	1	2	3	PAYBACK PERIOD
PROJECT A	(2,000)	1,000	1,000	5,000	2
PROJECT B	(2,000)	0	2,000	5,000	2
PROJECT C	(2,000)	1,000	1,000	100,000	2

Investors seek short pay back to minimize risk. However, payback is not always a good indicator for selection of project alternatives.

Examples of three projects with different cash flows in terms of quantity and timing with the same payback period are shown. Under these circumstances it would be difficult to select one project over another on the basis of payback period. However, considering post-payback period cash

flows it is clear that project C is more attractive than project A or B. If the timing of the cash flows are considered only until payback is attained, then project A or C may be chosen as both have identical cash flows up to payback.

The weakness of payback period as a project selection method is that it ignores amounts and timing of cash flows occurring after the payback period.

## SURVIVAL RATIOS

**SURVIVAL RATIOS**

- ◆ LIQUIDITY
- ◆ LEVERAGE

Survival ratios provide information concerning the short and longer term resilience, or the ability of the project to withstand shocks that would threaten its existence. Liquidity ratios are essentially measures of short term solvency and leverage ratios are measures of risk.

Liquidity ratios are indicators of the project to cover its short term obligations.

Leverage ratios are concerned with the ability of the project to meet its longer term financial obligations. Some deal with asset coverage of liabilities and others with cash availability relative to financial obligations.

## LIQUIDITY RATIOS

**LIQUIDITY RATIOS**

**CURRENT RATIO** =  $\frac{\text{CURRENT ASSETS}}{\text{CURRENT LIABILITIES}}$

**QUICK RATIO** =  $\frac{\text{CASH} + \text{MARKETABLE SECURITIES} + \text{A/C RECEIVABLE}}{\text{CURRENT LIABILITIES}}$

During the planning stages these ratios should reflect the expected turnover of short term assets and liabilities as envisioned by the project designer. They indicate the ability of the enterprise to meet day today obligations in the short run.

The normal values are a function of the type of business. Comparisons with enterprises in the same industry are sometimes difficult. For example, a company relying on imported inputs would

tend to maintain higher current ratios than one using only domestic inputs. Risk is reduced when short term assets at least cover short term liabilities. There are no specific standards, but certainly these ratios should be sufficiently greater than unity. The standard for the current ratio, which includes more risky asset components, would tend to be higher than for the quick ratio.

**Current ratio:** The current ratio shows the relation of current assets and current liabilities; it indicates the ability of the enterprise to cover its current liabilities. A higher current ratio indicates greater solvency. However, the components of current asset are an important consideration. When most of the current assets represent

inventories the risk is somewhat higher as inventories are generally not as liquid as receivables. Current assets tie up cash, so high levels may indicate that the resources of the enterprise are not well-employed.

Quick ratio: This ratio, or 'acid test', is a more conservative view of the short-term position of the enterprise with regard to covering short-term liabilities. Only highly liquid assets, those easily converted to cash, are considered as available to cover current liabilities, such as cash, marketable securities and receivables. If the 'quick' assets are maintained at a level in excess of current liabilities (say 20% or more in general), risk should be manageable.

## LEVERAGE RATIOS

LEVERAGE RATIOS	
DEBT/EQUITY =	$\frac{\text{TOTAL LIABILITIES}}{\text{EQUITY}}$
DEBT/ASSETS =	$\frac{\text{TOTAL LIABILITIES}}{\text{TOTAL ASSETS}}$
FIXED ASSETS COVERAGE =	$\frac{\text{NET FIXED ASSETS}}{\text{LONG - TERM DEBT}}$
DEBT SERVICE COVERAGE =	$\frac{\text{CASH GENERATED PER PERIOD}}{\text{PRINCIPAL REPAYMENT + INTEREST}}$

Financial leverage refers to the amount of debt used in the capital structure. It is normally understood that debt is a cheaper source of finance and the cost of debt is tax deductible, hence the use of debt decreases the weighted cost of the capital, thereby increasing the returns for the equity holders. However, the use of debt increases risk in the project. For this reason it is necessary to control the use of debt in project financing. Leverage ratios basically indicate the relationship of debt in the total capital or against equity or

total assets.

**Debt/Equity:** The debt to equity ratio shows the relative contributions to the investment package of creditors and owners. Financial institutions generally set limits on the ratio to minimize risk; typically debt would be permitted up to perhaps 1.5 times equity. Debt/equity ratios higher than 2 are generally considered risky. The ratio is calculated by dividing the total liabilities (long term and short term) with the total equity (consisting of net worth and preference capital). In the formative stages debt would consist of a proportion of the financing for the initial investment including the working capital margin.

When the project generates returns greater than the cost of debt, the equity owners benefit from more debt (trading on equity).

**Debt/Assets:** This ratio, also called the debt ratio, measures the amount of assets supported by debt funds. It is calculated by dividing the total liability (long and short term) by total asset (the balance sheet total). There is no standard for this ratio; however, a ratio of 0.67 or lower is usually considered acceptable.

**Fixed assets coverage:** This ratio measures the ability of fixed asset to repay long term debt. In other words, it measures the cover provided by fixed assets to long term debt. It also provides information on the amount of fixed assets funded through long term debt. The ratio should provide some margin of security for financiers, but the precise number would be determined by them considering the liquidation value of the assets.

**Debt service coverage:** This is not a leverage ratio in the pure sense, but is included here as it indicates the ability of cash generated to cover debt service (interest plus principal repayments). This is one of the major indicators for financiers as it measures the amount of risk in the project related to servicing the debt.

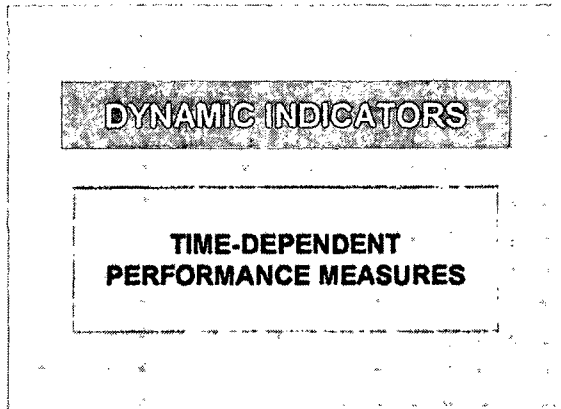
The debt service coverage ratio can be defined as the period cash generated to the debt service. Cash generated per period (from operations) could be defined as Net profit before interest and depreciation. This definition shows how operating cash (without financial flows) covers the debt service.

The UNIDO Manual for Preparation of Feasibility Studies, 1991, defines "annual cash generation" as "net profit after tax plus interest and depreciation plus net increase of liabilities (equity or debt) minus new investment.

An acceptable range of DSCR is 1.5 - 3.0. The upper limit is used by financial institutions to restrict the repayment period.

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# DYNAMIC INDICATORS



Some of the most effective measures of financial performance for investment projects are indicators that take in the entire span of time from inception of a project to its planning horizon. During the planning stages, when the project does not physically exist, hypothetical snapshots are much more prone to error than measures that encompass the entire span of a project's life plan. Inaccuracies can be smoothed out over time to some extent, although it is true that uncertainty in prediction increases with time. To alleviate

this problem of increasing uncertainty with time the planning horizon can be shortened, but has the disadvantage of neglecting operations that could play a significant role in the investment decision.

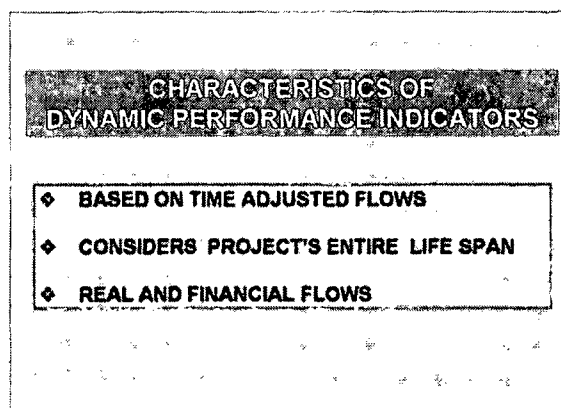
Another reason for favoring these dynamic measures is that they average out variations over time in projected operational patterns. The fact that they are so widely used in the investment arena attests to their usefulness.

Several types of dynamic indicators are discussed. Ordinary and dynamic payback are means of determining the length of time necessary for an investor to recoup the investment. Analysis of sources and uses of funds covering the project life span is a measure of liquidity (sufficiency of financial resources to meet operating and service needs). Other dynamic indicators measure the rates of return on the assets committed, on investors' equity and for venture partners.

Another use of these indicators is capital rationing. Generation of benefits per unit of scarce resource employed in each project alternatives are indicators that can be compared to decide which projects utilize these scarce resources favourably.

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## CHARACTERISTICS OF DYNAMIC PERFORMANCE INDICATORS



Static financial indicators are essentially snapshots of the proposed project that provide estimates of projected financial performance at a point in time or for a single period of operation. Dynamic indicators consider the entire span of the project's life. These indicators are considered generally more reliable in the planning stages as they take a broader view of the project's financial characteristics (see Dynamic Indicators Example showing development of indicators).

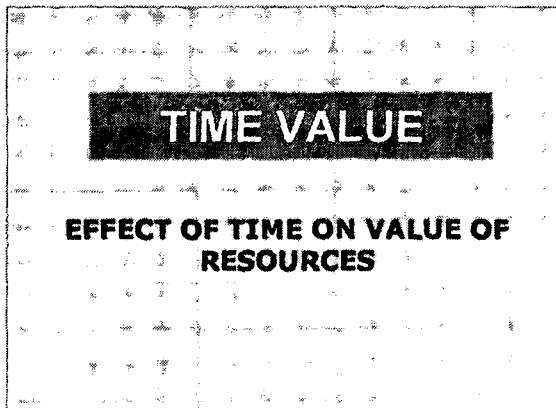
**Based on time adjusted flows:** To be measured compatibly, the values of inputs and outputs have to be adjusted according to the time of occurrence. The concepts of discounting and compounding (see the section on Time Value) are used to adjust the values of transactions from one point in time to another. Normally all values are ultimately converted to the present, taken as the time of project inception.

**Considers project's entire life span:** Inflows and outflows are considered over the project's entire life span, from inception to the planning horizon. In this sense the perspective is temporally panoramic. They are combined compatibly using the time-adjusted values as described above. In some cases the planning horizon is shortened as a means of reducing risk.

**Real and financial flows:** 'Real' (tangible and intangible) flows are the physical resources and services utilized and generated by the project. In this context 'real' flows are all inputs and outputs that are not financial. Dynamic indicators depend in some cases upon real flows and in others on a combination of real and financial flows. To deal with the real flows in a manner compatible with the financial analysis, their values are expressed in monetary terms.

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## TIME VALUE - EFFECT OF TIME ON VALUE OF RESOURCES



In the world of investment time is of the essence. When resources are put to work the benefits to be derived are a function of the efficacy of their use and the amount of time during which they are employed.

Identical amounts of money earned today and next year will not have the same value. The passage of time changes value for several reasons: (1) Individuals prefer the relative certainty of consumption today rather than uncertain consumption in future. (2) By foregoing today's

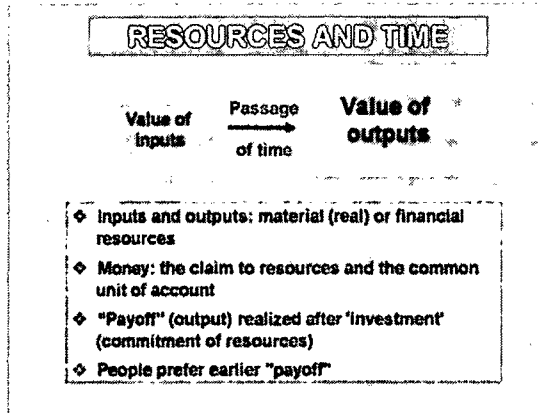
consumption, funds can be invested so that the value grows with time. (3) Inflation, a feature that prevails most of the time in most economies, tends to reduce the future value of money.

The concept of time value is applicable to financial and real (tangible and intangible) resources. Discounting and compounding are the basic mathematical principles employed in dealing with the relationship between current and future values. Discounting is a method of diminishing future values when weighed at present and compounding raises the value of a current amount when projected into the future.

Time value is introduced at this point because it has important relevance in determining dynamic indicators of project performance and criteria of investors.

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## RESOURCES AND TIME



In regard to an investment project, if resources are used judiciously (the value of inputs) the value of what is produced (the value of output) should be greater than the input, sufficient to cover the original investment and a surplus. The surplus should satisfy the expectation of benefits of the investor.

**Inputs and outputs:** These are material (real) resources or financial resources depending upon the type of analysis undertaken. Real resources are those that

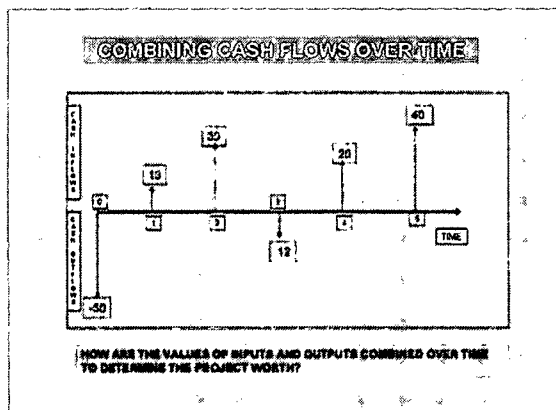
are not financial in nature, and can be both tangible and intangible. Examples were provided in the section on Investment Cost.

**Money:** The claim to resources and the common unit of account. The value of financial and resource flows can be expressed in monetary terms; in fact, this is necessary to perform meaningful financial calculations.

The "payoff" (output) is realized after the 'investment' (commitment of resources). The purpose of investing capital resources is to have adequate output through the use of assets created using the investment in order to generate future benefits.

**People prefer the "payoff" sooner rather than later:** This is the basis for time value. Whether the reason for the preference is earlier consumption, or for available investment opportunities leading to future consumption, or for having less risk, almost invariably the choice is for early availability of benefits.

## COMBINING CASH FLOWS OVER TIME

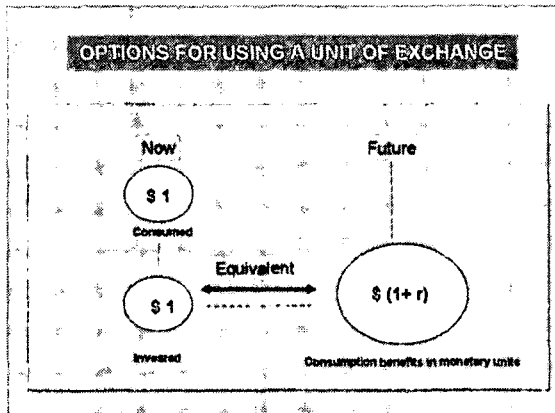


Considering the variations in value of monetary units and resources over time, the investor and the project analyst are faced with the problem of combining values over the project life so that they are compatible. If a monetary unit today is not worth the same as the same unit five years from now, then a way has to be found to modify the values so that when they are compared the result is meaningful.

A typical pattern of project monetary flows is shown. Cash outflows are negative values and cash inflows positive. The outflows might represent the investment in assets and the inflows the net effect of producing and selling the output. In normal business situations, these flows occur at different points in time, so the values shown can not simply be added and/or subtracted to ascertain their combined value.

The concept of time value can be applied in such cases so that all inflows and outflows are made mathematically compatible, and then can be combined to obtain an overall value.

## OPTIONS FOR USING A UNIT OF EXCHANGE



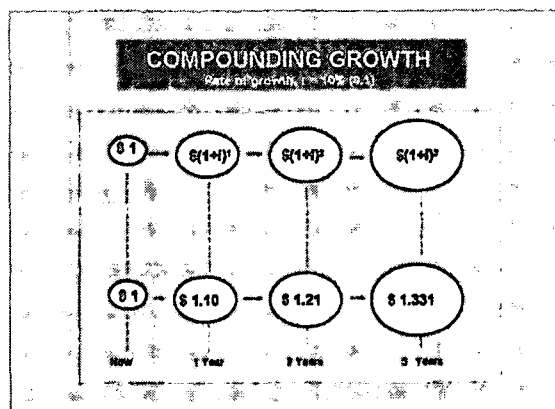
The holder of a unit of monetary exchange has a choice of spending it now or investing. If the \$1 is spent now, \$1 of consumption benefits are immediately realized. The other choice is to invest, in which case the value of the \$1 should grow. At some future time, say one period from now, the value should increase by the rate earned on the investment. Generally the holder would not forego present consumption unless some advantage was offered. In this case, if the rate of return is  $r\%$  (or expressed in

decimal fraction  $r\%/100$ ), \$1 invested at  $r$  becomes  $\$(1 + r)$  one period into the future.

Whether or not the individual decides to invest really involves two issues. One is the rate at which the investment will grow if invested. The other is how the (prospective) investor views future vs. present consumption, an issue that will be addressed shortly.

For now, it is sufficient to note that the  $\$(1 + r)$  received in future would provide some benefit to the investor, who would determine if it is acceptable on the basis of the relative valuation of future and current benefits.

## COMPOUNDING GROWTH



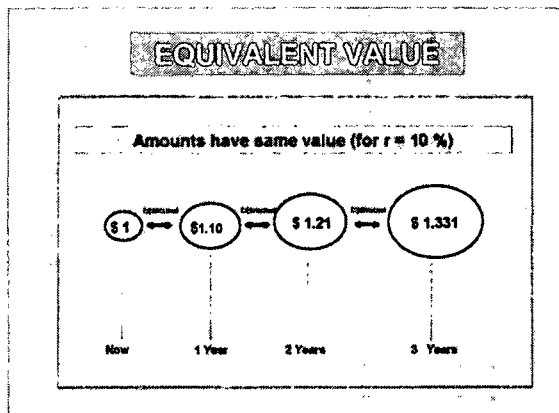
As previously noted, when a monetary unit (say \$1) is invested, it will normally grow at a rate determined by the strength of the investment. Generally the higher the growth rate, the higher the amount to be received in future time. The value after one period, when invested at a rate of  $r$  ( $\%/100$ ) will grow to  $(1 + r)$  after one period. At the beginning of the second period the amount available for investment will be  $(1 + r)$ ; when invested for the second period its value will grow to  $(1 + r)(1 + r)$  or  $(1 + r)^2$ . Similarly, at the

beginning of the third period the amount  $(1 + r)^2$  will be available for investment so that at the end of the third period the original \$1 would have grown to  $(1 + r)^2(1 + r) = (1 + r)^3$ . If the reinvestment is continued for more periods the original value will grow by  $(1 + r)$  times the starting amount in the period. With  $r$  increasing or decreasing, the growth would correspondingly increase or decrease.



This is the compounding effect. In the example \$1 invested now at a rate of 10% per annum grows to \$1.331 at the end of 3 years. In such cases, annual growth rate of 10% would be called compounding rate of growth.

## EQUIVALENT VALUE



In the previous example the way that \$1 of monetary value would grow if invested at a rate of 10% per period was illustrated.

Are these values equivalent, and if so, in what sense? The major consideration is the view of the investor. If the expectation was that the \$1 would grow at a rate of 10%, then presumably the investor would be indifferent to receiving \$1 today, \$1.10 one year from now, \$1.21 two years from now, etc. Although the

absolute amounts grow in each year, relatively they have the same value to the investor over the years.

Now suppose the actual rate of growth of the \$1 invested is 10%, but the investor values present consumption as 15% more valuable than a unit of consumption 1 year from now. That means the investor expects the investment to grow at a rate of 15% every year. Under the circumstances, would the values as shown be equivalent in each year to the present \$1? There would likely be some dissatisfaction in this case. The investor would most likely not accept that the values are equivalent.

### Actual

### Expected

Now \$1.00  $\{1 \times (1.1)^0\}$

Now \$1.00  $\{1 \times (1.15)^0\}$

1 year \$1.10  $\{1 \times (1.1)^1\}$

1 year \$1.15  $\{1 \times (1.15)^1\}$

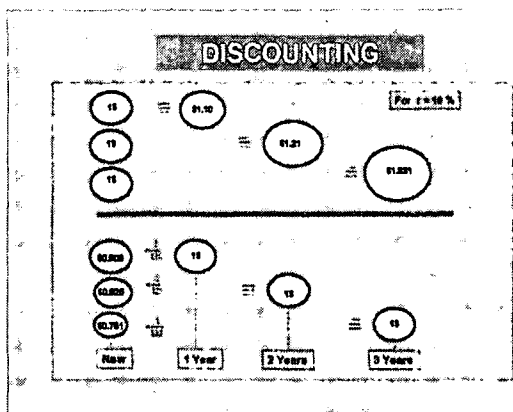
2 years \$1.21  $\{1 \times (1.1)^2\}$

2 years \$1.322  $\{1 \times (1.15)^2\}$

3 years \$1.31  $\{1 \times (1.1)^3\}$

3 years \$1.521  $\{1 \times (1.15)^3\}$

## DISCOUNTING



In the upper part of the presentation the effect of investing \$1 at a rate of 10% is shown. As previously indicated, under these conditions \$1 will grow to \$1.10 in the first year, then to \$1.21 in the second year and to \$1.331 in the third year. If 10% is the expectation of return the investor would be indifferent to receiving any one of these amounts at each point in time - e.g. \$1 today or \$1.21 in the second year.

Now what would be the equivalent value at present of \$1 at some future time, assuming that 10% is the expectation of return? For this we need to resort to the process of "discounting".

Note the effect of discounting in the value of money. \$1 received in the first year is equivalent to \$ 0.909 now. \$1 received in the second year would be the equivalent of \$0.826 and in the third year \$0.751. The investor of \$0.751 now would be indifferent to receiving \$1 in three years if the expectation of return is 10%.

This relationship between future and present values, in this case, is determined by discounting, which is the reverse of compounding.

## COMPOUNDING AND DISCOUNTING FORMULAE

**COMPOUNDING AND DISCOUNTING FORMULAE**

COMPOUNDING	DISCOUNTING																
$F = A(1+r)^j$	$P = \frac{A}{(1+r)^j}$																
$cf = (1+r)^j$	$df = \frac{1}{(1+r)^j}$																
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;"><b>A</b></td> <td>amount compounded or discounted</td> </tr> <tr> <td><b>F</b></td> <td>future value</td> </tr> <tr> <td><b>P</b></td> <td>present value</td> </tr> <tr> <td><b>r</b></td> <td>compounding or discounting rate per period</td> </tr> <tr> <td><b>j</b></td> <td>time period, <math>j=1, \dots, n</math></td> </tr> <tr> <td><b>n</b></td> <td>number of time periods</td> </tr> <tr> <td><b>cf</b></td> <td>compound factor</td> </tr> <tr> <td><b>df</b></td> <td>discount factor</td> </tr> </table>		<b>A</b>	amount compounded or discounted	<b>F</b>	future value	<b>P</b>	present value	<b>r</b>	compounding or discounting rate per period	<b>j</b>	time period, $j=1, \dots, n$	<b>n</b>	number of time periods	<b>cf</b>	compound factor	<b>df</b>	discount factor
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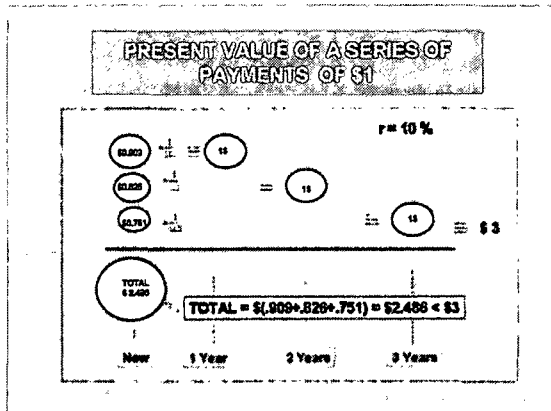
Compounding is the buildup of value over time of an amount at present at an expected rate of return. The formula expressing the increase in value of an amount A is shown in the form of an exponential function, where the exponent is j, the number of the period, for the factor (1+r), where r is the rate of return. The compounding factor cf is (1+r)<sup>j</sup>. The exponent j can take on values from 0 to any number of periods. Any number raised to the exponent 0 has a value of 1. Therefore, (1+r)<sup>0</sup> = 1 and A (1+r)<sup>0</sup> = A.

This means that a value A in the year 0 is not compounded.

Discounting is the reverse process. A future amount A is converted to present value when it is multiplied by the discount factor, 1/(1+r)<sup>j</sup>. The present value P is determined by multiplying A, the value at some time in the future, by the discounting factor. For all r greater than 0 the present value will be less than the future value.

Note that j is not necessarily denoted in years. It can represent any time period, a month or a quarter, so long as the rate r corresponds to the period selected.

## PRESENT VALUE OF A SERIES OF PAYMENTS OF \$1

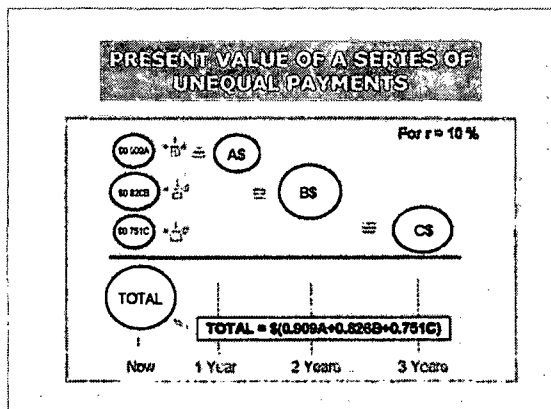


If an amount \$1 is to be received at the end of each period from the present to some period in the future, the present value of the series of payments of \$1 can be determined by discounting \$1 in each period by the appropriate discounting factor.

This is shown in the illustration for a rate  $r = 10\%$ . The discount factors for years 1, 2 and 3, as previously explained, are applied to the amounts of \$1 received at the end of each period. If \$1 is to be

received at the end of first year, its present value is \$ 0.909. \$1 received at the end of second year has a present value of \$0.826 and \$1 received at the end of third year has a present value of \$ 0.751. The total present values of future receipts can be determined by adding the discounted values, in this case  $\$0.909 + \$0.826 + \$0.751 = \$2.486$ . This is less than the simple sum of the amounts received, which is logical, considering the time value concept.

## PRESENT VALUE OF A SERIES OF UNEQUAL PAYMENTS



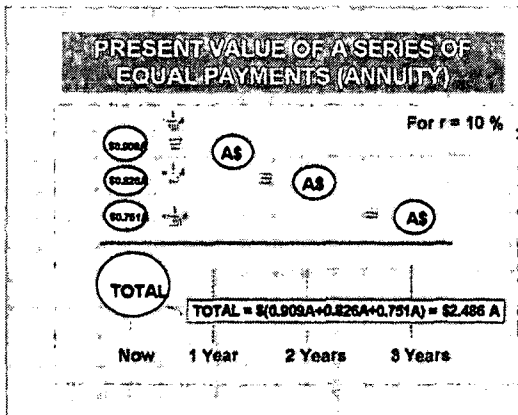
The discounting principle applies to a series of unequal payments. This situation is closer to what might be expected in the project investment situation, where the cash flows in each period are generally unequal and uncertain.

The present value of a series of unequal payments is calculated by discounting the amount in each period by the appropriate discounting factor for the period. In the illustration, amounts A, B and C are received respectively at the ends of years

1, 2 and 3. Using the appropriate discounting factors for  $r = 10\%$ , the present value of the series of payments is  $P = 0.909A + 0.826B + 0.751C$ . Note that for another rate,  $r \neq 10\%$ , the discount factors would differ.

Suppose the amounts received in each year were respectively \$100, \$200 and \$300. Then the present value of the series of payments would be  $P = \$0.909(100) + \$0.826(200) + \$0.751(300) = \$481.40$ .

## PRESENT VALUE OF A SERIES OF EQUAL PAYMENTS (ANNUITY)

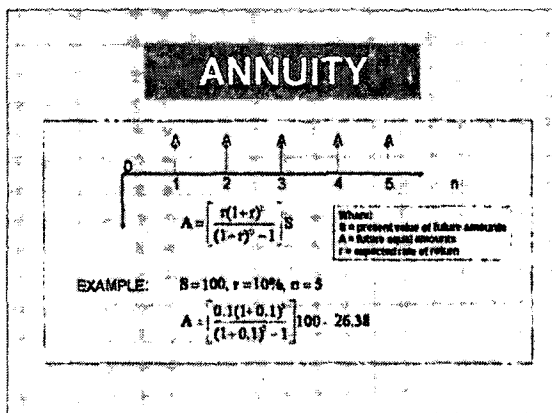


A special and important type of future payment series is the case where the future payments are equal. In the example an amount  $A$  is received at the end of each period. The present value of this series of payments is derived in the same manner as the previous example, except that the amount is constant.

The present value of an annuity is simply the sum of the present value of all the installments of the annuity. In the example, when the discount factors for  $i =$

10% are applied to the amounts  $A$  received at the end of years 1, 2 and 3 the result is a present value of  $P = 0.909A + 0.826A + 0.751A = 2.486A$ . If the amount  $A$  is, say 300, then the present value would be  $2.486(300) = 745.8$ ; for  $A = 500$ ,  $P = 1243.00$ .

## ANNUITY



An annuity is a series of periodic cash flows of equal amounts  $A$  that are equivalent to a present value  $S$ . The annuity formula (see a mathematical text on infinite series for the derivation) expresses the relationship between the future amounts  $A$  and the present amount  $S$ .

The system works in both directions. An investor with an amount  $S$  at present and with an expectation of return  $r$  would be satisfied with receiving an amount  $A$ , as

determined by the formula, for the specified number of years. In the example, if the amount  $S$  is 100, the investor would be satisfied by receiving 26.38 for 5 years if the expectation of return is 10%. Similarly, a banker would be satisfied by receiving payments of 26.38 for 5 years in exchange for disbursing a loan principal of 100 at the present time.

The amount  $A$  (26.38 in the example) includes both principal and interest when the outstanding principal at the end of every year starting with year 0, expects a return of  $r$ , 10% in the example. (see the section on Finance for further illustration). The amount  $A$  is constant, but includes varying amounts of principal and interest. In the early periods the interest is relatively high and principal low. In later periods interest declines (based upon the principal balance at the end of the prior period) and principal increases as the outstanding principal amount would decrease year after year due to yearly repayments.

Examples of annuity are the periodic premiums paid for a life insurance policy and annuity-type loans extended by financiers, like leasing.

## PRESENT VALUE OF AN ANNUITY FACTOR

**PRESENT VALUE OF ANNUITY FACTOR**

$$A = \frac{r(1+r)^n}{(1+r)^n - 1} S$$

$$S = \frac{A}{\frac{r(1+r)^n}{(1+r)^n - 1}} = \left[ \frac{(1+r)^n - 1}{r(1+r)^n} \right] A$$

PRESENT VALUE OF ANNUITY FACTOR  $\frac{(1+r)^n - 1}{r(1+r)^n}$

EXAMPLE:  $r = 10\%$ ,  $n = 5$

PV OF ANNUITY FACTOR  $\frac{(1+0.1)^5 - 1}{0.1(1+0.1)^5} = 3.791$

A convenient way to deal with annuities is to use the present value of annuity factor. This factor can be multiplied by the constant payments A to be received over a number of periods n at a rate of return, or interest rate r. The factor is determined as shown in the illustration.

In the example, payments of 100 are to be received at the end of each of the next 5 (n = 5) years at a rate of return, or interest rate, of 10% (r = 0.1). The present value of annuity factor is

determined by inserting the values of r and n into the formula. For these values the factor is 3.791. This means that the present value of the annuity is 3.791A = 379.10.

Once the factor is determined for any r and n, the present value S can be determined by multiplying the factor by A, the future periodic equal payments.

## CAPITAL RECOVERY FACTOR

**CAPITAL RECOVERY FACTOR**

NOW                      YEAR

0                      1                      2                      3                      ...                      n

(\$1) PRESENT VALUE

FUTURE PAYMENTS: (\$r) (\$r) (\$r) ... (\$r)

$$r = \frac{i(1+i)^n}{(1+i)^n - 1}$$

R: Capital recovery factor	Example: Principal = \$1000
r: Rate of expected return	r = 10% per annum
n: Number of periods	Years = 20
	Solution: R = 0.1
	Each payment = \$1000 * 0.11746 = \$117.46

The capital recovery factor is the inverse of the present value of annuity factor.

The latter is used to determine the present value of a series of future payments. The capital recovery factor determines the amount of future equal payments A, discounted at a rate i over a period of years n that are equivalent to a present value S. In other words, if the amount S is invested at the present time, what will be the future value of payments A that will satisfy the rate of return

requirement.

The formula was shown previously in the Annuity presentation. In the example, an amount of \$1,000 is invested at the present time. The capital recovery factor for i = 10% and n = 20 years is 0.11746. This factor can be multiplied by the original investment amount to determine the equal payments over 20 years that would be required to cover both the original investment plus the expected return. In this case the payments would be 0.11746(\$1,000) = \$117.46.

## ELEMENTS OF TIME VALUE RELATED TO BORROWING AND INVESTMENT

BORROWING AND INVESTMENT - ELEMENTS OF TIME VALUE		
	LOAN	INVESTMENT
INFLOW OF FUNDS	AMOUNT OF BORROWED CAPITAL	NET OPERATIONAL BENEFITS
OUTFLOW OF FUNDS	DEBT SERVICE	INVESTMENT
TIME PREFERENCE	INTEREST RATE	DISCOUNT RATE
TIME	PHASING OF DISBURSEMENTS AND REPAYMENTS	PHASING OF INVESTMENT AND RECEIPT OF BENEFITS

Time value applies to both borrowing and investment. The table indicates the basic parameters for each situation: inflow of funds, outflow of funds, time preference and time.

**Loan:** From the point of view of the project (the lenders perspective is reversed) inflow of funds occurs when the loan is disbursed and the outflow when the debt is serviced. Interest is a cost for the borrower and the rate of return for the lender. The amounts and phasing of

disbursements and payments over time are established so that the lender realises the intended rate of return and the return of the capital extended to the borrower.

**Investment:** Investors commit funds or resources (values expressed in monetary terms) to a project. This is the outflow from their perspective. The project then produces net operational benefits over time (inflows). The time preference is expressed in terms of a discount rate, that relates the future benefits to current value. The amounts and phasing of investments and benefits determine the discount rate that equates the outflows to the inflows and defines the rate of return. As in the loan situation, the investor expects to receive both the return of capital and a rate of return.

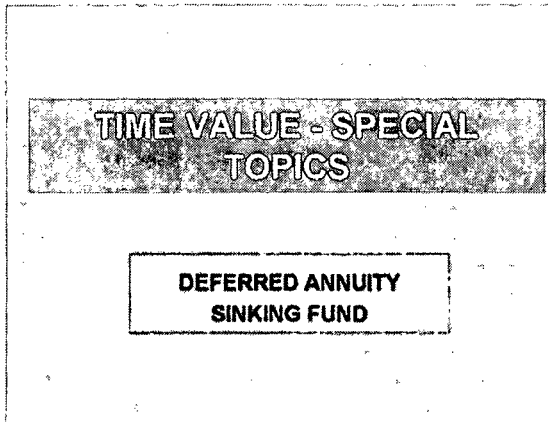
### ***TIME IS MONEY***

There is an old adage in the business world that 'time is money'. In the common interpretation this refers to the fact that the time of an individual has an opportunity cost - if the human resource is employed in an activity alternative to the normal course of doing business the individual foregoes what could be earned in the business at hand. For example, playing golf precludes attention to commercial possibilities with its attendant rewards.

In the context of investment the same principal applies, but in this case to resources that may be other than human. Whether financial or 'real' resources are considered, their employment in the industrial or commercial setting is intended to produce rewards. There is an expectation that the 'bird in the hand' is not only better than 'two in the bush' but will eventually produce two in the hand.

The basic idea is that control of a resource is what counts. Its source is of concern only in terms of what obligations assuming its control imply. When it is under control it can be employed for the generation of future benefits. In this sense 'time is money'.

## TIME VALUE - SPECIAL TOPICS



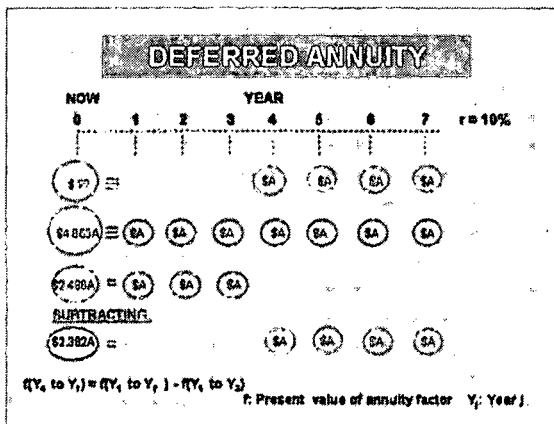
Situations related to the time value of funds and resources that are rarely encountered but which may be of interest to the project analyst are described.

**Deferred annuity:** This technique can be applied when the project borrows funds with payments to commence at some period in the future. In this system of repayments neither principal nor interest is paid during the hiatus, which differs from a grace period as no interest payments are due. It would be applied in

cases where early cash requirements preclude repayment of the debt.

**Sinking fund:** This is a method of accumulating funds for a future purpose, e.g. replacement of a depreciated asset. A series of payments (principal) are made to the fund, which are accumulated together with interest over a number of periods. The program of payments is designed to accumulate a determined amount at its termination point.

## DEFERRED ANNUITY



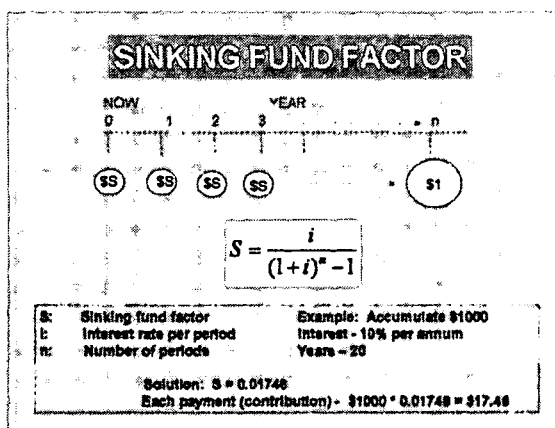
A useful concept is the method of determining the present value of a future annuity (deferred annuity). This is the case where the value of a future series of payments is to be determined when the series of payments does not start at the end of the first year but rather is postponed until some future period. In other words, the cash inflows will not occur at the end of the first year but after a gap of few years.

The method uses the device of subtracting the present value of an annuity series covering the gap from an annuity series covering the entire span of time.

In the example, the installments start at the end of the 4th year and continue until the end of the 7th year. The present value of annuity factor (factor) for the entire span  $n = 7$  years at  $r = 10\%$  is 4.868. The factor for years 1 - 3 (the gap) is 2.468. The latter factor can be subtracted from the former to obtain the factor for years 4 - 7,  $4.868 - 2.468 = 2.383$ . In this way the present value of a future annuity can be determined.

For example, if the constant payments during years 4 - 7 are \$100, the present value of the (deferred) annuity is  $2.838(\$100) = \$283.80$ .

## SINKING FUND FACTOR

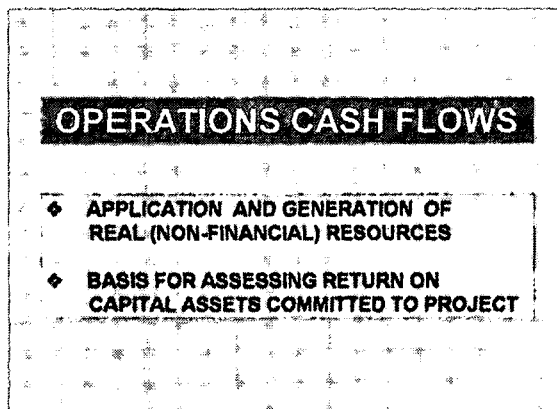


A sinking fund is normally created to accumulate a fund or corpus to be available at some time in the future. Periodic contributions to the fund accumulate at a rate of return so that at the end of the time span the amount accumulated is at the desired level. The fund can then be used for the intended purpose, e.g. replacement of an asset.

The formula derivation can be found in a text on finite series.

In the example shown the intent is to accumulate \$1,000 over a 20 year time span assuming a rate of return on committed funds of 10%. The sinking fund factor for  $i = 0.1$  and  $n = 20$  is 0.01746. The amount that would have to be contributed at the beginning of each of the 20 years is then calculated as  $\$1,000(0.01746) = \$17.46$ . If \$17.46 is deposited in the fund for a period of 20 years and if the rate of return on the committed funds is 10% the accumulated value at the end of the time span will be \$1,000.

## OPERATIONS CASH FLOW (OCF)



**Application and generation of real (non-financial) resources:** An important measure of effectiveness for an industrial investment is the generation of benefits by the capital resources committed to the project. To enable the project analyst to perform this type of assessment it is necessary to isolate the 'real' inputs and outputs - capital assets and production inputs and outputs - from the purely financial flows. To make (figuratively) apples and oranges computationally compatible monetary

values are employed (all these transactions ultimately involve monetary transactions in any case). Isolating the 'real' resources employed and generated from the monetary flows is a quasi-economic approach, but one that is widely used in investment analysis. The 'real' resources generally consist of goods and services.

**Basis for assessing return on capital assets committed to project:** The Operational Cash Flow (OCF) for each project period is necessary to determine the value of some dynamic indicators, e.g. the return on capital assets committed to the project. Although only the generation and application or use of real resources are relevant, in some cases income tax, really a financial flow, is included in the determination of OCF. Another slight distortion is the inclusion of some financial transactions in the working capital estimates. Changes in receivables and payables are really financial matters but are included in the OCF by convention.



## OPERATIONS CASH FLOW (OCF) FOR EACH PROJECT PERIOD

OPERATIONS CASH FLOW for EACH PROJECT PERIOD (OCF <sub>t</sub> )	
CASH FLOWS FOR EACH PROJECT PERIOD (SOURCES LESS USES)	
LESS :	FINANCIAL INFLOWS
	- EQUITY CONTRIBUTIONS
	- LONG TERM LOAN DISBURSEMENTS
	- SUBSIDIES AND GRANTS
PLUS :	FINANCIAL OUTFLOWS
	- PRINCIPAL REPAYMENTS
	- INTEREST*
	- DIVIDENDS DISTRIBUTED
<small>* See notes</small>	

The OCF can be generated from the cash flow for financial planning (sources and uses of funds). This is the financial plan for the project, showing both real and financial flows in each project period. To determine the OCF, the financial flows are eliminated, leaving essentially the 'real' flows.

Financial inflows such as equity contributions, long term loan disbursements and subsidies are deducted. Financial outflows such as debt

service on loans, both interest and principal payments, and dividend payments on equity are added back. In the method illustrated taxes are not added back as the OCF is employed (somewhat inconsistently, as tax is a financial flow) on an after-tax basis.

Interest, as a financial flow, is to be added back. Some might argue that interest adjusted for tax savings should be added back (i.e. adjust by  $1-T$ , where  $T$  is the tax rate). The validity of the argument rests on which discount factor is used on the operational cash flows. If it is the weighted average cost adjusted by tax, then the tax adjustment is justified. If not, then the whole interest should be added back.

The OCF's can alternatively be calculated by starting with profit after tax and adding back the depreciation and other amortizations, and interest (adjusted for taxes as in the method described above). This would normally be sufficient for the operating periods of an ongoing enterprise. However, for the project the value of capital resources committed and any residual value of assets at the planning horizon would also have to be included.

The logic of this development, as previously explained, is that the use and generation of real resources is relevant to this quasi-economic view. The few violations of this principle in the method employed herein involve the inclusion of changes in receivables and payables in working capital increments and income tax.

An example of the derivation of operations cash flow (OCF) from the Cash Flow for Financial Planning is shown for the first few periods of a project (see Attachments). The first example is identical to Cash Flow for Financial Planning, with flows to be adjusted shown shaded. The second example is the OCF with the financial flows eliminated. It is identical to the Cash Flow (NPV and IRR) - Total Investment.

One useful feature of the cumulative flow is that the point at which its value converts from positive to negative is the payback period for the total investment. In the example shown, the payback period would occur at some point after year 3.

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## TYPES OF DYNAMIC INDICATORS

**TYPES OF DYNAMIC INDICATORS**

- ◆ Dynamic Payback Period
- ◆ Net Present Value (NPV)
  - total investment
  - equity
- ◆ Internal Rate of Return (IRR)
  - total investment
  - equity
- ◆ Modified IRR
  - total investment
  - equity
- ◆ Net Present Value Ratio (NPVR)

A uniform characteristic of all of the following indicators is that transactions occurring in all project periods and at points in time are time-adjusted. Only in this way can they be meaningfully combined and compared.

**Dynamic Payback Period:** The time required to recover the investment outlay from time-adjusted net benefits. The investment outlays are considered as outflows and the number of periods determined for which future net benefits

cover the outlays.

**Net present value (NPV):** The sum of time-adjusted values of outflows (negative) and inflows (positive), aggregated algebraically. NPV can be determined for the total investment, for the entire equity, or for a particular investor or class of investors. This is the fundamental indicator for financial assessment.

**Internal Rate of Return (IRR):** The discount rate at which the values of aggregate time-adjusted inflows equal aggregate time-adjusted outflows. IRR can also be regarded as the rate at which the investment generates net benefits. IRR can similarly be determined from the differing perspectives of investor classes.

**Modified IRR:** A form of internal rate of return that takes into account more realistic assumptions concerning opportunities for reinvesting generated surpluses of the project and the return on capital reserves to be applied to future investment. The reinvestment 'problem' pertains also to NPV, but is less significant because the decision maker selects a discount rate that represents the expected return on reinvestments or alternative investments.

**Net Present Value Ratio:** A measure of net benefits generated per unit of scarce resource, used primarily in capital rationing situations.

## DYNAMIC PAYBACK

**DYNAMIC PAYBACK**

$$\sum_{t=0}^{T-1} OCF_t \left( \frac{1}{(1+r)^t} \right) \geq 0$$

OCF<sub>t</sub> = Operations Cash Flow, Period T

$$OCF_t = -A_t + NP_t + I_t + D_t + R$$

A <sub>t</sub>	INVESTMENT, period t
NP <sub>t</sub>	NET PROFIT AFTER TAX, period t
I <sub>t</sub>	INTEREST, period t
D <sub>t</sub>	DEPRECIATION and OTHER AMORTIZATION, period t
R	RESIDUAL VALUE OF ASSETS AT PLANNING HORIZON
r	DISCOUNT RATE, %
T	PERIOD IN WHICH SUMMATION EXCEEDS ZERO

The payback period is the time necessary to recover the initial investment from future benefits generated by its employment. In the section on Static Indicators a method of determining the payback period was presented that considered the current magnitude of the flows in each period.

An alternative method of determining the payback period applies the concept of discounting to future flows. The rate to be

applied would normally be the challenge or hurdle rate for the investor (see the section on Financial Criteria). The payback period is the time  $p$  in which the summation of cash flows goes from negative to positive, indicating that the capital investment plus the expected rate of return has been covered. This method is more conservative than the standard payback as the time required to cover the investment with discounted benefits will be greater.

In the formula shown interest is added back to net profit. Residual value represents the liquidation value of the assets at the end of planning horizon or their value equivalent to their employment in future benefit-generating activity.

## NET PRESENT VALUE

**NET PRESENT VALUE**  
**[NPV]**

- ◆ **BASED UPON CASH FLOW**
- ◆ **EXPLAINS SURPLUS GENERATED BY INVESTMENT**
- ◆ **MAIN INDICATOR OF PROJECT'S FINANCIAL MERIT**
- ◆ **EXPLAINS VALUE OF INVESTMENT**

Net Present Value (NPV) is the fundamental measure of value in the world of finance. In virtually every rational financial arena financial instruments are valued at the NPV, which is the present value of net future benefits to be derived from ownership of the instrument. This holds in the conventional equity and credit markets as well as in the world of highly speculative finance. The leveraged buy-out is no exception. The discount rates used to calculate NPV may be on the high side due to the risk involved, but the

same principles apply nevertheless.

**Based upon cash flow:** As a dynamic indicator the NPV is calculated on the basis of the appropriate cash or resource flow for each time period to the planning horizon.

**Explains surplus generated by the investment:** The NPV indicates how well the investment is employed to generate benefits. It represents the surplus value generated over and above the investment at the selected discount rate (the hurdle rate of return on invested capital). Normally if the NPV is positive the project is acceptable. If the discount rate is the opportunity cost of capital, or its return in the best of alternative application, then a positive NPV indicates that there is no alternative project that will yield a better return. If several mutually exclusive projects are under consideration the NPV ratio (discussed below) may indicate the best choice for investment.

**Main indicator of project's financial merit:** As previously discussed, capital has a depletion cost and a rental cost (actual or opportunity). The value of NPV at a particular discount rate  $r$  signifies the excess over the capital invested and the expected return, i.e. the excess wealth that would be generated by the project if all goes according to plan. The discount rate  $r$  to be applied is logically the expectation of return.  $NPV=0$  means that the capital is recovered and the rental charge or expectation is realized, with no excess wealth generated.

**Explains value of investment:** The basic mechanism for determining value of an investment is the discounted value of the benefits that it generates. As such, the present value of future benefits generated is one means of valuing assets.

## CALCULATING NPV

**CALCULATING NPV**

- ◆ ESTIMATE FINANCIAL AND RESOURCE FLOWS
- ◆ APPLY APPROPRIATE DISCOUNT RATE
- ◆ SUM PRESENT VALUES OF CASH FLOWS

**Financial and resource flows:** NPV is based upon the funds and resource flows during each project planning period to the planning horizon. Estimates of the flows in each period are required, that derive from the techno-economic study of resources committed to and generated by the project.

**Apply appropriate discount rate:** Once the flows in each period have been converted to a standard unit of account, usually monetary, a discount rate can be

applied to the flow in each period. The discount factor varies from period to period, as discussed in the section on Time Value.

**Sum present values of cash flows:** The NPV is the sum of the discounted values of the cash flows in each period for a specified number of project periods, usually to the planning horizon (life of the project). Discounting at an appropriate rate (the hurdle or challenge rate) can be applied separately to inflows and outflows or to the net of inflows and outflows. The result will be identical. The NPV is the total present value, discounted at the hurdle rate, of cash/resource inflows minus outflows.

### EXAMPLE: CALCULATING NPV

**EXAMPLE: CALCULATING NPV**

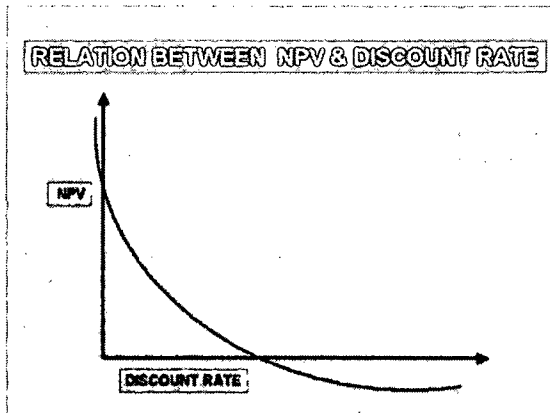
Year	Outflow	Inflow	Net flow	df for 10% discount rate	Present value	df for 15% discount rate	Present value
0	10,000	0	-10,000	1.0000	-10,000	1.0000	-10,000
1	500	4,000	3,500	0.9091	3,181	0.8696	3,044
2	1,000	4,000	3,000	0.8264	2,479	0.7961	2,388
3	5000	4,000	-1,000	0.7513	-751	0.6575	-658
4	3,000	7,000	4,000	0.6830	2,732	0.6718	2,687
5	3,000	8,000	5,000	0.6209	3,104	0.4972	2,486
NET PRESENT VALUE					745		-573

In the example the inflows and outflows are shown for each period to the planning horizon. The net flow is the difference between inflows and outflows. A positive value signifies a net inflow and a negative value a net outflow.

Discounting is applied to the net flow in each period at two different discount rates of 10% and 15%. The assumption is that all flows occur at the end of the period.

The NPV is determined as the sum of the discounted values in each period. In the example, the NPV at a discount rate of 10% is positive 745 and at 15% negative 573. Generally the NPV will decline with increasing discount rate.

## RELATION BETWEEN NPV AND DISCOUNT RATE



For most projects the NPV decreases with increasing discount rate. At low rates of discount, for a good project, the NPV will be relatively high and will decrease as the discount rate is increased. Above some discount rate the NPV will be negative. It is possible that the NPV will again turn positive as the discount rate is further increased. This can happen when there is more than one negative-positive change in net cash flows from one period to the subsequent period. In fact, the NPV will cross the zero axis for each such change.

It is not usually a problem because the NPV has a definitive value for any discount rate and is normally evaluated at a rate determined by the participants.

## NPV of TOTAL INVESTMENT

**NPV OF TOTAL INVESTMENT**

$$NPV = \sum_{t=0}^{t=n} OCF_t \left( \frac{1}{1+r} \right)^t$$

OCF <sub>t</sub>	OPERATIONS NET CASH FLOWS FOR TIME PERIOD t
r	DISCOUNT RATE
n	PLANNING HORIZON

The cash/resource flows applicable for determining NPV depend on the viewpoint represented by the flows, return on assets committed to the project, the total equity, or the viewpoint of a partner.

The NPV of total investment indicates the excess, if any, over the cost of capital generated by the project. The cost of capital includes the depletion and expected return. The relevant flows are the Operations Cash Flow (OCF) in each period, which includes essentially only the

"real" flows (expressed as monetary values of resources committed and generated), although the calculation is conventionally performed on an after-tax basis. The discount rate,  $r$ , is either the opportunity cost of capital (return on the most favorable alternative investment) or the cost of capital used to finance the project. If finance is obtained from more than one source then the weighted cost of capital is taken as the discount rate (see the section on Cost of Capital).

The NPV is calculated mathematically by multiplying each period flow by the appropriate discount rate and summing the result. Inflows and outflows can be discounted to the beginning or end of the first period - the choice will have some effect on the NPV. Discounting to the very beginning of the project is more realistic. Some consideration may be given to the time within each period that the flows actually occur. A typical assumption is that all flows occur at the end of the period. In some cases more accurate estimates of timing may be decisive.

## NPV of EQUITY

**NPV of EQUITY**

$$NPV_e = \sum_{t=0}^n NCF_{et} \left( \frac{1}{(1+r_e)^t} \right)$$

NPV <sub>e</sub>	NET PRESENT VALUE of EQUITY
NCF <sub>et</sub>	NET CASH FLOWS FOR EQUITY, PERIOD t
r <sub>e</sub>	DISCOUNT RATE FOR EQUITY

The Net Present Value (NPV) of equity is developed from the NCF, as explained previously, for each project period. Each period inflow and outflow (or their algebraic sum) is discounted at a rate appropriate for the equity investor.

The discount rate for the total investment and for the equity participants will usually not be the same. There are different expectations in credit vs. equity markets, indicated by the differences in returns on investment in each market. As most

projects usually involve both equity and debt financing, the weighted cost of capital that would be used as the discount rate for determining NPV, would be different in each case. Investments that are riskier generally require higher returns (see the section on Risk and Uncertainty).

As in the case of the NPV on total investment, only projects with non-negative NPV's are considered acceptable (assuming the discount rate represents the opportunity cost of equity capital).

A similar approach to NPV for a partner can be developed by applying the partner's discount rate to the net flows in the Cash Flow Statement - Partner (see Financial Statements).

## SIGNIFICANCE OF NPV<sub>e</sub>

**SIGNIFICANCE OF NPV<sub>e</sub>**

- ◆ EXPLAINS PROJECT'S CONTRIBUTION TO INCREASE IN WEALTH OF INVESTORS
- ◆ EXPLAINS THE REAL VALUE OF NET WORTH

The NPV of Equity indicates whether or not a project is acceptable for investment ( $NPV \leq 0$ ) and other important information:

**Explains project's contribution to increase in wealth of investors:** The NPV is the surplus value over the cost of capital, which includes both the equity contribution and the expectation of return. This is the surplus wealth accruing to the owners of the project, assuming it proceeds according to plan. The actual

recovery of this surplus would be through the increased value of ownership (shares), which could be either be liquidated or dedicated to continuing operations.

**Explains the real value of net worth:** What is the real net worth of the project? This can be determined at the inception of the project for the assumed cost of capital, as the NPV plus the capital invested. The reason for this is that NPV represents the value of future benefits discounted at the cost of capital minus the investment, also discounted at the cost of capital. So, to arrive at the value of future benefits it is necessary to add back the present value of the investment.

## NPV of EQUITY – EXAMPLE

EXAMPLE: NPV of EQUITY							
YEAR	0	1	2	3	4	5	6
SURPLUS/DEFICIT per	0	0	47	150	200	300	400
Cash flow for financial planning							
Less: Equity adjustments	400	200					
Plus: Dividend adjustments			10	15	20	20	
NET CASH FLOW for EQUITY	-400	-200	67	165	220	320	400
DISCOUNTED NCF, @ 15%	-400	-174	43	103	128	159	175

NET CASH FLOW FOR EQUITY

NET PRESENT VALUE (NPV) = 110

The example has been modified from that in the somewhat to show the proportions of equity and debt financing. Also in the accompanying chart, data for the years 3-6 have been added with the last year,  $n=7$  showing the residual value of the assets (200) at the end of the planning horizon.

Starting with the Surplus/Deficit from the Cash Flow for Financial Planning, the equity contributions in each year (in this case years 0 and 1) are deducted and the

dividends are added back as they are generated by the project and accrue to the equity holders. The results are shown in the line 'Net Cash Flow for Equity' (see chart).

In the following line the discounted values are shown for the net value in each year. The discount rate is 15%. The Net Present Value for Equity (NPVe) is 110, the sum of the discounted values, indicating that a surplus over the cost of capital is generated. In this example the values are discounted to the end of the zero period. It is assumed that all flows occur at the end of each period.

## NPV for JV PARTNER – EXAMPLE

NPV for JV PARTNER					
SOURCES OF CASH (INFLOW)	CONSTRUCTION		OPERATIONS		
	Year 0	Year 1	Year 2	Year 3	Year n
NET FLOW (INFLOW - OUTFLOW)	0	0	47	164	200
JV PARTNER'S SHARE (50%)	0	0	23.2	82.4	120
JV PARTNER'S DIVIDENDS	0	0	5	20	0
INFLOW FOR JV PARTNER	0	0	33.2	117.4	120
JV PARTNER'S EQUITY	(240)	(120)	0	0	0
NET FLOW, JV PARTNER	(240)	(120)	33.2	117.4	120
DISCOUNTED NET FLOW, 12%	(240)	(107.56)	25.46	83.08	?
CUMULATIVE FLOW, JV PARTNER	(240)	(360)	(228.4)	(208.4)	?

An example is shown for calculating the NPV for a partner. This is the same as the example shown in "Financial Statements". Here the cash flow for the partner in each period is discounted by the cost of capital for the partner (in this case 12%). The NPV is determined by adding the discounted values for all periods to the planning horizon.

In the example, data is shown for years 0-3 and for year n (undefined). The NPV up to and including year 3 is (237.11). The

actual NPV would require adding to this amount the values of discounted cash flow for all remaining years up to year n. Up to year 3 NPV is negative, but for this to become a good project for the partner, the NPV should be non-negative by the planning horizon.

## INTERNAL RATE OF RETURN (IRR)

**INTERNAL RATE OF RETURN  
(IRR)**

- ◆ DISCOUNT RATE AT WHICH NPV = 0
- ◆ PV OF OUTFLOWS EQUALS PV OF INFLOWS
- ◆ RATE AT WHICH THE PROJECT GENERATES NET BENEFITS

An Internal Rate of Return is a measure of acceptability for a project. As explained further in the section on Financial Criteria, in general it should be higher than the opportunity cost or weighted cost of capital. The IRR is a discount rate that can be explained from several perspectives:

**Discount rate at which NPV = 0:** As discussed previously, when the NPV equals zero the investment consumed plus the investments' rental cost is just covered by future benefits. This is called

an Internal Rate of Return.

**PV of outflows equals PV of inflows:** When the NPV equals zero, i.e. the discount rate is an IRR, the present value of outflows just equals the present value of inflows. The outflows and inflows can be discounted separately, then summed and combined algebraically; or, the net of inflows and outflows can be discounted and summed. In either case the result will be identical.

**Rate at which the project generates net benefits for the investor:** Perhaps this is the most useful and descriptive interpretation of an IRR. In this sense it is an internal rate. This is the rate at which the un-recovered investment generates return up to the planning horizon.

## IRR for TOTAL INVESTMENT

**IRR FOR TOTAL INVESTMENT**

$$NPV = \sum_{t=0}^{t=n} OCF_t \frac{1}{(1+r)^t} = 0$$

**OCF<sub>t</sub>** OPERATIONAL NET CASH FLOWS  
**r\*** IRR, OR DISCOUNT RATE FOR WHICH NPV=0

The IRR for the total investment (value of assets committed to the project) is determined on the basis of the operational cash flows or OCF's (excluding financial flows as in the calculation of NPV on total investment). The IRR is a discount rate  $r^*$  which sets the sum of the discounted flows (NPV) to zero.

When the pattern of flow in each project period is such that there is more than one change in net cash flows, i.e. from negative to positive (or the reverse) there

will be additional discount rates for which the NPV=0. This is explained further below in 'Limitations of IRR'.

The IRR can be found with a search routine. As it is calculated by interpolation from NPV values at higher and lower  $r$ 's, it is implicitly an approximation. For accurate value the higher and lower  $r$ 's should be fairly close together. Using a digital computer the error will be insignificant.



## IRR – EXAMPLE

EXAMPLE: INTERNAL RATE OF RETURN							
Year	Outflow	Inflow	Net flow	Df at discount rate 10%	Present value @ 10%	Df at discount rate 15%	Present value @ 15%
0	10,000	0	-10,000	1.0000	-10,000	1.0000	-10,000
1	500	4,000	3,500	0.9091	3,181	0.8696	3,044
2	1,000	4,000	3,000	0.8264	2,479	0.7561	2,268
3	5,000	4,000	-1,000	0.7513	-751	0.6575	-658
4	3,000	7,000	4,000	0.6830	2,732	0.5718	2,287
5	3,000	8,000	5,000	0.6209	3,104	0.4972	2,486
NET PRESENT VALUE					745		-573

$$IRR = 10\% + \frac{745 - 0}{745 - (-573)} (15\% - 10\%) = 12.8\%$$

An Example showing the method of determining the IRR is presented. The previous example showing the method of determining NPV is used to illustrate the method. The IRR is found between two successive discount rates for which there is change in sign of the NPV (negative to positive or the reverse).

In this case there is a change in sign for the NPVs at 10% and 15%. This means that the NPV vs. discount rate graph will cross the zero NPV line at some point

between the 10% and 15% discount rates. The point is estimated by interpolation as shown. In practice, this would be determined by a search routine. A number of readily available software packages, e.g. electronic spreadsheets, have functions that perform the search and produce the IRR.

## IRR for EQUITY

IRR for EQUITY

$$NPV_e = \sum_{t=0}^n NCF_t \frac{1}{(1+r_e^*)^t} = 0$$

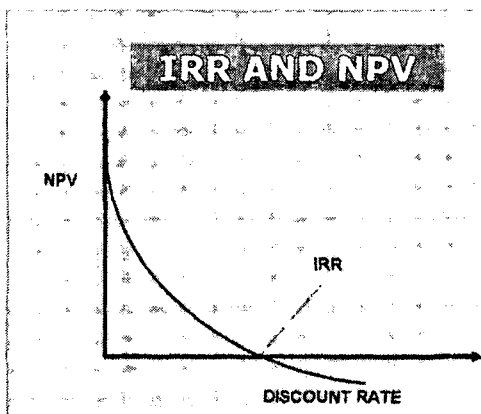
NCF<sub>t</sub> = NET CASH FLOW OF EQUITY FOR T TIME PERIOD

NCF<sub>t</sub> = Net Cash Flow, Equity for period t  
r<sub>e</sub><sup>\*</sup> = IRR, or DISCOUNT RATE AT WHICH SUM=0

The IRR for the portion of the project financed with equity uses the Net Cash Flow (NCF<sub>e</sub>) as developed for the NPV for equity. This derives from the cash flow for financial planning, which represents the financial plan for the project and indicates the surpluses and deficits that accrue to the project's owners. The equity contribution in each period is deducted and dividend payouts to equity holders are added back as these represent benefits generated by the project and received by the shareholders.

The IRR is the discount rate r\* that sets the present value of the NCF's to zero. This is rate at which the equity generates net benefits. The IRR can be found using a search routine or by graphical means (NPV vs. discount rate).

## IRR and NPV



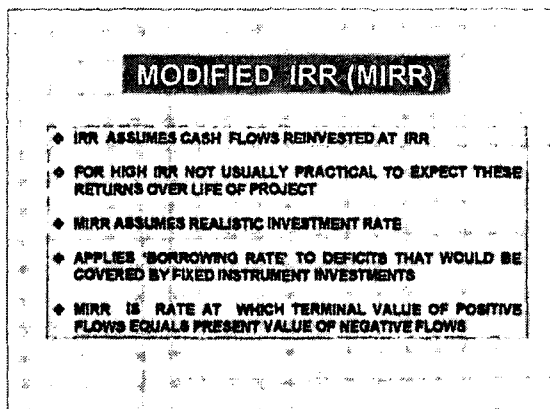
For a normal project as the discount rate is increased from zero, the NPV generally decreases. At some discount rate the NPV graph will cross the zero axis. This is the IRR.

The IRR can be found by an iterative process. Starting with an estimate of the IRR (say the hurdle rate), the NPV is calculated. If the NPV is positive the discount rate is increased and the new NPV calculated; if negative the process is reversed. When a crossover of  $NPV=0$

occurs an interpolation process can be used to determine the IRR more accurately. The IRR can be determined graphically, but a computerized search routine is more convenient and accurate.

IRR is actually the solution of a polynomial of order  $n$ , where  $n$  is the number of periods in the project (see Limitations of IRR, below). For this type of function there can be as many as  $n$  roots, some of which may be 'real' or 'imaginary' in the mathematical sense. Alternative real solutions occur when there are negative flows after initial outflows. Additional IRR's will be generated for every change in sign of the net flows from one period to the next. Usually this is not a problem as the flow patterns have large negative outflows early in the project and then usually positive flows during the production phase. Relatively minor negative outflows will not affect the normal IRR search procedures.

## MODIFIED IRR (MIRR)



The problem of unrealistically high IRR for a project can be resolved by ignoring IRR entirely as a measure of project worth. Net Present Value is a much more fundamental way to assess an investment project as it provides a definitive result - the NPV is non-negative at the cost of capital or not.

If a correct IRR is to be pursued, one way of dealing with the problem of inordinately high IRR is to use the Modified Internal Rate of Return (MIRR), but is not without

its detractors. An objection is that no investment decision should be dependent on other opportunities for investment of generated surpluses. In this method the assumption that the surpluses generated by the project are reinvested at the IRR is avoided by simulating the reinvestment of the surpluses at a more realistic rate of return and to the planning horizon. In this way the terminal value of the surpluses are matched with the present value of deficits (mainly the initial investment) to determine an equivalent rate of return for the project.

To state the problem once again:

**IRR assumes cash flows reinvested at IRR:** This has been explained previously.

**For high IRR not usually practical to expect these returns over life of project:** It is important to consider that in the investment world financial resources are destined for reinvestment, and not for other purposes such as consumption. Applications for surplus funds that may be available in each period have to be found. Normally for a growing enterprise the funds will be absorbed internally in expansions of the enterprise beyond the project. In other situations these funds will be employed in other enterprises or subsidiaries. When the IRR of the project is inordinately high, opportunities to reinvest surpluses at the high rate of return will not be easily found.

In the MIRR approach the following adjustments are made:

**Assumes realistic investment rate:** A realistic reinvestment rate is applied to surpluses to the planning horizon. This simulates the reinvestment of surplus funds with a rate of return equal to the assumed reinvestment rate.

Applies 'borrowing rate' to deficits that would be covered by fixed instrument investments: A "borrowing" rate (a secured rate based upon the more conservative credit market rather than the equity market) is used to discount all negative flows to present value, a simulation of investment of funds at the start of the planning period to cover future investments or operating deficits. The approach is identical to the method of calculating the standard IRR with the exception that the 'borrowing rate' rather than the IRR is the discount rate.

**MIRR is rate at which terminal value of positive flows equals present value of negative flows:** A single discount rate will equate the terminal value of positive flows (P) with the present value of negative flows (N). This is the MIRR (of course, if the discounted negative flows are higher than the compounded positive flows, an MIRR will not be found). In other words, the MIRR is that rate which at which P is reduced by discounting to the absolute value of N.

MIRR is more applicable to equity analysis than to return on total investment. The reason is that the former deals with funds whereas the latter is concerned essentially with resources. MIRR, if anything, is more a financial technique than one that can deal with other types of resources. It can be applied in both, but not with same degree of significance.

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## CALCULATING MODIFIED IRR (MIRR)

**CALCULATING MODIFIED IRR (MIRR)**

$$P = \sum_{j=1}^n FP_j (1 + r)^{n-j}$$

$$N = \sum_{j=0}^n FN_j \frac{1}{(1 + \beta)^j}$$

$$m = \left( \frac{P}{N} \right)^{\frac{1}{n}} - 1$$

$FP_j$	Positive flow, period $j$
$FN_j$	Negative flow, period $j$
$r$	Re investment rate
$\beta$	Borrowing rate
$n$	number of project periods
$m$	Modified IRR

The mathematical form of the MIRR calculation is presented. P is the terminal value of all surpluses (positive flows) compounded to the end of the planning horizon at a reinvestment rate  $r$  (a rate based upon the return on anticipated investment opportunities). N is the present value of all negative flows discounted at the "borrowing" rate  $\beta$ . The rate at which P is discounted to equal N in value is the MIRR, m. Basically this is the rate at which the reinvested surpluses equal the investment on a time-adjusted

basis.

## LIMITATIONS OF IRR

**LIMITATIONS OF IRR**

- ◆ **IMPLICIT ASSUMPTION THAT NET CASH FLOWS RE-INVESTED AT IRR**
- ◆ **IF IRR IS ABNORMALLY HIGH THIS ASSUMPTION IS UNREALISTIC**
- ◆ **POSSIBILITY OF MULTIPLE IRR'S**

Use of IRR for investment project appraisal can be problematic under some circumstances (for further treatment see the file Problems of IRR):

**Implicit assumption that net cash flows reinvested at IRR:** There is an inherent assumption in the method of calculating the IRR that the surpluses in each period are reinvested at the IRR. This implicit assumption derives from the way that IRR is calculated. The net flow in each period is discounted; these

discounted values are then summed. An IRR occurs when the sum of the present values of all periods equals zero.

A method of calculating IRR that is precisely equivalent mathematically is to compound the positive periodic values at a reinvestment rate to the planning horizon and sum them (the terminal value of positive flows); discount the negative values at the same rate and sum them (the present value of the negative flows); discount the terminal value of positive flows at the same rate to the present and add the result to the present value of negative flows. The result will be the NPV. If NPV=0 then the discount rate applied is an IRR. This illustrates the equivalence of the assumption of reinvestment at the discount rate with the standard method of calculating IRR.

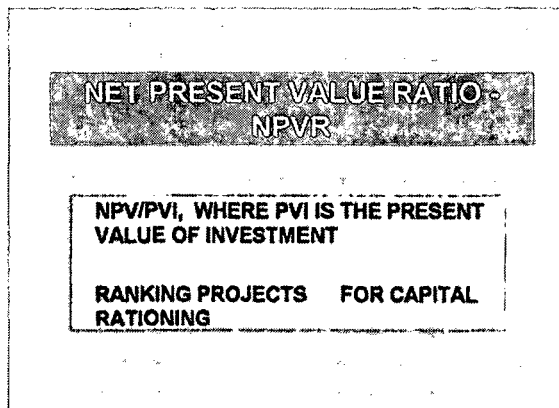
This is also a limitation for the NPV; however it is less significant because the discount rate is selected by the decision-maker, which probably represents the expectation of return on present and future capital resources.

**If IRR is abnormally high this assumption is unrealistic:** The IRR is a rate at which the NPV=0. If the IRR is very high, this assumption may be unrealistic. It may not be possible to find such reinvestment opportunities for the surpluses over the life of the project.

**Possibility of multiple IRR's:** As discussed previously, when there are changes in the period flows from negative to positive or vice versa, IRR's (mathematical roots) are generated by the polynomial equation describing the relation between discounted values of period flows. If there is more than one credible IRR the problem is to decide which one to use. There is, of course, a minimum IRR, and that can be accepted as the IRR and used as the measure against which the cutoff rate (expected rate of return for the investor) is evaluated. But this is not entirely satisfactory. In some cases IRR has to be discarded and NPV used as the primary financial assessment instrument.

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## THE NET PRESENT VALUE RATIO (NPVR)



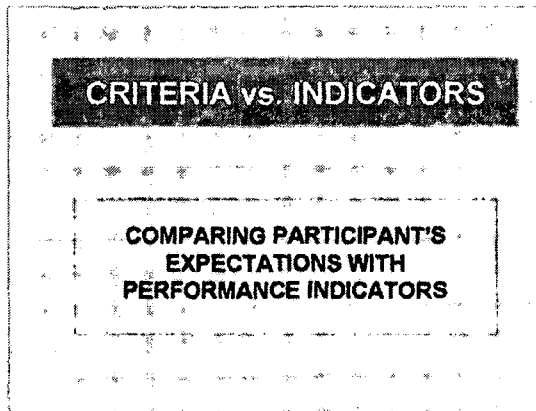
NPVR is a measure indicating increase in wealth generated by a project relative to total investment. The ratio is Net Present Value (NPV) to Present Value of Investment (PVI). NPV has been discussed at length previously. PVI is determined by discounting all the investment value in each period, including increments of working capital, to present value at the selected discount rate.

The ratio can be interpreted as the amount of surplus value generated per unit of investment. It is a measure that can be determined for a basket of projects; those with higher NPVR's are more desirable from this perspective.

NPVR is used for capital rationing. Any projects with positive NPV can be pooled and selected in whole or in part (if separable) to yield the best return on limited available capital, with priority based upon the value of NPVR for each project possibility.

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# CRITERIA VS. INDICATORS



Static and dynamic financial indicators that define predicted performance are derived from the financial study of the project, which is based upon the project design - the approach to the market, the technical configuration, the organization, in short the functional entity conceived by designers and how it will interact with the external environment.

The question now is: are the participants satisfied with what they see? Each of the participants has criteria - the goals and

objectives of each individual, corporate entity or other party to the project may, and usually will, differ. Performance indicators are to be compared with criteria. If the criteria are met or exceeded presumably the project will be regarded favorably; if not it will either be rejected, or perhaps recycled in some way.

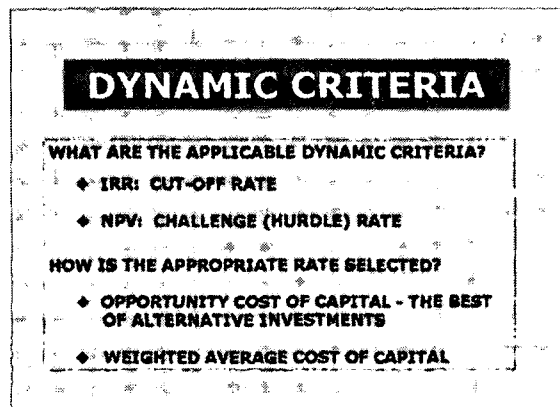
Determination of criteria is a crucial exercise; if criteria are not properly defined the decision process goes awry. In some cases there are a number of criteria that have to be regarded simultaneously. How they can be regarded in composite when only some are satisfied is an issue that confronts investors.

Another problem for financial criteria is inflation and currency exchange rates. When the project is launched in an environment where inflation is high, its effect on selecting appropriate criteria has to be considered. If the project involves foreign exchange requirements or earnings, exchange rate variations have to be anticipated in determining criteria.

Financial criteria can not simply be referenced to debt and equity markets. How market rates of return, for example, relate to appropriate criteria depends, at the least, on how the project analysis was performed.

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## DYNAMIC CRITERIA



Dynamic financial indicators are estimated from the predictions of project performance. They are to be compared with the criteria of investors and other participants.

What are the applicable dynamic criteria? The principal dynamic indicators that have been explained previously are Net Present Value (NPV) and Internal Rate of Return (IRR). The former is the fundamental indicator for investment projects, with the

advantage that the method produces a definitive result, which is not always the case for the IRR.

The IRR is a rate of return, expressed as a percentage, based upon either equity capital invested or total assets committed. In determining NPV a rate must be selected as the discount rate - the challenge rate or hurdle rate. An acceptable NPV must be non-negative; if the project is challenged with the hurdle of a particular discount rate, a negative NPV is grounds for rejection. For the IRR the criterion is the cut-off rate; a predicted IRR below the cut-off rate is considered unacceptable.

How is the appropriate rate selected? The criterion for both the cut-off rate (IRR) or hurdle rate (NPV) should be the opportunity cost of capital, the return on the most favourable alternative investment. When there is more than one source of finance to be applied to the project, the weighted average cost of capital should be the criterion (see the section Cost of Capital, Weighted Average Cost of Capital).

For an existing enterprise planning to finance the project internally, the criterion should be the weighted cost of its capital structure. In this case the market value of equity and debt may enter into the calculation of weighted cost.

The weighted cost of capital is an appropriate criterion for an enterprise contemplating an investment to be financed with its own funds. The existing capital cost is representative of the kinds of investments that is reflected by the company's historical rate of return. This is, in effect, its opportunity cost as it would likely reject some projects with characteristics that were not suitable according to its corporate culture (level of risk or industrial sector).

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## NPV or IRR - HURDLE or CUT-OFF RATE?

NPV or IRR – HURDLE or CUT-OFF RATE?	
◆	<b>Conventional projects: NPV and IRR criteria result in same accept or reject decisions</b>
◆	<b>Non-conventional projects: multiple IRR's cloud decision</b>
◆	<b>Advantages of NPV over IRR:</b> <ul style="list-style-type: none"><li>- <b>Definitive signal</b></li><li>- <b>Avoidance of reinvestment issue</b></li></ul>

The choice of dynamic criteria - the hurdle rate for NPV or a cut-off rate for IRR - usually will not alter the signals in regard to financial viability of an investment project. However, for some types of projects applying the cut-off rate to IRR is problematic.

**Conventional projects - NPV and IRR criteria result in same accept or reject decisions:** A 'conventional' project, in this context, has a normal pattern of inflows and outflows. The investment

occurs early in the project; financing matches the needs according to the asset acquisition plan. There may be operating deficits in the early periods, covered either by existing or additional financing or by internally generated funds. In general, there are outflows in the early periods representing mainly the investment, and primarily inflows during the operations phase. The same accept or reject decision will result.

If applying the hurdle rate as the discount rate produces a positive NPV, the IRR will be higher than the hurdle rate; therefore, using the same cut-off and hurdle rate will provide the same answer in regard to the acceptability of the project.

**Non-conventional projects:** multiple IRR's cloud decision: A non-conventional project, with a pattern of inflows and outflows that result in multiple IRR's, leaves room for doubt in regard to the accept-reject decision. Which IRR should be applied? There is a minimum IRR, and this can be compared with the cutoff rate. If the minimum IRR is below the cutoff rate the project could be considered unacceptable. A more satisfactory approach is to apply a hurdle rate and determine the NPV.

**Advantages of NPV over IRR:** The NPV is a more effective tool than IRR for assessing the financial viability of investment projects. IRR is more applicable in credit markets, where flow patterns are more regular, moderate and definitive. In applying NPV in project assessment a definitive signal is obtained: the NPV is either non-negative or it is positive. The other advantage is avoidance of reinvestment issue. The NPV method, as the IRR approach, does have the inherent assumption of reinvestment, but the reinvestment rate is the discount rate selected, which is the cost of capital, a more realistic approximation of the returns that can be expected for available investment opportunities.

Another advantage of the NPV approach is that selective reinvestment rates (discount rates) can be applied to funds at different points in time and intended for different purposes.

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## MUTUALLY EXCLUSIVE PROJECTS



Investors may be faced with the need to select one or more projects from among a group of possibilities when limited by available investment capital or by incompatibility of alternatives. Mutually exclusive projects can be ranked by comparing projected performance indicators.

An unambiguous way to rank mutually exclusive projects is to apply the hurdle rate and determine the corresponding NPV for each of the mutually exclusive projects. This indicator provides the surplus generated for each project at the specified rate and is the most reliable way to arrive at an investment decision.

Another factor that may be taken into account is risk - the risk premium associated with each project may differ. The criterion should be the NPV at the risk-adjusted discount rate. A further refinement is to compare the NPV ratios, Net Present Value generated per unit of investment for each project. The project with the higher NPV ratio would appear to be a more efficient investment opportunity.

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## RANKING MUTUALLY EXCLUSIVE PROJECTS - NPV AND IRR

**RANKING MUTUALLY EXCLUSIVE PROJECTS  
NPV and IRR**

**NPV AND IRR METHODS MAY GIVE  
CONFLICTING RANKING WHEN WIDE  
DIFFERENCES IN:**

- CASH FLOW PATTERN
- INITIAL CASH OUTLAYS
- PROJECT LIVES

NPV of an investment project represents the expected surplus value, over the cost of capital (depletion and rental costs), to be generated by a project. It is a measure of the anticipated increase in wealth of the project's owners. From this perspective, more is better. A project with higher NPV is more advantageous to investors, all other factors being more or less equal. IRR is the internal rate of return based on the planned inflows and outflows. Presumably in this case also, higher IRR is more desirable.

When ranking mutually exclusive projects, NPV and IRR can provide conflicting signals. This can occur when there are wide differences in cash (or resource) flow patterns, initial cash outlays and project lives.

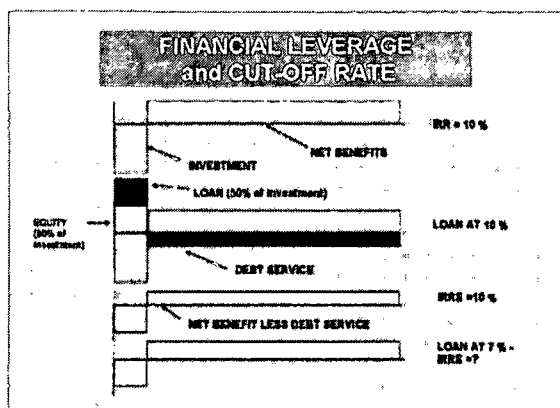
An example of two mutually exclusive projects with differing NPV and IRR signals is shown (see attachment *DIFFERENT SIGNALS*). Project M has higher IRR, but lower NPV at 9% discount rate. Project N has a higher NPV at the same discount rate, but a lower IRR.

The graph of NPV vs. Discount Rate for the two projects is shown (see attachment *NPV OF PROJECTS M AND N*). At discount rates below the crossover rate of about 10% Project N has higher NPV. At higher discount rates Project M has the higher NPV.

In this example, if the cut-off rate for IRR is 15% both projects would appear to be acceptable, with Project M perhaps favored for its higher IRR.

This example illustrates the superiority of NPV as an assessment tool. A definitive hurdle rate will clearly show one project to be more favourable than the other (except at the one rate for which the NPV's are equal). The advantage is even more fundamental, however. The hurdle rate represents the cost of capital, an indication of the expected rate of return on surpluses generated by the project.

## FINANCIAL LEVERAGE AND CUT-OFF RATE



This example is intended to illustrate why the cut-off rate is the cost of capital.

In the upper area a simple resource flow pattern for a project is shown. There is an initial outflow representing the assets committed to the project, with equal net benefits generated for a number of years. Project financing is not considered at this point. The IRR of 10% is the return on the total investment.

Now consider how the project is financed (second illustration from the top), with equal amounts of equity and debt. The total charges on the debt (interest rate) is 10% (for simplicity assume this to be also the cost of equity). In this simple pattern of flow, it is clear that the amount of debt service (assuming the annuity-type repayment plan) is equal to one half the net benefits.

The next illustration shows the position of the equity participants. Equity finances one half of the project, but receives only one half of the net benefits (the other half is used for debt service). What is the NPV for the equity holders? It must be 10%.

In the last illustration it is assumed that the cost of debt is 7 %, lower than the 10% return on the total assets committed to the project. From the point of view of the equity holders, the surplus generated from the half of the project financed with debt accrues to them and raises their rate of return. If the cost of debt were higher than 10% the effect would be to reduce the return for equity holders below the cost of capital.

The cut-off rate should be at least equal to the cost of capital. Otherwise, a project could be approved but it would not be able to generate returns that are satisfactory to investors.

Blue shows the scenario for determination of IRR, the commitment of real resources (investment) and the corresponding generation of net benefits. Assume that the project's IRR is 20% (future net benefit stream discounted by 20% to equate to initial investment)

When the financing is added in (red for loan and green for equity) debt service is incurred. Assume that the loan is at 20% on half of the total investment (the other half financed by equity). Then the value of the debt service stream is equal to one half of the value of the net benefit stream. The result is the third scenario (green) where discounting values of one half the net benefit stream against one half of the total investment again provides a return (on equity in this case) of 20 %.

If the interest on the loan is less than 20%, the net benefit from the point of view of equity will increase, and there will be an increase in the IRR for the equity. The reverse is true if the interest rate is more than 20%.

## VALUATION

<b>VALUATION</b>		
OPTION	VALUATION BASIS	CRITERIA
CONTINUE OPERATIONS	PRESENT VALUE OF FUTURE BENEFITS OF OWNER	OWNER'S HURDLE RATE
SELL THE BUSINESS AS GOING CONCERN	PRESENT VALUE OF FUTURE BENEFITS OF BUYER	BUYER'S HURDLE RATE
LIQUIDATE THE ASSETS	MARKET VALUE OF ASSETS	REPLACEMENT VALUE ?

Investors are often faced with the problem of determining what a business is worth - how much is actually invested in a business compared with its actual value or what price should be paid for assuming control of an enterprise.

An owner of an enterprise is constantly confronted with three possibilities: (1) the business can continue (perhaps with expansion or some other project in mind), (2) it can be sold as a going concern or (3) it can be dismantled and the assets

liquidated. There are one or more others, but we must deal here only with the legal alternatives.

How is the business to be valued in each circumstance? What is the basis for establishing an appropriate price? The fundamental mechanism is Net Present Value, the value of net benefits accruing to ownership to the planning horizon.

**Continuing enterprise:** If the enterprise is to continue, the balance sheet tells little about value of the enterprise. The prices or values of assets and liabilities are not really relevant. What is important is how these assets can be utilized to generate future benefits. The value of the enterprise is the present value of future net benefits, discounted at the opportunity cost of the owner.

**Sell a going concern:** The buyer's perspective comes into play. The process is similar, but the buyer has her/his own way of regarding the company or project in terms of expected rate of return and risk. The value from the buyer's perspective is the present value of future benefits foreseen, discounted at the buyer's opportunity cost of capital. For any investor, existing owners, prospective mergers or acquirers, or new entrants to the field, the past is only relevant in terms of what impact it has on the future. In evaluating investment options, historical information should be employed to simulate future performance from the point of view of the analyst's sponsor, who may be the existing owners or a prospective acquirer. The current balances should reflect the values that are linked to future funds and resource flows. Fixed asset values and corresponding depreciation rates, for example, should be set in accordance with anticipated future depreciation as it influences earnings and cash flows.

Values and liquidation schedules for current assets and liabilities should comprise the best estimates that will accurately reflect their future financial impacts. Under these conditions the net worth, or shareholders' equity, as reflected in the balance sheet may not be meaningful.

**Liquidation:** In this case a balance sheet is important, so long as it reflects the actual market values of assets and liabilities. The book value of an asset, for example, may or may not represent its liquidation value. Under these conditions the balance sheet should reflect the net worth (difference between asset and liability values). The financial analysis would consist of establishing a current Balance Sheet for the proprietors, showing the liquidation value of all assets, the settling value of all outstanding liabilities and the net worth or residual monetary value that would accrue to the owners upon liquidation.

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## INFLATION AND DYNAMIC CRITERIA

INFLATION and DYNAMIC CRITERIA
◆ NORMALLY PROJECTS ARE APPRAISED AT CONSTANT PRICES
◆ NOMINAL COST OF CAPITAL AFFECTED BY INFLATION
◆ THE IRR AT CONSTANT PRICES NOT COMPARABLE WITH THE NOMINAL COST OF CAPITAL
◆ HURDLE RATE ADJUSTED FOR INFLATION

**Normally projects appraised at constant prices:** When inflation is general, i.e. all inputs and outputs are similarly affected by inflation, there is usually no need to adjust prices for inflation when performing financial analysis of an investment project. The relationship of inputs and outputs will be the same. Analysis can be performed using the assumption of constant (not inflation-adjusted) prices, either those prevailing at present (recommended) or at some future point in time.

If there are cost elements that are expected to change relative to general inflation, then the escalations in such costs should be included in the analysis, even when performed at constant prices. However, the escalations should not be confused with inflation. Scarcities of certain commodities may force prices higher, but if there is not a general impact on prices in general then only the relative changes in such prices should be included.

Special care should be taken with debt and foreign exchange exposure. The currency in which debt is designated can affect nominal debt service requirements and their constant price equivalents. When inflows or outflows are in a foreign currency the effects of relative inflation and possible exchange rate fluctuation should be taken into account when analyzing the return on a project investment at constant prices.

**Nominal cost of capital affected by inflation:** In circumstances where the inflation is high, the cost of capital will be affected. With general inflation the nominal, or apparent rate of return on investments will usually increase, but will not reflect the real rate. This phenomenon is explained subsequently. The rate of return will increase approximately by the inflation rate, as expressed in the following relationship:

$$d=r+i$$

**d** - nominal rate of return  
**r** - real rate of return  
**i** - inflation rate

The actual relationship is slightly more complicated. Its derivation and explanation are included in Dynamic Criteria and Inflation.

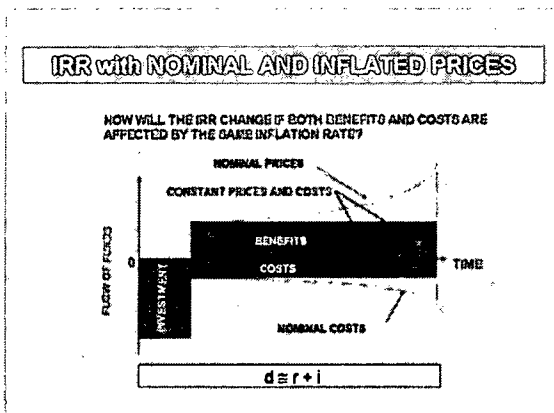
Under conditions of general inflation nominal rates of return on investment will appear to be higher. Real rates, tied to the actual purchasing or economic power of the benefits, may not change.

**The IRR at constant prices not comparable with the nominal cost of capital:** If the financial return on a project analyzed at constant prices is compared with the same project at current prices, there will usually be a difference in the dynamic indicators. The field is not the same. The difference will usually approximate the above relationship - the return (IRR) will be increased approximately by the rate of inflation.

**Hurdle rate adjusted for inflation:** It is unreasonable to compare indicators developed using constant price assumptions with criteria that are based upon the nominal cost of capital in the marketplace (see section on Cost of Capital, Capital Markets). The 'playing field' is not level. With constant price analysis, as a general principle, inflation-adjusted cost of capital should be the hurdle rate, with any risk premium included. In other words, only inflation should be stripped from the capital market rates. At current prices it is appropriate to use the nominal cost of capital as the criterion.

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## IRR WITH NOMINAL AND INFLATED PRICES



In the illustration, the pattern of inflows and outflows are shown for a project at nominal (current) prices and at constant prices. For simplicity, the investment occurs at the start and the benefits and costs are uniform for each period to the planning horizon.

Suppose the IRR is first determined for the project using constant prices.

For an acceptable project benefits must exceed costs. When both benefits and costs are inflated, which will increase faster? Benefits, because they have the higher values; when inflated at the same rate as costs the absolute increases will be greater. This means that under conditions of inflation the nominal (inflated) differences between benefits and costs during each period will be greater than the corresponding differences under constant pricing.

If the net benefits are higher in each period for the inflation case the IRR should also increase. By what amount? Usually close to the inflation rate. In other words the nominal, or inflation-based IRR will exceed the constant price IRR approximately by the rate of inflation included in the current pricing.

For a good project the benefits exceed the costs. If general inflation is applied the benefits grow in value faster than the costs. Then when the IRR is computed the value must exceed that for the constant price assumption.

This supports the idea that under conditions of inflation the market or nominal rate should be applied as a criterion only if the prices are at current (inflated) levels. Otherwise, both the criterion (discount rate) and analysis should be applied in current prices, with the effects of inflation removed.

### EXAMPLE: IRR AT CONSTANT AND CURRENT PRICES

**EXAMPLE IRR AT CONSTANT AND CURRENT PRICES**  
INFLATION RATE,  $i = 10\%$

YEAR	NCF - CONSTANT PRICE	NCF - CURRENT PRICE
0	-15,000	-15,000
1	4,000	4,400
2	5,000	6,050
3	6,000	7,986
4	6,000	8,785
5	6,000	9,663
IRR	$r = 21.6\%$	$d = 33.8\%$

$d = r + i + ni$   
 $d = 0.216 + 0.100 + (0.216)(0.100) = 0.338$  or  $33.8\%$

This example is intended to illustrate the relationship between the rates of return (IRR's) calculated for the same project under current and constant price assumptions. For years 1-5 the Net Cash Flows are shown for the constant price case and the inflation case. NCF's in each period for the constant price case are inflated at a 10% rate. The total inflationary effect depends upon the number of years of inflation. For example, the constant price value of 5,000 in the second year is inflated by the factor

$(1.1)^2$  or 1.21; the value of 6,000 in the third year is inflated by  $(1.1)^3$  or 1.331.

The IRR's in each case are  $r=21.6\%$  and  $d=33.8\%$ , where  $r$  is the constant price rate and  $d$  is the inflated price rate. The relationship between the 'real' rate (constant-price rate in this example) and the nominal rate (inflated-price rate), is precisely in accordance with the equation shown (see derivation in Dynamic Criteria and Inflation).

When prices are inflated to expected current levels, the IRR so determined is higher than the nominal rate of return by approximately the rate of inflation.

## CONSTANT OR CURRENT PRICES?

<b>CONSTANT OR CURRENT PRICES?</b>		
	CONSTANT PRICES	CURRENT PRICES
<b>CONDITIONS</b>	ZERO INFLATION OR ALL INPUTS AND OUTPUTS AFFECTED EQUALLY; HOWEVER, RELATIVE INCREASES IN PRICES INCLUDED (ESCALATIONS)	PRICE INFLATION AND ITS IMPACT ON LIQUIDITY, PARTICULARLY IN THE CASE OF FOREIGN EXCHANGE EXPOSURE
<b>HURDLE RATE</b>	REAL COST OF CAPITAL - NOMINAL COST ADJUSTED FOR INFLATION; REAL RETURN ON MOST FAVOURABLE ALTERNATIVE PROJECT	NOMINAL COST OF CAPITAL MARKET PRICE; NOMINAL RETURN ON BEST OF ALTERNATIVE PROJECTS
<b>CUT-OFF RATE</b>		

Should the analysis be performed at constant or current prices, and what should be the decision criteria in either case?

Even under hyper-inflationary conditions, it is usually better to perform the rate of return analysis at constant prices. Under hyper-inflation the analysis can be performed in terms of a foreign currency that is not undergoing a high rate of inflation.

Normally general inflation will affect both inputs and outputs. Nominal returns will be affected by inflation, but when costs and benefits are reduced by the appropriate deflators, assuming the appropriately modified criteria are the benchmarks for acceptance or rejection, appropriate investment signals will be presented.

### Conditions

**Zero inflation or all inputs and outputs similarly affected:** Prices should be at constant level, but including relative price changes anticipated (escalations): It is appropriate to use the real cost of capital as the criterion (hurdle or cut-off rate), the nominal market rate adjusted for inflation, but including any risk premium.

**Price inflation with concerns about liquidity, particularly in regard to foreign exchange exposure:** Prices can be at current levels. It is appropriate to use the nominal (market price) cost of capital as the criterion, or the opportunity cost based upon the expected nominal return on the most favourable alternative investment. The most significant application of current price analysis is for confirmation of liquidity during the early periods when inflation may escalate debt service in the case of foreign currency-denominated loans and may also cause liquidity problems in relation to loans denominated in domestic currency from the high capital cost under these conditions. For rates of return probably constant price analysis is more accurate.

## PRINCIPLE CRITERIA WITH INFLATION

		POINT OF VIEW	
		INVESTOR SATISFACTORY RATE OF RETURN	LENDER RECOVERY OF LOAN PRINCIPAL AND INTEREST
ANALYSIS:	CONSTANT PRICES, REAL COST OF CAPITAL	CURRENT PRICES, NOMINAL COST OF CAPITAL	
CRITERIA:	REAL OPPORTUNITY COST OF CAPITAL	NOMINAL OPPORTUNITY COST OF CAPITAL; FLOW OF FUNDS SUFFICIENT TO COVER DEBT SERVICE	

UNDER HYPER-INFLATIONARY CONDITIONS ANALYSIS CAN BE PERFORMED WITH ALL PRICES EXPRESSED IN FOREIGN EXCHANGE

This is a recapitulation of ideas presented previously. It is intended to suggest the appropriate form of analysis depending upon its purpose and perspective. Participants in a project may have different perspectives and concerns, but in no case is it plausible that the primary concerns of one are not at least secondary concerns of the others.

**Investor:** The investor seeks a satisfactory rate of return on investment. The analysis is more appropriately

performed using constant prices. The hurdle or cut-off rate should be the real cost of capital. If the market is used as a reference for capital costs, the prices (rates) should be adjusted for inflation - the 'real' opportunity cost of capital should be the benchmark. The combination of constant prices and 'real' cost of capital reflect constant purchasing or economic power of future costs and benefits.

**Lender:** The lender is interested primarily in recovering principal and receipts of interest and other charges. The principal criterion is liquidity. The ability of a project to service its debt may be affected by inflation, particularly in the case of high interest rates scaled to the level of inflation by the market, or where there is foreign currency exposure. In either case, at least for the early periods, analysis under current prices should be performed with the intention of demonstrating that the project can maintain adequate liquid reserves to service the debt. The rate of return under conditions of inflation is ordinarily only of secondary interest.

Again the concept of the level field is presented. If the analysis is done at constant prices then the real, inflation adjusted rate of return for cost of capital and for debt service should be applied.

For current price analysis, useful mainly for the analysis of liquidity early in the project, the nominal or market cost of capital and interest rates can be applied.

# RISK ANALYSIS

## RISK ANALYSIS

### DEALING WITH UNCERTAINTY IN PROJECT ANALYSIS

Markets do not like uncertainty. Whenever normal business conditions are threatened by economic, social or political instability investors tend to reduce their exposure. There is good reason for this. Normally business performance suffers, although some astute entrepreneurs are adept at taking advantage of such situations.

Heretofore, the approaches to financial preparation and appraisal of projects have been based upon expected scenarios. However, risk is a factor in any business situation and can not safely be ignored in most investment decisions. Risk Analysis is an integral part of project development. The realization of adverse conditions can have consequences from annoying to fatal. Fortunately many risk factors can be estimated and quantified. Measures to avoid, mitigate or spread risk may be undertaken. Building the risk factor into project analysis will lead to better decisions with more secure predictions of how investment in a project will perform.

## CONCEPTS OF RISK

### CONCEPTS OF RISK

- ◆ CHANCE OF RUIN
- ◆ POSSIBILITY OF LOSS
- ◆ VARIABILITY OF RETURN
- ◆ PROBABILITY OF AN UNDESIRABLE OUTCOME

Risk can take on a number of appearances in the minds of investors. As a general rule, risk connotes danger, the possibility that something will happen to threaten the economic position or status.

**Chance of ruin:** The possibility that oncoming changes in economic, political or social conditions will cause the project to collapse - that the external environment will become so hostile that the project can not survive is a concern for some investors.

**Possibility of loss:** In some cases it is not so much a fear of collapse; even the possibility of suffering a loss is sufficient to concern investors. A business or project can survive as a viable entity, but perhaps the rates of return will be less than expected with attendant reduction in value of the enterprise.

**Variability of return:** A basic concept of risk is probability of occurrence. When the range of possible occurrences is wide, such fluctuations, e.g. in rates of return, pose an element of risk. When performance is highly variable markets respond in kind. In fact, markets have developed a means to deal with variability in performance. A volatility measure,  $\beta$ , is widely used to assess the risk in an investment. This indicator measures the movements in value of the enterprise with respect to the overall market. For enterprises with high  $\beta$  changes in value during economic upturns and declines are more pronounced than the averages.



**Probability of an undesirable outcome:** A general view of risk is the probability of an undesirable outcome. How this undesired outcome is defined is for the investor to decide. At that point the analyst can take over and assess the associated risks.

## RISK FOR PARTICIPANTS - WHAT IS AT RISK FOR PARTIES INVOLVED IN THE PROJECT?

**RISK FOR PARTICIPANTS**  
WHAT IS AT RISK FOR VARIOUS  
PARTIES INVOLVED IN THE PROJECT?

- ◆ INVESTOR: LOSS OF CAPITAL INVESTMENT OR RESULTS THAT DO NOT MEET CRITERIA
- ◆ FINANCIER: DEFAULT ON THE LOAN
- ◆ GUARANTOR: DEMANDS OF CREDITORS
- ◆ GOVERNMENT: MISALLOCATION OF INVESTMENT RESOURCES

Each of the classes of participants in an investment project has differing views on risk. The project plan should take these perceptions of risk into account in planning and promotion. Only when risks are ameliorated to a satisfactory level will participants collaborate to bring the project into existence.

**Investor:** The investor tries to avoid loss of capital or commitment to an investment that does not meet established criteria such as rate of return or payback.

**Financier:** The lender is concerned with default on the loan and seeks to mitigate or eliminate the possibility of such an eventuality.

**Guarantor:** The guarantor has the ultimate responsibility for covering default in the debt service and seeks to hedge these risks.

**Government:** For a governmental regulatory body there is risk of misallocation of scarce investment resources.

## PERSPECTIVES ON RISK

**PERSPECTIVES ON RISK**

- ◆ RISK GENERALLY INCREASES WHEN:
  - PROJECTIONS OF FUTURE EVENTS MADE OVER LONGER PERIOD
  - HISTORICAL DATA, FUTURE PROJECTIONS INDICATE GREATER VARIABILITY
- ◆ RISK MAY BE ANALYZED FROM THE POINT OF VIEW OF:
  - PROPOSED PROJECT
  - PARTICIPANTS
  - INVESTMENT PORTFOLIO

The dimensions of risk are variability and time. Risk generally increases when:

**Projections of future events made over longer period:** Risk generally increases when projections are made far out into the future. The further out in time the greater the uncertainty in conditions and outcomes.

**Historical data, future projections indicate greater variability:** When historical data reveals a pattern of

variability risk appears to be greater. Periodic or cyclical variations are generally predictable and connote less risk than the kind of random variability that is the case in many markets.

Risk may be analyzed from the point of view of:

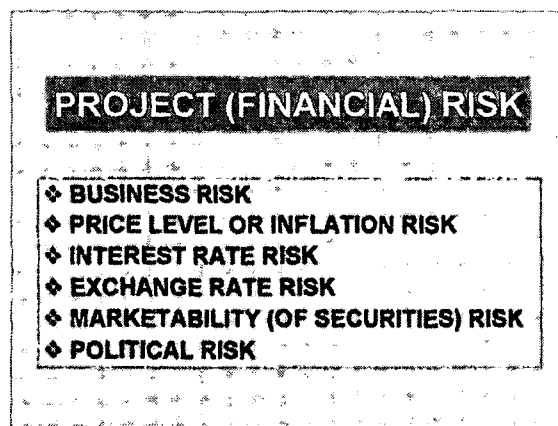
**Proposed project:** Project risks involve the degree to which predicted operational characteristics may not be realized.

**Participants:** Investors are concerned with risks associated with meeting investment criteria (rate of return, NPV). Lenders and guarantors attempt to deal with the risk of loan default by seeking projects with characteristics that minimize this possibility. Regulatory agencies seek to assure that scarce investment resources are productively employed by minimizing survival risks.

**Investment portfolio:** Another approach available to the investor is to seek projects that minimize risk to an investment portfolio. Portfolio risk is associated with the degree of synchronization of outlook and performance of the project in relation to other investments in the portfolio.

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## PROJECT (FINANCIAL) RISK



Risks abound in any investment environment. The project analyst is obliged to consider how risk elements in environment can be mitigated to the satisfaction of participants.

**Business risk:** Business risks involve the probability of not meeting operational targets, such as sales levels, production schedules, implementation, and operating costs.

**Price level or inflation risk:** The risk of price level changes due to inflation, and particularly escalations in prices of project inputs, can affect both the costs of investment and operational margins.

**Interest rate risk:** The risk of rising interest rates can affect assumptions about the cost of capital. An increase in short term rates can effect the cost of financing working capital. Increase in long rates can effect the cost of long term debt, particularly when floating rate instruments are employed in project financing. The valuation of fixed rate instruments held by the enterprise can be adversely affected. There is an inverse relationship between market value of fixed income instruments and interest rates.

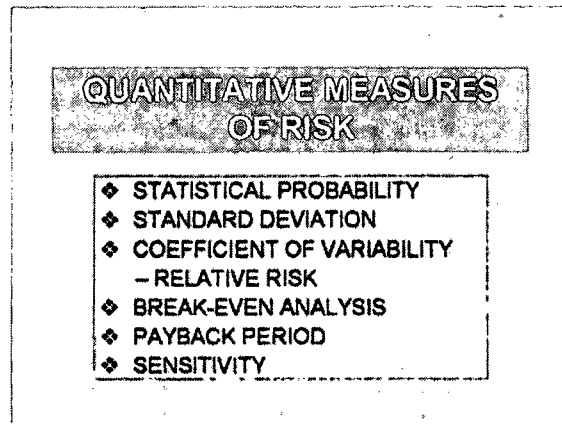
**Exchange rate risk:** If the enterprise is involved in trade exchange rate fluctuations can adversely affect the cost of imported intermediates or the value of exported outputs.

**Marketability (of security) risk:** Shareholders are subject to the vagaries of the market, as prices of their holdings vary according to factors related to the general business climate as well as the performance of the project. Another element in regard to marketability is government intervention. If currency restrictions are imposed, for example, foreign currency-denominated instruments may lose value.

**Political risk:** Political instability usually has adverse consequences for business and capital markets. Industries variously move in and out of favor with government, which sometimes offers encouragement in the form of incentives, profit repatriation and protection and at other times places more restrictions, even to the extent of confiscating project assets.

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## QUANTITATIVE MEASURES OF RISK



The assessment of risk can be qualitative and/or quantitative, in accordance with the methods of forecasting employed (see Market and Marketing, Forecasting). Qualitative risk assessment would normally be included in the scenario forecasts. Quantitative risk assessment would be applied to quantitative data, predictions and the resulting indicators of project performance.

**Statistical probability:** If the probability distributions of various scenarios can be quantitatively estimated, numerical measures of risk can be determined. Either standard statistical distributions can be employed, available in the form of probability distribution curves and tables, or distributions can be derived from historical data.

**Standard deviation:** The standard deviation is a statistical parameter that measures the variability of a phenomenon. Standard deviation is, therefore, one means of assessing risk. A higher standard deviation connotes greater risk

**Coefficient of variability - relative risk):** Rather than looking only at standard deviation, its quantitative relation with the expected value provides a relative measure of risk.

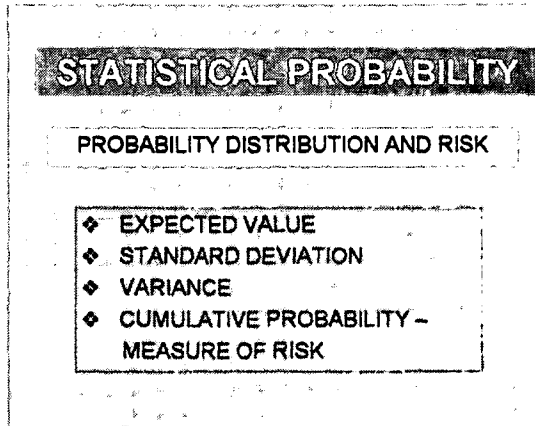
**Break-even analysis:** The break even point as a percentage of capacity is a measure of risk. A break-even point close to capacity leaves little margin for error and indicates a high level of risk. Operating parameters can be varied over anticipated ranges to determine the effect on break-even point and profitability.

**Payback period:** Events in the future have greater susceptibility to variation, thus enhancing risk. A short payback therefore connotes less risk for the project.

**Sensitivity:** Project parameters are varied over expected ranges to determine their effects on project operating characteristics.

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## PROBABILITY DISTRIBUTION AND RISK



If the distribution of probability of events, e.g. sales volume, price or net flow, can be determined it is possible to derive a quantitative assessment of risk. The subject of probability distribution and the association with risk is discussed in more detail in Probability Distribution and Risk.

**Expected value:** The expected value is the weighted average of possible values. It is not necessarily equal to the most likely value. For example, if there are three possible values, 100, 200 and 300,

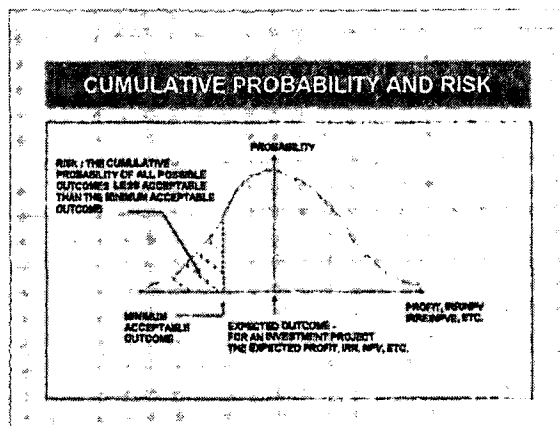
with probabilities of 10%, 60%, and 30% probability of occurrence, the most likely value is 200, but the expected value or mean is  $100(0.1)+200(0.6)+300(0.3)=220$

**Standard deviation:** The standard deviation is a measure of dispersion of the values of the population elements events. For example, it may be possible to estimate the expected value and standard deviation for the net flow in a future project period. A relatively large standard deviation connotes greater risk.

**Variance:** The variance is the squared standard deviation. It is another measure of dispersion of possibilities and, therefore, risk.

**Cumulative probability - measure of risk:** A definitive measure of risk is cumulative probability, the sum of probabilities that the phenomenon of interest will take on certain values.

## CUMULATIVE PROBABILITY AND RISK



A continuous probability distribution curve is shown. The principle described applies to discrete distributions as well.

The ordinate (vertical axis) is the probability of the occurrence of the phenomenon, e.g. NPV, IRR, profit. The abscissa (horizontal axis) is the value. The curve shows the probability of occurrence for values. For continuous distributions it is possible only to determine the probability of a finite interval of values.

The expected value is the most likely to occur. In this kind of symmetrical distribution the expected value is the average or mean value. In this case it represents the expected outcome for an investment project.

The investor has a criterion, a minimum value of profit, IRR or NPV that is acceptable. Any value below that level is unacceptable. The measure of risk, therefore, is the likelihood of performance below the criterion. This is represented

by the cumulative probability below the criterion, or minimum acceptable outcome.

If the probability distribution is known the area under the probability curve below the minimum acceptable outcome can be determined. For example, if the distribution is Normal or Gaussian, the probability can be found by determining the number of standard deviations between the mean and the minimum acceptable level. The probability of a value below the minimum can then be determined from tables or charts that provide the probabilities for the number of standard deviation from the mean.

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## STANDARD DEVIATION OF NET PRESENT VALUE

**STANDARD DEVIATION OF NET PRESENT VALUE**

- ◆ APPLICABLE WHEN PROBABILITY DISTRIBUTION OF FLOW IN EACH PROJECT PERIOD IS AVAILABLE
- ◆ EXPECTED FLOW AND SD FOR EACH PERIOD CALCULATED USING ONE OF THE AVAILABLE METHODS
- ◆ THE STANDARD DEVIATION OF NPV DETERMINED BY COMBINING STANDARD DEVIATION FOR EACH PERIOD

Net Present Value (NPV) is the fundamental tool for assessing the attractiveness of investment opportunities. If the probability distribution of cash and resource flow can be estimated for each project period, the standard deviation of NPV can be determined, providing an important measure of risk.

**Applicable when probability distribution of flow in each project period is available:** This approach can

be employed only when it is possible to estimate the probability distribution for flow in each project period.

**Expected flow and standard deviation (SD) for each period calculated using one of the available methods:** The expected flow and the standard deviation can be estimated using one of the approaches described in Estimating the SD of NCF.

**The standard deviation of NPV determined by combining standard deviation for each period:** The estimates of SD for the flow in each period can be combined to determine the SD of NPV. The method is explained in NPV Risk.

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## COEFFICIENT OF VARIABILITY

**COEFFICIENT OF VARIABILITY**

Coefficient of Variability =  $\sigma_{NPV} / E_{NPV}$

$E_{NPV}$  - Expected value of NPV  
 $\sigma_{NPV}$  - Standard deviation of NPV

Another indicator of relative risk is the Coefficient of Variability. This is determined as the ratio of standard deviation (SD) of NPV to expected value of NPV. This indicator perhaps is more meaningful as an indicator of risk than the SD alone as it measures the variability relative to the value of the NPV.

If the NPV is, for example, 1000 and the SD is 10, the risk is not very great. However for the same SD with an NPV of 100 the risk is obviously much

more significant. If the distribution is 'normal' one standard deviation on each side of the expected value represents a probability of about 67%, i.e. there is a probability of about 67% that the NPV will actually be between  $\pm 1$  SD of the expected value.

For example, if the coefficient equals 1 the SD equals the expected value. This means that there would be a chance of 33.5%/2 (assuming a symmetrical distribution) or about 16.75% that the NPV could be below zero.

## DISCRETE PROBABILITY – MULTIVARIATE

		INDEPENDENT VARIABLE Y		
		PESSIMISTIC	LIKELY	OPTIMISTIC
INDEPENDENT VARIABLE X	PESSIMISTIC	300/0.3 (0.09)	150/0.4 (0.12)	300/0.3 (0.09)
	LIKELY	400/0.3 (0.12)	700/0.2 (0.14)	1800/0.15 (0.21)
	OPTIMISTIC	300/0.3 (0.09)	375/0.12 (0.045)	2000/0.09 (0.18)

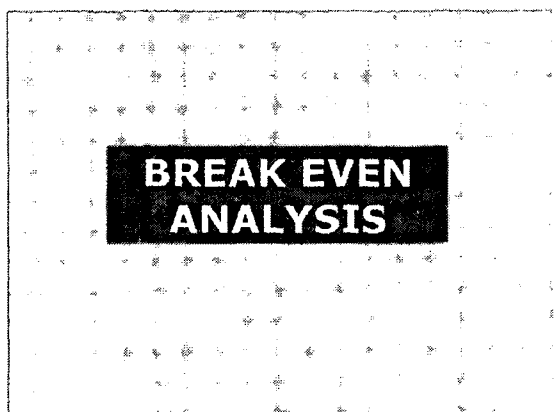
If the probabilities of discrete values of independent variables can be determined, the probability of any combination is the product of the individual probabilities. In the example the value and the probability of occurrence are shown of two independent project parameters for the pessimistic, likely and optimistic scenarios.

The NPV is calculated for each combination of the two parameters and the probability of each combination is

calculated as the product of the probability of each. For example, the probability of  $X = 150$  and  $Y = 300$  is  $(0.4)(0.3) = 0.12$  or 12 %. The sum of probabilities in all cells = 1 (certainty).

The probability of negative NPV can then be estimated by summing the probabilities in each cell (combination of the two parameters) for which the NPV is negative. This will be the probability of an unacceptable outcome. The probability of  $NPV < 0$  (not acceptable) =  $0.06 + 0.08 + 0.06 + 0.15 = .35$  or 35%.

## BREAK-EVEN ANALYSIS



The purpose of break-even analysis is to determine the equilibrium point at which sales revenues equal the costs of products sold. When sales (and the corresponding production) are below this point, the firm is making a loss; when above this point, the firm is making a profit and at the point where revenues equal costs, the firm is breaking-even - there is neither profit nor loss.

The break-even point can also be defined in terms of physical units produced, or the level of capacity utilization at which sales revenues and production costs are

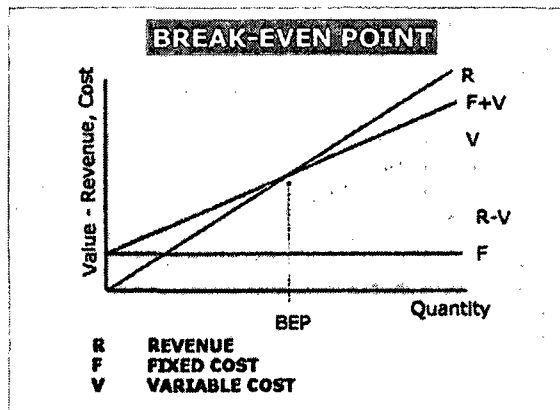
equal. The sales revenues at the break-even point represent the break-even sales value, and the unit price of a product in this situation is the break-even sales price.

Before calculating the break-even values, the following main conditions and assumptions should be satisfied:

- Production and marketing costs are a function of the production or sales volume (for example, in the utilization of equipment);
- The volume of production equals the volume of sales;
- Fixed operating costs are the same for every volume of production;
- Variable costs vary in proportion to the volume of production;
- The sales prices for a product or product mix are the same for all levels of output (sales) over time.

The above assumptions will not always hold in practice. Therefore, the break-even point should also be subject to sensitivity analysis, assigning different fixed and variable costs as well as sales prices.

### BREAK EVEN POINT



Break-even is a measure of risk. The graphs of Revenue, Fixed Cost and Variable Cost are shown. Break even occurs when Revenue covers both Fixed Costs and Variable Costs. If operations are above the BEP the enterprise will be profitable; if below an operating loss will result.

The break-even chart is shown with (R-V) as the contribution (difference between Revenue and Variable Cost). Break-even (BEP) occurs where the contribution line crosses the Fixed Cost line. Another way of

viewing the relationship is the intersection of (F+V) and R. This follows from the relationship at BEP:

$$F + V = R$$

$$F = (R - V)$$

The BEP can be determined mathematically in terms of quantity, sales revenue and percent full production:

$$\text{BEP}_Q = \frac{F}{(p - v)}$$

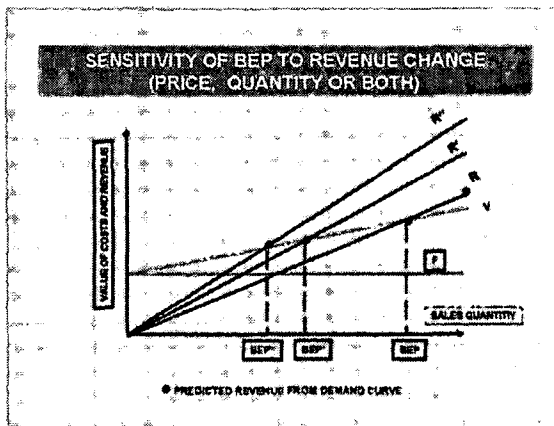
$$\text{BEP}_V = \frac{FC}{1 - v/p} = \frac{pF}{(p - v)}$$

$$\text{BEP}_\% = \frac{F}{R - V}$$

- Q Quantity (level of production)
- V Value of production at break-even
- F Fixed costs
- p Unit price
- v Variable cost per unit
- R Revenue at full production
- V Variable cost at full production

The measure of risk is the closeness of the BEP to the production capacity. If the BEP quantity of production is low (e.g. 50% of production capacity) then there is considerable room for adverse operational results due to lower than expected sales or higher than expected investment or operating costs. When the BEP is close to the production capacity, e.g. 90%, the project has greater risk of operating loss.

### SENSITIVITY OF BEP TO REVENUE CHANGE



An indication of risk is the sensitivity of profitable operation to changes in revenue.

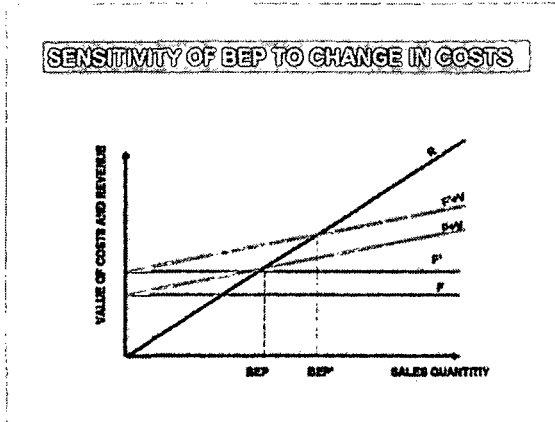
The sales revenue line can be varied through the anticipated range of values from optimistic to pessimistic and the effect of BEP observed. If the revenue lines shown represent the expected limits of the range (R representing pessimistic revenue, R' the most likely and R'' the optimistic) the break even points are always more or less acceptable, with the maximum at about 80%. The margin between break-even and

capacity provides latitude for error, miscalculation or events that adversely affect sales.

Also appearing on the chart are the expected revenues based upon the demand curve. This shows that the lowest revenue projection produces a profitable situation, but even then it is somewhat risky with BEP about 80%. The other revenue scenarios are either just at or below break even and would not appear to represent viable pricing policies. Selecting a pricing policy that would most likely result in the highest profit level is a way to reduce risk.



## SENSITIVITY OF BEP TO CHANGE IN COSTS



The sensitivity of Break Even Point (BEP) to changes in fixed and variable costs are illustrated. The break-even charts shown assume (1) fixed costs independent of operating level and (2) linearly proportional variable costs. Neither of these conditions is normally a totally accurate picture of the cost situation, but for many purposes it is a sufficiently close approximation. If more detailed information is available for both fixed and variable costs, it would be more accurate to plot the actual values with respect to operating level (sales or

production quantity).

**Fixed costs:** An increase (decrease) in fixed costs raises (lowers) the level of total costs (fixed plus variable) so that the resulting total cost line is above (below) and parallel to the original. Fixed costs can be varied through the anticipated range of possible values to determine the effect on break-even. When total costs are increased (decreased) the BEP is generally higher (lower). This represents a more risky situation for the project. The sensitivity can be expressed in terms of the change in BEP per unit change in Fixed Cost.

**Variable costs:** When variable costs are increased (decreased) the slope of the total cost line increases (decreases). Variable costs can be varied through the anticipated range of possible values to determine the effect on break-even. The effect is to raise (lower) the BEP. Sensitivity of BEP to variable cost change can be expressed in terms of the change in BEP per unit change in variable cost (on a unit or total basis).

## PAYBACK AS A MEASURE OF RISK

PAYBACK AS MEASURE OF RISK

- ◆ PAYBACK PERIOD: LENGTH OF TIME NECESSARY TO RECOVER INITIAL INVESTMENT FROM OPERATING SURPLUSES
- ◆ INVESTORS GENERALLY CONSIDER THAT RISK INCREASES WITH LENGTH OF PAYBACK PERIOD

Time is an element of risk. Events planned long into the future entail more uncertainty than in the near term. For this reason investors often would like to recover their investment in a short time frame as a risk-avoidance measure.

**Payback period - length of time (after commencing operations) that is necessary to cover initial investment from operating surpluses:** The concept of Payback Period is discussed more thoroughly in the sections on Static

Indicators and Dynamic Indicators. Payback can be determined in nominal terms or in discounted form. The latter is the more conservative approach as it will almost invariably show a longer payback. As previously discussed, the discount rate for the dynamic payback should be the hurdle rate for the project.

**Investors generally consider that risk increases with length of payback period:** An acceptable payback can only be defined by the investor. The experience of many corporations is that planning for a period longer than 5 years is often meaningless. In fact, a study of managers of enterprises in the industrialized countries revealed that many companies limit their planning to 3 years. This range might indicate practical limits for the payback period for investors interested in this means of risk avoidance.

## SENSITIVITY ANALYSIS

**SENSITIVITY ANALYSIS**

- ◆ EFFECT ON PERFORMANCE INDICATOR FROM CHANGE IN PROJECT PARAMETER
- ◆ PARAMETERS SELECTED BY TWO SIMULTANEOUS CRITERIA:
  - SUBJECT TO LARGE UNCERTAINTY
  - LARGE QUANTITATIVE IMPACT

Sensitivity analysis is time consuming and costly. It is most effective when applied selectively. Parameters should first be varied individually to understand the consequences. Later, parameters can be varied simultaneously to understand their combined effects. The worst-case scenario may provide unacceptable conditions, but its likelihood should be taken into account in the investment decision.

### **Effect on performance indicator from change in project parameter:**

Parameters of the project subject to major project uncertainties are varied over the anticipated ranges to observe the effect on project financial indicators.

**Parameters selected by two simultaneous criteria:** The sensitivity analysis should be applied to parameters selected by two simultaneous criteria: those that are subject to large uncertainties and that also have a large quantitative impact. Using only one criterion, e.g. subject to large uncertainties, allows for spending resources on items that have only minor financial impact. If all items with large quantitative impact are selected for this analysis, some may be fairly definitive so that sensitivity analysis is not useful.

## SENSITIVITY ANALYSIS - PARAMETERS AND INDICATORS

**SENSITIVITY ANALYSIS  
PARAMETERS AND INDICATORS**

**PARAMETERS**

- ◆ INVESTMENT
- ◆ REVENUE
- ◆ PRODUCTION COST
- ◆ DISCOUNTING RATE OR HURDLE RATE

**PERFORMANCE INDICATORS**

- ◆ NPV, IRR
- ◆ NPVE, IRRE
- ◆ PROFIT
- ◆ RATIOS
- ◆ PAY-BACK PERIOD

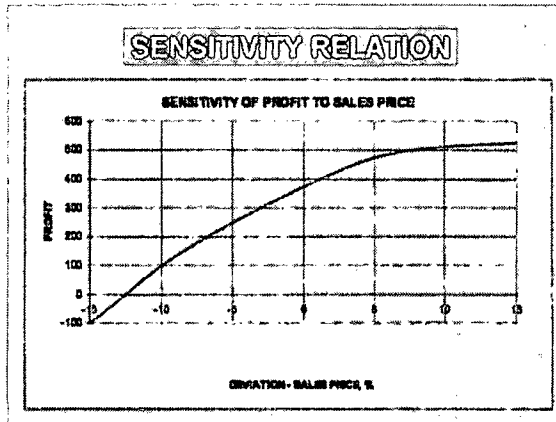
**Parameters** to be subjected to sensitivity analysis according to the simultaneous criteria can be selected from any segment of the financial plan, investment, revenue, or production cost. The sensitivity should not necessarily be applied to total investment, for example. There may be elements of the investment plan that meet the criteria for sensitivity analysis, a particular class of machinery or construction costs, for example, rather than the entire investment package. Sales price, rather than quantities, may be the

major area of uncertainty with regard to revenue.

**Performance indicators:** The effect of variations on financial performance indicators are the most effective means of determining sensitivity. A sensitivity might be expressed in terms of percent change in IRR per percent change in Sales Price. Any financial indicator can be studied with regard to its sensitivity with respect to project parameters: NPV and IRR, NPVE and IRRE, Profit, Ratios (activity, profitability, leverage), Payback period.

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## SENSITIVITY RELATION



The graph illustrates the kind of relationships that can be developed for project parameters in regard to deviations from the nominal plan values. In this graph the effect on profit of deviations from the expected sales price are shown. The parameter, sales price, is varied through a range of values above and below the expected price, with the resultant profit calculated for each change in parameter.

In this case sales price and profit move in the same direction - increase in price results in increased profit. In some cases the indicator will move opposite the parameter, e.g. interest rate as a parameter and IRR as the indicator.

This same type of analysis can be performed for any static or dynamic financial performance indicator. The sensitivity can be expressed in absolute terms, e.g. +20 units of profit per +1 unit of sales price; as percentages, e.g. 10% change in profit per 1 % change in price; or as shown in the graph, absolute change in indicator per magnitude (percent) deviation in sales price. As shown in the graph, the relative sensitivity is generally not constant with respect to % deviation of the parameter.

Generally the changes in the parameter are measured in terms of percent deviation from the expected value. The zero (0) deviation point represents the expected value. In this case, for example, at the expected sales price (0% deviation) the profit is about 375. If the sales price dropped by 10% the profit would reduce to 100. The sensitivity could be expressed as: -275 units of profit per -10% change in sales price.

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## RISK IMMUNIZATION FOR INVESTORS

### RISK IMMUNIZATION for INVESTORS

- ◆ RISK PREMIUM
- ◆ SHORT NPV
- ◆ DYNAMIC PAYBACK
- ◆ CERTAINTY EQUIVALENT
- ◆ PORTFOLIO DIVERSIFICATION
- ◆ HEDGING WITH DERIVATIVES
- ◆ COMPLETION CONTRACT

Most investors are risk averse - they are conservative about the possibility of losing their capital. If means can be found to minimize, or at least alleviate, risk it is more likely that the project will be able to find financial backers. Some of the methods available to reduce or spread risk are as follows:

**Risk premium:** The hurdle or cut-off rate for a project can be increased with a risk premium. This raises the barrier, in effect demanding of a project a higher return for

its inherent risk or for the risk in the selected environment.

**Short NPV:** Rather than considering operations to the normal planning range, some investors ignore anything that is to occur beyond a limited period, as uncertainty looms larger with time. This can be anywhere from 3-5 years. If the NPV is not positive in this relatively short term, the project is not accepted.

**Discounted payback:** The normal break-even is ascertained essentially on a constant price basis. One approach that decreases risk is to find the break-even on a discounted cash flow (not profit) basis (see Dynamic Indicators).

**Certainty equivalent:** Conventional indicators such as NPV and IRR are based essentially upon the prices extant in the market (constant prices). A more conservative approach, accounting for risk, is to use certainty equivalents, as previously described.

**Portfolio diversification:** Portfolio diversification is a strategy for minimizing risk. Essentially it involves selecting projects for investment that are dissimilar in regard to their volatility patterns than those already within the investment portfolio. This method is described in more detail in Portfolio Risk.

**Hedging with derivatives:** The values of derivative financial instruments are based upon an underlying commodity or security. Relatively small financial resources can be used to leverage large amounts of the underlying units. Hedging involves the use of derivatives to buffer potential losses. Hedging mechanisms for ownership are generally not readily available to investors in developing countries; however, in commodity-related enterprises the use of commodity futures is a very important hedging approach.

**Completion contract:** A minimum level of performance is guaranteed, usually with the intervention of third parties or other insurance mechanisms. For example, from the point of view of investors, 'completion' could refer to construction or delivery of goods and services (e.g. contract to purchase plant output).

## RISK PREMIUM – EXAMPLE

### EXAMPLE: RISK PREMIUM

Period	1	2	3	4
Nominal flow	-1000	390	450	500

AT DISCOUNT RATE - 10%, NPV = +68  
 AT DISCOUNT RATE - 15% (5% RISK PREMIUM), NPV = -27

- PROJECT ACCEPTABLE AT NOMINAL DISCOUNT RATE
- NOT ACCEPTABLE WHEN RISK PREMIUM ADDED TO DISCOUNT RATE

Previously it was pointed out that there are basically three elements in the market price of capital - a basic rate of return, inflation and risk (see section on Cost of Capital). If the project is to be financed with capital raised in the local markets, the cost will generally reflect the level of risk in the particular industrial sector and/or the environment.

When the project is to be financed with the sponsor's equity, the normal expectation or hurdle rate would properly

be adjusted upward to account for the general risk and risk associated with the particular sector. Increasing the discount rate will have the effect of reducing the value of NPV, perhaps to the point of driving it to a negative value so that the project would be rejected.

An example is shown for the calculation of NPV without and with a risk premium. At the nominal rate of 10% discount the NPV is positive and the project would appear to be acceptable. When the risk adjustment of 5% is added to the discount rate the NPV is negative. If the risk premium is justified by the state of the economy or by the nature of the venture, then the project should be rejected.

## SHORT NET PRESENT VALUE

### SHORT NET PRESENT VALUE

$$NPV = \sum_{j=0}^n pv_j$$

NPV Net Present Value

$pv_j$  Present value (OCF, NCF), period  $j$

\* n \* LIMITED TO PLANNING HORIZON OF INVESTOR; ALL FLOWS BEYOND THIS POINT IN TIME IGNORED

Time as an element of risk enters into this approach to risk avoidance. The investor limits the planning horizon to the point beyond which the uncertainty appears to be too great for comfort. The horizon selected would be a function of both the industrial sector and the general economy.

To calculate the short NPV all events beyond the end of this short horizon are ignored. The project must show a positive NPV in the number of years specified -

otherwise, the project is rejected.

The short NPV is the sum of present values of the net flow, using the investor's hurdle rate, up to and including the last year to the shortened planning horizon.

## DYNAMIC PAYBACK

### DYNAMIC PAYBACK

$$NPV = \sum_{j=0}^n pv_j$$

NPV Net Present Value

$pv_j$  Present Value, Period  $j$

$n$  Period where NPV becomes positive

This method of determining the payback period was discussed in the section on Dynamic Indicators. It is a method of risk reduction.

Normally the payback for the total investment is determined from the operating cash flows (OCF's in each operating period); payback for the equity portion of financing is found similarly, but using NCF instead of OCF. The point at which the cumulative value changes from negative to positive is the payback time.

In the more conservative form the discounted values of the cash flows are summed to find the period in which the cumulative value changes from negative to positive. The discounting will invariably result in a later break-even period.

This affords a greater protection for the investor, if only in the sense that the criterion is more difficult to meet, assuming that the investor would apply the same maximum payback period in either case.

## RISK IMMUNISATION FOR FINANCIERS

### RISK IMMUNIZATION for FINANCIERS

- ◆ GUARANTEE (most common form)
- ◆ COLLATERAL
- ◆ INSURANCE
- ◆ CROSS DEFAULT CLAUSE IN LOAN CONTRACT
- ◆ COMPLETION CONTRACT
- ◆ DERIVATIVES: FUTURES CONTRACTS, OPTIONS (PUTS AND CALLS), SWAPS, ETC.

Financing of projects in unstable economic and political environments is often a problem that can only be solved by immunizing financiers from risk. Project designers should be aware of the concerns of financiers and how they may be alleviated. This subject is discussed in greater depth in Risk Immunization.

**Guarantees:** Third parties can be called upon to provide backing for the project in the form of guarantees, in which assurances are provided to lenders that

the debt will be serviced, or that output will find a market.

**Collateral:** Pledging of assets by the project sponsors is often required to secure credit. The lender would assume control of the assets in the event of default.

**Insurance:** Premiums can be paid to insurers to cover assets or against default or adverse business conditions. Coverage for most risks is usually difficult to obtain. Some governmental or quasi-governmental entities such as the US Overseas Private Investment Corp. (OPIC) or the Multilateral Investment Guarantee Agency (MIGA) provide coverage for political risk. Also, the package can be structured to provide increased adverse consequences of default, delays or increased costs attributable to actions of the host country.

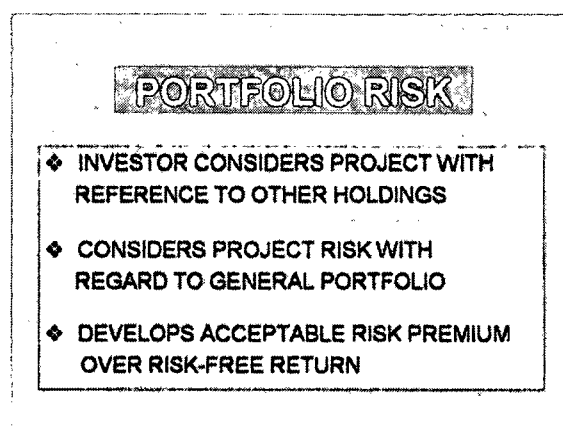
**Cross default clause in loan contract:** A cross default clause in a loan contract provides that in case of default, all other loans from the same institution are also in default. This provides some risk reduction for lenders as the other projects for which loans have been secured may be able to provide some degree of coverage.

**Completion contract:** This type of contract guarantees that the project will operate according to specifications, e.g. a determined quantity of output of prescribed quality at specified cost, by a given date and for a specified duration.

**Derivatives - futures contracts, options (puts and calls), swaps, etc.:** Derivatives are financial instruments for which the market price depends upon some other factor or commodity. It may be possible in some cases to use derivative financial instruments as hedging or risk-avoidance mechanisms, but these are rarely available in developing countries. Some of instruments currently in use in the developed markets are: futures contracts, options (puts and calls), swaps, etc. One type of derivative is widely available for enterprises involved in the production or use of commodities. Buying and selling futures allows project sponsors to hedge the prices of output or input.

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## PORTFOLIO RISK



Risk can be managed with portfolio analysis. One of the models for establishing the risk-adjusted expectation for a project based upon its characteristics with regard to the rest of the investment portfolio is the Capital Asset Pricing Model. The model is described further in Portfolio Risk.

**Investor considers project with reference to other holdings:** The investor regards the project under consideration in relation to other holdings.

The basic idea is to construct the portfolio so that 'all the eggs are not in one basket'.

**Considers project risk with regard to general portfolio:** In this model one of the major factors is  $\beta$ , which is the ratio of project risk to the risk for the general market or portfolio.

**Develops acceptable risk premium over risk-free return:** Essentially the risk premium increases if the project is expected to follow the market or portfolio because this does not add to diversification. A lower premium is added if there is greater divergence between the project characteristics and that of the portfolio.

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## UTILITY - ATTITUDE TOWARD RISK

**UTILITY  
ATTITUDE TOWARD RISK**

**UTILITY (of wealth):** Physical and psychological satisfaction derived from possession.

**MARGINAL UTILITY:** Change in utility per additional unit of wealth

**RISK ORIENTATION:** Attitude toward risk of the individual or corporate entity

CLASS OF INDIVIDUAL	MARGINAL UTILITY OF ADDITIONAL INCOME
RISK-AVERSE	DECREASING
RISK-NEUTRAL	CONSTANT
RISK-TAKING	INCREASING

Project designers should understand that investors and other participants (individuals and institutions) in a project may have differing attitudes toward risk. There are risk-takers, risk-neutral and risk-averse individuals. For further discussion see Attitude Toward Risk.

**Utility of wealth:** One measure of the response to the potential gains from an investment project is utility. This is the physical and psychological satisfaction derived from additional wealth.

**Marginal utility:** The marginal utility is the satisfaction derived from the next unit of wealth. For a risk-averse individual the marginal utility of additional income decreases with additional wealth. This means that a loss of one unit of wealth has more impact on satisfaction than a gain of one more unit. The risk-neutral individual is indifferent to the marginal utility (a loss of one unit of wealth is weighted equally with a gain of one unit). The risk-taker has an increasing marginal utility. The next unit of additional wealth is valued more highly than a loss of one unit.

**Risk orientation:** The attitude toward risk of the investor and other participants should be taken into account in designing the structure of the project and in attracting financing and other types of support. The relationship between risk and potential reward is an important criterion for the investor.

## FOREIGN INVESTORS AND RISK

**FOREIGN INVESTORS AND RISK**

- ◆ AVERSE TO INTERNATIONAL AND DOMESTIC ECONOMIC UNCERTAINTY
- ◆ LARGE COMPANIES MORE LIKELY TO TAKE RISK IN ONE MARKET
- ◆ EXPECT LOCAL PARTNERS TO SHARE RISK
- ◆ RISK REDUCTION MEASURES
  - PRESTIGIOUS CO-INVESTORS AND FINANCIERS
  - RISK-REDUCING FINANCIAL STRUCTURE
  - RESTRUCTURING TO SEGREGATE ATTRACTIVE ASSETS
  - SPECIALIZED INSURANCE

Foreign investors are generally averse to change and uncertainty. As non-citizens, they are unfamiliar with the terrain and seek to have a stable platform in which to operate.

**Averse to international and domestic economic uncertainty:** If political change or uncertainty in government policies is on the horizon, foreigners will be discouraged from investing.

**Large companies more likely to take risk in one market:** Large foreign enterprises working with local partners are more likely to accept the risk of entering a single market, rather than seeking market diversification. Large companies have greater flexibility in this regard. To engage in a small project with greater risk than their usual portfolio is not so threatening to their survival. Expect local partners to share risk: It is usually expected that local partners share risk by exposing their own capital resources. Local partners would be expected to provide or support new equity requirements and liability for any new debt incurred for the project.



**Risk reduction measures:** Given their presence in unfamiliar terrain, foreign investors will be more inclined to seek risk reduction than those more familiar with the territory.

**Prestigious co-investors and financiers:** Seeking support from international institutions as co-investors to help gain support of international banks and export credit agencies. They may seek one or more co-investors (e.g. international institutions), either foreign or local, to cover part of the investment package.

**Risk-reducing financial structure:** They may try to find investment structures that reduce immediate financial risk (e.g. joint ventures, management contracts with options to buy shares later).

**Restructuring to segregate attractive assets:** Existing enterprises may have to be restructured so that the new investment is applied to attractive assets only, with the non-performing assets sold or liquidated.

**Specialized insurance:** Foreign investors may insist, as a condition of their participation, that insurance is provided to protect their assets (e.g. Overseas Private Investment Corporation). In some cases the government will back debt with its full faith and credit.

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## QUALITATIVE RISK ASSESSMENT

**QUALITATIVE RISK ASSESSMENT**

**EXPERT OPINION CONCERNING:**

- ◆ DEGREE OF UNCERTAINTY IN ECONOMY, POLITICS, SOCIAL SYSTEM, CAPITAL MARKETS
- ◆ SECULAR TRENDS
- ◆ CYCLICAL PHASE

All of the qualitative approaches to forecasting (see Market and Marketing, Forecast - *Judgmental, Compilatory, Technological* methods) include assessment of risk. Perhaps qualitative assessment of risk is more frequently employed than quantitative methods.

These methods invariably involve the consultation (study and resulting opinion) of experts in the industry or in the economy in general concerning:

Degree of uncertainty in economy, politics, social system, capital markets: A systematic analysis of the economy, social and political systems and capital markets by knowledgeable individuals is undertaken to predict the future and to understand the major elements of risk and their consequences to the project or enterprise, particularly in regard to the judgmental forecasting methods described.

Secular trends: The long-term trend of the economy in general, and the industry of interest in particular, are studied with the driving forces, those that will tend to increase or decrease the rate of growth, of particular interest in regard to risk assessment.

Cyclical phase: The performance of economies and particular industries are often cyclical. Some industries are decidedly synchronized with the economic cycle, for example consumer durables. Other industries follow their own cycles, e.g. those that are more attuned to the pace of technological development. The particular

phase of the cycle is of interest to analysts in regard to risk. The upward cyclical phase is more propitious for launching a project than the downward phase. There is always the question of the extent to which the current cycle will follow past patterns. These are issues for those who are deeply immersed in studying the nature and nuances of the industry.

RELATED  
DOCUMENTS

# ATTITUDE TOWARD RISK

The attitude of individuals and institutions toward risk varies according to the attitude toward marginal utility of income.

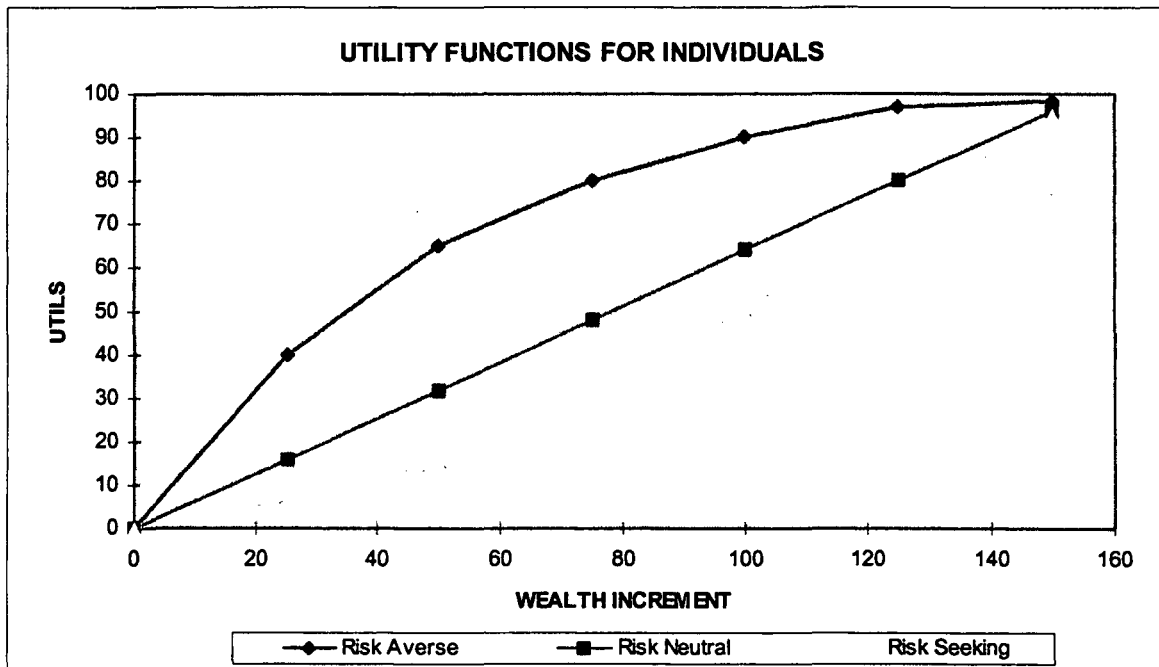
**Utility (of wealth):** The physical and psychological satisfaction derived from possession.

**Marginal Utility:** The change in utility per additional unit of wealth

**Risk Orientation:** The attitude toward risk of the individual or corporate entity

Class of individual	Marginal utility of additional income
Risk-averse	Decreasing
Risk-neutral	Constant
Risk-taking	Increasing

For a risk-averse individual, the decline in utility from a loss of a given amount of wealth is greater than the increase in utility from an equal increase in wealth. This individual would probably not accept the wager if the chance of winning or losing a given sum was 50:50, because the potential loss weighs more heavily than the potential gain.



Suppose the following investment alternatives:

- A Return of 100 with certainty, or
- B Return of 300 with probability of 0.5  
Loss of 100 with probability of 0.5

The second alternative has the same expected value  $[(.5 \times 300) + (.5 \times -100) = 100]$  as the first. Which is preferred? A risk-averse investor would prefer A; a risk-taker would tend to prefer B.

As a practical example of this situation, investment in electrical utilities offers low return with quasi-certainty, whereas the electronics industry offers high returns with lower probability of success.

The utility function for an individual can be determined using the concept of the Certainty Equivalent, the amount an investor would accept in lieu of an opportunity for gain that is less than certain (i.e., involves risk):

Individuals of the three classes of risk-attitude (of the same level of wealth) are asked to give their indifference probability for the following lottery in lieu of a gain of a particular amount  $x$  with certainty: Gain of 150 with probability  $p$  or loss of 50 with probability  $(1-p)$ . The gain indicated for each probability is the expected value.

For example, suppose the certain amount is 100. The individual is asked what probability would be equivalent to this amount if instead there is the chance of gaining 150 with a certain probability  $p$  or losing 50 with a probability of  $(1-p)$ . If the answer is 67%, the expected gain would be  $150(.67) - 50(.33) = 84$ .

The answers given by three types of individuals are shown in the table below. The risk-neutral individuals choose a probability that provides the same expected return as the certain amount. The risk-averse individuals value loss in terms of utility as greater than an equal gain. The reverse is true for the risk-taking individuals.

INDIFFERENCE PROBABILITIES FOR THREE CLASSES OF INDIVIDUALS

x (Certain gain)	RISK AVERSE		RISK NEUTRAL		RISK TAKING	
	E(gain)	p, %	E(gain)	p, %	E(gain)	p, %
0	0	0	0.0	0	0.0	0
25	30	37.5	25	25	-26	7
50	90	50	50	50	0	25
75	134	62.5	75	75	30	40
100	140	75	100	100	50	50
125	144	87.5	125	125	113	81
150	150	100	150	100	148.0	99

The indifference probability can be equated to 'Utils'. The data could then be plotted as shown in the following figure above.

The Utility-Wealth curve for an individual rationalizes investment decision for the individual.

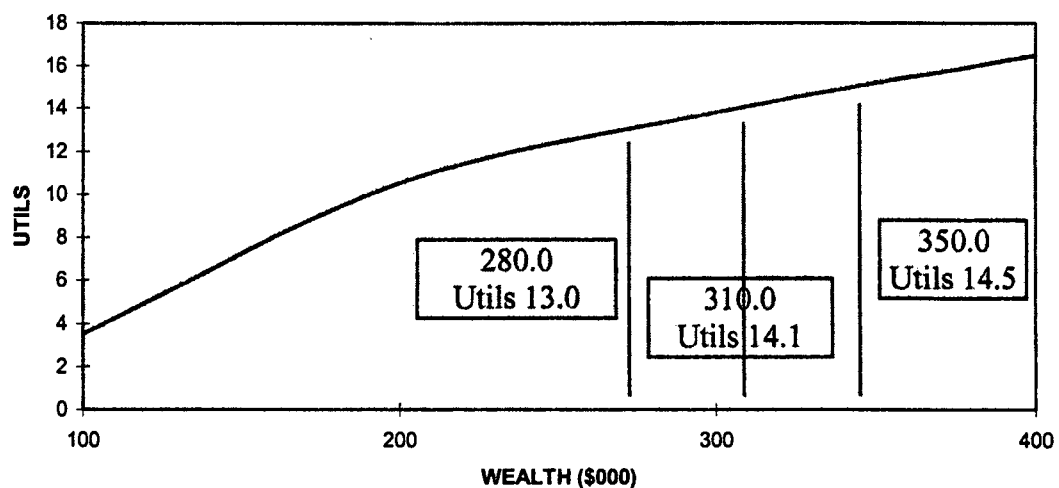
EXAMPLE: A risk-averse investor with wealth of 300 is given the opportunity to invest 100 with the following conditions:

Expected outcomes	Terminal investment value	Total terminal wealth	Utility (Utils)	Probability	Expected utility (Utility x Probability)
Success	150	350	14.5	0.50	7.25
Failure	80	280	13.0	0.50	6.50
Total expected utility					13.75

The same investor is given the opportunity of investing the 100 in government bonds with a yield of 10%. In this case the yield is certain so that the expected utility is 14.1 (at Total Terminal Wealth = 310).

The investment of choice according to the risk preference of this investor is government bonds.

### DECLINING MARGINAL UTILITY FOR MOST INDIVIDUALS



## DYNAMIC CRITERIA AND INFLATION

In dynamic analysis of flow of funds and resources of a project, inflation will have an effect on the calculated rate of return. The relationship can be expressed as follows:

$$VA_j = \frac{A_j}{(1+i)^j(1+r)^j} = \frac{A_j}{[(1+i)(1+r)]^j} = \frac{A_j}{(1+r+i+ri)^j} = \frac{A_j}{(1+d)^j}$$

$$d = r + i + ri$$

$$r + ri = r(1+i) = d - i$$

$$r = \frac{d - i}{1 + i}$$

$VA_j$	Present value of period j
$A_j$	Flow in period j
$d$	Nominal discount rate
$r$	Real rate of return
$i$	Inflation rate

This relationship provides the present value of a future amount as it is affected both by the standard time preference and the deflator.

If the inflation rate is relatively low the term  $ri$  will be small and the relationship reduces to:

$$r = d - I$$

Under these circumstances the real rate can be determined by deducting the rate of inflation from the nominal rate. If a project is analyzed at current (inflation-adjusted) prices, the real rate of return is the calculated rate less inflation.

## ESTIMATING STANDARD DEVIATION OF FLOW

Several methods can be applied for measuring the standard deviation (SD) of the flow of funds and resources in each project period.

Estimate of range methods: An example of the use of the range for estimating the SD of flow in a given period is as follows: An expert (e.g. consultant or general manager) provides the following estimates of the range for the cash flow for a period (year):

Cash flow for the year with a probability of 50%:

Expected value (average) - 15000  
Estimate of range      10000 - 20000

For the standard Normal distribution, 50% probability around the mean (25% on each side of the mean) falls within 4/3 standard deviations. In other words, 25% of the area under the distribution curve on both sides of the mean falls within 4/3 standard deviations.

Estimate of  $\sigma^*$ :      20000-10000 = 10000  
 $4/3 \sigma = 10,000$   
 $\sigma = (3/4) \times 10,000 = 7,500$

$\sigma^*$  is the standard deviation of the flows.

$\sigma$  can be estimated similarly by considering the total range of possibilities. The expert predicts the entire range, which is assumed then to lie between  $\pm 3 \sigma$  (approximately).

Statistical method: For an existing company past data can provide the basis for statistical analysis of flow in each period. This would not be possible for a new enterprise, but data can perhaps be drawn from similar operations. The approach would be to obtain the data for flow in each of the preceding years. This data can be analysed statistically to find the mean and standard deviation. These statistical parameters can then be used for estimating the distribution of future period (e.g. annual) flows.



## WEIGHTED AVERAGE COST OF CAPITAL

This example shows how an existing enterprise would determine its cost of capital. The assumption is the new project will be financed internally. If new sources of financing are required for an investment project the cost of capital would be determined on the basis of the proportions of internal and external capital to be employed.

The 'opportunity' cost of capital is the benchmark for deciding on the viability of a project. 'Opportunity' in this case refers to the best alternative use of the resources. In the case of the existing company utilizing its own resources for the project, its opportunity cost is considered as the actual cost of capital, as the expectation of return on capital would be at least equal to its cost. It is not absolutely necessary that a project cover the capital depletion and rental cost to be viable. However, to generate surplus wealth there should be an excess of benefits over costs. The benefits, in this case, must include returns at least equal to the benchmark rate, as any alternative use has to be regarded relative to this expectation.

Consider a company with the following balance sheet (Liabilities and Net Worth) – All values are US\$(000). – Corporate tax rate assumed to be 30% of profits

<b>A – CURRENT LIABILITIES</b>		
Accounts payable	113,212	
Bank overdraft (6%)	45,673	
		158,885
<b>B - LONG-TERM LIABILITIES</b>		
6% Bonds 2001 (market value \$800)	400,000	
7% Promissory note 2002 (Market value?)	100,000	
6.5% Bank loan due 1993	50,000	
5.5% Convertible bond (issued at \$98,750)- growth rate 11%, earnings '97: \$1.40)	100,000	
		650,000
<b>C – NET WORTH</b>		
8% non-cumulative preferred shares (MV high \$112, low \$10, par value \$100)	65,109	
Ordinary shares (27 million) (MV\$19.5, P/E 13.5)	526,500	
		591,609
		1,400,494

### CURRENT LIABILITIES

**Accounts payable:** There is a charge of 1% after 30 days, but the company usually complies with payment terms so the cost of this portion is essentially zero.

**Bank overdraft:** The 6% interest on balances is the only charge; the cost of this capital is therefore equal to the interest rate of 6%.

## LONG-TERM LIABILITIES

**6% bonds 2001:** The cost, as a percentage, is considered as the sum of the coupon rate and the excess of market value over par (issue) value for each remaining year to maturity.

$$\frac{\text{Bond coupon} + (\text{par value} - \text{market value})/\text{avg. remaining life}}{(\text{par value} + \text{market value})/2}$$
$$= \frac{60 + (1000 - 800)/3}{(1000 + 800)/2} = .1064$$

**7% promissory notes 2002:** This cost is determined in a manner similar to the 6% bonds.

$$\frac{\text{Note coupon} + (\text{par value} - \text{market value})/\text{avg. remaining life}}{(\text{par value} + \text{market value})/2}$$
$$= \frac{70 + (1000 - 840)/4}{(1000 + 840)/2} = .1195$$

**6.5% bank loan 2003:** The manner of calculating the cost is virtually identical to the previous two examples:

$$\frac{\text{Interest rate} + (\text{par value} - \text{market value})/\text{avg. remaining life}}{(\text{par value} + \text{market value})/2}$$
$$= \frac{65 + (1000 - 780)/5}{(1000 + 780)/2} = .1225$$

**5.5% convertible bond:** The cost is based upon the net present value of the *after-tax* outflows from the enterprise point of view. Each bond converts into 50 common shares.

The bond was issued at a price of \$98,750. It is to be converted when the market price reaches \$25 with a growth rate of 11% and assuming that the price/earnings ratio (P/E) will remain at the current level of 13.5%. The earnings in 97 were \$1.42 per share.

Time for common share price to reach \$25:

$$\$1.42(13.0)(1.11)^t = \$25$$

$$t = 3 \text{ years}$$

After tax cash flow per bond: The coupon value of 5.5% requires a payment of \$5,500 per annum. However, the after tax cost (30% tax rate) is \$5,500(1-.3) = \$3,850 per annum. It is assumed that the bonds were issued at the beginning of the current year. The inflow from the sale of the bond is the issue price of \$97,750. The redemption price is 50 (common shares per bond) times the conversion price of \$25 or \$125,000.

YEAR	1998	1999	2000	2002
Inflow	98,750			
Outflow coupon	3,850	3,850	3,850	3,850
Redemption				125,000
Total outflow	3,850	3,850	3,850	128,850

Assuming that the inflow (sale of convertible) was at the beginning of 1998 and discounting to the beginning of the same year, the internal rate of return, or applicable discount rate is 9.7%. This means that the after-tax cost of the convertible is 9.7%.

#### Weighted cost of debt, $K_d$ :

	Value \$(000)	Before-tax Cost	After tax cost	Weight	Weighted cost
Accounts payable	113,212	0	0	0.1390	0
Bank overdraft	45,673	0.0600	0.042	0.0565	0.0024
6% bonds	400,000	0.1064	0.074	0.4945	0.0366
7% promissory note	100,000	0.1195	0.084	0.1236	0.0104
6.5% bank loan	50,000	0.1225	0.086	0.0618	0.0053
5.5% convertible	100,000	-	0.097	0.1236	0.0120
Total value	808,885				0.0667

#### NET WORTH or EQUITY, $K_e$

**8% non-cumulative preferred shares:** The cost is based upon the ratio of the current dividend to the average market price of the shares. The market values have ranged from a high of \$112 to a low of \$101.

$$\frac{\text{Current dividend}}{\text{Average market price per share}} = \frac{8.00}{(112 + 101)/2} = .075$$

**Ordinary shares:** Several methods are used to determine an estimate of the cost of ordinary shares.

A - Dividend /market price: Current dividend level \$.075/share, market price \$19.5/share.  $\$0.075/\$19.5 = .036$

B - Earnings/market price: Current earnings are \$1.42 per share.  $\$1.42/\$19.5 = .073$

C - B plus estimated growth rate: This is predicated on the assumption that the market does not recognize fully the value of the shares. The growth rate of 11% per annum in earnings is added to B. The cost is .183 or 18.3%.

D - Capital asset pricing model: The estimate is developed as follows:

$$\begin{aligned} & \text{Risk - free rate} + \text{Risk index [Avg. market rate of return (5 yrs.) - Risk - free rate]} \\ & = R_f - R_i(\text{Mkt} - R_f) = 0.04 + 1.4(0.1 - 0.04) = 0.124 \end{aligned}$$

The risk index is a measure of volatility of the shares compared to general market movements, or  $\beta$ .

**Weighted cost of equity,  $K_e$  at market cost:**

	Value \$(000)	Cost	Weight	Weighted cost	Total weighted cost
8% non-cum preferred	65,109	0.075	0.110	0.0083	
Ordinary shares	526,500				
A		0.036	0.890	0.0320	0.0402
B		0.073	0.890	0.0650	0.7322
C		0.183	0.890	0.1629	0.1711
D		0.124	0.890	0.1104	0.1186
Total value	591,609				

The minimum weighted cost of equity is alternative A of 4.02%. The maximum is for alternative C of 17.11%.

**COMBINED WEIGHTED COST OF CAPITAL (DEBT AND EQUITY)**

	Value \$(000)	After tax cost*	Weight	Weighted cost	Total weighted cost
Debt	808,885	0.0667	0.5776	0.0385	-
Equity	591,609				-
A		0.0402	0.4224	0.0177	0.0562
B		0.0732	0.4224	0.0309	0.0694
C		0.1711	0.4224	0.0722	0.1107
D		0.1186	0.4224	0.0501	0.0886
Total value	1,400,494			0.0667	

\* After tax value applicable to debt only

If the total cost of capital is based on a combination of the cost of debt and the cost of C and D equity alternative approaches, the cost of capital for the company is about 9%.

A variable for the project designer is the target debt/equity ratio. From this analysis it can be seen that the cost of debt is below the cost of equity. It appears to be advantageous for the company to leverage the project. To what extent will be determined by constraints on the availability of debt financing and the actual cost of debt and equity allocated specifically to the project.

- 1 Overview
- 2 Market Analysis and Marketing
- 3 Technical Analysis
- 4 Financial Analysis
- 5 Economic Analysis
- 6 Expansion/Modernization Projects
- 7 Project Appraisal

