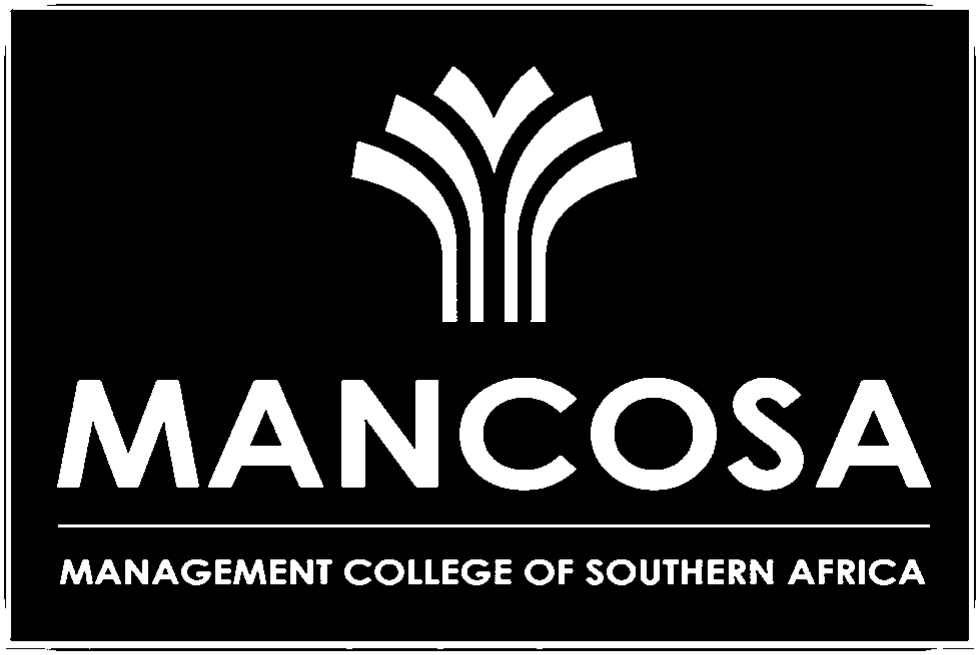

POST GRADUATE DIPLOMA IN PROJECT MANAGEMENT

PROJECT FINANCIAL MANAGEMENT

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DEFINITIONS OF MAJOR TERMS AND SYMBOLS USED IN THIS MODULE

Accounting Statements

Accounting policies ensure financial statements are: relevant to the decision-making needs of users; reliable in that they represent faithfully the results and financial position of the enterprise; reflect the economic substance of events and transactions and not merely the legal form; are neutral, that is free from bias; are prudent; and are complete in all material respects.

Accuracy

The percentage range above and below the *Base Estimate*, within which the actual cost is expected to lie. This range is dependent upon the degree of formality in project scope, the methodology of estimating and the degree to which project implementation activities have commenced. Evaluating accuracy requires a review of project risk. The estimate classes are based on this range.

Adjusted Present Value (APV)

Net Present Value of an asset if financed solely by equity, plus the *Present Value* of any financing side effects.

Adjusting Events

Amounts recognised in the financial statements should be adjusted to reflect events after the balance sheet date when:

- The event relates to a condition that existed at the balance sheet date (adjusting events), or
- The going concern assumption is no longer appropriate.

After Tax

All cash flows need to be adjusted for taxation. Only after tax cash flows should be used in determining NPV, IRR and Payback Period.

Amortisation

The systematic allocation of the depreciable amount of an item of PPE to operating profit as it is consumed over its useful life.

Amortisation is calculated on the straight-line method over the useful life of the asset limited to the life of mine. In the case of projects in the ramp-up phase, amortisation is calculated as a percentage of the

straight-line amortisation that would have been charged if the project was in full production based on the units produced during the period and compared to units that are expected to be produced during a steady state production period. The units to be applied should be those most closely linked to the life of the asset. The timing of commencement of amortisation of major projects will depend on the particular project.

Amortisable Amount

The precise amount of money that is required to be accrued during the amortisation process to provide for the replacement of an PPE

Annuity

An investment that produces a level stream of cash flows for a limited number of periods.

Asset

A resource, controlled by the Group as a result of past events from which economic benefits are expected to flow to the Group.

Assets Carried Under Section 36(11)(d) of the Income Tax Act

Assets that are capitalised and amortised over the wear and tear periods determined by the Income Tax Act which approximates the useful lives of these assets. Amortisaion is charged in full in the anniversary of the initial acquisition month.

Asset Impairment Model (AIM)

An asset impairment model (AIM) is designed to provide an early warning indicator to the potential impairment of an asset. It is not the definitive indicator that an asset has been impaired and accordingly should not be relied upon for this purpose.

Audit Controls

Audit and accounting principles require that an approved project must be loaded onto the Capex System by a department other than the operation which approved the project.

Authors

Authors are Heads of Deprtments or subject specialists designated by the *sponsors* to perform the research and development necessary to implement,change and/or delete a policy or procedure, ensure that policies and procedures are current, accurate and comply with any legal requirement, obtain the

necessary written approval via the sponsor for the release of new, changed or deleted policies and procedures for publication, oversee the actual data capturing and ensure that operational procedures are in line with the approved Policy and Procedures.

B

Base Estimate

The sum of all direct and indirect costs which have been quantified from a known scope of work. The costs and prices shall be free of all contingency and escalation provisions.

Borrowing Costs

Borrowing costs are interest and other costs incurred by Group company in connection with the borrowing of funds.

Borrowing costs may include:

- interest on bank overdrafts and short-term and long-term borrowings,
- amortisation of discounts or premiums relating to borrowings,
- amortisation of ancillary costs incurred in connection with the arrangement of borrowings,
- finance charges in respect of finance leases recognised in accordance with IAS 17, Leases, and
- exchange differences arising from foreign currency borrowings to the extent that they are regarded as an adjustment to interest costs.

Break-even Analysis

Analysis of the level of sales at which a project would just break even. May or may not include opportunity cost of capital.

Budget

The planned cost for an activity or project.

Budget Cost

The cost anticipated at the start of a project.

Budgeted Cost of Work Performed (BCWP)

A measure used in earned value management system that allows you to quantify the overall progress of the project in monetary terms. BCWP is calculated by applying a performance measurement factor to the planned cost. (By comparing BCWP with ACWP, it is possible to determine if the project is under or over budget.) Another term for BCWP is *Earned Value*.

Business Case

A document used to justify the commitment of resources to a project.

The business case also defines why the project is required and what the change will be. It should include an outline of the project's objectives, deliverables, time, cost, technical, safety, quality and other performance requirements as well as the major project risks and upside opportunities. It can also include information on the competitive impacts, key performance indicators and critical success factors of the project and its outcome. The project's *sponsor* (person or group responsible for defining and developing the project against the business case) should 'own' the business case

Business Planning Policy

The objective of a Business Planning Policy is to align and integrate the activities and processes of the Group to satisfy the Group's Objectives and Strategy; to ensure that the Corporate Strategy and goals are cascaded to all appropriate levels of the organisation and to communicate the Group's objectives and intentions to those stakeholders to whom this may be relevant.

Business Principle

A Business Principle can be defined as the rule or guiding principles which will need to be followed in order to ensure effective execution of the strategy. Business Principles have as their main objective the setting of a framework and direction for the strategic and operational management of the Group, consistent with the strategy. In addition it is to ensure that the operational philosophies are clearly defined

Buy-back

A repurchase agreement

C

Capex

Abbreviation for 'Capital Expenditure'

Capital

Capital Budget

A list of planned investment projects, usually prepared annually.

Capital Budgeting

It refers to the evaluation and selection of long-term investments that are consistent with the organisations strategic business and corporate policies.

Capital Control Framework

The Capital Control Framework is a master code and forms the basis from which all Project Codes are generated. It is a fundamental Project Management tool, and is essential for the proper control of Capital Projects. A Project Code is the common thread linking the various control systems within a project. It identifies and classifies all costs incurred in the execution of capital projects. It provides a consistent reference for facilities, equipment, materials, services, etc., as well as drawings, documents and correspondence. The code is structured in such a way that it enables project work to be controlled at all levels.

Capital Efficiency

A philosophy aimed at achieving a return on capital after tax which is in excess of the cost of capital. The directors of an organisation are responsible for managing the capital efficiency risk as part of the overall risk management responsibility delegated to the Executive Committee by the Board and has the responsibility of achieving a return after tax at least equal to their organisations cost of capital.

Capital Expenditure

An outlay of funds by The organisation that will be expected to produce benefits in terms of increased production or improved efficiencies, in terms of the Group's strategic business policies.

Capital Expenditure Fund Application

A formal application that has to be approved before any project can commence

Capital Market

Financial market (particularly the market for long-term securities).

Capital Reports

Cash flow reports that are available from SAP on a real time basis. They are updated instantly, with summary reports being updated every 24 hours during the night.

Capex Management Governance Manual

A formal document, approved at the highest level, that contains all aspects, procedures, policies, organisational, line and reporting structures that provides a written outline of the framework for the governance of Capex management at the organisation.

Carrying Amount

Carrying amount is the amount by which an asset is reflected in the balance sheet after deducting any accumulated depreciation

Cash Costs

All those costs, whether fixed or variable, that are actually incurred as cash, rather than as entries in a ledger (e.g. depreciation) when production is proceeding

Cash Generating Unit

The smallest identifiable group of assets that generates cash inflows from continuing use that are largely independent of the cash inflows from other assets or groups of assets.

Change of Scope

A Change of Scope (COS) is an alteration to a fundamental concept of the original design criteria, or to a basic parameter that changes any part of the original accepted and agreed scope of a project. Typical COS's are: to deepen a shaft or add extra levels; to reduce the number of inhabitants per room in single quarters; to defer or omit a shaft or part thereof; to increase the capacity of a plant.

Close-out Report (Project Close-out Report)

A management executive report that serves to terminate a project. The close-out report includes both the closure of all technical issues and items (Technical Closure), a closure of all commercial issues (Commercial Closure and a post-project evaluation of business investment issues (Post Implementation Review)

Commodity Capital

Commodity items are those which do not require scope definition, design etc of a project. Commodity Capital consists of single items which do not require extensive specifications etc. and can be ordered "off the shelf" e. g. a bakkie, forklift etc. This will include some items which are currently classified as CARA and Working Costs and which may be capitalised in terms of the Group Asset Policy

Commissioning

Associated with bringing the project on line; to ensure the successful working of mechanical equipment. The commissioning process is generally followed by an evaluation and optimisation of the equipment

Computer Coding System

The computer coding system is dictated by the organisation standard format, and compatible with the organisation computer reporting systems. The coding matrix must be determined well in advance of PCE/CBE preparation to suit Project Management and future operational requirements. Where possible the coding is to be followed for drawing numbering and filing systems

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Conceptual Estimate (Class 0 Estimate)

This class of estimate is often based on assumed parameters of process throughput or mining output. Design drawings are not usually prepared, but previous similar drawings or process flow diagrams may be used for quantification. Unit costs, e.g. capital cost/kW or factors based on unit cost are frequently employed. Historical data for similar plants, mine or infrastructure components are often utilized.

Metallurgical test work is not essential if the process is generally well known. A visit to the project site, although desirable, is not essential. Conceptual Estimate is regarded as an order-of-magnitude estimate. Its accuracy is doubtful because the scope may be hypothetical and the estimate may require significant contingency to improve its precision. This type of estimate is often adequate to reject a project development but not sufficiently adequate to prove the viability of one. Its principal use is to evaluate alternatives and to select one for further study and development to the Class 1 level or the 2 level. The provision of funds to proceed to a more detail level can be estimated with greater accuracy at this time

Continual Improvement

Fostering creativity and improvement in the management and performance of Projects, and in meeting the challenges facing the organisation. Implementing review and benchmarking processes to ensure

best practice performance, promote knowledge management and knowledge sharing practices to support organisational learning.

Constraints

Factors that will limit the project management team's options, for example a predefined budget, deadlines or technology choices, scope or legislative processes

Contingency

The allowance which when added to the *Base Estimate* gives a project estimated cost which has a prescribed probability level of achievement. Contingency includes estimating added to the *Base Estimate* to cover estimating inaccuracy. Adding the contingency value to the *Base Estimate* value decreases the probability of overrun of the project

Contingency Planning

The development of a management plan that uses alternative strategies to ensure project success if specified risk events occur.

Contract

A mutually binding agreement in which the contractor is obligated to provide services or products and the buyer is obligated to provide payment for them. Contracts fall into three categories: fixed price, cost reimbursable or unit price

Cost

Cost is the amount of cash or cash equivalents paid or the fair value of the other consideration given to acquire an asset at the time of its acquisition or construction.

Cost of Assets

This is the required rate of return on the assets of the firm. It is higher than the cost of capital because it ignores the tax benefits of debt financing. It is the discount rate that can be used to value projects if the benefits of debt financing are estimated separately.

Cost of Debt

This is required return of the debt-holders of the firm and is lower than the other costs of capital defined above, because debt is less risky. However, debt on the balance sheet increases the risk and therefore

the cost of equity. There are potentially tax benefits associated with debt financing, but the extent of this advantage is controversial.

Cost of Equity

This is the rate of return required by the shareholders of the firm. It is the discount rate that should be used in valuing the equity of the firm. It should not be used to discount all-equity cash flows (unless the firm has no debt), because it ignores the fact that part of the financing is provided by debt-holders. The cost of equity increases with increases in financial gearing.

Current Asset

Asset that will normally be turned into cash within a year.

Current Liability

Liability that will normally be repaid within a year.

D

Decision Tree

Method of representing alternative sequential decisions and the possible outcomes from these decisions.

Decommissioning Obligation

All surface plant, shafts and infrastructure installed during pre-production (and during production) results in a rehabilitation obligation in terms of the Minerals Act. All of the infrastructure that must be removed in terms of the approved Environmental Management Program Report (EMPR) should therefore be included in the estimates as “decommissioning costs”. Pertains to the removal of plant and infrastructure and the rectification of preparation work performed at the pre-production stage. Any additional obligations resulting from additions to or expansion of the infrastructure will also be classified as decommissioning obligations.

Development Expenditure

Expenditure incurred in order to establish access to the mineral reserve which could include, but is not limited to:

sinking shafts and underground drifts

permanent excavations

roads and tunnels
advance removal of overburden and waste rock
other individually identifiable items of mining PPE

Development Expenditure to Maintain Production
Additional expenditure of a development nature to maintain the initially assessed standard of production and may include expenditure such as:
additional ore development beyond that originally capitalized on commissioning;
new shafts;
new infrastructure
etc.
They are capitalized and amortized over their expected useful life.

Discounted Cash Flow (DCF)
Future cash flows multiplied by *discount factors* to obtain *present value*.

Discount Rate
Rate used to calculate the present value of future cash flows.

E

Environmental Rehabilitation Obligations
Estimated long-term environmental obligations, comprising pollution control, rehabilitation and mine closure are based on the Group's environmental management plans, in compliance with current technology, environmental and regulatory requirements.

Estimating Plan
The Estimating Plan describes the execution of the scope of services of the estimating discipline and identifies all interfaces with other disciplines and external parties. The Estimating Plan recognizes constraints imposed by the overall *Study Plan* and schedule, and forms an integral part of the *Study Plan.*

Equity Risk Premium

This is the additional minimum return required by investors in a particular stock market to compensate them for the market-related risk they bear. An interesting comparison, then, is between the risky return on equities and the return on treasury bills. The time series most often employed goes back to 1926 (Ibbotson Associates). The historical difference between the return on the US stock market and US treasury-bills over the 1927-1997 period has been 8.93%. Over the 1946-1997 period, the US risk premium has been 8.6%. Using more recent data only (1966-1997), the US risk premium declines to 5.95%. In the UK, the risk premium over the 1946-1997 period has been 9.35% (Barclays Capital).

To use a risk premium based on historic data for valuation we need to make the assumption that the risk premium in the future is similar to its average value in the past. Some observers argue, however, that the risk premium may have declined recently, because a much smaller risk premium is needed to justify current valuations in the stock market. The jury is still out and current valuations may simply be a bubble. We are using 8% as our estimate of the risk premium as recommended by Professor Servaes of London Business School. This is consistent with a quote from Brearley and Myers in their latest addition of the Principles of Corporate Finance '...we believe a range of 6 to 8.5% is reasonable for the United States. We are most comfortable with figures towards the upper end of this range.'

Equivalent Unit Cost (EUC)

A factor, which when multiplied by the schedule of unit output, produces a cash flow, which has the same life and present value as the asset. Therefore it can be thought of as the total after tax cost (capital, operating and the opportunity cost of capital) of producing each unit of output.

Events After the Balance Sheet Date

Events after the balance sheet date are those events, both favorable and unfavorable, that occur between the balance sheet date and the date when the financial statements are authorised for issue. Two types of events can be identified:

Those that provide evidence of conditions that existed at the balance sheet date (adjusting events after the balance sheet date)

Those that are indicative of conditions that arose after the balance sheet date (non-adjusting events after the balance sheet date).

Expansion Capital Expenditure

Capital expenditure that increases the performance of an asset, that is the output of the asset, to a level in excess of the initially assessed performance standard, thus, improvements to existing assets. Expansion capital expenditure can also give rise to the initial recognition of an asset as and when it is incurred, i.e. additions to assets, which gives rise to recognition of a completely new asset as opposed to an asset replacing another. They are capitalized and amortized over the useful life of the asset or life-of-mine whichever is the shortest.

Expansion Projects

An Expansion Project is a project **of any size** that will increase the production of Tonnes or Ounces of a Business Unit. These projects are managed directly by the Projects Division.

Expected Return

Average of possible returns weighted by their probabilities.

F

Feasibility Estimate (Class 2 Estimate)

This estimate represents a realistic assessment of a project's capital development cost. This type of estimate requires that sufficient pilot metallurgical test work is completed in order to optimize the process flow diagrams and material balance. For an underground mine, sufficient mine planning should have been completed in order to identify optimum surface and underground layouts and shaft configurations. Similar appropriate planning should be done for open pit configurations. General arrangement drawings would be prepared and all major equipment sized. Key equipment specification would be prepared and key enquiries would be issued to several suppliers who could supply costs on a budget basis. The compilation of the estimate would depend on a mixture of techniques, including approximate quantity take-offs, factoring techniques and unit costs. This type of estimate should also include a preliminary environmental study to identify potential impacts which would have knock-on effects on project development. On projects which require financing, a preliminary financing strategy should be developed so that any impacts on the procurement strategy can be assessed at an early stage. Implementation strategies should also be identified, in order to develop a realistic project implementation direction and provide sufficient funds in the estimates for its achievement.

Finance Lease

A finance lease is a lease that transfers substantially all the risks and rewards incident to ownership of an asset. Title may or may not eventually be transferred.

Financial Statements

Financial Statements provide information about the financial position, performance and changes in financial position of an enterprise that is useful to a wide range of users in making economic decisions. The financial statements show the results of management's stewardship of the resources entrusted to it.

Five-Year (5-Year) Plan

A Budget Plan, over a rolling 5-year period, that reflects the cash flows of the anticipated programme of the projects being undertaken or being considered by the Group. The anticipated roll over of expenditure from one financial year to the next is to be taken into account .

Forward Cover

Purchase or sale of forward foreign currency in order to offset a known future cash flow.

Forward Exchange Rate

Exchange rate fixed today for exchanging currency at some future date

G

Governance

A behavioural-based philosophy and practice aimed at ensuring that all policies, work procedures and practices are based on achieving the highest possible level of excellence, business ethics/ morality, sustainability and employee development.

Governance of Capex Management

A framework through which all persons involved in The organisation Capex Management work are accountable for continually achieving the highest possible level of excellence, business ethics/ morality, sustainability and employee development. It also provides a framework for all persons to improve the quality of their services and to safeguard the high standards of Capex Management.

H

Hedging

Generally hedging is assumed to be a zero NPV transaction, excluding transaction costs, when put in place. However, when already in existence, hedging of any sort, either commodity price, currency or interest rate hedging, may have a positive or negative value and should be included in valuations if they are contractually in existence or called for, such as by lenders to a project. The value of the hedge should be determined separately to the value of operating assets.

Hurdle Rate

Minimum acceptable rate of return on a project.

I

Impairment

Impairment is when as asset is carried or reflected at more than its recoverable amount, which occurs when it's carrying amount exceeds the amount to be recovered through use or sale of the asset.

Impairment Loss

Impairment loss is the amount by which the *carrying amount* of an asset exceeds its recoverable amount.

Incremental Cash Flows

The value of an investment is determined by how much more valuable the company would be with the project (i.e. by making the investment) compared to without the project, i.e. what its Incremental Cash Flows will be with the completed project.

Indicated Resource

An indicated resource is one where sampling by drill holes, underground openings or other procedures are at locations too widely spaced to ensure continuity but close enough to give a reasonable indication of continuity and where geo-scientific data are known with a reasonable level of reliability. *Inferred resources* have the lowest level of confidence attached to them and are estimated based on very limited sample data and extrapolation of the information used to calculate Indicated Resources.

Intangible Asset

Non-material asset, such as technical expertise, a trademark, and a patent

Internal Rate of Return (IRR)

Discount rate at which investment has zero net *present value.* The advantage of using an IRR lies in the fact that it provides an answer in the form of a percentage. It does have certain disadvantages, especially the fact that it cannot be used to evaluate cost savings. It is also not appropriate for dealing with non-standard cash flows that involve more than one sign change (e.g. where the cash flow goes from positive, to negative and back to positive).

Investment Calculations

A set of financial management calculations that evaluate the investment merits of a proposed outlay of funds in terms of the The organisation Investment Evaluation Guidelines. Where an Investment Model is used, the parameters used in such a model are provided by the The organisation Financial Management Department.

J

K

L

Latest Cost Forecast (LCF)

The LCF is prepared to verify the projected cost forecast to confirm whether the remaining works or sections thereof will be within the **CBE** allowable. An LCF may be requested by the Client's representatives at any time during a Project if deemed necessary. This level of estimate is a calculation based on actual costs and orders placed, together with an estimate of costs to complete the project based on issued and extremely well defined information. This estimate is prepared under instruction of a change of scope for a project. The estimate is reviewed by the project team and finalized before any figures are issued. The result may require a change of scope or extension of the fund application. The contingency % allowed is arbitrated together with the project team in accordance with the level of information available.

Liability

A liability is a present obligation of the enterprise arising from past events, the settlement of which is expected to result in an outflow from the enterprise of resources embodying economic benefits.

M

Management Principles (for Projects)

A set of business and management principles that govern, manage and control the management of projects. The principles include: commitment, organisation of work, competence, performance standards, evaluation, management action, stakeholder engagement and continual improvement.

Materiality

Information is material if its non-disclosure or misstatement could influence the economic decisions of users taken on the basis of the financial statements.

Market Risk (also called systematic risk)

Risk that cannot be diversified away.

Major Projects

Such projects are usually expansion capital expenditure but can also be projects undertaken as ongoing capital expenditure. Such projects have a total cost in excess of R 50m.

Examples of major projects are:

Establishment of a new mine;

Establishment of a new shaft;

Construction of a new concentrator;

Construction of a new smelter;

Construction of a new refinery.

Major projects are amortized at the beginning of the commissioning period. Timing of the commencement of amortization should be agreed on an item by item basis with the engineering/technical department, executive management, accountants and tax manager. These representations should be submitted to the external auditors.

Measured Resource

A measured resource has been clearly determined in terms of its size, shape, density and grade. It has been tested by drill holes, underground openings or other sampling procedures at locations, which are spaced closely enough, to confirm continuity and where geo-scientific data are reliably known.

Mineral Resource

A mineral resource is defined as an identified in-situ mineral occurrence from which useful minerals may be recovered. It is implicit that there are reasonable prospects for eventual economic exploitation of the resource. The sub-categories of resource - Measured, Indicated and Inferred, depend upon the quantity and quality of the data available, and the level of confidence attached to those data. These factors will vary from deposit to deposit depending upon the mineral type and geological setting, and therefore each resource must be classified independently.

Mine Development Costs, Accounting Policy for

Mine development cost is capitalized to capital work-in-progress and transferred to mining property, plant and equipment when the mining venture reaches commercial production quantities. Capitalized mine development cost includes expenditure incurred to develop new mining operations, to define further mineralization in existing ore bodies, to expand the capacity of the mine and to maintain production. Costs include interest capitalized during the construction period where financed by borrowings and the present value of future decommissioning costs. Items of mining property, plant and equipment are amortized on a straight-line basis, over the lesser of thirty years or their expected useful lives, to estimated residual values. Amortisation is first charged on mining ventures from the date on which the mining ventures reach commercial production quantities, at which time capital work-in-progress costs are transferred to mining property, plant and equipment.

Mining PPE

Mining PPE are *assets* held for use directly and indirectly in the production of refined metals and include:

Expansion Capital Expenditure.

Ongoing Capital Expenditure being an asset which exceeds R300,000 and the useful life is at least 2 years: and is also irrespective of cost - Computer Equipment, Vehicles and Office Furniture.

Section 36 (11) (d) assets (of the Income Tax Act).

Development cost to maintain production.

Monte Carlo Simulation

Method for calculating the probability distribution of possible outcomes e.g. from a project.

N

Net Direct Cash Cost

Represents the cash cost incurred at each processing stage, from mining through to recoverable nickel delivered to market, less net by-product credits (if any).

Net Present Value (NPV)

A project's net contribution to wealth – *present value* minus initial investment.

Net Profit Interest

A portion of the profit remaining after all charges; including taxes and bookkeeping charges (such as depreciation) have been deducted.

Net Working Capital.

Current assets minus current liabilities.

Net Worth

Book value of a company's *common stock*, surplus, and *retained earnings*.

Non-adjusting Events (see also *Adjusting Events)*

Non-adjusting events are disclosed in the financial statements, if material, with no adjustment made to amounts recognised in the financial statement.

Examples of non-adjusting events:

Acquisition or disposal of major subsidiaries, joint ventures or associates

Announcing a plan to discontinue an operation

Major purchases or disposals of assets

Destruction of major assets

Commencing or announcing major restructurings

Major share transactions

Entering into significant commitments or contingent liabilities

Commencing major litigation.

O

Opportunity Costs

The cost of a resource may be relevant to the investment decision even if no cash changes hands. Use of an asset (e.g. land) presently owned, but not used, is *not* necessarily free; it could possibly be used for other projects or be sold for cash and therefore needs to be built into the incremental cash flow analysis

Opportunity Cost of Capital (*hurdle rate, cost of capital*)

Expected return that is forgone by investing in a project rather than in comparable financial securities.

Ongoing Capital Expenditure

Capital expenditure to maintain or restore the performance of an asset, that is the output of an asset, to the initially assessed performance standard. The result of this type of expenditure is usually of the form:

A major component is replaced in total without adding benefits in excess of the originally assessed standard of performance, or;

Replacement of a consumed asset at the end of its useful life with a new asset.

Ongoing capital expenditure should be recognized as an asset when and only when:

The amount of the capital expenditure exceeds **R 300 000** for the item acquired or constructed, and

The useful life of the item acquired or constructed are at least **2 years**.

Where any of these two criteria are not met, the ongoing capital expenditure should be charged to working cost as and when it is incurred. These thresholds should be applied on an item by item basis for asset items and separately identified major components.

Ongoing Engineering Projects

Ongoing Projects are those that will maintain the current production of a business Unit. An Ongoing Project is defined **regardless of size** requiring up front scope definition, design, planning and project management.

Other Projects

These are projects that could be either expansion or ongoing capital expenditure, which do not meet the definition of a major project.

They are capitalized and amortized over their useful lives.

P

Payback Period

Time taken for a project to recover its initial investment. A 5 year payback would normally be an acceptable payback period. Where the payback period is very short say 1 – 2 years and the other valuation criteria indicate that the project should be rejected, this could indicate that the project still has some merit.

Platinum Producers' Environmental Trust

The Group makes annual contributions to the Platinum Producers' Environmental Trust, which was created to fund the estimated cost of pollution control, rehabilitation and mine closure at the end of the lives of the Group's mines. Contributions made are accounted for as an investment and are classified under non-current assets. Contributions are determined on the basis of the estimated environmental obligation over the life of mine and annually reviewed. Income earned on moneys paid to the Trust is accounted for as investment income.

Pre-feasibility Study

A relatively comprehensive analysis which is qualified by the availability and accuracy of fundamental criteria and assumptions to the degree that it cannot be the basis for final decisions.

Preliminary (Cost/Budget) Estimate (*Class 1 Estimate)*

This estimate represents a first realistic assessment of a project's capital development cost. This type of estimate requires that sufficient bench scale metallurgical test work is completed in order to determine the process flow sheet and approximate material balance. For an underground mine, sufficient mine planning should have been completed in order to identify preliminary surface and underground layouts and shaft configurations. Similar appropriate planning should be done for open pit configurations. Some general arrangement drawings would be prepared and major equipment sized. No special equipment specification would be prepared and enquiries would be limited to single suppliers who could supply costs on a budget basis. The compilation of the estimate would depend on a mixture of techniques, including approximate quantity take-offs, factoring techniques and unit costs. This type of estimate would not normally include a preliminary environmental impact study, however if available, it will help to identify potential impacts which would have knock-on effects on project development. This level of estimate is the second level of definition based on preliminary designs and planning with defined layout and flow drawings. Defined mechanical and equipment lists are required

with established specifications and scope. This level of estimate is used for better defined costs to allow a business decision to be made to continue with detailed design and estimating. The contingency allowed in this type of estimate would be between **10 and 15%.**

Present Value

Discounted value of future cash flows.

Present Value of Growth Opportunities (PVGO)

Net present value of investments the firm is expected to make in the future.

Project Definition

The project definition is the framework laid down for all the objects created within a project. It contains default values and profile data for the *WBS* elements, for example assignments to particular organisational units. Additionally, the basic dates for the whole project and the planning parameters for costs and dates are stored on the project definition level. The project definition contains neither planning nor actual data.

Project Execution Method Statement (PEMS)

The Project Execution Method Statement (PEMS) consists of procedures and references to procedures that govern how a project will be managed.

Project System

Project System is used to produce accurate, timeous, relevant, reliable project information to the management team. Project System enables the following:

Developing and maintaining integrated reporting systems that provide read-time, accurate, relevant and reliable project information;

Improving the speed and accuracy of business decisions made by the management team through the quality of information, and

Supporting the company's vision to apply world class best practices in their project management process, effectively integrating internal and external resources, suppliers and customers.

Provision

A provision is a liability of uncertain timing or amount.

Policy and Procedures

The organisation Group Policies and Procedures each in their own right are defined as the highest level of corporate instruction or guideline, approved and implemented by Executive Management, which serves to direct or inform Management and Employees on matters of broad interest, and where appropriate, provides the framework on which Divisional, Business Unit and Departmental Policies and Procedures are based. A policy or procedure is a Group Policy or Procedure, if the policy or procedure impacts on employees who do not fall within the sphere of authority of the policy maker (i.e. "do not report to the policy maker, directly or indirectly"), or if the policy or procedure is made by the Operations Director and applicable to a/all Business Unit/s.

Post Implementation Review Process

The Post Implementation Review Process is a systematic review of all aspects of a completed project, including a technical review, a commercial/financial review and a review of the investment philosophy and financial parameters used in analysing and approving the project. The Project Owner is responsible for compiling the post implementation review. A post implementation review must be carried out for all projects that exceed R500,000 in total costs or for which a vote is opened. The timing of the reviews should be agreed between the Project Sponsor and the Project Owner before the project is commissioned but the recommendation is that the first review should be carried out within six months of the project having been completed. The review is carried out every six months until such time as the Project Sponsor is satisfied that the review process is complete. The record of the reviews are maintained on site as part of the project documentation and should form part of the *Project Close-out Report.*

Principal

Amount of debt that must be repaid.

Project Cost Management

As defined in PMBOK, the processes required to ensure that a project is completed within an approved budget. It is primarily concerned with the cost of the resources that are needed to complete the project.

Project Closure

This is the process that leads to the submission of the *Project Close-out Report* that serves to terminate of the project. The process includes a *Technical Closure*, that evaluates and finalizes all technical aspects of the work carried out and the final project deliverable, a *Commercial Closure,* that finalizes all

commercial aspects, like orders, payments, contracts, etc., and a *Post Implementation Review*, that evaluates the success or otherwise of the investment aspects.

Project Design Basis

The Project Design Basis is prepared by the Project Manager and his technical team. It has three main purposes: to form the basis for agreement pertaining to the design scope, approach, criteria and standards used in the study; to support the Basis of Estimate narrative document (as the design standards directly affect cost); and to act as a control base from which to trend the detailed design, once the project go-ahead is given.

Project Execution Plan

Projects require resources to be marshalled and used in order to achieve objectives. The identification of these resources and the methods by which they will be "bought out" and then managed, is fundamental to understanding the magnitude of the management job ahead. While the *Project Scope* document describes the scopes of work and services which form part of the project, the *Project Execution Plan* describes how these works and services will be classified or "broken up" into manageable chunks; how the project management team will be organised, and how responsibility will be divided among the team members; how the resources will be procured to execute the work and how the project will be controlled, from a cost, time and quality view point.

Project Finance

Debt that is largely a claim against the cash flows from a particular project rather than the firm as a whole.

Project Owner

The Project Owner will be actively involved in the detail of a project throughout the project process from budget planning to close out reports. The Project Owner will be responsible for:

Preparation of project documentation for the budget plan, and on approval, the Capital Expenditure Request.

Ensuring the project appears on the Business Unit's project register and maintenance of the information.

Manage the preparation of documentation for estimating and signing off the estimate at CBE level for vote approval.

Management of the vote application / extension application.

Maintaining the appropriate project documentation in accordance with the Capital Management Process.

Reporting on the status of a project.

Ensuring that the Investment Calculations are completed in documentation as required and that they meet with the required hurdle rates.

Project Proposal

The initial document that converts an idea or policy into details of a potential project, including the outcomes, outputs, major risks, costs, stakeholders and an estimate of the resourcing and time required.

Project Schedule

The Project Schedule describes the key activities and their logical timing arrangement with each other. For a typical feasibility study it should focus mainly on the critical activities and interfaces with external activities. The Project Schedule also includes: identification of the critical path activities; a definition of the key interfaces both within the project and to outside factors; and a list of key milestones that are important for control purposes.

Project Scope Document

The Project Scope Document is a detailed description of the proposed project and includes two main sections: *Scope of Facilities* and *Scope of Services.*

Project Sponsor

The Project Sponsor is the person who will ultimately take responsibility for the project but will not actively manage the details of the project throughout the project process. The Project Sponsor is responsible for signing the project off at the appropriate level in terms of the Capital Management Process. The Project Sponsor will be responsible for:

Ensuring that the proposal is in line with the The organisation Group's strategic production and investment intention.

Ensuring that the proposal meets the prescribed technical and investment parameters.

Authorizing the proposal and the associated expenditures and exposure.

Project Systems

The Project Systems (PS) information system is an integrate part of the SAP environment. Information on Projects, e.g. budgeting, forecasts, cash flow, actuals, etc. can be accessed via the PS Report Tree that is part of the Project Systems.

Q

Qualifying Asset

A qualifying asset is an asset that necessarily takes a substantial period of time to get ready for its intended use or sale.

Examples of qualifying assets are manufacturing plants, power generation facilities and investment properties.

Quality Management

Quality management is the policy and associated procedures, methods and standards required for the control of a piece of work or of a work flow. The purpose of quality management is to increase certainty by reducing risk of project of rejected work or even failure. It also provides the opportunity for continuous improvement.

R

Real Assets

Tangible assets and intangible assets used to carry on business

Real Interest Rate

Interest rate expressed in terms of real goods; i.e., *nominal interest rate* adjusted for inflation

Recoverable Amount

Recoverable amount is the higher of an asset's net selling price or its value in use.

Reimbursable (Reimbursable Costs)

Expenditure incurred on contractors and consultants.

Reimbursable costs will be amortised for Ongoing Projects over a period of three years. For Expansion and Major Projects to be determined according to the type of Project.

Restoration Obligation

Pertains to the costs associated with restoring the environmental damage caused progressively as a result of continued production. In other words, an obligation is created during the life of a mine (or plant) to restore damage caused due to on-going activities that lead to environmental impacts (e.g. surface water and ground water pollution, waste generation, etc.). All of the commitments made in the EMPR in this regard should be included in the estimates as "restoration costs". (Restoration costs post-decommissioning, but prior to final closure must also be included in these estimates).

Risk Analysis (of Projects)

Ideally, risk analysis involves examination of the risks faced by the project and determining how those risks could best be managed. The end product of the analysis is the identification of the key risks, which have a reasonable probability of occurring and which, if they occurred, would have a material impact on the value of the project. These project-specific risks should then be quantified in the *sensitivity analysis.*

Risk-free Rate

This is a rate of interest in a capital market that is risk-free and our best estimate of this is based on the returns on US government bonds. Treasury Bills, which currently yield 4.8% are considered risk-free because the chances of default are minimal. Long-term bonds cannot be considered risk-free, because they are exposed to interest rate risk. The excess premium for 30-year bonds over short-term bonds between 1926 and 1997 was 1.75% and between 1946 and 1997 0.99%. Based on this, Professor Servaes of London Business School recommends a typical adjustment of 1.4% for interest rate risk and the current yield of 30-year bonds is 6.1%. These are nominal rates and our US inflation rate forecast must be the same as the market's expectations for purposes of valuation. Interest rates and inflationary expectations are continually changing. For consistency, we prefer to define the risk-free rate in real terms. Real interest rates do change, but they are less volatile. Indexed-linked government securities in the UK and more recently in the US have yielded between 2 and 4.5% in real terms and we have concluded that 3% per annum in real terms is our best estimate of the long run risk-free rate.

Return on Investment (ROI)

Generally, book income as a proportion of net book value.

S

Salvage Value

Scrap value of plant and equipment

Security

Authors together with the sponsor should establish the levels of security clearance employees need to access any or all information within the system. This is normally done when creating a new policy by entering the relevant code when publishing a policy/procedure.

Security Code

The admission code applicable to individual employees or groups of individual employees in terms of their respective clearance to access information on the information systems.

Sensitivity Analysis

Projects are often evaluated by testing the economics by varying the base assumptions, by a given percentage (e.g. Capex 10%, recovery 10%). This is useful, but limited. It is more informative to provide a sensitivity range that reflects the uncertainty of the variables (e.g. Capex 20%, recovery 3 units).

Sponsor

A sponsor, normally an Executive Director of The organisation, has the overall responsibility for policies and procedures within his/her specific area of responsibility and division. He/she is the person who sits on the authorative body, ADCO (EXCO/OPCO) and approves the introduction of new policies, the changes and review to existing policies and deletion of outdated policies and procedures.

Standard Contract/Agreement

A contract/agreement which has been pre-approved as a template by the Legal and Resource Management Department.

Study Plan

The Study Plan is based on a study motivation proposal for a proposed new project as presented to the board prior to release of the study. The Study Plan will cover the following topics: scope of facilities (facilities to be estimated); statement of work (services to be performed); work methods plan (how the

work will be performed); resource plan (who will do the work); cost plan (budget and work breakdown structure (WBS), and time plan (the schedule).

Stakeholders

Persons and groups of persons who can be directly influenced by the economic well being of The organisation. Examples include employees, customers, suppliers, local communities, trade associations, agencies, associated businesses and unions

Stakeholder Engagement

The promotion and maintenance of open and constructive dialogue and good working relationships with employees, local communities, regulatory agencies, business organisations and other affected and interested parties, to increase knowledge and enhance mutual understanding in matters of common concern. Mechanisms should be in place for identifying key stakeholders (at local, regional and international level), understanding their priorities, responding to their expectations and following up results

Sustainable Development

Industrial development that does not detract from the potential of the natural environment to provide benefits to future generations.

T

Technical Closure

The component of the *Project Close-out Report* that deals with the evaluation and closure of all technical issues and aspects of a Project

U

Unacceptable Risk

An unacceptable level of risk will arise when a division earns less than its cost of capital. Should the division continue to earn less than its cost of capital for a full year, then the division must submit to AA plc EXCO a detailed plan for remedying the situation. Such a plan should show the impact of additional measures already introduced and reported in the *capital efficiency* report. It will be the responsibility of the AA plc EXCO to review the plan and propose any changes it considers necessary.

Useful Life

The period of time over which an item of PPE is expected to be used by the Group.

V

Value Added (Amplats Value Added) (VA)

The organisation has developed and is implementing the Amplats Value Added assessment tool, which has been tailored from the traditional EVA measure to meet the needs of the mining industry. The organisation developed this approach, because it recognised that too narrow a focus on costs or return on investment type measures could result in value-adding growth being ignored. Value Added has been built into The organisation incentive schemes

Value Added Tax (VAT)

VAT should only be introduced into the cash flow analysis where it has a significant impact from a timing perspective or where the company is not entitled to an input credit (e.g. the purchase of a passenger car). In most cases the impact of VAT can be ignored.

Value in Use

Value in use is the present value of estimated future cash flows expected to arise from the continuing use of an asset and form its disposal at the end of its useful life.

Variation Order (VO)

A Variation Order (VO) is an alteration to the design criteria or an item without changing the basic scope of the original project. For example: unforeseen conditions such as bad foundations, changes in preliminary assumptions used in the preparation of the original estimate, detailing changes of pipe runs or connections.

Vote

The vote represents the formal sanctioning of a project by the level of approval as dictated by the nature of the project. This is generally regarded as Board Approval.

Vote Closure

A vote closure represents the formal termination of a project. Vote closure is motivated by the Business Unit in accordance with the close out figures supplied by the Project Team.

W

Weighted Average Cost of Capital (WACC)

The weighted average of the after tax cost of debt, the cost of equity, and the cost of other financing sources. WACC includes the tax benefits to the corporation of debt financing; these do not need to be computed separately. Note that WACC, is calculated using the project's overall contribution to the firm's borrowing power, not the amount actually borrowed, if borrowing appears to exceed a prudent level for the specific project concerned, it is because the company is really borrowing against its other existing assets

Work Breakdown Structure (WBS)

The WBS is a hierarchical listing of all activities, or groups of activities that have to be completed on a project. The WBS also provides additional information on Business Unit reference, Project or Annual Sort, Project Vote Number, Area Number (Optional), Sub Head Number, Commodity Code, Item Number, Company Number, Lotus Notes references, SAP references. It is a deliverable-oriented grouping of project elements that organises and defines the total scope of the project. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services. The WBS is a tool for defining the hierarchical breakdown and work in a project. It is developed by identifying the highest level of work in the project. These major categories are broken down into smaller components. The subdivision continues until the lowest required level of detail is established. These end units of the WBS become the activities in a project. Once implemented, the WBS facilitates summary reporting at a variety of levels. The organisational and coding structure, developed specifically for a project, that subdivides the project in manageable packages of work, components or elements consistent with the manner in which the work will allow the establishment of meaningful project performance baselines and progress and cost measurement modules

Work Package

Detailed short-span tasks, or material items, identified by the performing contractor for accomplishing work required to complete a project. A work package represents a further breakdown of the work defined by the cost account. In traditional cost/schedule systems, the criteria for defining work packages are as follows: 1) each work package is clearly distinguishable from all other work packages in the program. 2) each work package has a scheduled start and finish date. 3) each work package has an assigned budget that is time-phased over the duration of the work package. 4) each work package either has a relatively short duration, or can be divided into a series of milestones whose status can be

objectively measured. 5) Each work package has a schedule that is integrated with higher-level schedules.

Working Capital

Current assets and current liabilities. The term is commonly used as synonymous with net working capital.

X

Y

Z

Symbols

A

ADCO
The Administration Committee

B

C

CAPM
Capital asset pricing model

CBE
Control Budget Estimate

CF
Cash Flow

CMP
Capex Management Process

CMS
Capex Management Services (The organisation)

COS
Change of Scope: An application by the Project Team for changes in the scope of the original intent and meaning of the project.

D

DCF
Discounted cash flow.

E

EPCM (Engineering-Procure-Construct Management)

Arrangement with contractor to provide equipment, procurement, construction and management.

EXCO

The Executive Committee

F

FCF

Free Cash Flow for a specific period

FV

Future Value

G

H

I

IRR

Internal Rate of Return

J

K

L

LCF

Latest Cost Forecast

M

N

NOPT
Net Operating Profit After Tax

NPV
Net Present Value

O

OME
Order of Magnitude Estimate

P

PCE
Preliminary Cost Estimate

PEMS
Project Execution Method Statement

PMBOK
Project Management Body of Knowledge (Project Management Institute)

PPE
Property, Plant and Equipment

PV
Present Value

Q

R

REMCO
The Remuneration Committee

ROA
Return On (Total) Assets

ROE
Return On Equity

ROI
Return On Investment

RTS
Request for Technical Services

S

T

U

V

VA
Value Added (Amplats Value Added)
The organisation has developed and is implementing the Amplats Value Added assessment tool, which has been tailored from the traditional EVA measure to meet the needs of the mining industry. The organisation developed this approach, because it recognised that too narrow a focus on costs or return on investment type measures could result in value-adding growth being ignored. Value Added has been built into The organisation incentive schemes

VAT

Value added tax

VO

Variation Order: An application for a change within the original scope of the project.

W

X

Y

Z

TOPIC 1

PROJECT FINANCIAL MANAGEMENT:

AN INTRODUCTION

LEARNING OUTCOMES
Students should be able to: ■ understand why a knowledge of elements of both financial accounting and management accounting is necessary for the study of "project financial management". ■ define basic financial accounting concepts and cost concepts.

CONTENTS

READING
Recommended reading
► **Burke, R. (2006) Project management: Planning and control techniques.5th Edition. China: Burke Publishing. pp 195** ► **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited. pp 11** ► **Goodpasture, J.C. 2004) Quantitative Methods in Project Management. 1st Edition. Mumbai: Shroff Publishers. pp 14-18** ► **Turner, J.R. and Simister, S. (2004) Project Management: A Comprehensive Handbook. 1st Edition. New Delhi: Gower Publishing Limited. pp. 293-295** **Serra, C. E. M. & Kunc, M., 2014. Benefits Realisation Management and its influence on project success and on the execution of business strategies. Also, no. International Journal of Project Management, Issuehttp://dx.doi.org/10.1016/j.ijproman.2014.03.011.**

1. INTRODUCTION

According to Burke (2006:195) **Project Financial Management** uses a combination of both financial and management accounting together with some project management tools to integrate the project accounts with the other project parameters.

Financial accounting keeps a record of all financial transactions. This record serves as a basis to report on the financial performance and financial position of an enterprise using generally accepted accounting principles. The reporting is in the form of four main statements viz. the Statement of Comprehensive Income (Income Statement), the Statement of Financial Position (Balance Sheet), the Statement of Changes in Equity and the Statement of Cash Flows

Management accounting uses the above financial information to analyse the performance of the company. This analysis assists management in making decisions relating to estimating, planning, budgeting, implementation and control. Management accounting is thus concerned with providing information within the business that will assist in making informed decisions in order to improve the efficiency and profitability of the business.

2. BASIC ACCOUNTING CONCEPTS

The knowledge of the terminology used in accounting is useful for the understanding of the various topics discussed in this study guide.

2.1 Financial accounting concepts

The financial position of a business is reflected in the measurement of its assets, liabilities and equity. Financial position reflects the wealth of an enterprise on a certain date. This is presented in a financial statement called a **Statement of Financial Position (Balance Sheet)**. The Statement of Financial Position reflects the Assets on one hand and on the other hand the Equity and Liabilities.

Assets are the possessions of the entity (business/enterprise) that have monetary value. Assets include non-current assets and current assets. **Non-current assets** are assets that have a useful life of more than one year e.g. equipment, vehicles, property. **Current assets** are those assets that are cash or expected to be realised in cash within a year e.g. cash in the

bank, debtors, and inventories.

Liabilities are the debts of an enterprise. Liabilities may be classified as non-current or current. **Non-current liabilities** are debts that are payable after more than one year e.g. mortgage loan. **Current liabilities** are debts payable within a year e.g. creditors resulting from the credit purchase of merchandise.

Equity refers to the interest of the owner(s) in the net assets (Assets minus liabilities) of the enterprise.

The above may now be expressed as an equation:
Assets = Equity + Liabilities
This is known as the **Accounting equation**

The main aim of every business enterprise is to make a profit that will provide a good return for the owner(s) on capital invested. The **financial result** of an enterprise is a measure of the profit or loss that the enterprise has made over a certain period of time, usually one year. This period of time is known as the **financial period**. The financial statement that reflects financial result of an enterprise is the **Statement of Comprehensive Income (Income Statement)**.

An enterprise makes a **profit** when the income earned exceeds the expenses incurred. When expenses exceed the income, a **loss** results. **Income** increases economic benefits to the enterprise and results in an increase in profit and thus equity. Examples of income include Sales, Rent income, Interest on investments etc. **Expenses** decrease economic benefits to the enterprise and results in a decrease in profit and thus equity. Examples of expenses include cost of goods purchased, salaries and wages, insurance etc.

2.2 Management accounting concepts

An understanding of the various costs used in management accounting is necessary. **Costs** may be defined as the value of economic resources used for the production of a product or service. Costs may be viewed as a necessity in producing a product or service. Costs may be classified according to type e.g. direct and indirect costs as well as by behaviour e.g. fixed and variable costs. Costs are considered to be direct or indirect to the extent to which they can be

accurately traced to a cost centre. A **cost centre** may be defined as any part of a business to which costs are charged e.g. a particular product or job or department or project.

Direct costs are costs that can be accurately identified as forming part of a cost centre. Examples of such costs would include the materials used to make the product (direct materials) and the wages of the employees who work with these materials (direct labour). **Indirect costs** are costs that cannot be easily traced to a particular cost centre. They may be said to include all costs with the exception of direct costs.

Fixed costs are those costs that remain the same irrespective of the level of output or activity. Examples include rent and insurance. However, it must be remembered that fixed costs remain fixed over a certain range. For example, if a factory is producing goods at full capacity and if more units have to be produced then additional premises would be needed resulting in additional rent expense being incurred. **Variable costs** are those costs that change in proportion to the changes in the level of output or activity. Examples include direct materials, direct labour and certain variable overheads e.g. packing materials.

Manufacturing costs consists of three elements viz. direct material, direct labour and manufacturing overheads. Included in manufacturing overheads are indirect materials and indirect labour. **Non-manufacturing costs** include marketing costs and administrative costs. All these concepts are explained below.

Material consists of direct material and indirect material. **Direct material** can be regarded as the primary material used to manufacture a product. It forms a part of the final product and its usage depends on the volume of production. Direct material forms one part of the primary (direct) cost of a product. **Indirect material** does not form part of the final product e.g. cleaning materials, maintenance materials. The quantity used is not linked to the volume of production. Indirect materials form part of manufacturing overheads.

Labour can also be divided into two components viz. direct labour and indirect labour. **Direct labour** refers to labour that is physically applied to the manufacturing of a product and can also be easily traced to the manufactured product. Direct labour forms part of the primary (direct) cost of a product. **Indirect labour** refers to labour costs that cannot be directly linked to a

particular product. For example the wages of the employees who maintain and service the machines used during manufacturing are classified as indirect labour. Indirect labour forms part of manufacturing overheads.

Manufacturing overheads include indirect materials, indirect labour and all other costs incurred during the manufacturing process that cannot be directly traced to the product. In other words in includes all costs excluding direct material and direct labour that are incurred during the production process. Apart from indirect materials and indirect labour, manufacturing overheads include rent (of the factory floor space), insurance (of the factory stock and buildings), depreciation of production machinery etc.

Marketing costs are costs incurred to market the product and are largely expenses incurred in promoting sales, obtaining orders and delivery of products. Examples include advertising and commission on sales.

Administrative costs

These are costs incurred during the performance of administrative duties. They include costs that arise from departments such as finance, administration, human resources and management. Examples include salaries of executives, legal costs, clerical costs etc.

2.3 Understanding Accounting Concepts

To understand Accounting, we need to understand the works of Fra Luca Bartolomeo de Pacioli (sometimes *Paciolo*) (1446/7, Sansepolcro – 1517) was an Italian mathematician and Franciscan friar, collaborator with Leonardo da Vinci, and seminal contributor to the field now known as accounting, for which he is often regarded as the "**Father of Accounting**". He was also called Luca di Borgo after his birthplace, Borgo Santo Sepolcro, Tuscany. Pacioli published several works on mathematics, including:

Summa de arithmetica, geometria, proportioni et proportionalita **(Venice 1494)**, a textbook for use in the schools of Northern Italy. It was a synthesis of the mathematical knowledge of his time and contained the first printed work on algebra written in the vernacular (i.e. the spoken language of the day). It is also notable for including the first published description of the method of bookkeeping that Venetian merchants used during the Italian

Renaissance, known as the double-entry accounting system. Although Pacioli codified rather than invented this system, he is widely regarded as the "Father of Accounting".

The system he published included most of the accounting cycle as we know it today. He described the use of journals and ledgers, and warned that a person should not go to sleep at night until the debits were equal to the credits. His ledger had accounts for assets (including receivables and inventories), liabilities, capital, income, and expenses — the account categories that are reported on an organization's balance sheet and income statement, respectively. He demonstrated year-end closing entries and proposed that a trial balance be used to prove a balanced ledger.

The first key issue to understanding accounting is to be able to identify the assets, liabilities, expenses, income and capital of the business. Using the double-entry system (which involves debits and credits in ledger accounts) the accountant also needs to calculate the values of these different items.

Assets

There are 2 points to consider when deciding if something is an asset to the business. These are:
Assets are things that are owned by the business.
Assets have a retained value that can be expressed in monetary terms. This usually means that assets are either cash or can be converted into cash.

There are two types of business assets:

1. Non-current assets	**2. Current assets**
Non–current (fixed) assets are usually kept in the business for longer than one year	**Current assets are those assets which are cash or will be turned into cash within the next twelve months**
Tangible assets: **Land and buildings** **Plant and machinery**	**Inventories:** **Raw materials on hand** **Work-in-progress on hand**

Vehicles	**Trading stock on hand**
Furniture and equipment	**Consumable stores on hand**
Intangible assets:	**Trade and other receivables:**
Patents	**Trade debtors**
Trademarks	**Accrued income**
Goodwill	**Prepaid expenses**
Financial assets (investments):	**Cash and cash equivalents:**
Shares in other companies	**Bank**
Loans to other companies	**Petty Cash**
Fixed deposits	

In Summary, an asset is seen as any item of economic value owned by an individual or corporation, especially that which could be converted to cash. Examples are cash, securities, accounts receivable, inventory, office equipment, Property, a car, and other property. On a balance sheet, assets are equal to the sum of liabilities.

Liabilities

Liabilities refer to the outstanding debts of the business (i.e. the money the business owes to others).

A liability is therefore an obligation that legally binds an individual or company to settle a debt. When one is liable for a debt, they are responsible for paying the debt or settling a wrongful act they may have committed. For example, if Dennis hits John's car, Dennis is liable for the damages to John's vehicle because Dennis is responsible for the damages. In the case of a company, a liability is recorded on the balance sheet and can include accounts payable, taxes, wages, accrued expenses, and deferred revenues. Current liabilities are debts payable within one year, while Non-Current (long-term) liabilities are debts payable over a longer period, usually one year.

There are two types of business liabilities:

1. Non-current liabilities	2. Current liabilities
Non-current liabilities are those liabilities that will take longer than one year to pay back	**Current liabilities are the liabilities that will be paid back within the next twelve months**
Mortgage bond **Long-term loan**	**Trade and other payables:** **Trade creditors** **Accrued expenses** **Prepaid income** **Other:** **Bank overdraft** **Income tax payable** **Dividends payable to shareholders**

Expenses

Expenses and assets have much in common:

Both are needed in order to run a business and make a profit

A business has to pay money (or borrow or obtain credit from a supplier) for both

"So what is the difference between an expenses and an asset?" The difference is that when we buy an asset we are buying something that we can reconvert into cash, i.e. it retains its value like when we buy a computer. (We will deal with depreciation on assets as they get older later on in this course.) With an expense, however, the business pays out money, but (except for when it buys its stock-in-trade) it does not receive anything that it intends to resell for cash. When paying for telephone calls, salaries, etc., it doesn't get something with a financial resale value in return. Expenses do not “retain” their value in the business like assets do. They are “consumed” and decrease the net worth of the business.

For this reason we call expenses the costs of running a business, i.e. operating costs. Although assets also cost the business cash to secure they do not result in a decrease in the net worth of the business.

Income

Income is the money earned/generated from the running of a business; i.e. it is the money a business makes. A business uses its assets and expenses in order to make this income. Income increases the net worth of the business.

It is important not to just see income as money coming into a business. Money also comes into a business for reasons other than income. So when a business sells an old vehicle valued in its books at R 10 000 for R 10 000 cash - a new asset (cash of R 10 000) comes into the business, but no extra value is being added because another asset (vehicles worth R 10 000.00) is reduced - resulting in a net change of nil to the value of the assets and the net worth. Liabilities (like a loan) also result in money coming into the business but this also does not result in an increase in net worth as a new liability (loan of say R 2 000) increases and so does the asset (cash of say R 2 000).

Capital

Capital is the money that the owner/s contribute to (invest in) the business.

Drawings are cash or other assets that the owner/s take out of the business for personal use and these drawings reduce the capital of the business. Drawings only apply in the case of a sole proprietorship or partnership. Drawings are not permitted in a company or close corporation.

Summary

Assets are possessions that a business owns. They retain their value and/or can be converted into cash (like debtors).

Liabilities are the debts that a business owes to others.

Expenses are the operating costs of running a business and earning its income.

Income is the money generated (earned) by a business from sales or services rendered.

Capital is the money and/or other assets put into a business by its owner/s.

Owners Equity

Owners Equity is the owner/s interest in the business - i.e. what the owner/s are entitled to claim of the business assets, after the rest of the firm's assets have been used to pay off its outstanding liabilities (refer to the basic accounting equation below). Owners Equity is the "net worth" of the business.

In a sole proprietorship, Owners Equity is made up of:

+ Capital i.e. net capital
- Drawings

+ Income
- Expenses i.e. net profit

In a company, Owners Equity is made up of:

+ Share Capital
+ Retained Income (Accumulated Profit)

ACTIVITY 1

In your department, identify any two in each of the following categories: Assets, Liabilities, Income and Expenses.

3. Account types (nature)

Type	Represent	Examples
Real	Physically tangible things in the real world and certain intangible things not having any physical existence	Tangibles - Plant and Machinery, Furniture and Fixtures, Computers and Information Processing Equipment etc. Intangibles - Goodwill, Patents and Copyrights
Personal	Business and Legal Entities	Individuals, Partnership Firms, Corporate entities, Non-Profit Organizations, any local or statutory bodies including governments at country, state or local levels
Nominal	Temporary Income and Expenditure Accounts for recognition of the implications of the financial transactions during each fiscal year till finalisation of accounts at the end	Sales, Purchases, Electricity Charges

Example: A sales account is opened for recording the sales of goods or services and at the end of the financial period the total sales are transferred to the revenue statement account (Profit and Loss Account or Income and Expenditure Account). Similarly expenses during the financial period are recorded using the respective Expense accounts, which are also transferred to the revenue statement account. The net positive or negative balance (profit or loss) of the revenue statement account is transferred to reserves or capital account as the case may be.

Account types (periodicity of flow)

The classification of accounts into real, personal and nominal is based on their nature i.e. physical asset, liability, juristic entity or financial transaction. The further classification of accounts is based on the periodicity of their inflows or outflows in the context of the fiscal year.

Income is immediate inflow during the fiscal year.

Expense is the immediate outflow during the fiscal year.

An asset is a long-term inflow with implications extending beyond the financial period and by the traditional view could represent unclaimed income. Alternatively, an asset could be valued at the present value of its future inflows.

Liability is long term outflow with implications extending beyond the financial period and represents unamortised expense as per the traditional view. Alternatively, a liability could be valued as the present value of future outflows.

Type of accounts	Long term inflows	Long term outflows	Short term inflows	Short term outflows
Real accounts	Assets			
Personal accounts	Assets	Liability		
Nominal accounts			Incomes	Expenses

Items in accounts are classified into five broad groups, also known as the elements of the accounts: Asset, Liability, Equity, Revenue, Expense.

The classification of Equity as a distinctive element for classification of accounts is disputable on account of the "Entity concept", since for the objective analysis of the financial results of any entity the external liabilities of the entity should not be distinguished from any contribution by the shareholders.

The Accounting Equation

The accounting equation states that: Assets = Owners Equity + Liabilities

$$A = 0 + L$$

The accounting equation results in a key principle upon which all accounting is based. This principle is...

The extended accounting equation must also balance: *'A + E = L + OE + R'*

(where A = Assets, E = Expenses, L = Liabilities, OE = Owner's Equity and R = Revenues)

So 'Debit Accounts (A + E) = Credit Accounts (L + R + OE)'

Debits are on the left and increase a debit account and reduce a credit account.

Credits are on the right and increase a credit account and decrease a debit account.

ASSETS			=	LIABILITIES + OWNERS EQUITY				
Current Assets	+	Fixed Assets	=	Current Liabilities	+	Long-term Liabilities	+	Owners Equity
Cash		Land		Creditors		Bank loan		Share Capital
Debtors		Buildings		Overdraft		Debentures		Profits
Stock		Machines						
		Vehicles						
		Computers						
The extended accounting equation								

2.4 The Double Entry System

A business transaction is a business activity that will affect the value of the basic accounting equation. I.e. it will change the value of the assets and/or owner's equity and/or liabilities in the business. Every transaction will affect the accounting equation in at least two ways. So there will be a double entry in the business's books for each transaction, as one account (or more) is debited and another account (or more) is credited with an equal amount. Each transaction consists of debits and credits, and for every transaction they must be equal. For Every Transaction: The Value of Debits = the Value of Credits.

Debits, Credits and T-accounts

Back in the 15th century when Luca Pacioli first developed the double entry system he also developed two concepts: debits and credits, which would enable him to apply his double entry system...

Credit

The Latin word ***Creditum***, meaning to loan, from neuter past participle of ***Credere***, to entrust.

Debit

simple, dr. stands for 'debtor' simple, dr. stands for 'debtor'Answer. The abbreviation dr. comes from the latin form of the word debit, which is debere.

Etymology: from Middle French *debet*, from Latin *debilitum*, "thing owed"; past participle of *debere*, "to owe"; from Old French *dete*, from Latin *debitam*, "thing owed"; originally, "keep something away from someone"; from *de*-, "away" + *habere*, "to have".

To apply the rules of debit and credit the first thing we have to do is to group transactions that are similar into different accounts. For example in the books of a small building contractor:

Amounts of money going in and out of the bank will be grouped into the BANK account.

Cement mixers, wheelbarrows, shovels, saws and hammers bought will be grouped into the TOOLS & EQUIPMENT account. This is an asset account.

Cement, sand, bricks and other building and construction supplies and materials bought to use on projects will be grouped into the SUPPLIES account. This is an expense account.

Pens, paper, envelopes and files will be grouped into the STATIONERY account. This is an expense account.

Jobs completed and charged for (whether for cash or on credit will be grouped in the SALES account. This is an income account.

Each of these different accounts in any business is recorded in a separate General Ledger account with a left-land (DEBIT) side and a right-hand (CREDIT) side. For each transaction an equal amount is debited to one account (or more) and credited to another account (or more) as follows:

Accounts with Debit balances are: **Assets** (but when an asset decreases in value it is credited)

&

Expenses (expenses decrease Owners Equity)

Accounts with Credit balances are: **Liabilities** (but if a liability decreases in value it is debited)

&

Income (income increases Owners Equity)

&

Owners Equity (Capital)

2.5 GAAP Principles

In the introduction you saw that external financial reports need to follow uniform rules as applied nationally and internationally, because the users (readers) of these reports are not involved in the particular business. Shareholders and other outside parties need financial information which they can compare with that of other businesses. Financial accounting therefore has to comply with GAAP – Generally Accepted Accounting Practice.

In the Income Statement section there was an example of a GAAP requirement; overheads should be included in cost of sales.

GAAP is determined by accountants from all over the world, because they all belong to an institute. In South Africa it is the South African Institute of Chartered Accountants (SAICA). SAICA publishes statements setting out GAAP, which all accountants have to follow in financial accounting.

In this short section, we will teach you only the principles of GAAP - there are numerous statements which you need not worry about.

The four fundamental accounting concepts underlying all the GAAP statements are:

The going concern concept
The matching concept
The consistency concept
The prudence concept

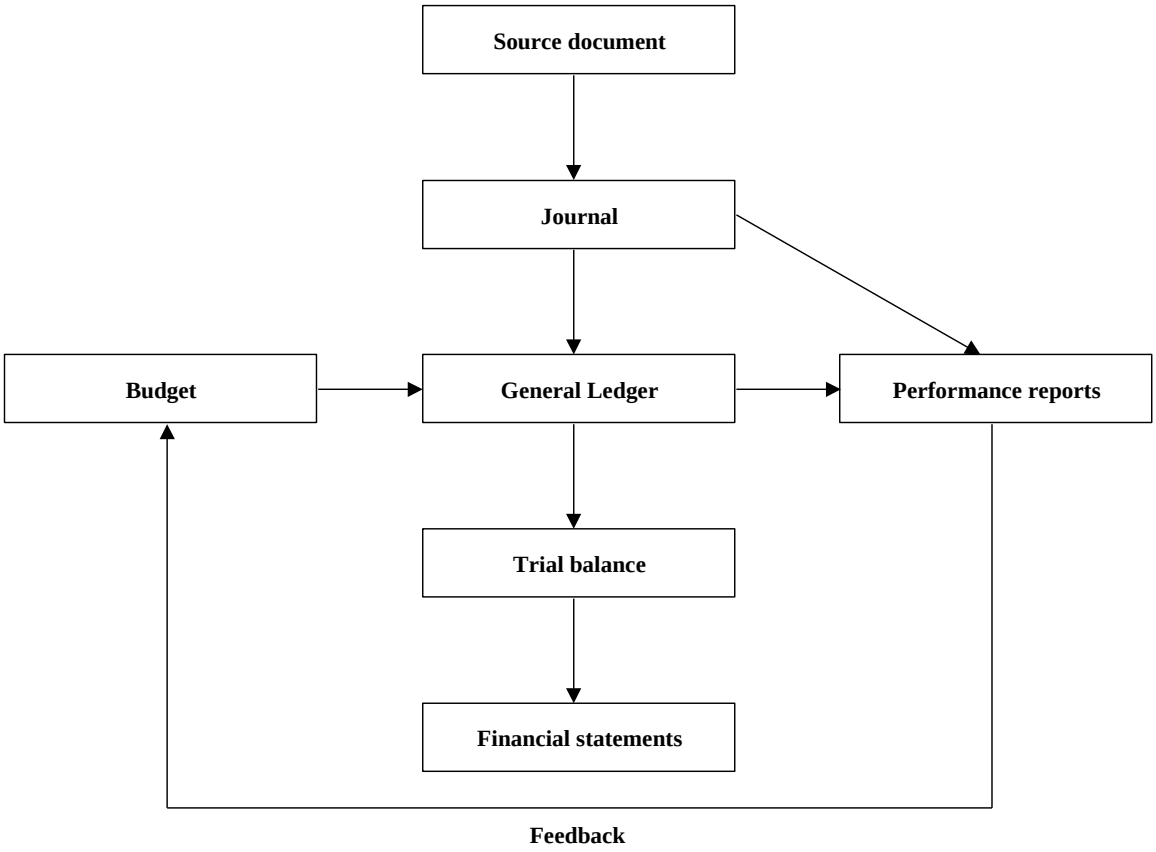
The going concern concept means that the business will continue to operate for the foreseeable future. It does not face bankruptcy.

The matching concept means that income and costs are matched to the same period of time - the same financial year. If a business sells an item on credit, the income is recognised immediately - not when the customer pays the debt.

The consistency concept means that there is consistency of accounting treatment of similar items within a financial year and from one year to the next.

The prudence concept means that income and profits are only shown in the income statement when it is reasonably sure that the relevant cash will be generated (i.e. that the debtor will pay the debt). It also means that provision is made for all known liabilities.

2.6 The Recording of a Transaction



It is important to realise that there are various types of **transactions** in a business:

Purchases (buying stock and raw materials from suppliers, called creditors)

Payments (paying the creditors')

Production (transforming raw materials or input to a product or output)

Sales (selling the product for cash and to customers or debtors)

Receipts (receiving money from the debtors)

Salaries & wages (paying the employees for their labour)

ACTIVITY 2

State whether the following accounts are assets, liabilities, expenses or income and whether it will appear in the balance sheet or income statement.

	BALANCE SHEET	INCOME STATEMENT	TYPE OF ACCOUNT
1. Salaries			
2. Rent received			
3. Depreciation			
4. Stationery			
5. Bank overdraft			
6. Sales			
7. Water and lights			
8. Plant and machinery			
9. Stock (closing)			
10. Customs Duty			
11. Debtors			
12. Advertising			

13. Furniture			
14. Telephone			
15. Marine Insurance			
16. Creditors			
17. Dividend payable			
18. Rent			
19. Interest received			
20. Bad debts			
21. Duty and landing			
22. Discount allowed			
23. Import duty			
24. Railage inwards			

ACTIVITY 3

when you pay rent with cash: you increase rent (expense) by debiting, and decrease cash (asset) by credit.

when you receive cash for a sale: you increase cash (asset) by debiting, and increase sales (revenue) by credit.

when you buy equipment (asset) with cash: You increase equipment (asset) by debiting, and decrease cash (asset) by credit.

when you borrow with a cash loan: You increase cash (asset) by debiting, and increase loan (liability) by credit.

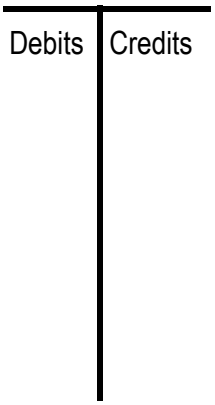
When you Pay salary with cash: you increase salary (expenses) by debiting, and decrease cash (asset) by credit.

	Account	Debit	Credit
1.	Rent	100	
	Cash		100
2.	Cash	50	
	Sale		50
3.	Equip.	5200	
	Cash		5200
4.	Cash	11000	
	Loan		11000
5.	Salary	5000	
	Cash		5000

T' Accounts

The process of using debits and credits creates a ledger format that resembles the letter 'T'. The term 'T' account is commonly used when discussing bookkeeping.

A 'T' account showing debits on the left and credits on the right.



TYPE	DEBIT	CREDIT
Asset	+	−
Liability	−	+
Income	−	+
Expense	+	−
Capital	−	+

Therefore, if an Asset account is debited, the Asset amount (value) is increased. Same with an Expense account. If a Liability or an Income account is debited, the numerical figure will decrease, etc. If a particular account is credited, there must be a corresponding Debit in another account in order to balance the transaction.

As used in banking terminology, 'Debits" refer to withdrawals, not necessarily in the same context as discussed here.

ACTIVITY 4

The concept of double entry bookkeeping

Any transaction which is incurred in a business can be broken into one of four categories:

Assets
Liabilities
Expenditure
Income

This leads to a further expansion of the accounting equation:

CURRENT ASSETS + FIXED ASSETS = LIABILITIES + OWNERS EQUITY

For each and every transaction there is a need for two accounting entries, this is known as the **"double entry bookkeeping system"** – one of which is positive and the other is negative.

This can best be illustrated by means of an example:
Usaf Halabi has recently started a new business.
The following transactions have occurred:
An advance from a banking institution, Dhs1,000.
Usaf Halabi invested his own capital amounting to DHS6,000.
Purchased office furniture for Dhs500.
Purchased office equipment, Dhs700.
Paid rent for offices located in Abu Dhabi, Dhs400.
Cash paid for advertising, Dhs200.
Paid cash for purchases of stock amounting to Dhs7,000.
Cash received from sales of goods Dhs12,000.
Cash paid for salaries Dhs800.
Cash paid for telephone Dhs100.

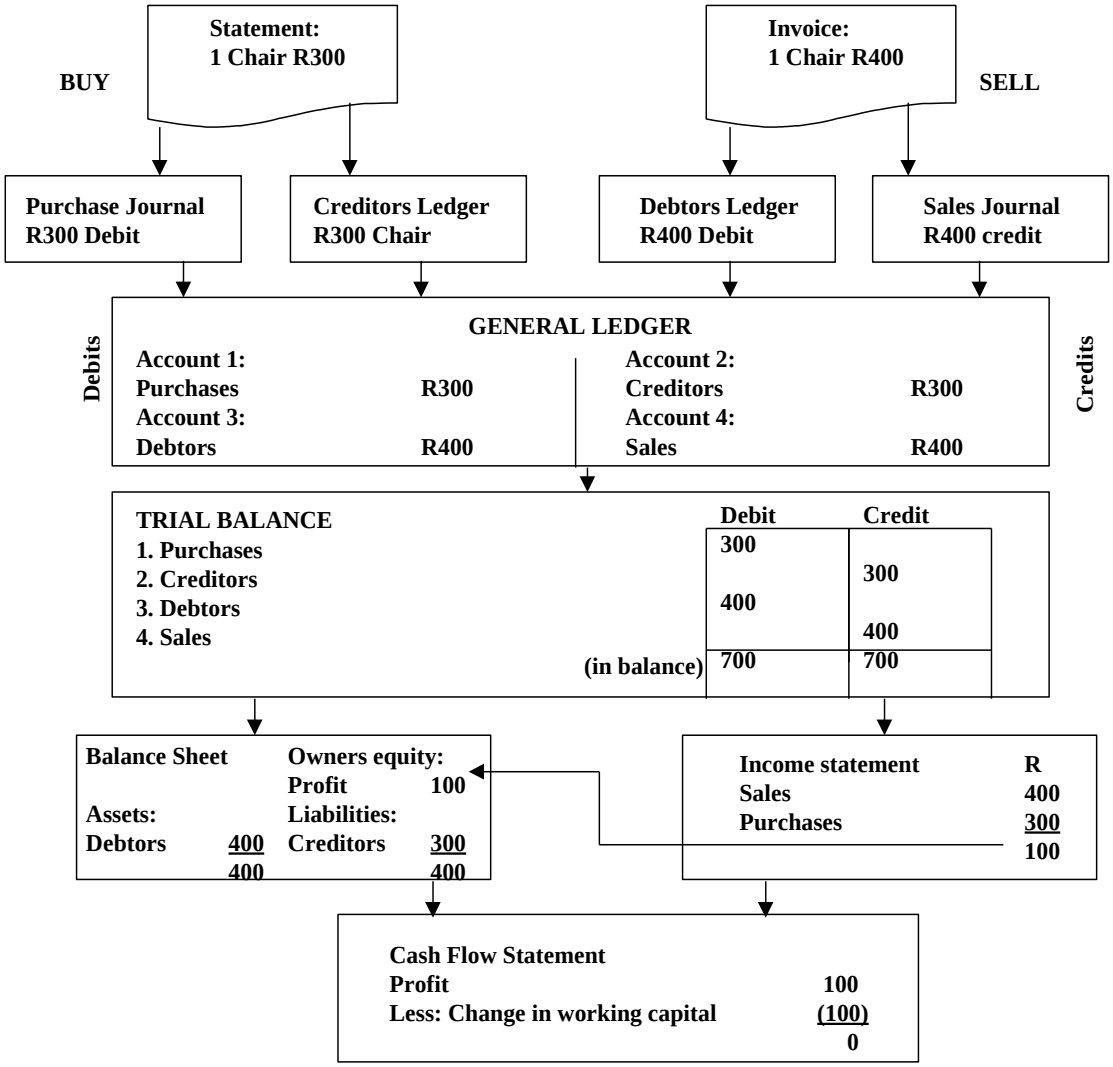
All transactions are in cash.

ASSETS [Uses which have value @ End of period]		**LIABILITIES** [sources that are repayable]	
③ Office Furniture	500	① Loan capital	1,000
④ Office equipment	700	② Capital	6,000
Balancing amount – cash	9,300		
	10,500		**7,000**
EXPENDITURE [uses which do not have value at end of the period]		**INCOME** [sources which are not payable]	
⑤ Rent	400	⑧ Sales	12,000
⑥ Advertising	200		
⑦ Purchases	7,000		
⑧ Salaries	800		
⑨ Telephone	100		
	8,500		**12,000**
TOTAL ASSETS + EXP :	19,000	TOTAL LIAB. + INC.:	19,000

		ASSETS			LIAB.		EXPENDITURE					INC.
#	Desc.	Cash	Off. Fur.	Off. Equ.	Loan	Cap.	Rent	Adv.	Purch.	Sal.	Tel.	Sales
1	Loan	1,000			-1,000							
2	Capital	6,000				-6,000						
3	Off.Fur	-500	500									
4	Off. Eq	-700		700								
5	Rent	-400					400					
6	Adv.	-200						200				
7	Purch.	-7,000							7,000			
8	Sales	12,000										-12,000
9	Salaries	-800								800		
10	Tel.	-100									100	
TOTAL		9,300	500	700	-1000	-6000	400	200	7,000	800	100	-12,000

2.7 Summary

Look at the flow of financial information presented in the following diagram:



Study the diagram and relate everything you have learned in this section to the diagram.

2.8 ACCOUNTING APPLICABLE TO PROJECT MANAGEMENT

It is important to determine whether a proposed project will be able to service the debt and whether it will provide a satisfactory return to the providers of the capital. Therefore much of this module relates to the following specific accounting aspects:

- Capital investments
- Cost of the project
- Financing of the project
- Financial estimates and projections
- Break-even point
- Cash flow of the project
- Time value of money
- Investment criteria

2.9. SELF ASSESSMENT ACTIVITIES AND SOLUTIONS

4.1 Define the following terms:

4.1.1 Assets

4.1.2 Current assets

4.1.3 Non-current assets

4.1.4 Liabilities

4.1.5 Non-current liabilities

4.1.6 Current liabilities

4.1.7 Equity

4.1.8 Income

4.1.9 Expenses

4.1.10 Profit

A. Classify the following costs as direct or indirect. Place a tick in the appropriate column.

No.	Cost	Direct cost	Indirect cost
4.2.1	Fabric used in the manufacture of shirts		
4.2.2	Grease for the factory machines		
4.2.3	Depreciation of factory machinery		
4.2.4	Cleaning materials		
4.2.5	Salary of the supervisor		
4.2.6	Wood used in making tables		
4.2.7	Wages of the person who operates the machine that makes the shoes		
4.2.8	Rent of the factory		

B. Classify the following costs as fixed or variable in terms of the level of output. Place a tick in the appropriate column.

No.	Cost	Fixed cost	Variable cost
4.3.1	Rent expense		
4.3.2	Direct materials		
4.3.3	Property rates and taxes		
4.3.4	Commission of salesperson		
4.3.5	Depreciation using straight-line method		
4.3.6	Direct labour		
4.3.7	Insurance		
4.3.8	Salary of factory manager		

C. Classify the following costs as manufacturing, marketing or administrative costs. Place a tick in the appropriate column.

No.	Cost	Manufacturing	Marketing	Administrative
4.4.1	Advertising			
4.4.2	Salary of the typist			
4.4.3	Repairs to the factory machine			
4.4.4	Depreciation on office furniture			
4.4.5	Bad debts			
4.4.6	Audit fees			
4.4.7	Carriage costs on materials purchased			
4.4.8	Rent of the office building			

SOLUTIONS

A

No.	Cost	Direct cost	Indirect cost
4.2.1	Fabric used in the manufacture of shirts	✓	
4.2.2	Grease for the factory machines		✓
4.2.3	Depreciation of factory machinery		✓
4.2.4	Cleaning materials		✓
4.2.5	Salary of the supervisor		✓
4.2.6	Wood used in making tables	✓	
4.2.7	Wages of the person who operates the machine that makes the shoes	✓	
4.2.8	Rent of the factory		✓

B

No.	Cost	Fixed cost	Variable cost
4.3.1	Rent expense	✓	
4.3.2	Direct materials		✓
4.3.3	Property rates and taxes	✓	
4.3.4	Commission of salesperson		✓
4.3.5	Depreciation using straight-line method	✓	
4.3.6	Direct labour		✓
4.3.7	Insurance	✓	
4.3.8	Salary of factory manager	✓	

C

No.	Cost	Manufacturing	Marketing	Administrative
4.4.1	Advertising		✓	
4.4.2	Salary of the typist			✓
4.4.3	Repairs to the factory machine	✓		
4.4.4	Depreciation on office furniture			✓
4.4.5	Bad debts		✓	
4.4.6	Audit fees			✓
4.4.7	Carriage costs on materials purchased	✓		
4.4.8	Rent of the office building			✓

D

1.	The financial statement that reports the revenues and expenses for a period of time such as a year or a month is the

balance sheet income statement statement of cash flows

income statement

2.	The financial statement that reports the assets, liabilities, and stockholders' (owner's) equity at a specific date is the

balance sheet income statement statement of cash flows

balance sheet

3.	Under the accrual basis of accounting, revenues are reported in the accounting period when the

cash is received service or goods have been delivered

service or goods have been delivered

4.	Under the accrual basis of accounting, expenses are reported in the accounting period when the

cash is paid expense matches the revenues or is used up

expense matches the revenues or is used up

5.	Revenues minus expenses equals _____ _____.

Net Income

6.	Resources owned by a company (such as cash, accounts receivable, vehicles) are reported on the balance sheet and are referred to as _____. Assets
7.	Assets are usually reported on the balance sheet at which amount?
cost current market value expected selling price	

cost

8.	Obligations (amounts owed) are reported on the balance sheet and are referred to as _____.

Liabilities

9.	Liabilities often have the word _____ in their account title.

Payable or Creditors

10.	Unearned Revenues is what type of account?
Asset Liability Stockholders' (Owner's) Equity	

11.	Accounting entries involve a minimum of how many accounts?
one two three	

two

12 A.	Which term is associated with "left" or "left-side"?	Debit	Credit
12 B	Which term is associated with "right" or "right-side"?	Debit	Credit
12 C	When cash is received, the account Cash will be	Debited	Credited
12 D	When a company pays a bill, the account Cash will be	Debited	Credited
12 E	What will usually cause an asset account to increase?	Debit	Credit
12 F	What will usually cause the liability account Accounts Payable to increase?	Debit	Credit
12 G	Entries to expenses such as Rent Expense are usually	Debits	Credits
12 H	Entries to revenues accounts such as Service Revenues are usually	Debits	Credits

Debit

Credit

Debited

Credited

Debit

Credit

Debits

Credits

13.	The basic accounting equation is Assets = Liabilities + _____ _____.

Owners Equity

For each of the transactions in items 2 through 13, indicate the two (or more) effects on the accounting equation of the business or company.

14.	The owner invests personal cash in the business.			
	Assets:	Increase	Decrease	No Effect
	Liabilities:	Increase	Decrease	No Effect
	Owner's (or Stockholders') Equity:	Increase	Decrease	No Effect

Increase

No Effect

Increase

15.	The company repays the bank that had lent money to the company.			
	Assets:	Increase	Decrease	No Effect
	Liabilities:	Increase	Decrease	No Effect
	Owner's (or Stockholders') Equity:	Increase	Decrease	No Effect

Decrease

Decrease

No Effect

16.	The company purchases equipment with its cash.			
	Assets:	Increase	Decrease	No Effect
	Liabilities:	Increase	Decrease	No Effect
	Owner's (or Stockholders') Equity:	Increase	Decrease	No Effect

Increase

No effect

No Effect

17.	Which of the following is not a **current** asset?		
Inventory	Prepaid Insurance	Fixtures	

Fixtures

18.	Current asset MINUS current liabilities is the		
current ratio	net worth	working capital	

working capital

19.	Current assets DIVIDED BY current liabilities is the		
current ratio	the net worth ratio	working capital	

current ratio

TOPIC 2

CAPITAL INVESTMENTS

LEARNING OUTCOMES
Students should be able to:
■ define capital investments.
■ describe the various types of capital investments.
■ explain the importance of capital investments to an enterprise.

CONTENTS

READING
Recommended reading ► **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited.** **pp. 3-5; 19-23**

1. INTRODUCTION

Capital budgeting is a complex process that involves careful analysis and calculation especially for large projects. There are some basic principles you need to take into consideration when performing capital budgeting.

Chandra (2002:19) points out that what you see in an organisation today is largely the result of capital allocation decisions made in the past. An organisation's strategic decisions, tangible or intangible, can be traced to investment options exercised in the past. Capital allocation decisions are therefore the responsibility of top management.

A capital allocation framework defined by top management guides the identification, evaluation, and selection of individual investment proposals. The capital allocation framework specifies the kinds of businesses the enterprise wants to be in, the strategy of the enterprise, the types of investments that are appropriate for the enterprise, the approach of the enterprise towards conglomerate diversification and so on.

One of the key things in evaluating the project is to estimate the future cash flow of the projects, however, Several types of project interactions make the future cash flow analysis challenging.

The following are some of these interactions:

CASH FLOW

Cash Flow is a phrase meaning the actual movement of cash in and out of an enterprise. Cash flow in (or positive cash flow) is cash received and cash flow out (negative cash flow) is cash paid out. The difference between these two flows is the *net cash flow.*

Effect of Tax, Inflation and Escalation on Cash Flow

All cash flows need to be adjusted for taxation. Only after tax cash flows should be used in determining NPV, IRR and Payback Period.

VAT should only be introduced into the cash flow analysis where it has a significant impact

from a timing perspective or where the company is not entitled to an input credit (e.g. the purchase of a passenger car). In most cases you can ignore the impact of VAT.

Income and expenditure streams should be adjusted so as to exclude the effect of inflation. It is important to note that the discount rate stipulated (currently 12%) is not inflated, and it is imperative that the discount rate is based on the same money terms as the cash flows (i.e. if the cash flows have to be inflated then the current inflated discount rate should be applied.

FINANCIAL RISK

In financial management terms, **Risk** can basically be defined as the chance of financial loss. Assets having greater chances of loss are viewed as having higher risks than those with lesser chances of loss. More formally, the term *risk* is used interchangeably with *uncertainty* to refer to the *variability of returns* associated with a given asset.

Because of differing managerial or organisational preferences, it is important to specify a generally acceptable level of risk and for this purpose there are generally three basic risk preference behaviours: *risk averse, risk indifferent* and *risk seeking.*

When we talk about risk, we normally think in terms of downside. However, risk is generally defined in financial economics as the volatility of the expected return on an asset; i.e., more outcomes can happen than will happen and the return may be higher or lower than we expect. The larger the possible deviations of the actual (realised) return on an asset from the expected return, the riskier the asset. Investors do not like to be exposed to risk unless they can expect to receive compensation for their exposure. Different types of risk are handled in different ways in calculating a **NPV.**

Specific Risks are all those risks associated with the investment, which are not directly correlated with capital market risk. Investors can eliminate this portion of risk by diversifying their investment portfolios and therefore do not require any additional minimum return. The assumption is that stock markets are efficient and that share prices reflect expected cash flows discounted at a rate, which reflects the systematic risk of the share. Therefore, when considering investments the discount rate should not be adjusted for specific risks.

Mining is generally considered to be 'risky'. As all assets do not move together, combining assets in a portfolio, investors are not exposed to the entire risk of a company or industry. Mining has relatively high specific risk (not compensated for in the discount rate) and low systematic risk. This illustrates why it is often not possible to explain why an industry has a high or low market risk and hence cost of capital and why therefore intuition is often dangerous.

Sensitivity Analysis is a behavioural approach that uses a number of possible return estimates to obtain a sense of the variability among a range of possible outcomes. One common method involves the estimation of the *pessimistic* (worst), the *most likely* (expected) and the *optimistic* (best) returns associated with a given asset. In this case, the asset's risk is measured by the *range,* which is found by subtracting the pessimistic (worst) outcome from the optimistic (best) outcome. The greater the range for a given asset, the more variability, or risk, it is said to have.

Probability can be used to more accurately assess an asset's risk. The probability of a given outcome is its chance of occurring. If an outcome has an 80% probability of occurrence, the given outcome would be expected to occur 8 times out of 10 times. If an outcome has a probability of 100%, it is certain to occur. Outcomes of zero probability will never occur.

On Independent versus mutually exclusive projects: Independent projects are projects whose cash flows are independent of each other. Mutually exclusive projects compete directly with each other. For example, if Projects A and B are mutually exclusive, you can choose A or B, but you cannot choose both.
Sometimes there are several mutually exclusive projects, and you can choose only one from the group.

Project sequencing: Many projects are sequenced through time, so that investing in a project creates the option to invest in future projects. For example, you might invest in a project today and then in one year invest in a second project if the financial results of the first project or new economic conditions are favourable. If the results of the first project or new economic conditions are not favourable, you do not invest in the second project.

Unlimited funds versus capital rationing: An unlimited funds environment assumes that the company can raise the funds it wants for all profitable projects simply by paying the required rate of return. Capital rationing exists when the company has a fixed amount of funds to invest If the company has more profitable projects than it has funds for, it must allocate the funds to achieve the maximum shareholder value subject to the funding constraints.

2. DEFINITION OF CAPITAL INVESTMENT

Chandra (2002:3) defines a **capital investment (also called capital project or just project or capital expenditure)** as the current outlay (or current and future outlay) of funds in anticipation of a stream of benefits that extend well into the future. This definition is not necessarily the same as how it is defined in accounting. In accounting, a capital expenditure/investment is an expenditure that is shown as a non-current asset in the Statement of Financial Position. This asset (except for a non-depreciable asset like land) is depreciated over its life. Expenditure on research and development, advertising campaigns, and reconditioning of plant and machinery are usually treated as revenue expenditure for accounting purposes but they qualify as capital expenditure/investments because they are expected to generate a stream of benefits in the future.

3. TYPES OF CAPITAL INVESTMENTS

Chandra (2002:5) states that capital investments may be classified in various ways.

3.1 Tangible, intangible or financial

Capital investments may also be classified as tangible assets, intangible assets and financial assets. **Tangible assets** are assets that one can see and touch e.g. land, buildings, machinery, equipment. **Intangible assets are assets** that one cannot see or touch i.e. they have no physical substance e.g. research and development, market development, training. **Financial assets** are investments made outside the enterprise e.g. purchase of shares in another company, bonds, and deposits.

3.2 Strategic and tactical

A **strategic investment** is one that has a great impact on the direction and future of an enterprise. For example the decision of Toyota to enter into the non-passenger car market is

considered to be a strategic investment. A **tactical investment** is one that aims to implement a current strategy as profitably or efficiently as possible. For example, the decision by Toyota to replace out-dated machinery to improve productivity is regarded as a tactical investment.

3.3 Classification for planning and control

- **Mandatory investment**: refers to capital expenditure that is necessary to comply with legal requirements e.g. pollution control equipment and medical dispensary.
- **Replacement investment**: stems from need to replace obsolete equipment to reduce operating costs, improve efficiency and enhance profitability.
- **Expansion investment**: is aimed at increasing capacity to cope with increasing demand.
- **Diversification investment**: aims at developing new products or services or entering new geographical areas.
- **R&D (Research and Development) investments**: are meant to improve the technological edge of the enterprise by developing new products and processes.
- **Miscellaneous investments**: represent a catch-all category and includes items like recreational facilities and interior decoration.

3.4 Classification according to corporate resource allocation

Chandra (2002:21) states that the building blocks of the corporate allocation strategy are the following elementary investment options:

- **Replacement and modernisation**: This investment is aimed at maintaining the production capacity of the firm, improve quality and decrease costs. The competitive advantage of the enterprise can be seriously jeopardised without such investments. In fact, the neglect of such investments can jeopardise the very existence of the enterprise.
- **Capacity expansion**: becomes necessary when an enterprise expects growth in the market size of its product range or an increase in the market share.
- **Vertical integration**: may be either backward or forward. Backward integration involves the manufacture of raw materials and components that are necessary for the existing operations of the enterprise. Forward integration relates to the manufacture of products that use the existing products of the enterprise as the input.
- **Concentric diversification**: results when an enterprise widens the product range by adding related products.
- **Conglomerate diversification**: involves investing in fields that are not related to the existing

line of the enterprise.

- **Divestment**: is the termination or liquidation of the plant or a division of an enterprise.

Think point 1!

Why do you think that some enterprises consider:

* conglomerate diversification

* divestment

4. IMPORTANCE OF CAPITAL INVESTMENTS

Capital investment decisions are often the most important decisions taken by an enterprise. Chandra (2202:4) states that their importance stems from the following inter-related reasons:

- **Long-term effects**: Once a capital expenditure decision is taken, the effects of it extend far into the future. The present manufacturing activities of an enterprise is determined largely by the capital expenditures of the past. Similarly, capital expenditure decisions made now provide the framework for future activities.
- **Irreversibility**: In many cases, capital equipment is custom made according to the buyer's specifications. Once the equipment is acquired, overturning the decision may mean scrapping the equipment.
- **Substantial outlays**: Capital expenditure usually involves outlaying thousands if not millions of rands. As technology advances, capital costs tend to increase.

5. UNDERSTANDING TIME VALUE OF MONEY

In order to deal with issues of valuation, we need to understand that R5 million 10 years from now, is not worth R5 million today. The reason for this has to do with the concept of time value of money. What do we mean by "time value of money"?

R1 today is worth more than R1 in 1 year's time.
Or we can say that if we can get R10 in 2 years from today, in today's value it will be worth less than R10.
This is due to, amongst other things, inflation. Also, as time progresses, the certainty of actually receiving the money diminishes, increasing the risk.
In order to provide for time value of money, we either discount (bringing the future value to the present value), or we compound (taking the present value to the future value).

Example of discounting:

We can get R20 in 1 year's time. What is the value today? The rate of return (interest rate) is 10 %.

Future value = R20

Discount rate = 10 %

Period = 1 year

$\therefore$ Present value = 20/(1 + 0.1) = R18.18

- We can get R20 in 2 years' time. What is the value today?

Future value (FV) = R20

Discount rate (r) = 10 %

Period (n) = 2 years

$\therefore$ Present value (PV) = $(20/(1 + 0.1)^2$ = R16.53

We therefore see that the further away into the future we get the cash flow, the less its worth today.

A general formula for discounting is therefore as follows:

When we take the present into the future, we compound. An example of compounding is as follows:

- We have R20 today. What will the value be in 1 year's time?

Present value (PV) = R20

Discount rate (r) = 10 %

Period (n) = 1

Future value (FV) = $20 \times (1 + 0.1)^1 = R22$

- We have R20 today. What will the value be in 2 years' time?

PV = R20

r = 10 %

n = 2

FV = $20 \times (1 + 0.1)^2 = R24.40$

We therefore see that the further away into the future we take the cash flow, the higher it becomes.

R20 today = R24.20 in year 2.

or

R20 in year 2 = R16,53 today.

A general formulae for compounding: $FV = PV \times (1 + r)^n$

An important thing to remember is that the discount rate also provides for the riskiness of the cash flows. Therefore, if we do not discount future cash flows to get a present value that we can compose sensibly, we are ignoring the risk involved with future cash flows.

- Your Hewlett Packard 10B has a function to determine the PV and FV.

- PV = R20

n = 3 years

r = 12 %

What is the FV?

We have to compound. Press the following on your calculator.

-20 PV

3 N

12 I/YR

Ask for FV = R28.10

- FV = R30

n = 5 years

r = 15 %

What is the present value (PV)

We have to discount. Press the following on your calculator:

-30 FV

5 N

15 I/YR

Ask for PV = R14.92

The financial manager has as his primary task the answering of the following 3 questions:

- What long-term investments should the company take on? That is, what lines of business will they be in and what sorts of buildings, machinery and equipment will they need?

- Where will the company get the long-term financing to pay for the investment? Will they retain the profits which they make, will they bring in other owners or will they borrow the money?

- How will they manage their everyday financial activities such as collecting from customers and paying suppliers?

These are not the only questions, but they are among the most important.

For the purpose of this section, we are primarily interested in the first question. The process of planning and managing a firm's long-term investment is called capital budgeting. In capital budgeting, the financial manager tries to identify investment opportunities that are worth more to the firm than they cost to acquire.

Loosely speaking, this means that the value of the cash flow generated by an asset exceeds the cost of that asset.

The types of investment opportunities that would typically be considered depend in part on the nature of the organisations business.

- For Pick 'n Pay, deciding whether or not to open another store would be an important capital budgeting decision.

- For Microsoft, the decision to develop and market a new spreadsheet package would be a major capital budgeting decision.

- For the SA Navy, to acquire new corvettes would also be a major capital budgeting decision.

Regardless of the specific nature of an opportunity under consideration, financial managers must be concerned with not only how much cash they expect to receive, but also when they expect to receive it and how likely they are to receive it. Evaluating the size, timing, and risk of future cash flows is the essence of capital budgeting.

We are therefore primarily concerned with capital expenditure, which has the following characteristics:

- It will probably involve substantial expenditure.
- The benefits may be spread over very many years.
- It will be difficult to predict what the benefits will be.
- It will help the company to achieve its organisational objectives.
- It will have some impact on the company's employees.

6. SELECTION OF PROJECTS

There is little point in investing in a project unless it is likely to make a profit. The exceptions are those projects that are necessary on health, defence, social, and welfare grounds, and these are particularly difficult to assess. In other cases, there are 5 main techniques that are used in the appraisal of capital investments.

- Payback method.
- Discounted payback method.
- Accounting rate of return.
- Internal rate of return.
- Net present value.

We will be looking at an example of each of the first 4 techniques, where after we will be studying the net present value (NPV) approach in detail.

6.1. PAYBACK METHOD

The payback period is the length of time it takes to recover the initial investment. An investment is acceptable if its calculated payback period is less than some pre-specified number of years (determined by top management).

The recovery of an investment in a project is usually measured in terms of net cash flow, which is the difference between cash received and cash paid during a defined period of time. In order to adopt this method, the following information is required:

- Total cost of the investment.
- The amount of cash instalments payable back on the investment.
- The accounting periods in which the instalments will be paid.
- The cash receipts and any other cash payments connected with the project.

Example:

- Initial investment : R50 000
- Net cash flow year 1 : R30 000
- Net cash flow year 2 : R20 000
- Net cash flow year 3 : R10 000
- Net cash flow year 4 : R 5 000

It is useful to draw a time line:

0	1	2	3	4
-50 000	30 000	20 000	10 000	5 000

In order to determine when the project pays back, we determine the cumulative net cash flow:

Year 1 : 30 000

2 : 50 000

3 : 60 000

4 : 65 000

As the cost is R50 000, we see that after year 2, the cumulative net cash inflow is also R50 000. The project therefore has a payback period of 2 years.

When the numbers do not work out exactly, it is customary to work with fractional years. For example:

- Initial investment : R60 000
- Net cash flow year 1 : R20 000
- Net cash flow year 2 : R90 000

The cash flows over the first 2 years are R110 000, so the project obviously pays back sometime in the second year.

- After year 1, the project has paid back R20 000, leaving R40 000 to be recovered.
- To figure out the fractional year, note that this R40 000, is R40 000/R90 000 = 4/9 of the second year's cash flow.
- Assuming that the R90 000 cash flow is paid uniformly throughout the year, the payback would thus be 1 4/9 years.

The following table illustrates cash flows for 5 different projects:

Expected cash flows for projects A through E

Year	A	B	C	D	E
0	-R100	-R200	-R200	-R200	-R50
1	30	40	40	100	100
2	40	20	20	100	-50 000 000
3	50	10	10	-200	
4		60	130	200	

- The payback for A is easily calculated. The sum of the cash flows for the first 2 years is R70, leaving R30 to be recovered. In year 3, cash flow is R50. Therefore, to recover the R30 will take 30/50 = 0.6 years. Add this to the 2 years we already have, and we see it takes 2.6 years for the project to pay back. If this is shorter than the criterion determined by the firm, accept the project, otherwise reject it.

- The payback for B is also easy to calculate – it never pays back.

- C has a payback of exactly 4 years.

- D is a little strange. Because of the negative cash flow in year 3, we can easily verify that it has 2 different payback periods, 2 years and 4 years. Which is correct? Both.

- E is obviously unrealistic, but it does pay back in 6 moths thereby illustrating the point that a rapid payback does not guarantee a good investment.

What are the advantages and disadvantages of the Payback Period Criterion?

- **Advantages**

Easy to understand

Adjusts for uncertainty of later cash flows

Biased toward liquidity

- **Disadvantages**

- It ignores the time value of money (concept will be explained shortly).
- Requires an arbitrary cut-off point.
- Ignores cash flows beyond the cut-off date.
- Biased against long-term projects, such as research and development and new projects.

6.2. DISCOUNTED PAYBACK METHOD

We saw that one of the shortcomings of the payback period criterion was that it ignored time value. The discounted payback period is the length of time until the sum of the discounted cash flows is equal to the initial investment.

The discounted payback period rule states that an investment is acceptable if its discounted payback period is less than some pre-specified number of years. We discount at some or other percentage return, normally referred to as the required return (or cost of capital).

The actual determination of the required return is quite a complex process and falls outside the scope of this course. We can see it as the return that we want in order for the investment to be the worthwhile. If we were to borrow the money, the required return must at the very least be equal to the interest we pay.

Let's look at the following example:

The investment costs R300 and has cash flows as follows:

	CASH FLOW		ACCUMULATED CASH FLOW	
Year	Undiscounted	Discounted	Undiscounted	Discounted
1	100	89	100	89
2	100	79	200	168
3	100	70	300	238
4	100	62	400	300
5	100	55	500	355

Before we determine the payback period, let's recap how we determine the discounted cash flow for year 4.

- R100 in year 4, is worth how much today?

FV = -100

N = 4

I/Yr = 12, 5 % (for example this case)

Ask for PV = R62.43

PV = $100 / (1 + 0.125)^4$

= R62.43

When we go back to the table, we see the following:

If we use the undiscounted cash flows, it takes 3 years for the investment to pay back.
If we use the discounted cash flows, it takes 4 years for the investment to pay back.

Obviously the latter approach is more correct, as it is a fact of life the R100 in year 4 is not worth R100 today.

What are the advantages and disadvantages of the Discounted Payback Period Criterion?

- **Advantages**

Includes time value of money
Easy to understand
Biased toward liquidity

- **Disadvantages**

- Requires an arbitrary cut-off point.
- Ignores cash flows beyond the cut-off date.
- Biased against long-term projects, such as research and development, and new projects.

6.3. AVERAGE ACCOUNTING RETURN

This criterion is also referred to as the accounting rate of return. It is, however, a flawed approach for the following reasons:

- The AAR (ARR) is not a rate of return in any meaningful economic sense. Instead, it is the ratio of 2 accounting numbers, and it is not comparable to the returns offered, for example, in financial markets.

- It ignores the time value of money and no discounting is involved in the computation of average net profits, for example.

- Since a calculated AAR is really not comparable to a market return, the target AAR must somehow be specified. There is no generally agreed upon way to do this.

- Finally, and perhaps the worst flow in the AAR, is that it doesn't even look at the right things. Instead of cash flow and market value, it uses net profit and book value. These are both poor substitutes. As a result, an AAR doesn't tell us what the effect on share price will be from taking an investment, so it doesn't tell us what we really want to know.

The AAR is defined as: Some measure of average accounting profit divided by some measure of average accounting value

Consider a project expected to earn the following accounting profits over its four-year life:

Year				
1	2	3	4	Total
R20 000	R28 000	R30 000	R18 000	R96 000

The average net profit after tax is:

R96 000/4 = R24 000

The cost of the project is R200 000. It will be depreciated over 4 years to zero book value and is expected to have no salvage value. Therefore, the average book value during the life of the investment is:

(Beginning cost (or book value) + End book value)/2

= (200 000 + 0)/2 = R100 000.

The AAR is therefore: Average net profit after tax/average book value

= 24 000 / 100 000

= 24 %

If the firm has a target AAR of less than 24 %, than this investment is acceptable; otherwise not.

6.4. NET PRESENT VALUE

One of the main disadvantages of both the payback method and the AAR is that they both ignore the time value of money. The NPV method recognizes that cash received today is preferable to cash receivable sometime in the future. The principle underlying the NPV method is that you compare the present value of the cash outflows with the present value of the cash inflows (with other words, you have discounted both the inflows and outflows). If the PV of the inflows is more than the PV of the outflows, the NPV is positive.

An investment is worth undertaking if it creates value for its owners. A positive NPV project will create value or add value. A negative NPV project uses up value. The NPV rule therefore states:

- Accept all positive NPV projects.
- Reject all negative NPV projects.
- NPV = PV inflow – PV outflow.

In working with NPV, we work with incremental after-tax cash flows. We will first have a look at the principle behind tax.

TAX

The following rules in respect of tax can be laid down:

Current expenses, such as operating costs, repairs to fixed assets (but not improvements), depreciation on fixed assets, loss with sale of fixed assets, etc., are all deductible from taxable income.
We therefore deduct the above items from our income before we determine the tax we owe the Receiver of Revenue.
The cost price of new assets as such may not be deducted from taxable income. However, we depreciate the asset and the depreciation is deductible from taxable income. In the RSA, we primarily use the straight-line method of depreciation.

E.g. an asset costs R10 000 and we can depreciate it over 5 years to a zero book value. The annual depreciation that we therefore can deduct from taxable income is:

R10 000 / 5 = R2 000 per year.

We talk of a tax shield. When we deduct depreciation from taxable income, we pay less tax. The amount depends on the tax rate. If the tax rate is 35 %, as was the case in the RSA, the amount we pay less is

R2 000 x 0.35 = R700

This is the tax shield that the depreciation gives us.

The sales price of old assets is not taxed as such. Instead, we must determine whether there was a profit or loss with the sale of the fixed asset:

Profit = Sales price – book value (per Receiver)

Book value = Cost price – accumulated depreciation.

Profit with the sale of an asset is taxable, but the taxable amount is restricted to the amount of depreciation previously written off.

Take cases A and B.

	A	B	
Cost price	100	100	
Depreciation			
Year 1	(20)	(20)	
Year 2	(20)	(20)	
Year 3	(20)	(20)	
Book value (100 – 60)	40	40	
Sales price	70	120	
Profit	30	80	
Taxable income	30	80	(60 and 20)

Capital gains are taxable in the RSA. It is the difference between the sales price of the fixed asset and the original cost price, and results when the sales price is higher than the original cost price.

Assume the profit is R30. The sales price is R70. Tax is paid on the R30. If the tax rate is 35 %, the tax payable is R30 x 0.35 = R10.50. Therefore the after tax income is R70 – R10.50 = R59.50.

Assume there was a loss of R20. The book value is R40 and the sales price is R20. We can get a tax shield from the loss of R20, namely 35 % of R20 = R7. Therefore the cash flow associated with the sale is not the R20 received, but R20 + R7 = R27. The R7 is the tax shield the loss provides.

Obviously, the tax shield on depreciation and other expenses work on the same principle.
Unless stated otherwise, the book value of an asset is 0 at the end of the life time of an asset when you use the straight-line method of depreciation. Therefore, any income from the sale of an asset at the end of its lifetime is taxable because the sales price = profit.

EXAMPLES

We will now proceed with numerous examples of this very important investment criterion. Basically, it involves taking the following steps:

Calculate the annual net cash flows expected to arise from the project.
Select an appropriate rate of interest, or required rate of return.
Discount the annual net cash flows to the present value.
Add together the present values for each of the net cash flows.
Compare the total net present value with the initial outlay.

Example 1

We want to buy a new machine costing R100 000. Depreciation is straight-line over 5 years to a zero book value. It is estimated that cash flow (after taking into consideration tax and depreciation) will increase with R27 500 per year over 5 years. The cost of capital is 18 % and the tax rate is 40 %.

a. What is the NPV of the new machine?

b. What is the NPV if the machine has a market value of R30 000 after 5 years?

c. What is the NPV if the machine has a market value of R75 000 after 5 years?

Answer

Year	0	1	2	3	4	5
Cost price	(100 000)					
Cash flow		27 500	27 500	27 500	27 500	27 500

In (a)

Market value 0

In (b)

Sales price	30 000
Tax	(12 000)
Cash flow	18 000

In (c)

Sales price	75 000
Tax	(30 000)
Cash flow	45 000

The cash flow identified in a, b and c for year 5 must be added to the R27 500 already calculated.

We will now proceed to use the HP 10B to determine the NPV.

-100 000 CFj (First clear the calculator – 1 P/YR)

27 500 CFj

5 ■ Nj

18 I/YR

C

■ NPV = -R14 002.80

The NPV rule says: only accept projects with a positive NPV. Therefore, reject this project.

-100 000 CFj (First clear calculator – 1 P/YR)

27 500 CFj

4 ■ Nj

45 000 CFj [27 500 + 18 000 (after tax profit)]

18 I/YR

C

■ NPV = -R6 134, 83

NPV still negative. Reject project.

-100 000 CFj (First clear the calculator – 1 P/YR)

27 500 CFj

4 ■ Nj

72 500 CFj [27 500 + 45 000 (after tax profit)]

18 I/YR

C

■ NPV = R5 667,12

NPV is positive. Accept project.

However, you now need to ask yourself whether you really would like to accept a project that only has a positive NPV under such extreme conditions as an after profit resale value of R45 000!

Example 2

Your company has a tax rate of 40 % and the cost of capital is 14 %. A new project is considered which will cost R500 000 and have a duration of 10 years. The net income after tax generated by this project is R60 000 per year. Assume that the cost price of the project will be depreciated over the duration of the project by means of the straight-line method. The project will have no residual value. What is the project's NPV?

Answer:

Profit after Tax : R60 000 p.a.

Depreciation : R50 000 p.a. (500 000 / 10)

Cash flow : R110 000

-500 000 CFj (First clear; 1 P/YR)

110 000 CFj

10 ■ Nj

14 I/YR

C

■ NPV = R73 772.72

Accept the project.

Example 3

We have a choice between Project A or Project B. The cash flows are determined as follows:

Year	Project A	Project B
0	-R5 000	-R5 000

1 R2 085 0

2 R2 085 0

3 R2 085 0

4 R2 085 R9 677

a. What is the NPV at 8 % discount rate?

b. What is the NPV at 14 %?

c. What project must be accepted? (You can only choose 1)

Answer

a. NPV 8 % : Project A = R1 905.78

Project B = R2 112.88

b. NPV 14 % : Project A = R1 075.09

Project B = R 729.56

c. It depends on the cost of the capital and therefore the risk of the project. If the discount rate for A and B are the same (same risk), we will choose A for higher rates (say 10 % and higher) and B for a rate less than 10 %.

Example 4

The AB Company is considering acquiring a certain machine which will save R8 000 in cash costs every year. The machine costs R22 000 and has a life time of 5 years with an end sales price of zero. Ignore tax. Should they buy the machine if the required rate of return is 16 %?

Answer: As tax is zero, depreciation and all profit/losses with the sale of the fixed asset becomes irrelevant.

-22 000 CFj (First clear; 1 P/YR)

8 000 CFj

5 ■ Nj

16 I/YR

C

■ NPV = R4 194.35

Accept the project.

Example 5

DEF-company owns a machine which was bought 3 years ago for R56 000. The machine has a remaining life of 5 years, but requires a major reparation in 2 years' time at a cost of R10 000. At present the machine can be sold for R20 000, while this value will decrease to R8 000 over 5 years. The annual running costs of the machine is R40 000.

A new machine on the market will cost R51 000, or R31 000 plus the old machine. The old machine is therefore traded in. This new machine's annual running cost will be R30 000; it will need no major reparation; and will also have a life of 5 years with a sales price of R3 000 after 5 years.

If the required rate of return is 14 %, use the NPV to determine whether the new machine should be bought (ignore tax).

Answer: In such a case it is always a good thing to express the cash flows in a diagram:

Keep old machine:

Year	0	1	2	3	4	5
Running Costs		(40000)	(40000)	(40000)	(40000)	(40000)
Reparation			(10 000)			
Sell old machine						8 000
Total	0	(40 000)	(50 000)	(40 000)	(40 000)	(32 000)

Replace old machine:

Year	0	1	2	3	4	5
Buy new machine	(31 000)					
Running cost		(30 000)	(30 000)	(30 000)	(30 000)	(30 000)
Sell new machine						3 000
Total	(31 000)	(30 000)	(30 000)	(30 000)	(30 000)	(27 000)

We can now use one of two methods:

Method 1: Calculate the PV of the old and new machine and determine the difference. If the PV of the costs of the new machine is lower as than PV of the old machine, replace the old machine.

Keep old machine : (R140 862.96)

Replace old machine : (R132 434.32)

The PV of the costs of the new machine is R8 428.64 less than that of the old machine. Replace the old machine.

Method 2: Work on the marginal/incremental cash flow, with other words subtract the cash flow of keep old machine from the cash flow of replace old machine.

0	1	2	3	4	5
(31 000)	10 000	20 000	10 000	10 000	5 000

NPV : -31 000 CFj (First clear; 1 P/YR)

10 000 CFj

20 000 CFj

10 000 CFj

10 000 CFj

5 000 CFj

14 I/YR

C

■ NPV = R8 428.64

Therefore, the NPV of the decision to replace the old machine is R8 428.64. As it is positive, replace the old machine.

Take note that when we calculated the cash flow of "Keep the old machine", we ignored the initial cost price as well as the initial 3 years' costs. As they have already taken place, they are considered to be irrelevant for the decision.

Example 6

The L-Company wants to replace an old machine with a new improved machine. The old machine's cost price was R22 000, while the book value is presently R10 000. Depreciation is straight-line and the remaining life is 5 years. The market value of the machine now is R4 000, and will be R600 in 5 years' time. It costs the company R50 000 annually in labour.

The new machine costs R15 000, and has an annual labour cost of R46 000. The life of the new machine is 5 years and the expected sales price is R700. Depreciation is also straight-line.

Asked: If the required rate of return is 10 % and the tax rate is 40 %, calculate the NPV in order to determine whether the old machine must be replaced or not. Assume that the old machine will be traded in if the new machine is bought.

Answer: Draw up a diagram again.

Keep old machine:

Year	0	1	2	3	4	5
Depreciation [2]		2 000	2 000	2 000	2 000	2 000
Tax shield on Dep [2]		800	800	800	800	800
Labour		(50 000)	(50 000)	(50 000)	(50 000)	(50 000)
Tax shield on labour [3] 20 000		20 000	20 000	20 000	20 000	
Sell old machine						600
Tax on old machine [4]						(240)
Total [5]	0	(29 200)	(29 200)	(29 200)	(29 200)	(28 840)

Replace old machine:

Year	0	1	2	3	4	5
Buy new machine	(15 000)					
Sell old machine	4 000					
Tax shield on loss 6)	2 400					
Labour		(46 000)	(46 000)	(46 000)	(46 000)	(46 000)
Tax shield on labour		18 400	18 400	18 400	18 400	18 400
Tax shield on Dep 7)		1 200	1 200	1 200	1 200	1 200
Sell new machine						700
Tax on profit						(280)
Total	(8 600)	(26 400)	(26 400)	(26 400)	(26 400)	(25 980)

Incremental cash flow

	0	1	2	3	4	5
Replace – Keep	(8 600)	2 800	2 800	2 800	2 800	2 860

NPV = R2 051

Decision: Replace old machine, because the NPV of replacement is positive.

Notes: 1. In this case the current book value is R10 000 and the remaining life is 5 yrs. The depreciation is therefore R2 000 p.a. The depreciation itself does not play a role, except insofar it serves as a tax shield.

2. Tax shield on depreciation: 90 % of R2 000 = R800. This is cash flow and does play a role.

3. Tax shield on labour: 40 % of R50 000. Labour can, as is the case with depreciation, be deducted from income to reduce the taxable income.

4. The old machine is sold for R600 at the end of its life. Straightline depreciation says that the end book value is supposed to be R0. Therefore the R600 is profit and taxable.

5. With the calculation of the total cash flow in this case, depreciation is not added. It will play a role later on.

6. The current book value of the old machine is R10 000. It is sold for only R4 000. Therefore a loss of R6 000. We can get a tax relief on the loss of R6 000, namely 40 % of R6 000 = R2 400. We can add this to the sales price of R4 000 to get the real cash flow involved.

7. Tax shield on depreciation = 40 % of R3 000 p.a. = R1 200.

Example 7

Nyoni Ltd must decide on the possible replacement of one of the machines in the factory. The following data is available:

- Price of new machine : R75 000
- Installation costs : R 5 000
- Initial training costs : R 3 000
- Annual sales with old machine : R40 000
- Price of old machine 3 yrs ago : R56 000
- Life of old machine : 8 years
- Depreciation : Straight line
- Cost of sales of old machine : R20 000
- Increase in net working capital of new machine : R10 000
- Life of new machine : 5 years
- Increase in net working capital of old machine : R 8 000
- Current market value of old machine : R25 000
- Market value of new machine after 5 years : R14 000
- Cost of viability study of new machine : R 2 000
- Annual sales of new machine : R55 000
- Required rate of return : 12 %
- Cost of Sales of new machine : R27 000
- Tax rate : 40 %

- Market value of old machine at end of life : R 5 000

Asked: Calculate the NPV in order to determine whether the new machine should be bought.

Keep old machine:

Item	0	1	2	3	4
Sales		40 000	40 000	40 000	40 000
-Costs of Sales		20 000	20 000	20 000	20 000
Profit		20 000	20 000	20 000	20 000
-Depreciation		7 000	7 000	7 000	7 000
Profit before Tax		13 000	13 000	13 000	13 000
-Tax		5 200	5 200	5 200	5 200
PAT		7 800	7 800	7 800	7 800
+ Depreciation		7 000	7 000	7 000	7 000
CFAT		14 800	14 800	14 800	14 800
Retrieve NWC [1]					
Sell old machine					
-Tax on profit					
Total CFAT	0	14 800	14 800	14 800	14 800

Buy new machine:

Item	0	1	2	3	4	5
Price & Installation[2]	(80 000)					
Training Cost [3]	(3 000)					
Tax shield on Trng	1 200					
Sales		55 000	55 000	55 000	55 000	55 000
Costs of Sales		(27 000)	(27 000)	(27 000)	(27 000)	(27 000)
Profit		28 000	28 000	28 000	28 000	28 000
Depreciation [2]		(16 000)	(16 000)	(16 000)	(16 000)	(16 000)
Profit before Tax		12 000	12 000	12 000	12 000	12 000
Tax		(4 800)	(4 800)	(4 800)	(4 800)	(4 800)
PAT		7 200	7 200	7 200	7 200	7 200
+ Depreciation		16 000	16 000	16 000	16 000	16 0000
CFAT		23 200	23 2000	23 200	23 200	23 2000
Sell Old Machine	2 500					
Tax shield on loss of R10 000	4 000					
Sell new machine						14 000
Tax on profit						(5 600)
NWC of new machine	(10 000)					10 000

Retrieve NWC of old machine	8 000					
Total CFAT	(54 800)	23 200	23 200	23 200	23 200	41 600

Incremental

CFAT (54 800) 8 400 8 400 8 400 8 400 15 800

NPV = -R20 320,92

Do not replace the old machine, as the NPV of the replacement decision is negative.

Notes:

1. Sometimes a project needs increased working capital. This amount is made available in year 0 and retrieved in the last year. Therefore, when you keep the old machine, you ignore the fact that you increased the working capital 3 years ago – it is a sunk cost. However, when you end the project, you can still retrieve the WC. Obviously, when you sell the old machine in order to buy the new machine, you also retrieve the working capital associated with the old machine in year 0. The same argument is applicable when you buy the new machine. In this case you show the increase in working capital in year 0 as a cost, and you retrieve it in year 5. There are no tax implications. The only impact is time value of money that has been lost.

2. The price of the old machine is irrelevant except in so far as it serves to determine the depreciation. The price of the new machine is relevant. To this one must add the installation costs. We are thus "capitalising" the installation costs. The increased sum is used to determine the depreciation. In this case depreciation = R75 000 + R5 000 = R80 000 / 5 = R16 000. In practice we frequently find that companies do not capitalize the installation costs, but write it all off in year 0, claiming a tax shield. We will not follow this practice.

3. Training costs are not capitalised, but shown as an expense. As such it provides a tax shield = R3 000 x 40 % = R1 200.

4. How did we determine the R10 000 loss on the sale of the old machine? Remember.

- Current market price of old machine = R25 000.
- The book value of the old machine is: ??
- Cost price of old machine / 8 yrs = depreciation per year
- Depreciation of 3 yrs = R21 000 (R7 000 x 3)
- Therefore book value = R56 000 (cost price) – R21 000 (Depreciation) = R35 000
- Therefore we have a loss of R10 000 (Market price – Book Value)
- 40 % of R10 000 = R4 000 tax shield on loss!

I think we now have more than enough examples on how to calculate the NPV of a project. The reason why I went into such depth with NPV is that it is the best criterion of them all.

You will notice that we completely ignored one item in Example 7, namely the viability study costs associated with the new machine. The reason why we did this is that the viability study costs are sunk costs and irrelevant for the decision. Whether we proceed with the project or not, the costs that have been paid remain sunk. Another item that also will be ignored, is the issue of head office costs that are retrieved from new projects.

6.5. INTERNAL RATE OF RETURN

This method is very similar to the NPV method. However, instead of discounting the expected net cash flows by a predetermined rate of return, the IRR seeks to answer the following question:

What rate of return would be required in order to ensure that the NPV = 0, or that the PV inflow = PV outflow?

In theory, a rate of return lower than the required rate of return would be rejected.

How do we calculate the IRR? We use the exact same incremental CFAT we determined for the NPV. After we asked for the NPV, we press ■ IRR and it gives us the IRR for the project.

Let's determine the IRR for each of the examples done with the NPV:

- **Example 1:**

a. IRR 11,65 %. The required rate of return is 18 %. Reject the project.

b. IRR 15,44 %. Still too low. Reject.

c. IRR 20,13 %. Higher than RRoR. Accept.

- **Example 2**

a. IRR = 17,68 %. Higher than RRoR (10 %). Accept.

- **Example 3**

- IRR of project A: 24,14 %.
- IRR of project B: 17,95 %.

- **Example 4**

- IRR = 23,92%. RRoR is 16 %. Accept.

- **Example 5**

- IRR = 26,13 %. RRoR is 14 %. Replace old machine.

- **Example 6**

- IRR = 18,93 %. RRoR is 10 %. Replace old machine.

- **Example 7**

- IRR = -3,06 %. RRoR is 12 %. Do not replace old machine.

We see that the IRR and the NPV gives the same decision. This will always be the case, unless the cash flows are not conventional. With a conventional cash flow we mean that we have an initial cash outlay in year 0, with positive cash flows for the duration of the project. The moment we find a negative cash flow other than in year 0, we could find more than one IRR for the same project. The rule is that the number of IRR's = the number of changes in the signs of the cash flow. When you have unconventional cash flows, do not use the IRR as it could be misleading. Use the NPV criterion.

6.6. CALCULATING THE DISCOUNT RATE OR COST OF CAPITAL

Up to now we have assumed a certain rate as a discount rate in calculating the NPV. In this section we look at the weighted average cost of capital (WACC) – it is the cost of capital of the company as a whole. Up till now we spoke of required return. Now we speak of cost of capital. There is no difference between the 2 concepts – it depends from which side you look at it:

- For investor : required return.
- For company : cost of capital.

Do not make the mistake of equating WACC to required return. The company's WACC is a weighted average of the cost of equity and the cost of debt. For the investor buying shares, the cost of equity is relevant. For the investor lending money to the company, the cost of debt is relevant. As a whole, the WACC is equal to the returns what the investor in equity wants plus the returns the investor in debt wants.

It is also important to remember that the cost of capital is an opportunity cost – it depends on where the money is used and not on the source of it. Therefore we can construct the following formula:

- Cost of Capital = Cost of Debt Capital + Cost of Equity Capital

The overall cost of capital is a mixture of the returns needed to remunerate the shareholders and lenders.

The assumption is that the company maintains a given capital structure. What is important here is the target capital structure, the combination of debt and equity that minimizes the company's cost of capital and maximizes the company's value.

6.7. COST OF EQUITY

In determining the cost of equity, there are 2 approaches:

- Dividend growth model
- Security Market Line approach

Dividend Growth Model

The price of a share can be obtained from:

P0 = D1 / (Re-g)

Re = D1 / (P0 + g)

where:

D_1 = dividend in next period

P_0 = price of share today

g = growth rate in dividends.

R_E is therefore equal to:

Yield (D1 / P0) + Growth

In calculating R_E,

- P_0 is easy to obtain.
- D_1 is easy to calculate.
- g has to be calculated.

How can g be calculated?

- Historical growth

take annual % change and determine average.
take geometric mean. Only uses first and last value and could be a problem.

- Analytical forecasts – available from a number of sources.

- g=b x ROE , where we assume that the ratio of dividends to earnings is constant.

The advantage of using the dividend growth model to calculate R_E is that it is easy and widely applicable. The disadvantages are:

- It is only applicable to companies paying constant dividends.

- It is sensitive to estimates of g.

- It makes no direct adjustment for risk.

The SML Approach

The cost of equity is equal to:

E(Re) = rf + B [E(Rm) – rf]

For this we need:

- r_f (riskfree interest rate) – use T Bill rate, NCD, BA rate.

- β_E – get from UCT or BFA Net.

- $(R_m – r_f)$ - Risk premium of the market.

The advantages of the SML Approach are:

- It is widely applicable.

- It makes adjustments for risk.

The disadvantage is that it needs estimates for β_E and the market risk premium.

The question could be asked which of 2 approaches should be used. In the best of worlds both should give the same answer. We could even use the average of the 2 answers. In order to standardize the calculations for the purposes of this course, I would like you to use the SML Approach, unless I explicitly state the contrary.

6.8. COST OF DEBT

The cost of debt is the interest rate on new loans. It is observable as:

- the return on current outstanding debt;
- the return on newly issued similar rated debt (AA, BB or whatever).

A β is not necessary for debt, as the interest rate is directly observable in the market.

We could also use the Yield to Maturity of bonds as the cost of debt.

6.9. THE WEIGHTED AVERAGE COST OF CAPITAL (WACC)

In calculating the WACC we assume the current debt/equity ratio (D/E) is optimal. If we want R100 million and the optimal D/E ratio is 1/3 , (or the optimal debt ratio is 0,25 or 25 %), we assume we will get R25 million of debt and R75 million of ordinary shares.

In the practical world it happens that companies do not issue both debt and equity, but only one of them. This will distort the optimal debt ratio, but it shouldn't be any problem if subsequent issues take the company back to its optimal debt ratio.

The point is that the company's capital structure can fluctuate on the short term. The target weights should always be used in the calculation of the WACC. In respect of this point, I would like to mention that there are a diversity of opinions around the issue of weights.

There are those that use book value weights. These weights refer to an ex post – approach based on accounting values. The original book values on the balance sheet when the financing was obtained originally, is used to determine the weights.

Book value weights are not suitable as they are not consequent with the RRoR that is directly concerned with the minimum RoR needed to maintain the current market value of the respective financial components.

Then there are those that use market value weights. Under this system the WACC reflects that RoR needed by investors rather than the historical rates fixed in the balance sheets. In die USA it was found in 1982 that market values were the most popular weighting system and that together with target structures formed 88 % of the systems in use. Iro the RSA Lambrechts found in 1975 that 55 % of the respondents used market values.

Target value weights reflect the capital structure the company would like to have. This system refers to a capital structure whereby market values are maximised and the RRoR is minimised. Numerous academics are of the opinion that this is the system that should be used. However, Gitman (2014) stated the following:

"… when one considers the somewhat approximate nature of the calculations, the choice of weights may not be critical …"

For the purposes of this course, we will assume that the current market value weights are the target value weights. We will also use the market value weights throughout.

For interest sake, the following findings of a 1991-study on the use of WACC as a RRoR. The number of respondents was 174.

- Use always : 87 (50 %)
- Frequently : 26 (14.9 %)
- Seldom : 17 (9.8 %)
- Never : 29 (16.7 %)
- No response : 15 (8.6 %)

The same study shows that more than 50 % of the respondents make use of target capital structure weights, but very few use market capital weights and even less use historical capital structure weights or balance sheet capital structure weights. Aside from the non-use of market capital structure weights, which is contrary to financial theory, the findings are in line with normative prescriptive financial theory.

40 % of the respondents were of the opinion that the WACC becomes irrelevant in high risk situations, as only equity capital can be used in such instances.

Those of you interested in this study can find it in:

Paulo, S. 1991. The Weighted Average Cost of Capital: Theory and South African Empirical Evidence. ***Journal for the Study of Economics and Econometrics****, vol 15, no 2.*

How the WACC is calculated:

Step 1 is to determine the market value of the capital of the company.

Determine the market value of the equity of the company by multiplying the current market price of the share with the total issued shares.
Determine the market value of the debt of the company. In this regard a company's debt frequently has a price in the market. If bonds are involved, you can use your knowledge of chapter 6 to determine the PV of the bonds.
We then say:

Value of company = Market value of debt plus market value of equity

V = D + E

1 = D/V + E/V

- We frequently say the D/E ratio is 1/3. This means that the D/V = 1/4 and the E/V is 3/4 . If we say the debt ratio is 25 %, we know the D/V is 0.25 and the E/V is 0.75.

Furthermore, note how debt is expressed. If we speak of capital structure, we speak of long-term debt. Some institutions use a wider approach in determining debt. Brigham and Gapenski, and Gitman and Mercurio, show that only long-term debt should be used. It is possible, however, to add the current portion of long-term debt (which is shown under current liabilities) to the long-term debt.

- **Now that we've determined the weights, we can use the formula of WACC:**

$WACC = (E/V) \times R_E + [(D/V) \times R_D \times (1 - T_C)]$

R_E = use SML

R_D = observable in market

T_C = after tax cost of debt is used.

Let's consolidate all of this bmo an example:

Boats Ltd has 1.4 million shares, with the market price per share at R20 per share. Its debt trades in the public and has a face value of R5 million. Coupons are paid annually and the coupon rate is 12%. The remaining life is 10 years while the YTM is 16%. The riskfree rate is 14%. The market risk premium is 10.6%, while Boats has a β of 0.74. The tax rate is 35%.

Step 1: Market value of debt:

- FV = 5 000 000
- PMT = 600 000 (12 % of 5 000 000)
- N = 10
- I/YR = 16
- Ask for PV = R4 033 354.50

Step 2: Market value of equity:

- 1 400 000 shares
- R20 market price
- Equity = R28 000 000

Step 3: Value of Company: R32 033 354.50

Step 4: Determine R_E

$R_E = r_f + \beta (Mrp)$

= 14 + 0.74 (10.6)

= 21.84 %

Step 5: R_D = 16 % (given)

Step 6: Determine WACC

$WACC = (E/V) \times R_E + [(D/V) \times R_D \times (1 - T_C)]$

= 19,09 + 1,309

= 20,399 % = 20,4 %

Always remember to use the β that reflects the risk of the project. You can only use the company's β if the project is a replica of the company's current operating activities.

ISSUE COSTS AND WACC

Up till now we assumed that the issue of debt and equity was free. This is not the case. It costs money to issue loans as well as shares. There are 2 approaches in treating the issue costs of debt and equity.

- There are those that adjust the WACC upward to provide for issue costs. This is not a good method as the RRoR is a function of the use of the funds and not of the source.

- The best approach is to determine the weighted average of the issue costs of equity and debt and to inflate the costs of the project with it.

Let's explain the process bmo an example:

Accept a target capital structure of 60% equity and 40% debt. The issue costs of equity is 10% of funds obtained from shares, and the issue costs of debt is 5% of funds obtained from debt. The project cost is R100 million – typically the capital outlay in year 0, plus the installation costs.

fa = (E/V) x fe + (D/V)x fd

= 0,6 x 10 % + 0,4 x 5 %

= 8 %

Project cost after issue costs : R100 million / (1 – fa)

= 100 000 000 / 0.92

= R108 695 652,17

2.9. DIVISIONAL AND PROJECT COST OF CAPITAL

There will be circumstances when the company's WACC is not suitable as RRoR because the risks differ. If you use the company's WACC in such a case:

- You can reject projects while you should've accepted it.
- Accept projects while you should've rejected it.

What happens if the company has 2 divisions? Say a company has the following:

- A transport division with low risk.
- An electronics division with high risk.

The company's WACC is therefore a mixture of 2 different costs of capital – one for each division. If the 2 divisions compete for funds and the company uses a single WACC as hurdle rate, who is going to get more funds?

Remember: high risk – high return!

Therefore the electronics division will be the "winner." Large companies are aware of this problem and work at developing separate divisional costs of capital.

What do you do if you cannot determine the β of the project, but you know that the project's risk differs from that of the company? Here we talk of the "pure play approach." You look at other investments outside the company that are the same risk class as the project under consideration. You then use the market required returns on these investments as the discount rate. The principle is that you must find companies that focus exclusively on the type of project we are interested in.

The third way of getting a discount rate is to use the "subjective approach." It entails that you make subjective adjustments to the company's WACC.

- You determine 3 to 4 categories of risk.
- An adjustment factor for each category is determined.
- The company's WACC is adjusted upward or downward with the adjustment factor.

The effect of this is that you assume that all projects fall into 1 of 4 sectors. The risk still remains that a project can be mistakenly accepted or rejected.

In principle it is better to determine the required return for such projects separately in an objective manner. In practice it is not always possible to go much further than subjective adjustments due to the fact that the necessary information is missing, or it is not worth the cost and effort.

GENERAL

Someone one day said companies suck a hurdle rate from their thumbs and even couple it to a payback period. This is not far off the mark. I spoke to the financial manager of a large listed company in the 1980's. His answer was that they decided on a discount rate of 27 % – there were no grounds for this figure other than the feeling that if a project cannot give a 27 % return, it wasn't worthwhile. Furthermore, it was coupled to a payback period of 3 years. We can indeed speak of a discounted payback method.

3 SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

3.1 Match the type of capital investment in Column A with the appropriate statement in Column B. Write down the letter of the correct answer only.

	Column A	Column B	
5.1.1	Mandatory investment	A	New equipment purchased due to growing demand.
5.1.2	Replacement investment	B	A soft drink manufacturer purchases new equipment so that it can also make chocolates.
5.1.3	Expansion investment	C	Purchase of new equipment because the existing one is obsolete.
5.1.4	Diversification investment	D	Outlay of capital for a gym for the employees and landscaping the gardens.
5.1.5	R&D investment	E	Purchase of fire-fighting equipment.
5.1.6	Miscellaneous investment	F	Enterprise investing in a new production process to sharpen its competitive edge.

3.2 Classify the following assets as Tangible (T), intangible (I) or financial (F). Write down the letter T, I or F as your answer.

5.2.1	Purchase of shares in another company	
5.2.2	Research and development	
5.2.3	Land and buildings	
5.2.4	Trademark	
5.2.5	Machinery	
5.2.6	Government bonds	
5.2.7	Vehicles	
5.2.8	Franchises	

3.3 Consider the enterprises in the country you live in. Provide examples of enterprises that chose the following investment options:

3.3.1 Vertical integration

3.3.2 Concentric diversification

3.3.3 Conglomerate diversification

3.3.4 Divestment

SOLUTIONS

Think point!
Conglomerate diversification
Need to overcome limited growth potential of the existing line of business.
Need to reduce the overall risk exposure of the enterprise.
Divestment
Low profitability
Declining market share
Incompatibility with corporate strategy

3.1

3.1.1 E

3.1.2 C

3.1.3 A

3.1.4 B

3.1.5 F

5.1.6 D

3.2

3.2.1	Purchase of shares in another company	F
3.2.2	Research and development	I
3.2.3	Land and buildings	T
3.2.4	Trademark	I
3.2.5	Machinery	T
3.2.6	Government bonds	F
3.2.7	Vehicles	T
5.2.8	Franchises	I

3.3 Answers will vary from country to country.

TOPIC 3

PROJECT COST MANAGEMENT COMPONENTS

LEARNING OUTCOMES
Students should be able to: ■ understand why a knowledge of elements of both financial accounting and management accounting is necessary for the study of "project financial management". ■ define basic financial accounting concepts and cost concepts.

CONTENTS

READING
Recommended reading
► **Burke, R. (2006) Project management: Planning and control techniques.5th Edition. China: Burke Publishing. pp 195** ► **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited. pp 11** ► **Goodpasture, J.C. 2004) Quantitative Methods in Project Management. 1st Edition. Mumbai: Shroff Publishers. pp 14-18** ► **Turner, J.R. and Simister, S. (2004) Project Management: A Comprehensive Handbook. 1st Edition. New Delhi: Gower Publishing Limited. pp. 293-295**

PMBOK Definition of Project Cost Management

The processes required to ensure that the project is completed within an approved budget. It is primarily concerned with the cost of the resources that are needed to complete the project.

Components of Cost Management

Resource Planning

Determining what resources (people, equipment, materials) and what quantities of each should be used, and for how long, to complete the project

Cost Planning (Estimating and Budgeting)

Developing an approximation of the costs of the resources and compiling them in a document that shows how costs will be allocated to individual tasks.

Cost Control

Controlling the costs to ensure that estimates and budgets are adhered to and controlling any changes that arise during the project.

Risk Management

Identifying, evaluating and managing all risks that may impact on the costs of the project.

1 RESOURCE PLANNING

Resource Planning considers the form and required quantities of the following major interrelated resources needed for designing, planning, executing and closing the project:

Money

Time

Manpower

Materials

The following information is required to undertake the resource planning function:

The work breakdown structure (WBS)

This document identifies that various elements or tasks that will need resources

Historical information, based on previous similar projects, project audits, lessons learned from previous projects, etc.

This information is useful for identifying the typical resources needed for the project and, from previous experience, how they can be best ultilised

The scope of the project

The project scope contains the motivation and justification of the project as well as the main project objectives

Resource pool description

This document/information indicates what resources are generally available for the project as well as what resources may have to be specially procured or allocated for the project

Organisational policies that relate to project management, financial management, technology management and human resource management

The organisational policies of the company performing the project will indicate, e.g. how the HR function operates in relation to staffing the project, the basis on which finance is allocated and what procedures and standards have to be followed for the purchasing or procurement of material, etc.

Resource planning is carried out by the project team in conjunction with, or assisted by:

Specialist functions within the organizing company

Consultants and specialists, e.g. quantity surveyors, discipline engineers, etc.

Computer simulations

Suppliers and contractors

Trade associations

The deliverable or output of the Resource Planning function is:

A description of the various resources required and their specific quantities for each element (or task) of the work breakdown structure (WBS)

Project Time Planning

Duration of Individual Activities

One of the fundamental tasks of Project Time Planning is the estimation of the duration of individual activities, as prescribed in the WBS.

The accurate estimation of the amount of time an activity will take may be calculated in a number of ways:

Historical data

Individual knowledge and experience

Suppliers estimation

Computer simulation

Apart from the direct time related to the execution of the respective activities the project time planning function must also consider the various aspects that can cause major delays to the project.

Some of these are:

The time required to specify and procure an item.

Shipping delays

The possible influence of sub contractors outside the control of the Project Team and not specifically catered for in the Main Contract.

Weather influences

Labour action

Acquisition of labour

The various design processes

Sequencing of Activities

Sequencing of activities is one of the processes in the resource planning phase that requires a large amount of common sense and or experience. Projects may have only a few sequential tasks or many thousands of interrelated activities.

Critical Path Analysis (CPA)

Critical Path Analysis (CPA) is a technique whereby the shortest time it will take to complete a specific task is determined, while considering the logical flow and dependencies between the various other tasks in the project. *Stated conversely, it is the longest path through the project, which will therefore determine the earliest time a project will be completed.*

Critical Path Method (CPM).

A *network analysis* technique used to predict project duration by analysing which sequence of activities (which *path*) has the least amount of scheduling flexibility (the least amount of *float*). Early dates are calculated by means of a *forward* pass using a specified start date. Late dates are calculated by means of a *backward* pass starting from a specified completion date (usually the forward pass's calculated project *early finish date*).

Critical Path Analysis and Critical Path Method are known by other names as well. Basically all the names refer to the same concepts with some variations. An example is Project Evaluation and Review Technique (PERT).

CPA and CPM can be applied to every project, large or small, complex or simple.

The question as to when and where they should be applied is dependent on factors such as:

Criticality of time

Complexity of project

Size of project

Contractual obligations

Levels of Time Associated to the Degree of Detail

Various levels, related to the detail in which the time resource estimates are made, are usually applied. These levels should be consistent with the levels of detail shown in the WB.

Typical time estimate levels are:

Level 1. The key dates as derived from the project plan. These identify the key strategic activities (major milestones) to achieve the project objectives. This corresponds with the 'Project Level' in the WBS.

Level 2. Level 2 is consistent with the 'Project Area' or the 'Project Sub Area' of the WBS.

Level 3. This level is developed to a level consistent with the 'Work Package' or cluster of associated tasks, i.e. Level 3 or Level 4 of the WBS. It is usually used to co-ordinate and control the work of all discipline functions of the Project.

Level 4. This is known as the Control Level Schedule and is a detailed itemized description of the deliverables associated with an activity at Level 3. It is prepared and maintained by the person responsible for completing an activity, or activities, in the Project Schedule.

Level 3 activities and Level 4 deliverables should be uniquely numbered according to WBS code and the code of accounts that are being used. In addition, each activity should have a single point of accountability for its accomplishment. Once the Project schedule has been developed, it should be 'frozen' as the baseline for monitoring against to detect deviations from the planned schedule. Only formally approved changes shall affect the 'frozen' baseline and cause a new baseline to be prepared.

2 COST PLANNING (ESTIMATING AND BUDGETING)

Cost Estimating

Cost estimating involves developing an approximation of the costs of the resources that will be needed to complete all the activities associated with, and included in, the project.

Requirements for Cost Estimating

The resources required

The rates, tariffs or prices of the resources
The WBS
The activity duration and sequence estimates
Historical information
Trade information

Tools and Techniques

Analogous information

This method is also called 'top-down estimating' and uses the actual cost of a previous similar project as the basis for estimating the cost of the current project. It is frequently used for estimating total project costs when there is a limited amount of detailed information about the project, e.g. in the early phases of the project planning phase.

Parametric modelling

This method involves using the parameters of the project in a mathematical model to predict project costs. Models may be simple, e.g. the cost of residential houses are normally based on the area of the proposed house, or complex, using specialised software with various 'adjustment factors'. Parametric modelling are most likely to be reliable when the historical information used to develop the model is accurate, when the parameters used in the model are readily quantifiable and when the model is scalable, i.e. it works well for both large and small projects.

Bottom-up estimating techniques

This technique involves estimating the cost of individual work items, then summarising or rolling-up the individual estimates to get a total project cost. The accuracy of this method is determined by the size of the individual items, with smaller items improving the accuracy.

Computer techniques and simulations

Computer tools such as project management software and spreadsheets are widely used to assist estimating procedures. Such tools can simplify the use of other estimating methods and are especially well suited for considering alternative options.

Budget prices from suppliers based on a written specification
Competitive bids based on a full technical and commercial enquiry document

Deliverables

Cost estimates

Quantitative assessments of the likely costs of resources required to complete the project.

Base date

The date on which the cost estimates have been performed

Supporting detail

For example:

Reference to the WBS

The basis of the estimate: how it was developed

All assumptions that have been made

The range of costs, e.g. R10 000 + or - R1000 to indicate that the item is expected to cost between R9 000 and R11 000

Indirect and Other Costs

The direct costs of equipment, materials and labour are relatively easy to define and estimate. There are however costs of an indirect (or overhead) nature which are incurred during any engineering and construction project which are not always as easy to define. These costs include preliminary and general (P and G) type costs, freight and insurances, contract, e.g. EPCM, costs, and client costs such as spares inventories and operator training

Indirect costs and other costs are very much affected by the project management, contracting and construction strategy selected for the project. An execution strategy draft must be prepared early in the study for discussion with the client and will form as a basis for the estimate.

Factoring

For conceptual estimates and areas of low scope definition, it will be necessary to prepare estimates using factoring techniques. These areas should be clearly defined prior to estimating and all persons involved in the estimating procedures, including the client, should be aware of the factoring method to be applied, the basis of the factors, and the likely accuracy associated with the chosen methods.

Summary of Estimate

The estimating system must have the capability of summarising the estimate into various summary levels. These levels must correspond to the agreed work breakdown structure for the estimate, and

also to the system of codes of account being used. This summarisation of the estimate is vital for proper review and gives the first indication of where problem areas might be found. Key statistics for quantities and costs should be calculated as part of the summarisation process. These key statistics provide a macro view of the cost structure of the estimate by allowing unit rates for key quantities to be calculated and compared both across the estimate WBS areas and to current, or historical cost norms. Inconsistencies can be investigated before the main review process is started. The key quantity statistics also provide a check back to the basic project scope, and may highlight where elements in the scope are missing, have not been correctly quantified, or are in any other way inconsistent with the estimate.

As a minimum, estimate summaries should include:

Costs by WBS;

Costs by commodity;

Costs by direct and indirect type;

Key quantities, unit costs and cost ratios

Review of Cost Estimates

The review of the estimate is a vital part of the preparation and quality assurance process and where practicable, the review should always be formally documented. The review procedure takes place in a hierarchy of levels, starting with simple mathematical spot checks of calculations, by the estimator, or his supervisor, to a final review with senior management.

Check Estimating

One method of reviewing an estimate is by preparing check estimates using different estimating techniques. Thus, where a detailed estimate has been prepared from material take-offs and detailed unit pricing, an equipment factored estimate could be done to check the bulk material costs.

Comparison to Previous Estimates

In many cases the current study will have been preceded by a previous study, done usually at a more conceptual level. Sometimes the previous work is related in some way to the current study, but the scope may not be the same.

In these cases it is vital that the current estimate be compared to any previous estimates. Firstly this comparison provides a check on the current estimate, as gross omissions or a fundamental change in assumptions may be highlighted. Secondly, management will inevitably want an explanation for any change in cost from previous estimates, so the research is best done as part of the preparation for the management review.

Comparison to Like Projects

Where there is history on the actual costs of similar projects, or even of recently estimated projects, a comparison of the current estimate with the previous data should be done. These comparisons will usually be done at the macro level, so the previous work on summarising the key statistics, cost ratios and factors will help in this check.

All the above checks and reviews are basically internal to the estimating team, and are there to ensure that the likelihood of errors due to poor estimating quality is minimised.

Contingency

Contingency is defined as the allowance which when added to a base estimate gives a project estimated cost which has a prescribed probability level of achievement. Adding the contingency value to the base estimate value decreases the probability of overrun of the project cost. The accuracy and type of estimate is not altered.

The form of contingency, the way it is calculated and how it is used in practice are usually defined in the Company's estimating policies.

Contingency is often used for correcting omissions, estimating errors and unforeseen or unavoidable events. Best cost engineering practice, however, states that two categories of project contingency always are required:

Estimating Contingency

The estimating contingency is at the disposal of the project manager and is generally intended to compensate for errors and omissions associated with the current scope of work. It must be noted that the estimating contingency does not cater for changes of scope that may be requested either by the project team or by the client.

Client Contingency

The Client Contingency is a determined by the Client, solely at his discretion and is usually based on possible changes to the project scope being necessary in the future.

Calculating Contingency

The value of contingency to be used for a specific project is usually determined by a mathematical calculation based on an 85% probability of completing the project, or a section of the project, at less than or equal to budget. A typical contingency calculation, based on the above method, is given on the next page. Note that the contingency is related to the accuracy of the estimate.

CONTINGENCY CALCULATION

Contingency Reference No.	:	
Project No. / Description	:	
Phase No. / Description	:	
Estimate No. / Description	:	
Value of Estimate	:	**R 900,000**
Class Of Estimate	:	
Accuracy Range	:	**-15%** **+ 25%**

CALCULATION

Minimum Value			(a)	R	765,000
Likely Value			(b)	R	900,000
Maximum Value			(c)	R	1,125,000
Variance **:** maximum value minus minimum value (c - a)		=	(d)	R	360,000
Standard Deviation		=	(S.D.)		Variance / 6
		=	(S.D.)		360,000 / 6
		=	(S.D.)	R	60,000

Value of estimate = Minimum value (a) + [S.D. x N]
(N is read from the chart and has a value from 0 to 6)

Hence : **Value of estimate**		=	(a)	R	765,000
		+	(S.D.)	(R	60,000
N = 4 for 85% probability of cost underun		x	N		4
		=		**R**	**1,005,000**
	Contingency provision	=		**R**	**105,000**
	Contingency percentage	=			**11.67%**

Monte Carlo Simulation Method for Calculating Contingency

Best practice more recently calls for the application of Monte Carlo simulation techniques. A Monte Carlo technique simulates the execution of a project many times (typically one thousand times) and analyses the frequency distribution of the range of values for the estimated project value. Depending on the required risk profile a value for the estimating contingency can be obtained.

As an example, let us suppose that the indicated cost of a project is R 100 million. This indicated cost is an estimate of the final cost of the project before any estimating contingency is applied. After the completion of the Monte Carlo exercise (1 000 iterations), the analysis, for example, might reveal that only 400 iterations produced a value for the project less than R 100 million. This means that the probability of a cost under run is only 40 % and equally that the probability of a cost overrun is 60 %. With odds like these against him, no project manager would assume responsibility for the project without an appropriate safety net or contingency. The question then is how to derive a value for an appropriate contingency through using objective means and principles.

The same frequency distribution profile that showed that the probability of a cost under run was but 40 % can be used to determine an appropriate contingency but the required input is the degree of risk acceptable to the client. Contingency is like an insurance premium, the more cover that you require, the greater the premium. Consequently, if a client wants a 90 % probability of a cost under run, the contingency (premium) will be greater that for an 80 % probability. Analysis of the Monte Carlo results will indicate the appropriate contingency amount for the full range of probability factors.

Contingency, consequently, assumes a willingness of the project team and the client to share the risk of a cost overrun. For a client to require an estimate for a project that has zero probability of a cost overrun is both impossible and unfair. The sharing of risk is accomplished by agreeing beforehand that a contingency based upon, say, an 80 % probability will be adopted. This means that statistically the sum of the net amount plus the contingency will produce an 80 % probability of a final cost under run.

On the other hand, the client contingency caters for desirable changes to the current scope of work. The funds for such changes cannot be taken from the estimating contingency since it is meant only for errors and omissions in the current approved scope. The identification and agreement as to what constitutes a change of scope can create endless discussion. The best way to minimise such argument

(but it never eliminates it completely) is always to have detailed written documentation for the current scope of work agreed and signed by the project manager and the client. A client contingency cannot be quantified as can the estimating contingency. Obviously, the cost implications of several worst-case scenarios can be calculated and adopted as an appropriate client contingency. In practice, the client has to recognise that he, not the project manager, is responsible for these funds.

Inclusions in a Cost Estimate

A typical cost estimate for a capital project includes the following:

Direct Costs

Earthworks and civil engineering works
Concrete
Structural steel
Buildings
Equipment and machinery
Piping
Electrical work and fittings
Instrumentation
Insulation
Fire proofing
Scaffolding
Corrosion protection, e.g. painting

Indirect Costs

International expenses
Temporary construction
Facilities and other buildings
Construction vehicles
Construction equipment
Small tools and consumables
Site costs, including catering
Construction insurance
Security
Construction consultants

Field staff and travel costs
Preliminary and General (P and G)) costs
In-House (Company or Home Office) Costs
Project Management
Services
Design, engineering, drawing and modeling
Construction management
Commissioning management
Home office expenses
Consultants

Other Costs
VAT
Escalation
Royalties and licenses
Start-up costs
Start-up spares
Commissioning spares
Start-up modifications
Contingency

Types of Estimates

The form, type and accuracy of the estimates are generally dictated by the needs of the particular phase that the project is in, as indicated below. The approximate AAplc cost estimate classes are given in bold lettering and are outlined below: (*Reference: AA plc Estimating Check List E-C1)*

AAplc Cost Estimate Classes

Class 0 – Rapid scoping or trade-off comparisons to establish broad viability;

- Class 1– Appraisal studies to rank various alternatives in terms of both technical and financial viability, and to establish a chosen scope for development to feasibility level and funding approval;
- Class 2 – Feasibility study and funding approval, sometimes referred to as “Bankable” level;
- Class 3 – Control level estimate for development into a project control budget;

- Class 4 – Revised control estimates for establishing accurate forecast of costs to project completion.

Classes 0, 1 and 2 are used mainly for evaluation or for economic feasibility studies and Classes 3 and 4 are used for project control

Types and Required Accuracy of Cost Estimates

CONCEPTIONAL PHASE	DEVELOPING PHASE	DESIGN PHASE	EXECUTION	COMMISSIONING	CLOSURE
Conceptual Estimate (Order of Magnitude Estimate) Class 0 (+25% to -15%)	Preliminary Cost Estimate Class 1 (+25% to -15%)	Feasibility Cost Estimate (+15% to -5%) Class 2 Control Budget Estimate (+10% to -10%) Class 3 Latest Cost Forecast		Latest Cost Forecast	Revised Estimate (+5% to -5%) Class 4 Final Cost Forecast

Cost Budgeting

Cost budgeting involves the allocation of cost estimates to individual work items, or clusters of work items, to establish a cost baseline for measuring and monitoring the cost of a project.

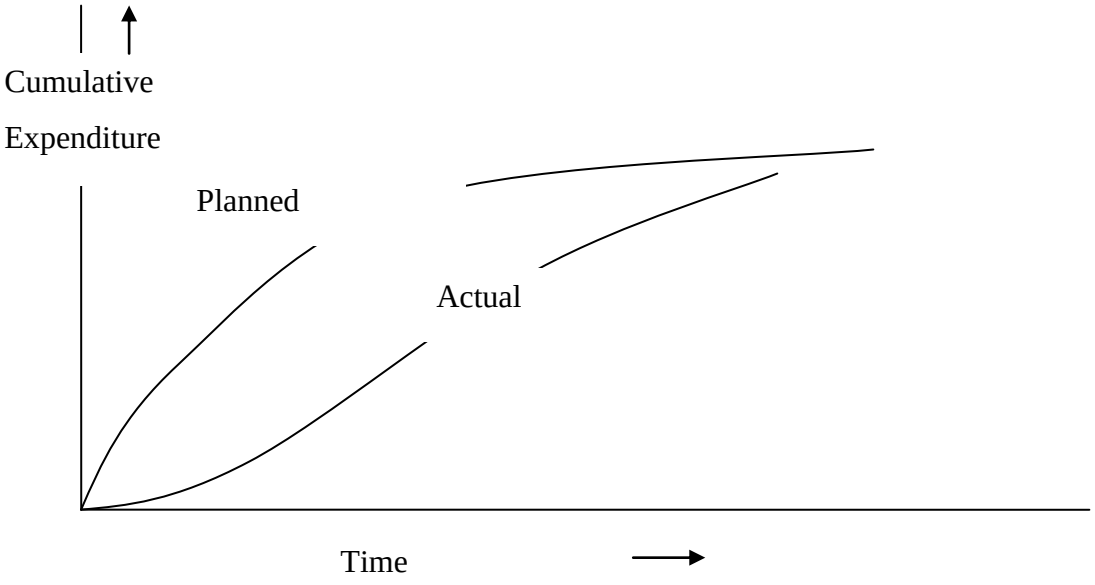
The following inputs are required to compile a cost budget for a project:

Cost estimates
Work breakdown structure (WBS). This identifies the various elements of the project to which costs will be allocated

Project Schedule. This includes the planned start and completion dates for the project elements that costs have been allocated to and provides the basis for assigning costs to the time period when the costs will be incurred.

The deliverables (outputs) of cost budgeting are:

Cost Baseline. The cost baseline is a time-based budget that will be used to measure and monitor the ongoing cost of the project. It is usually depicted as an S-curve (see below)



Typical S-curve Cost Baseline for a Project (PMBOK)

A Typical Procedure for Approving Cost Estimates

Step 1:

The Preliminary Cost Estimate (PCE) is prepared by the Project Team

Step 2:

The PCE is reviewed and/or revised and presented to Management (EXCO)

Step 3:

If the PCE is approved by Management, the Project Team is instructed to prepare a Control Budget Estimate (CBE) that includes more detailed design.

Step 4:

The CBE is reviewed and/or revised and presented to Management (EXCO) for approval.

Step 5:

If the CBE is approved by Management, the CBE is submitted for Board approval.

3. COST CONTROL

Cost Control is generally defined as the application of procedures to follow the progress of design and construction projects as well as manufacturing operations in order to minimise cost with the objective of increasing profitability and assuring efficient operations. There are three essential elements of control:

To establish the optimum, or ideal, set of conditions that will achieve the final cost of the project being identical to the budget value
To measure the variation from the optimum condition during all stages of the project
To take corrective action in order to minimise this variation.

The application of these procedures attempts to limit costs to only those that have been authorised and focuses control efforts in areas where they will be most effective thus achieving maximum control at minimum operation costs.

3.1. Cost Control is essentially involved with:

Making changes, or positively influencing, those factors which cause changes to the cost baseline
Ensuring that all changes are properly documented and recorded in the cost baseline
Preventing incorrect, inappropriate or unauthorized changes (e.g. unauthorized changes in the project scope) from being included in the cost baseline
Informing all stakeholders of the authorized changes

The project cost is generally administered at a high level through a Cost Control Account which is a statement of expenditure maintained in the principal ledger that progressively records the total value of all transactions that have been entered in detail in the cost ledger and that represent the total project expenditure at any one time.

3.2. Cost Report

The project Cost Report is a periodic compilation of information based on:

The Committed Cost in terms of ordered and/or procured items, obtained from the Procurement function
The Expended Cost in terms of actual payments made, obtained from the Accounts function
The Control Budget Estimate in terms of what monies have been allocated for tasks or activities in terms of the Work Breakdown Schedule (WBS)

The project Cost Controller uses this information to prepare the Cost Report and to report on any variances between the Committed and Expended Cost and the Control Budget Estimate.

Effective project cost control consists of a process of identifying hazards well in advance of their occurrence. When the cost controller brings out a cost report on a regular basis, it enables the project team to keep track of the recent (expenditure) cost of the project and any difference from the estimated costs. Variances serve as an early warning that corrective action is needed. This report will also reveal any mistakes made in the original estimate.

3.3. Variance

Cost control measures and monitors variance, both positive and negative, of the cost of the project in terms of the derived and approved cost baseline. Cost control needs to be integrated with other project control processes, e.g. scope change control, schedule control, change requests, performance reports, etc. An important part of cost control is to determine what is causing the variance and to decide whether the variance requires corrective action.

The input information required for effective cost control is:
Cost baseline
Performance reports
Scope change authorizations
The cost management plan

The deliverables or output of cost control is action to bring about:
Revised cost estimates and updated budgets
Corrective action plans
The Latest Cost Forecast (LCF) and Estimate at Completion (EAC, see below)
Lessons learned narrative reports

3.4. Changes to a Project

There are two specific types of changes that often have to be accommodated during the course of a Project:

3.4.1. Change of Scope (COS)

A Change of Scope is an application by the Project Team for certain changes in the scope of the project that are within the original intent and meaning of the project.

A change of scope is an alteration to a fundamental concept or to a basic parameter that changes any part of the original accepted and agreed scope of an individual task or to the project as a whole.

3.4.2. Variation Order (VO)

A Variation Order is an application by the Project Team for a change within the original scope of the Project.

A variation is an alteration to an item without changing the basic scope of a task or project. Examples of variations are: having conditions, such as poor foundations or having any detailing changes in connection to project management and design associated with mining, engineering, metallurgical, estimating or having changes to any preliminary assumptions that were made at the outset of the project.

3.5. Code of Accounts

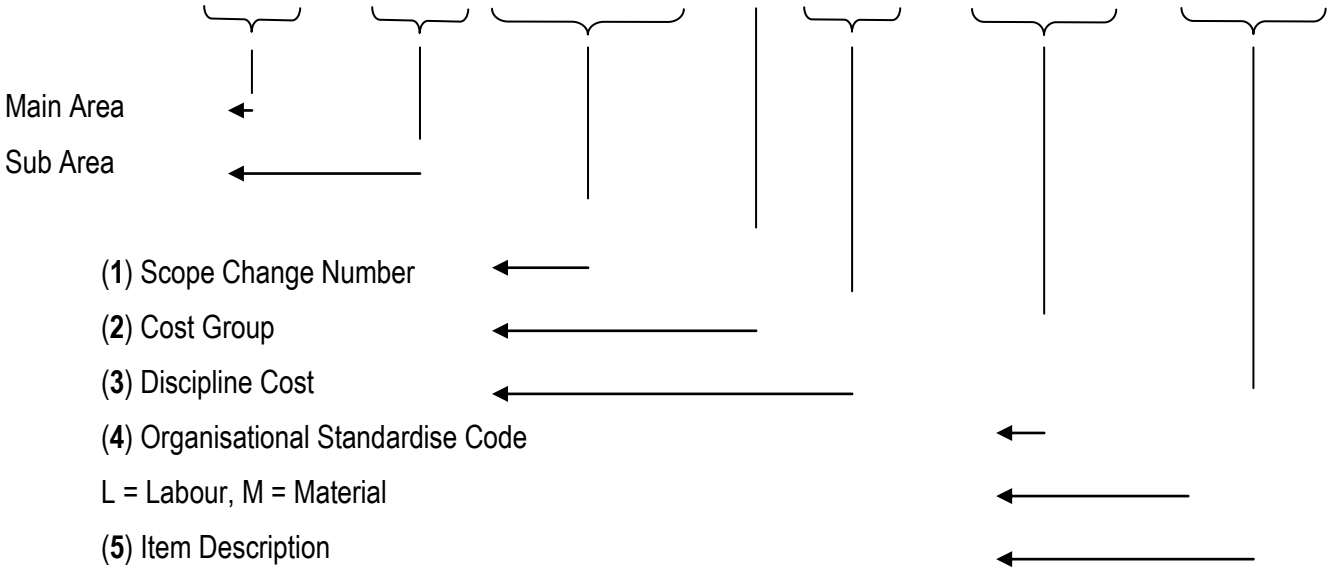
Each Company generally has its own Code of Accounts depending on their needs and policies. The aim of the Code of Accounts idea is to provide each item (task, activity, equipment, services, etc. or logical groupings or 'clusters' of them) in a project a unique number whereby it can be identified. This coding standard has been compiled in such a manner that it allows persons with varying levels of interest to gain an understanding at that respective level. It must be suitable for both manual and computerized application and is the source from which the Work Breakdown Structures is compiled. All concerned with the Project Execution should use the Work Breakdown Structure (WBS). It enables a systematic retrieval of information for the compilation, analysis and comparison of data for Project Management and Project Execution. It also provides a unique identification of all supply items and associated installation costs for each cost group.

The *Project Code* generally consists of *Free Codes* and *Mandatory Codes,* where:
Free Codes means that the project team is free to choose its own characters, but the format remains mandatory. These codes, therefore, are applicable to one individual project only. When established, they must be recorded for general reference by the Cost Engineer who acts as custodian of the Code of Accounts.

Mandatory Codes must be used as determined in the Company's standard prescribed Code of Accounts.

3.5.1. A typical Code of Accounts format is given below:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

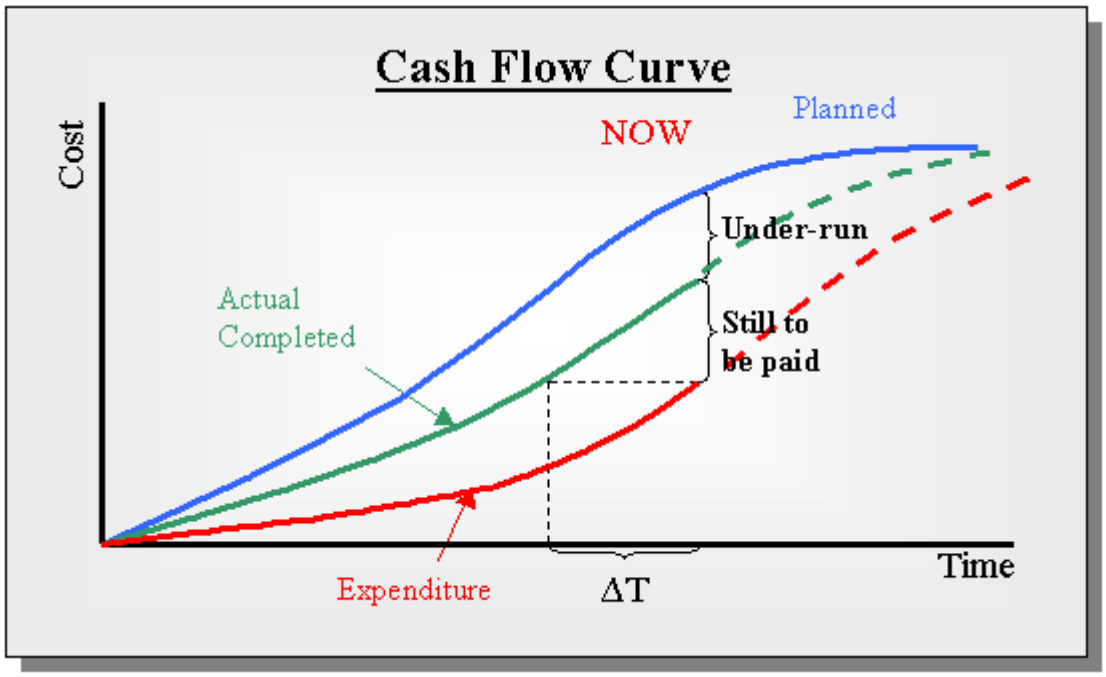


4. Cost Curve (Cash Flow Curve)

The project cost curve (or cash flow curve) is generally defined as the measure of the value of the money spent, at any particular time, and whether the project is ahead or behind in terms of the prescribed Cost Management Baseline.

Deriving the project Cost Curve entails a comparison between time and performance in terms of cost. It also compares work that is planned to be undertaken to work done and to work done and paid for.

A typical Cost Curve is shown below.



Estimate at Completion (EAC)

An EAC is a forecast of total project costs based on the project's cost performance. The most common ways of deriving an EAC are:

Actual costs to date plus the remaining project budget adjusted by a 'cost performance index' when current variances are seen as being typical of future variances

Actual costs to date plus a new estimate for all the remaining work. This approach is most often used when past performance shows that the original estimating assumptions were wrong or no longer relevant

Actual costs to date plus the remaining budget when the expectation is that variances similar to current variances will not occur in the future

Latest Cost Forecast (LCF)

The LCF is prepared to verify the projected cost forecast and to confirm whether the remaining work will be within the amount of money allowable in the CBE. An LCF is often requested by the Client at any time during a project.

Earned Value

For efficient project cost control, the Project Manager, at all stages of the project needs to know the precise cost and schedule status of the various elements/stages in the project. Based on the current performance of his team, the final outcome, in terms of cost and schedule, should be apparent if matters were to continue without correction or remedial action.

Earned Value is the key element of a project cost management methodology. The simplest way to think of Earned Value is to equate it with physical progress. As the name implies, it is something that is gained through some effort. In project management, this value is earned as activities are completed. Consequently, Earned Value is also a measure of progress. There is a direct relationship between Earned Value and the percentage completion of a project.

There are three main characteristics or attributes of Earned Value:

It is a unit of measure for total project progress or for any sub-element of the project.

It is a consistent method for analysis of project progress and performance.

It is a basis for the analysis of the cost performance of a project.

Determining Earned Value provides a uniform unit of measure for reporting progress of a project. Traditionally, the units that are used to measure progress include work hours and cost. For labour intensive efforts, however, work hours are often considered adequate. In such instances, the financial details of the remaining project cost are controlled by the accounting system. These costs include subcontractors, overheads and other direct costs. When the entire project cost is to be controlled from the project control system, then it is more effective to use a currency as the unit of measure for Earned Value. Since each labour hour has a price, currency can be used to control labour as well.

Earned Value also is a consistent method for the analysis of project performance. Suppose you ask the bricklayers and the carpenters how they're doing. You are likely to get different answers, influenced not only by how they are actually doing, but also by how they calculate their plan and their progress. Earned Value establishes a particular method for determining what the plan to date is and what the progress actually achieved is.

Earned Value provides the basis for cost performance analysis. If you want to know what's happening to the cost of your project BEFORE it is completed, you need to know what the planned cost at any time was and also what the cost of the completed work is. Referring to the Figure below, should the project manager of such a project be satisfied or should he be concerned? It seems that the actual costs are considerably below the planned cost. This appears to be good news. However, unless you look at the planned cost of the completed work, you don't really know if this is good news or not. That is exactly the missing information that Earned Value provides.

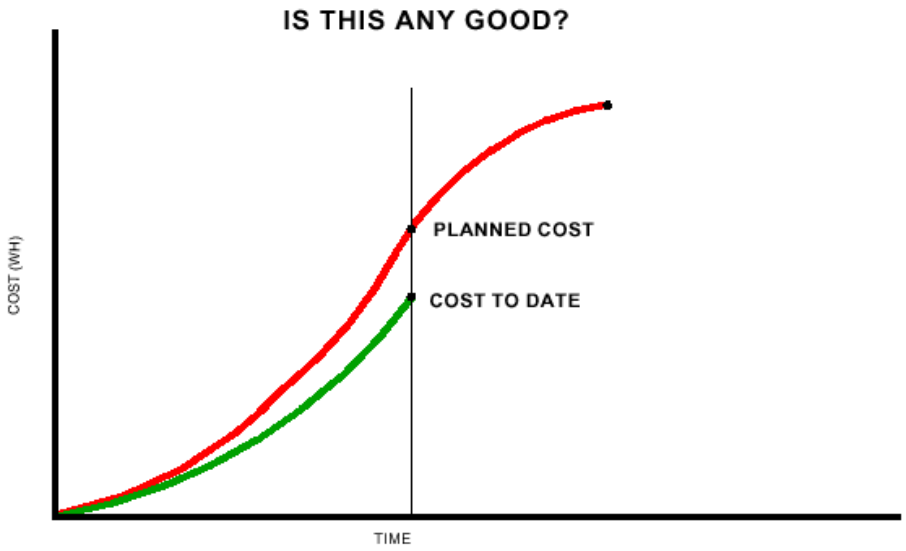


FIGURE 1 - TRADITIONAL COST ANALYSIS

In order to understand Earned Value thoroughly, we must become familiar with all the elements of the Earned Value method. The Figure below provides an overview of these elements.

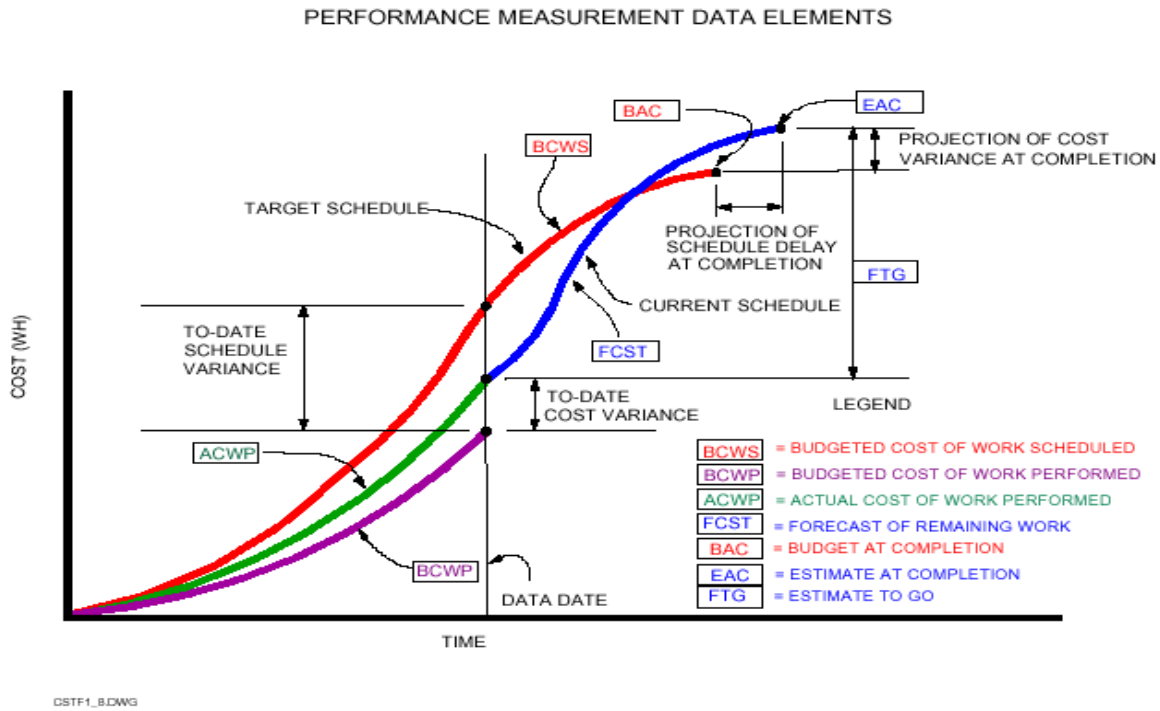


FIGURE 2 - EARNED VALUE ELEMENTS

The **BCWS (PV)** is the Budgeted Cost of Work Scheduled. Quite literally, it represents the budgets of the activities that are planned or scheduled to be completed.

The **ACWP (AC)** is the Actual Cost of Work Performed. It represents the actual cost charged against the activities that were completed.

The **BCWP (EV)** is the Budgeted Cost of Work Performed. This is Earned Value. The distinction between the BCWS and the BCWP is that the former represents the budget of the activities that were planned to be completed and the latter represents the budget of the activities that actually were completed.

These are the three major components of Earned Value. At any point in time, we have the planned work, the actual work and the cost of the actual work. This allows us to make the full analysis of our project progress and performance. Some of the other, related terms shown in Figure 2, include the Budget at Completion (BAC), the Estimate at Completion (EAC), the Schedule Variance (SV) and the Cost Variance (CV.

Why Use Earned Value?

Earned Value is a uniform unit of measure, a consistent methodology and a basis for cost performance analysis.

You might ask "What's so great about a uniform unit of measure?" Suppose that you are the project manager of a software development project. You're part way through your project and you wonder how things are. First, you want to know what per cent complete the project is. At a summary level, let's say that the project includes conceptual design, program specification, coding, documentation, user manual production, and debugging. Further, let's say that conceptual design and program specification are complete, coding and documentation are in process, manual production and debugging haven't started yet. So, how complete is the project? We've completed two out of six parts and are in process with two more. Does that mean we are 50% complete? Maybe, but, we don't know.

What is each part worth? Does writing one line of program specification equal one line of code and they, in turn, equal one line in the documentation? How is one to equate the various parts?

Now suppose we determine that conceptual design is expected to take 200 work hours, program specification writing 300 hours, coding 600 hours, documentation 100 hours, user manual 400 hours and debugging 500 hours. These labour "budgets" can easily be used as a weighting factor in establishing the worth of the various parts. That is exactly what Earned Value does. Since conceptual design and spec writing are done, we have "earned" 500 hours of value. For the in-process activities, we need to decide how we will earn the value. For now let's just say we are one quarter done with the coding and 10% with the documentation. We could then claim 150 hours for the coding and 10 hours for the documentation. The total earnings are then 660 hours. So, how complete is the project? Using Earned Value methodology, we would determine that the project is 31.4% complete (660 earned hours divided by 2100 hours of total project budget).

Earned Value allows us to combine the progress of vastly different work efforts. The same thing works with any kind of project. Earned Value lets us combine m^3 of concrete with m of pipe etc.

What does consistent methodology do for me? Remember the bricklayers and carpenters? If you ask the carpenters how they are doing, you might get an answer such as: "We're doing fine, we've already used half the lumber you sent us at the beginning of the project. We'll have the rest used up by next week." The bricklayer might say: "We're doing great. Ninety per cent of the budgeted labour hours are spent; therefore we're 90% complete." Both parties might be correct, but what can you as the project manager do with that information? You can pass it along, but chances are that your management is not interested in the details, they want summary information. Using Earned Value, the bricklayers and the carpenters would measure the total quantities of bricks and lumber installed and compare that against the budgeted quantities to determine the per cent complete. Similarly, they would compare the installed quantities against the quantities planned to be installed up this point in time to determine if they are ahead or behind schedule. Earned Value has provided a method that both the bricklayers and the carpenters can use to report progress.

Using Earned Value enhances the cost performance analysis of a project. Traditional cost analysis centres on the actual cost of the work that was completed. Therefore, much progress has been done to collect the actual costs through the time charge and accounting systems that exist on practically all projects. What Earned Value brings to the process is a measure of the amount of work that has been done in a unit of measure that is consistent and comparable with costs. In other words, it allows us to compare "apples with apples" by using the same unit of measure for physical progress as for cost.

How Do We Use Earned Value?

There are 5 steps in setting up the Earned Value system on a project, and 4 steps in using it.
These steps are described generically but they are the same for all projects.

Establish the Work Breakdown Structure (WBS) to divide the project into manageable portions.

The WBS is the roadmap for analysing the project progress and performance. It provides a multi-level structure for analysing the project at varying degrees of detail. A properly defined WBS also provides that each element of the structure at each level is the responsibility of an individual who has management authority over that element and all the elements that roll up into that element. Furthermore, the WBS must contain the full scope of the project; otherwise, the information generated will not represent the total project. The WBS is generally a hierarchical structure in which each lower level element rolls into one and only one element at the level above it. The bottom level of the WBS should be the activities of the project. The key here is that each element has a responsible individual identified with it and each element represents a part of the project that someone or more people are interested in monitoring. While this personal responsibility might bring to mind an Organisational Breakdown Structure (OBS), the WBS should not be confused with an OBS. The structure can function as the framework for analysing the project performance. However, an OBS is generally employed in a matrix organisation where the functional management of the organisation wants to analyse the performance of their functional unit on the project.

The WBS is organised along the component lines of the project. Refer to section 3.1.1 for the detail requirements of the WBS

Identify the activities to be scheduled that represent the entire project. The WBS provides the framework for identifying the project components. The completion of this step will produce the project schedule of activities, typically in a CPM network.

Allocate the costs to be expended on each activity. Since an activity represents a finite effort within the project, it has a duration and it requires the expenditure of some resources. The practitioner needs to decide whether to use labour resources only, such as work hours, or to use currency and load all project costs into the schedule. The allocation of resources (costs) requires a choice of the degree of detail with which one will allocate the resources. These options include linear spread across the

duration of the activity or use of a curve to approximate the expected expenditure during the activity's execution. These curves have an unlimited variety of shapes, the most common ones being symmetrical bell shape, front loaded triangle, back loaded triangle, equal triangle, lump sum at the beginning or end of the activity.

Schedule the activities over time. This step generally provides the spread of the resources over the entire time duration of the project. It generates the traditional S-curve of the project plan or baseline, also called the BCWS Curve.

Tabulate, plot and analyse the data to confirm that the plan is acceptable. The purpose is to ensure that the allocation of resources is properly planned. This includes analysis of individual resources to see if the maximum requirement during any time period is available. It also includes review of cash flows, if currency is entered, to see if the financing plan for the project supports the schedule. Third, it provides a review to see that all project resources and costs that are budgeted are entered into the program. Of course, correction of any anomalies discovered during this step is implied to be a part of this step.

Once these five steps are completed, the project team will have the basis for conducting periodic analysis of the project progress and performance. That process is explained in the next four steps.

How to use the information generated by the Earned Value calculations:

Update the schedule by reporting activity progress.

The first step in the periodic process is to update the schedule with the period progress. This is generally done whether Earned Value is used or not. The project schedule activities are reported as started, completed or with a remaining duration, as appropriate. The per cent complete of unfinished activities should also be reported. Here is where the practitioner should avoid subjectivity. For physical work it may be easy to determine the per cent complete. If 1000 m of development are planned and 300 m have been done to date, then the activity is 30% complete. For efforts that are not so easily measured, special earning rules will need to be employed. One common rule is to report per cent complete according to completed milestones within the activity. For example, if the activity is the creation of a design drawing, progress might be reported as follows: 10% when the preliminary research and background study are completed, 20% when the drawing draft is completed and passed on to drafting, 40% when the first draft is printed, 50% when the first draft is reviewed, 60% when the

second draft is completed, 75% when the client review is completed, 90% when the final draft is completed and 100% when the drawing is issued for construction. The key in defining this kind of rule is that each “milestone” is discrete, and its achievement is easily recognised by such evidence as transmittal memos. A second common rule that is quite effective when the project has several thousand activities is to use the 50-50 rule. In this rule, each activity is considered 50% complete when its start date is reported and it is 100% complete when the activity finish date is reported. Reporting progress provides the basis for the Earned Value calculations.

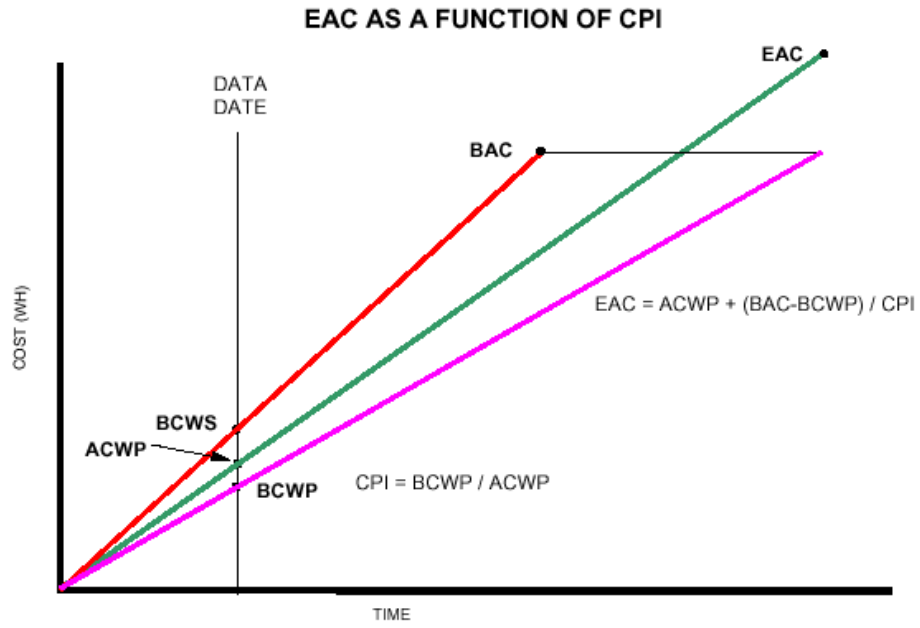
Enter the actual costs on the activities.

The second step in the periodic process is to enter the actual costs into the schedule. This information comes from the time sheets and invoices to the project.

The next step in the periodic process is to calculate the Earned Value and to print reports and plot charts for analysis.

The Earned Value is simply the per cent complete of an activity times its budget. This provides the key value in the Earned Value process. Other calculations include the schedule and cost variances, performance indices estimates at completion and per cent complete of the upper elements of the WBS.

The Schedule Variance (SV) is the Earned Value minus the planned budget for the completed work (BCWP-BCWS). Cost Variance (CV) is the Earned Value minus the actual cost (BCWP-ACWP). Performance indices are merely ratio expressions of the SV and CV. The Schedule Performance Index (SPI) is the Earned Value divided by the planned value (BCWP/BCWS). The Cost Performance Index (CPI) is the Earned Value divided by the actual cost (BCWP/ACWP). The Estimate at Completion (EAC) indicates where the project cost is heading. Calculating a new EAC is one of the great benefits of Earned Value.



Referring to the Figure above, assume a project is having some trouble meeting its cost goals. At the data date, the actual cost is greater than the planned cost for the completed work (ACWP > BCWP). If performance continues at the same trend, we can easily see that at completion the actual cost (EAC) far exceeds the budget (BAC). The simplest formula for arriving at the EAC at the time of the data date is:

This formula determines the unfinished or unearned work (BAC –BCWP) and divides it by the CPI. To that is added the sunk cost, or the cost of the completed work (ACWP). From this we can see that poor cost performance, a CPI less than 1, would result in an EAC that is greater than the BAC. One more calculation is noteworthy since it is specifically made possible by the use of Earned Value. That is the per cent complete at the upper levels of the WBS. While progress is typically recorded at the activity level of detail (the bottom of the WBS), those responsible for the project at higher levels of the WBS want to know the same kind of information as the “activity managers.” The process involves rolling up the data through the WBS. Budgets and actual costs are easy to roll up; simply add the values of the lower elements to get the value of the parent element. Analyse the data and write the performance narrative.

The final step in the Earned Value process is to analyse the data and report the results of the analysis.

5. RISK MANAGEMENT

Every project is exposed to Risk, which is a consequence of uncertainty and which can be either positive or negative. Managing risk is a fundamental part of project management in general and, more specifically in project cost control.

5.1 Risk Management

Risk Management is the systematic application of policies and procedures to the tasks of risk identification, risk analysis, risk assessment, management of the risk and monitoring of the risk. Risk management will not remove all risk from a project; its principal aim is to ensure that risks are managed most effectively.

Project Risk Management includes the processes concerned with identifying, analysing and responding to project risk. It includes maximizing the results of positive events and minimising the consequence, or implications, of adverse events.

The systematic application of risk management techniques result in more informed and well-considered project decisions which lead to an overall reduction in risk exposure for the project, and improve the probability of achieving the project goals.

Risk Management comprises of the following processes:

Risk Identification: determining which risks are likely to affect the project and documenting the nature and characteristics of each

Risk Assessment: evaluating risks and risk interactions (interrelationships between the various risks) to assess the range of possible outcomes

Risk Response (or action toward the risks): defining steps for exploiting opportunities (positive risk outcomes) or threats (negative risk outcomes)

Risk Response Control (risk monitoring, risk response planning): responding to changes in risk over the course of the project

These processes interact with each other as well as interacting with all the other project management processes and activities.

The table below gives an indication of some of the key questions that must be asked during the Risk Management activity of a project:

PHASE	KEY QUESTION
Establish the context	What are we looking at and why?
Risk identification	What could go wrong?
Risk analysis	What does that mean for the project?
Risk assessment	Which are the most important problems?
Risk treatment	How can they be managed?
Monitoring and review	How do we ensure they stay managed?

5.2. Typical Types of Risks

Financial Risks
Commodity Price
Exchange Rate
Interest Rate
Capital Efficiency
Operating Cost Efficiency
Safety, Health and Environment
Other
Employee performance
Industrial relations
Stakeholder relations
Legal and regulatory issues
Mineral resources and reserves
Licenses
Government and political issues
Technology
Information systems

5.3 Risk Identification

Risk identification is the process of identifying risks and their causes and determining what, how and why things may go wrong. The aim of the risk identification phase of the study is to identify and classify those risks that could impact on the project. The generation of a broad list of risks facing the project tends to facilitate structured thinking.

The accuracy of estimates increases as the project proceeds, but the major decisions are made early in the life of the project. So, despite the difficulties, a realistic estimate of the final cost and duration of the project is required as early as possible. It is then that all potential risks/uncertainties which can affect these estimates, and act as constrains to the project, should also be identified.

Risk identification should address both internal and external risks. Internal risks are things that the project team can control or influence, such as staff appointments, cost estimates and the selection/appointment of suppliers and contractors. External risks are things beyond the control or influence of the project team, such as market shifts, government or trade union action, etc.

Risks need to be identified for each of the key elements of the project and the following information should be documented.

A brief description of the risk
The critical success factors likely to be affected if the risk should occur.
The main phase within the project, or the main cost management activity in which the risk could occur.
An analysis of the likelihood of occurrence of the risk and the consequence if it, should it occur.
The individual assigned responsibility to manage the risk

Risk identification may be accomplished by identifying causes-and-effects (what could or might happen, and what will be the cause of this) or effects-and-causes (what results are to be avoided or encouraged and how might each occur).

The required input information for risk identification is:
The detailed description or scope of the project
Planning information:
WBS

Cost and duration estimates

Project Plan

Procurement and Cost Management Plan

Historical information:

Previous similar project histories or project audit reports

Commercial databases

Judgement of project team members

Specialist opinion

The output information (deliverables) from a risk identification process is usually in the form of:

5.4. The sources of risk.

Common sources of risk in a project are:

Scope changes

Poor timing for the project

Design errors or omissions

Misunderstandings in interpreting the scope of the project and its objectives

Poorly defined roles and functions of members of the project team

Insufficient or inadequate training

Lack of skills

Potential risk events, e.g.:

Development of new technology that might obviate the need for the project

Weather

Changing financial environments, e.g. increasing or decreasing interest rates, fluctuating foreign currencies

A change in government or changing government policies

Risk symptoms, also called 'trigger events', e.g.

Poor staff morale or apparent lack of motivation and focus

Poorly performing suppliers or contractors

5.5. Risk Assessment

The purpose of Risk Assessment is to quantify the effects on the project of the major risks that have been identified. It is the process of estimating the likelihood that things may go wrong and potential consequences for the objectives and critical success factors of the project. Risk assessment generates an initial assessment of the risks that can be followed by setting priority levels for the various risks.

Risk assessment can provide the following information:

An overview of the general level and pattern of risks facing the project

An indication of what high-priority risks are present

Short and longer-term action plans

Guidance on the allocation of resources

The methodology for performing a risk assessment ranges from simple qualitative methods to highly quantitative approaches.

Simple qualitative analysis uses direct descriptive scales for the likelihood and consequences of risks. This is particularly useful for initial studies. Likelihoods or probability factors can often be difficult for many people to estimate, and consequently many of the risks may not be able to be easily assessed and quantified in the early stages of the project. Alternative approaches use indicators or indirect measures instead of direct likelihood or probability estimates. Allocating numerical values to the descriptive scales can extend these forms of analysis. The numbers are then used to derive risk factors.

Quantitative methods use numerical scales for probability factors, rather than only narratives or descriptive scales and may also estimate distributions for consequences. These methods can also often be used with proprietary software packages such as '@RISK', which allows correlation and dependence to be included in the analysis.

Scenarios and Technical Analysis

Deriving various appropriate and relevant scenarios are often very useful for risk assessment. A scenario is a description of how a risk might arise, the effect of controls, the responses that might be implemented and their consequences. They can be very useful for analysing events outside of usual experience, and developing responses to them.

A variety of technical risk analysis methods are available for determining measures of probability and consequence (impact). It is important to select the most appropriate method for the issue being studied. Examples of such methods are HAZOPS, fault tree analysis, failure mode analysis, etc.

5.6. Risk Levels

A risk level, or risk factor, can be calculated by the product of the probability and the consequence (impact) if numerical values are available or have been estimated. Risk levels for simple qualitative probabilities and consequences can be determined from a purpose-designed matrix chart. A typical, simplified, risk assessment matrix chart is shown below:

Identified Risks	Probability (Likelihood) (0-1) (None →Certain)	Consequence (Impact) (1-3) (Low, medium, high)	Exposure (Probability X Consequence) (0-3) (Low, medium, high)

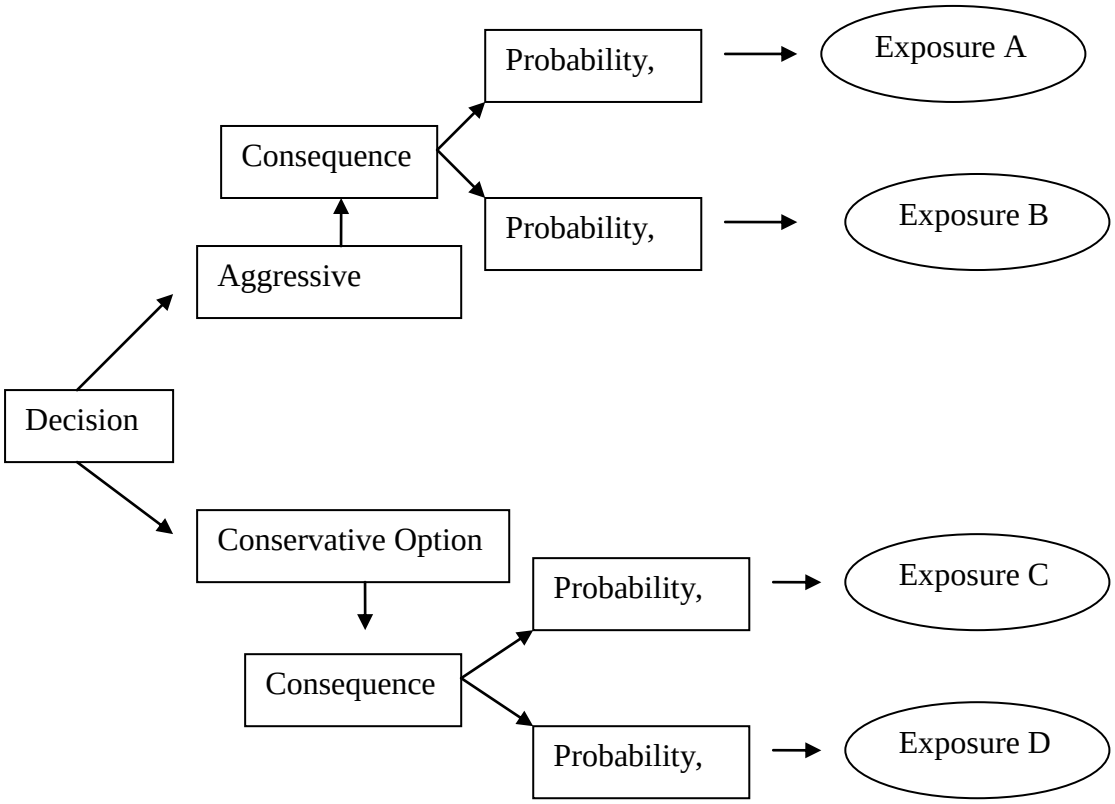
5.7. Other methods for Risk Assessment

Statistical Sums. These can be used to calculate a range of total project costs from the cost estimates for individual work items. The range of total project costs can be used to quantify the relative risk of alternative project budgets or proposal prices.

Simulation. Simulation uses a representation or model of a system to analyse the behaviour or performance of the system. The most common form of simulation on a project is schedule simulation using the project network as the model of the project. Most schedule simulations are based on some

form of Monte Carlo analysis. This technique 'performs' the project many times to provide a statistical distribution of the calculated risks.

Decision Trees. A decision tree is a diagram that depicts key interactions among decisions and associated chance events as they are understood by the decision-maker. The branches of the tree represent either decisions or chance events. A simplified example of a decision tree is given below.



Typical Decision Tree for Risk Assessment

5.8. Risk Response

Risk Response involves defining what steps are necessary to respond to the identified and evaluated risks that may influence the outcome of the project. This includes responding to opportunities (positive potential exposures) and to potential threats (negative or adverse potential exposures).

Responses to threats usually fall into one or a combination of 3 categories:

Avoidance. The specific threat is avoided, usually by eliminating its cause.

Mitigation. The expected exposure, usually in the form of a monetary value, is mitigated by taking steps to reduce the probability of the threat occurring. Examples are using alternative technology if the current technology is judged to be able to cause the expected risk or reducing the expected monetary loss by taking out appropriate insurance.

Acceptance. Accepting the consequences and exposure. Acceptance of a risk can be 'active', e.g. by developing a suitable contingency plan ('Plan B') or by accepting the potential monetary loss as a 'trade-off' against, say, a lower profit.

Selecting the Correct Risk Response Option

For each major and moderate risk evaluated the most appropriate response should be selected. This usually involves standard cost and/or value benefit trade-offs between the various responses in terms of potential benefits to be derived and the actual cost of implementation. The Risk Response options should be thoroughly reviewed in order to ensure that the assessment is consistent in its approach, assumptions and detail. Any actions for immediate implementation should be identified at this stage.

In selecting the best response, it is important to view any response from a total project perspective, so that the response selected will address similar risks within the various elements of the project. Responses may be implemented immediately or they could be implemented when a specific risk occurs, when risk indicators ('triggers') become critical or when a previously defined specific 'threshold' is attained.

Risk Response Action Plan

The Risk Response strategy should be fully documented in a Risk Response Action Plan that should include the following:

The identified and assessed risks, in terms of a detailed description of the risk, its potential exposure to (impact on) the project

The proposed responses to the risks, including options for avoidance, elimination or mitigation and a cost (value) benefit analysis for each option

Detailed action plans, including resources, responsibility and accountability matrices, implementation dates and timing, and proposed feedback action

5.9. Risk Management Plan

Risk identification, assessment and response forms part of the function of Project Risk Management, which is crucial to the successful conclusion of any project. Risk Management can be carried out on the project as a whole or on various aspects or during various phases of the project. In most cases, Risk Management is seldom carried out in isolation and all interrelating factors must always be considered.

In order to optimise the Risk Management function and process for any particular project it is necessary to formulate and develop a Risk Management Plan as a formal document to achieve the following objectives:

To place the project within the context in which the risk identification, assessment and response were carried out.

To provide a summary of the results of the risk identification, risk assessment (evaluation) and response

To detail the necessary action to manage the risks and to detail how the proposed action will be implemented

To describe what organisational and management structures and resources will be required to implement the action plans

To detail how the execution of the proposed action plans will be monitored and how the necessary communication will be effected

The Risk Management Plan should never be viewed as a static document but rather as a document that reflects the current judgement regarding the potential project risks that might be subject to continual change as risks are reduced or changed or as the scope or nature of the project might change.

Three important aspects need to be considered:

Risk management should be a regular agenda item for project meetings and use should be made of a punch list of major risks requiring attention. As these risks are resolved or change, the contents of the list should be updated.

Regular audits of the risk management plan should be conducted to ensure compliance with required responses.

The application of risk management techniques should commence with the pre-feasibility study and continue through the life of the project, and be maintained through the operational life of the venture.

5.10. Contents of a Risk Management Plan

A Risk Management Plan should consist of:

Project Information
Project description
Project scope, major issues, stakeholders and objectives
Criteria and critical success factors

Project Risks

List of identified risks
Assessment and evaluation
Consequences and exposures
Priority listing of risks: major, moderate and minor

Risk Response Action

Risk Action Plans

Implementation and Monitoring
Organisation and management
Functions and responsibilities
Planning and scheduling
Review and evaluation plan
Proposed process to revise the Risk Management Plan if necessary

5.11. SUMMARY OF RISK MANAGEMENT

Forward-looking view	Thinking toward tomorrow, identifying uncertainties, anticipating potential outcomes. Managing project resources and activities while anticipating uncertainties.
Open communication	Encouraging free-flowing information at and between all project levels. Enabling formal, informal, and impromptu communication. Using processes that value the individual voice (bringing unique knowledge and insight to identifying and managing risk).
Integrated management	Making risk management an integral and vital part of project management. Adapting risk management methods and tools to a project's infrastructure and culture.
Continuous process	Sustaining constant vigilance. Identifying and managing risks routinely through all phases of the project's life cycle.
Shared product vision	Mutual product vision based on common purpose, shared ownership, and collective communication. Focusing on results.
Teamwork	Working cooperatively to achieve a common goal. Pooling talents, skills, and knowledge.

TOPIC 4

PROJECT COST MANAGEMENT PLANNING TASKS

LEARNING OUTCOMES
Students should be able to: ■ identify and explain the various components of the total cost of a project. ■ discuss the various estimating techniques may be used to predict a project's resource requirements quickly and accurately. ■ collate estimates into an appropriate estimating format. ■ make provision for contingencies and escalation in making cost estimates. ■ explain the purpose of a cost baseline.

CONTENTS

READING
Recommended reading ► **Burke, R. (2009) Project management techniques. 1st Edition. China: Burke Publishing. pp 84-103** ► **Kerzner, H. (2006) Project Management: A systems approach to planning, scheduling, and controlling. 9th Edition. New Jersey: John Wiley & Sons, Inc. pp 633-635** ► **Schwalbe, K. (2009) Introduction to Project Management. 2nd Edition. Boston: Course Technology Cengage Learning. pp 147-152**

1. INTRODUCTION

According to Schwalbe (2009:147) project cost management includes the processes that are needed to ensure that a project team completes the project within the approved budget. Project cost management comprises two main planning tasks viz. cost estimating and cost budgeting. Cost estimating involves approximating or estimating the costs of resources required to complete a project. Cost budgeting involves the allocation of the overall cost estimate to individual tasks over time to establish a baseline for measuring performance.

2. PROJECT COST ESTIMATING

If a project manager wants to effectively plan and control a project, accurate estimating is vital. According to Burke (2009:84) the quality and accuracy of the estimate can be continually improved as the project is progressively executed, as more accurate and detailed information comes to the fore. However, the project manager is often forced to do a cost estimate at the tender or quotation stage when the amount of data and information is usually limited.

Burke (2009:88) subdivides project cost estimates as follows:

- Direct costs
- Indirect costs
- Fixed and variable costs
- Time related costs
- Labour costs
- Material and equipment costs
- Transport costs
- Preliminary and general (P&G) costs
- Project office costs
- Project team costs

Burke (2009:88) elaborates on these costs as follows:

2.1 Direct costs

As explained in topic 1, direct costs are costs that can be specifically identified with an activity or project. The trend nowadays is to assign as much costs as possible to direct costs since direct costs can be budgeted, monitored, and controlled more effectively than indirect costs.

Direct costs for a project may include the following:

Table 3-1

Direct management costs	Project office running costs. Includes salaries for the project manager, project engineer, planner, accountant, secretary and QA.
Direct labour costs	People working on an activity e.g. boilermakers, welders, fitters, computer programmers, etc.
Direct material costs	Materials, consumables, components which are used for completing an activity and an allowance for scrap and wastage.
Direct equipment costs	Refers to machinery, plant, and tools.
Direct expenses	Include bought-in services that are specific to the project e.g. plant hire, surveyor, designer, and subcontractor fees.

2.2 Indirect costs/Overheads

These are costs that cannot be directly assigned to an activity or project, but are needed to keep the company operational. They may include the following:

Table 3-2

Indirect management costs	Refer to senior managers, the estimating department, sales and marketing, accounts, IT, general office staff, secretarial, administration, and the personnel department.
Indirect labour costs	Refer to reception, maintenance, security, and cleaners.
Indirect materials	Include stationery, cleaning materials, and maintenance parts.
Indirect equipment	Includes computers, photocopiers, and fax machines.
Indirect expenses	Include training, insurance, depreciation, rent, and taxes.

2.3 Fixed and variable costs

These concepts were explained in topic 1. Costs such as rent and certain overheads are fixed and are independent of the number of units made. However materials, transport, and resource costs relate directly to the number of units made and are therefore variable costs.

2.4 Time related costs

One needs to examine what would happen if a project's duration is reduced or extended – how will costs change? To do this one must determine how costs are impacted by time. Consider

the following:

- Rent increases with time.
- Running costs such as water and electricity increase with time.
- If a project's duration is shortened, employee labour rate would increase if workers have to work overtime.
- Contract employees wages paid at a fixed rate are not affected by time, but if they work long hours their productivity may be reduced.
- Fixed price contracts are usually unaffected by time.

2.5 Labour costs

The labour costs considered in this section are for the project workforce and is thus a direct cost. Salaries are not the only costs associated with labour. The following costs are also included:

- Pension contributions
- Medical aid contributions
- Annual bonus
- Productivity bonus
- Training courses
- Protective clothing
- Car allowance
- House allowance
- Tool allowance

If all these costs are added (say, for the month), then the labour rate is calculated by dividing the total labour cost by the number of man-hours worked for the month. If work days are lost through sick leave, public holidays, training courses, idle time, and inclement weather, then this would reduce the number of man-hours worked.

Calculations and greater details relating to labour are covered in topic 5 (paragraph 3).

2.6 Procurement costs

Procurement costs to acquire all the goods and services required should be calculated. The easiest way is to add a percentage to the purchase price to cover all the procurement costs.

Table 3-3 below shows possible procurement costs:

Table 3-3

Department	Scope of work	Cost
Drawing office	Bill of materials, specification	
Buying office	Source of suppliers and vendors	
Quality department	Prequalify suppliers	
Buying office	Tender cycle, adjudication, and selection	
Planning office	Procurement schedule	
Buying office	Place order, expedite	
Quality department	Goods inwards inspection	
Warehouse	Material handling, inventory, and stock control	
Accounts department	Pay invoices	
Production	Scrap waste	
Shareholders	Profit	
Total costs		

$$\text{Procurement percentage} = \frac{\text{Procurement costs}}{\text{Total cost of materials}} \times 100$$

The procurement costs are generally applied to all company projects. Percentages are usually between 10% and 20%.

2.7 Transport costs

One must consider the fact that additional costs may be incurred to deliver goods from the suppliers' factories to the client's premises. The following terms are used in connection with transport:

- **Ex-works**: It is the responsibility of the purchaser to organise and pay for delivery, loading, transport, and insurance from the factory gate.
- **Free on board (FOB)**: The supplier arranges for goods to be loaded on board a ship, plane, train, or truck at an agreed place. While the supplier pays for port duties and export clearances, the client has the responsibility for transport, insurance, and any import duties.
- **Cost, Insurance and Freight (CIF)**: The supplier is responsible for the delivery of the goods to their final destination plus the insurance. The client is liable for the import duties.

- **Delivered Duty Paid (DDP)**: The responsibility for all risks and costs relating to transport, insurance, and duty lies with the seller. The goods will be delivered to the purchaser's door.

2.8 Project management office costs (PMO)

The project management office costs not only include the management fee, but also many other related costs. Table 3-4 shows examples of project office costs:

Table 3-4

Cost breakdown structure		Cost
Project teams salary	Project manager	
	Project engineer	
	Project planner	
	Project accountant	
	Procurement manager	
	Quality manager	
	Configuration manager	
	Project estimator	
	Project secretary	
Project office costs	Rent, water, electricity	
	Office equipment	
	Stationery	
	Telephone, Internet	
Travel	Accommodation, meals, carpool	
	Air flights	
Security	Reception, guards	
Training	Project management, TQM, computer skills	
Marketing	Entertaining clients	
Total costs		

2.9 Preliminary and general (P&G) costs

If the project necessitates work on site, on location, or away from the office, then these costs are done separately and are referred to as P&G's in the construction industry. The following headings would be used in a typical construction project:

- Site establishment
- Site supervision
- Insurance and performance bonds
- Plant hire, equipment, cranage, tools, vehicles, and generators
- Site establishment, huts, toilets, and fencing
- Site security – night watchman and dogs
- Site services including telephone, electricity, and water
- Temporary access roads and sign posts
- Scaffolding and ladders
- Temporary lights and power supply
- Accommodation for the workforce
- Special travelling expenses to site
- Special training and testing of tradesmen
- Material handling including receiving inspection, off-loading, storage, and inventory control
- Removal of rubbish, waste, and scrap

3. ESTIMATING METHODOLOGY

According to Burke (2009:96) various estimating techniques may be used to predict the project's parameters and resource requirements quickly and accurately. These include

- Jobbing
- Factoring
- Inflation
- Economies of scale
- Unit rates

The estimating techniques used by commerce and industry must be agreed to as the rules and procedures can vary a great deal from company to company. Burke (2009:96) elaborates on the five estimating techniques (listed above) as follows:

3.1 Jobbing (or Job costing or Operational costing)

It is the process of including all the operations that are required for an activity or task. Table 3-5 below provides an example of a job that is subdivided into its component parts:

Table 3-5

Task	Description	Labour	Materials	Plant hire	Transport	Total
100	Mark-out foundations	R2 000	R1 000			R3 000
200	Dig foundations	R10 000	R1 000	R2 000	R1 000	R14 000
300	Lay foundations	R6 000	R20 000	R6 000	R4 000	R36 000

Once the activity has commenced, job costing enables the progress to be quantified:

- It provides a cost estimate for all Work Breakdown Structure (WBS) packages and activities.
- Progress can be measured in terms of percentage complete or duration remaining.
- The profit or loss can be calculated when the activity is complete.

During tender stage there may not be sufficient time or need to produce an estimate with this level of detail. We therefore need to examine other estimating techniques that are quicker to produce a reasonable accurate estimate.

3.2 Factoring (or Component ratio or Parametric method)

This technique can be used when data stored from previous projects indicates than an item of the project may be expressed as a percentage of a known or calculated core cost. Table 3-6 below provides an example:

Table 3-6

Management fee	6% of contract price
Quality assurance	2% of contract price
Engine beds	3% of engine costs
Pipe work	18% of generator costs
Consumables	12% of material costs
Profit	25% of construction price

Once core costs are in place, the associated ratios can be calculated very quickly.

3.3 Inflation (or Time based indices)

One cannot ignore the effects of inflation on project costs. If a current project is similar to one done a few years ago, the financial figures for the previous project may be used as the basis for the current estimate. Table 3-7 illustrates an example of this:

Table 3-7

	2010	2011		2012	
	Base cost	Inflation rate	New price	Inflation rate	New price
Labour	R250 000	10%	R275 000	8%	R297 000
Material	R200 000	15%	R230 000	5%	R241 500
Total	R450 000	12.22% average	R505 000	6.63% average	R538 500

One of the problems with this method is that different commodities escalate at different rates. This problem can be addressed by using a separate escalation factor for each cost component, as is evident in Table 3-7.

3.4 Economies of scale (or Cost capacity factor)

If a job is twice as large as the previous one, the question is whether it will cost twice as much. The answer is that it usually will not, for the following reasons:

- **Indivisibility:** There may be certain indivisibilities (or fixed costs) in the production process that are not related to output e.g. manager, telephone, secretary etc. These costs are indivisible since one cannot have part of a manager if one wants to operate at a lower output.
- **Specialisation:** In small enterprises people have to do a variety of tasks but as the business grows, work is grouped and repetitive tasks are assigned to one person. This improves efficiency.
- **Technical:** Large scale production enables enterprises to benefit from the use of automated machinery. The high capital expenditure is divided over large production runs, thereby reducing the cost per unit.
- **Scaling:** The relationship between dimensions and volumes is not always linear e.g. the surface area on an oil tanker increases at two-thirds the rate of the volume. A tanker thus requires proportionally less steel per cubic metre of cargo as it increases in volume.
- **Diseconomy of scale:** It often happens that as output increases, the organisation structure becomes large and bureaucratic. As a result co-ordination between the management departments become increasingly more complex, costly, and inefficient.

3.5 Unit rates (or Parameter costs)

Although each project is unique, a lot of the work may be repetitive. Parameter costs are developed from unit rates for common items of work associated with previous projects. Table 3-8 shows some parameters:

Table 3-8

Type of rate	Scope of work	Unit rate
Per linear metre	Piping, wiring, welding, textiles	
Per square metre	Decorating, painting, house building	
Per cubic metre	Concrete, water supply	
Per tonne	Ship building, cargo freight	
Per KW	Power, electrical supply, install a generator	
Per KM	Transport	
Per day	Plant hire, car hire	
Per hour	Labour	
Per minute	Fashion garment construction	

In a controlled work environment unit rates work well. Unit rates are probably the most commonly used estimating technique as they provide a simple contract to measure and budget.

4. ESTIMATING FORMAT

The final estimate involves compiling figures from various sources. These must now be presented in a coherent summary document or budget. Tables 3-9, 3-10, and 3-11 are examples of estimating formats (Burke, 2009:100):

Table 3-9

Work Breakdown Structure (WBS)	Description	Budget
1.1		
1.2		
1.3		
1.4		
1.5		
Project management fee		

Sub-total		
Profit		
Total		

In Table 3-9 above the WBS work packages form the main structure of the estimate. In Table 3-10 below, the columns are subdivided into different types of costs as described in paragraph 3.1 earlier.

Table 3-10

WBS	Labour	Material	Machinery	Transport	Total
1.1					
1.2					
1.3					
1.4					
1.5					
PMO costs					
P&G costs					
Sub-total					
Profit					
Total					

Table 3-11 show how costs are subdivided into the different estimating methods discussed in paragraph 3.

Table 3-11

WBS	Jobbing	Factoring	Inflation	Economy of scale	Unit rates
1.1					
1.2					
1.3					
1.4					
1.5					
PMO costs					

P&G costs					
Sub-total					
Profit					
Total					

5. CONTINGENCIES AND ESCALATION

Normal working conditions and practices do not always prevail. Provision must be made for risks and uncertainties. These allowances are grouped together under the heading **contingencies**. Burke (2009:102) provides the following examples:

- Under-estimating work content owing to lack of scope definition.
- Additional work caused by design errors.
- Rework caused by production mistakes.
- Labour and equipment standing idle due to inclement weather and import delays.
- Lost production due to industrial action, strikes, or go slow.
- Limited supply of skilled labour locally.

A contingency allowance is usually added to either each work package or to the project as a whole. The estimating format may be revised as follows:

Table 3-12

WBS	Description	Budget	Contingency	Total
1.1				
1.2				
1.3				
1.4				
1.5				
PMO costs				
P&G costs				
Sub-total				
Contingency				
Profit				
Total				

During periods of high inflation Burke (2009:103) recommends that long term projects must consider the time value of money. An **escalation** clause would then be included in the quotation. The mechanics are this clause are:

- The contractor and the client should agree on an escalation index to use.
- The contract quotes the present day prices with no provision for inflation.
- Progress claims are escalated using published indices.

6. COST BUDGETING AND COST BASELINE

According to Schwalbe (2009:151) project cost budgeting involves the allocation of project cost estimate to tasks over time. These tasks are based on the work breakdown structure (WBS) for the project. WBS is a grouping of the work involved in a project that defines the total scope of the project. The WBS is thus a required input into the cost budgeting process.

The main aim of cost budgeting is to produce a **cost baseline**. A cost baseline may be defined as a time-phased budget that project managers use to measure and monitor cost performance. Estimating costs for each major project activity over time provides project managers and top management with a foundation for project cost control using **earned value management** (described in topic 8).

According to Kerzner (2006:634) the cost baseline is just one part of the cost breakdown. The cost baseline comprises all the cost accounts or work packages. The contractual cost to complete a project is the sum of the cost baseline and management reserve, if a management reserve exists. The contract price then is the contract cost plus the profit.

7. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

7.1 Using labour as an example, distinguish between direct costs and indirect costs.

7.2 If a project's duration is reduced or extended, will all costs change? Explain.

7.3 Labour rate per hour is calculated by dividing the basic salary by the number of hours worked. Is this correct? Explain.

7.4 Some companies determine their procurement costs using a percentage. How is this percentage calculated?

7.5 Explain the following terms used in connection with transport costs:

7.5.1 Ex-works

7.5.2 Free on board

7.5.3 CIF

7.5.4 DDP

7.6 The project management office costs not only include the project team's salary, but also many other associated costs. Provide examples of some of these costs.

7.7 P&G's is an abbreviation commonly used in the construction industry. Explain what is meant by it and provide some examples.

7.8 Discuss some of the major estimating techniques that may be used to provide a reasonably accurate estimate of costs for a project.

7.9 Provide an estimating format that you would use with columns indicating the different types of costs.

7.10 Why is it necessary to make provision for contingencies and escalation in quotations?

7.11 What is a cost baseline, and what types of costs does it include?

SOLUTIONS

7.1 **Direct costs** are costs that can be specifically identified with an activity or project e.g. boilermakers, welders, and fitters are people who work on an activity. **Indirect costs** are costs that cannot be directly assigned to an activity or project, but are needed to keep the company operational e.g. receptionists and security staff are not directly involved in a project's activity.

7.2 No. Not all costs are time related. Costs like rent, water, and electricity increase with time but costs like fixed price contracts are unaffected by time.

7.3 No. One must also add other labour associated costs to the basic salary e.g. pension and medical contributions, allowances for housing, tools and subsistence, bonuses, protective clothing, training, etc.

7.4 $$\text{Procurement percentage} = \frac{\text{Procurement costs}}{\text{Total cost of materials}} \times 100$$

7.5 Refer to paragraph 2.7

7.6 Project office costs e.g. rent, water, electricity, office equipment, stationery, telephone; travel costs such as air flights, accommodation and meals; security, training and marketing.

7.7 Refer to paragraph 2.9

7.8 Refer to paragraph 3.

7.9 Refer to Table 3-10 in paragraph 4.

7.10 Provision is made for contingencies since normal working conditions and practices is not always guaranteed. Allowances must be made for risks and uncertainties otherwise the company may stand to lose a lot. During periods of high inflation the time value of money must be considered for long term projects. An escalation clause in the quotation is necessary to offset increases in costs due to inflation.

7.11 A cost baseline is the approved time-phased budget against which project execution is compared and deviations are measured for management control. A cost baseline comprises both direct and indirect costs.

TOPIC 5

FINANCING OF THE PROJECT

LEARNING OUTCOMES
Students should be able to:
■ explain the various means of finance are available to meet the costs of a project.
■ identify the key business considerations in choosing the means of finance.

CONTENTS

READING

Recommended reading

- **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited. pp. 121-123**
- **Dempsey, A. and Pieters, H.N. (2005) Introduction to Financial Accounting. 5th Edition. Durban: LexixNexis Butterworths. pp125**
- **Marshall D.H., Mcmanus W.W. and Viele D.F. (2007) Accounting: What the numbers mean. 7th Edition. New York: McGraw-Hill. pp 250**
- **Turner, J.R. and Simister, S. (2004) Project Management: A Comprehensive Handbook. 1st Edition. New Delhi: Gower Publishing Limited. pp. 547-550**
- **Sarwate, D.M. (2004) Entrepreneurship Development and Project Management. 1st Edition. Pune: Everest Publishing House. pp. 107-112**

1. INTRODUCTION

Finance is necessary for all projects. A project cannot progress without financial resources. Turner and Simister (2004:547) state that the nature and amount of financing required during different phases of the project vary greatly. In most projects the rate of expenditure changes significantly as the project moves from the appraisal stage, where mainly human expertise and analytical skills are used, to the design stage, then to manufacture and finally to the operational phase.

In project financing, it is the future cash flow that becomes the basis for acquiring resources to invest in the project. The project finance team has the responsibility to package this cash flow in a manner that meets the needs of the project and at the same time is attractive to potential organisations and individuals willing to provide resources to the project for investment. To achieve this objective effectively, a thorough knowledge of the various means of finance is essential.

2. MEANS OF FINANCE

Various means of finance are available to meet the costs of the project. These include share capital, debentures, mortgage bonds, secured and unsecured liabilities and miscellaneous sources.

2.1 Share capital

Share capital is obtained by selling shares to the public. The maximum number of shares that a company is authorised to issue is called the authorised share capital. Companies usually register an authorised share capital that is larger than what is needed at the time. The shares that are actually sold are called the issued share capital. Unsold shares are called unissued or reserve capital.

Preference shares and ordinary shares

Preference shares and ordinary shares are main classes of shares in a public company.

Preference shares provide holders of them with a fixed percentage dividend. These shareholders have preferential rights to dividends over other shareholders and in respect of claims in the event of liquidation. Dividends are declared if sufficient profits are available.

Ordinary shares only qualify for dividends once preference shareholders have been paid. The share in the profit varies and depends on the availability of profits and the amount of dividend approved. It is possible for a company to buy back its own shares.

2.2 Debentures

Public companies are entitled to raise capital by issuing debentures. A debenture is a long-term loan (non-current liability) and is redeemed at the end of its term. Debentures therefore do not form part of the share capital. Debentures are often secured by a first mortgage over the property of the company. Debenture holders receive a fixed percentage interest usually paid annually to them. The interest on debentures is an expense and is taken into account when the profit is calculated.

2.3 Mortgage bond

When land and buildings are purchased and are financed by borrowing, a special loan called a **mortgage bond** is taken. If it is taken with a bank, the bank will register a bond over the land and buildings (fixed property). If the property is sold before the bond is settled, the bank has a preferential claim to the proceeds. If the conditions of the bond are violated (e.g. through non-payment of the loan), the bank has the right to sell the property and use the proceeds to settle the amount owing to it. The rest of the proceeds goes to the owner of the property.

2.4 Secured and unsecured liabilities

Liabilities, according to Dempsey and Pieters (2005:125), may be defined as claims made against the assets of a business. If these claims are **secured** it means that the creditor enjoys priority over the proceeds of the asset according to law. Mortgage bonds (discussed above) and instalment sale agreements are examples of secured loans. In the case of instalment sale agreements, whilst the buyer has full use of the asset, it may be repossessed if the buyer fails to make payments according to the agreement.

In the case of **unsecured** liabilities, the creditor does not enjoy any priority or preference to the proceeds of the sale of a debtor's assets, if the debtor fails to repay the loan as per agreement.

2.5 Miscellaneous sources

Project finance may also come from miscellaneous sources like venture capital as well as leasing and hire purchase finance. Sarwate (2004:111) states that venture capital is ideal for

promoters who have good projects but lack margin money. **Venture capital** is not a loan but is profit-sharing on a mutually agreed basis for a period. With **lease** agreements the ownership of the asset rests with the finance company (lessor) for the duration of the lease period. The user (lessee) usually pays a fixed monthly lease rental. **Hire purchase** finance usually involves paying a deposit for the asset with the balance as well as finance charges paid in instalments over a period of time.

3. KEY BUSINESS CONSIDERATIONS IN CHOOSING THE MEANS OF FINANCE

According to Chandra (2004:123) AND Gitman (2014), the key business considerations in choosing the means of finance are cost, risk, control and flexibility.

3.1 Cost

Generally, the cost of borrowed funds is less than the cost of equity funds. The main reason for this is that the interest payable on borrowed capital is a tax-deductible expense but the dividend payable on equity capital is not.

3.2 Risk

The main sources of risk for a project are business risk and financial risk. **Business risk** emanates from fluctuations in profit before interest and taxes and arise largely through changes in demand and variability of costs and prices. **Financial risk** represents the risk arising from financial leverage. According to Marshall et al. (2007:250) financial leverage refers to the difference between the rate of return earned on assets (ROI) and the rate of return earned on Equity (ROE). This difference results from the fact that the interest on debt is usually a fixed percentage, which is not a function of ROI. Thus if an enterprise can borrow funds at an interest rate of 12% and use that money to purchase assets on which it earns a return greater than 12%, then the owners will get a greater return on their investment (ROE) than if they had provided all the funds themselves. If an enterprise earns a lower ROE than the interest rate on borrowed funds, financial leverage will be negative and the ROE will be less than the ROI. Financial leverage adds risk to the enterprise because if the enterprise does not earn enough to pay the interest on its debt, the creditors will eventually force the enterprise into bankruptcy.

3.3 Control

The issue of control is important for the promoters of a project. They usually prefer a financing scheme that enables them to maximise their control over the operations of the enterprise given their commitment of funds to the project.

3.4 Flexibility

This refers to the ability of the enterprise to obtain additional capital from any source for future financing needs. This means that the enterprise does not exhaust its borrowing capacity. It must therefore maintain reserve borrowing powers so that it can raise borrowed capital for unforeseen future needs.

Turner and Simister (2004:552) advise that the skilled use of finance at fixed rates should be adopted to minimize risks. They also add that finance should be acquired over the long term to eliminate the refinancing risk.

Sarwate (2004:107) add that the following factors should also be considered when choosing the means of finance:

- The amount required
- Availability and limitations, if any
- Legal requirements involved

4. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

4.1 In which ways are preference shares different from ordinary shares?

4.2 Briefly describe the various means of financing a project.

4.3 One of the means of financing is leasing. Explain some possible:

4.3.1 advantages of leasing fixed assets

4.3.2 disadvantages of leasing fixed assets

4.4 Discuss financial leverage as a key business consideration in choosing the means of finance.

SOLUTIONS

4.1

Preference shares provide holders of them with a fixed percentage dividend. For ordinary shares the share in the profit varies and depends on the availability of profits and the amount of dividend approved.

The preference shareholders have preferential rights to dividends over ordinary shareholders.

The preference shareholders have preferential rights over ordinary shareholders in respect of claims in the event of liquidation.

4.2 Refer to paragraph 2.

4.3

4.3.1 Advantages of leasing

- Lease payments are tax deductible.
- Restrictive clauses like maintaining a certain level of liquidity (that loan agreements often include) are usually not included in lease agreements.
- The problem of the asset becoming obsolete to passed on to the lessor.

4.3.2 Disadvantages of leasing

- The cost of purchasing a fixed asset is usually less than the total of all lease payments.
- The lessee loses the benefit of a residual value at the end of the lease agreement.
- Lessees are not usually allowed to make improvements to leased land and buildings.

4.4 **Financial risk** represents risk arising from financial leverage. According to Marshall et al.

(2007:250) financial leverage refers to the difference between the rate of return earned on assets (ROI) and the rate of return earned on Equity (ROE). This difference results from the fact that the interest on debt is usually a fixed percentage, which is not a function of ROI. Thus if an enterprise can borrow funds at an interest rate of 12% and use that money to purchase assets on which it earns a return greater than 12%, then the owners will get a greater return on their investment (ROE) than if they had provided all the funds themselves. If an enterprise earns a lower ROE than the interest rate on borrowed funds, financial leverage will be negative and the ROE will be less than the ROI. Financial leverage adds risk to the enterprise because if the enterprise does not earn enough to pay the interest on its debt, the creditors will eventually force the enterprise into bankruptcy.

TOPIC 6

COST OF PRODUCTION

LEARNING OUTCOMES
Students should be able to:
■ valuate materials issue to production using the FIFO and AVCO methods.
■ calculate direct labour cost from stated information.
■ identify the various factory overhead costs and distinguish between those that are fixed and those that are variable.
■ calculate the total cost of production.

CONTENTS

READING
Recommended reading
► **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited. pp 124-127** ► Niemand, A.A., Meyer, L., Botes, V.L. and van Vuuren, S.J. (2004) Fundamentals of Cost and Management Accounting. 5th edition. Durban: Lexisnexis Butterworths. pp 45-48; 66-70; 82-86

1. INTRODUCTION

The estimated production expected from the project must be determined. Chandra (2002:124) observes that the estimated production will depend largely on the estimated sales. Using the estimated production, the cost of production can be calculated. The main components of the cost of production are:

- Material cost
- Labour cost
- Factory overhead cost

2. MATERIAL COST

Material is an important component of the cost of manufacturing a product. We have learnt from topic 1 that material cost may be divided into direct materials and indirect materials. The purchase price of materials is often subject to constant change. These changes could be through the effects of inflation, shortages in supply, unstable markets etc. Materials need to be valued for **two purposes** viz:

To determine the value of materials issued to production
(affects cost of production).
To determine the value of the materials on hand (inventory valuation).

According to Niemand et al. (2004:45) various methods are used to value inventory. These include the first-in-first-out method (FIFO), last-in-first-out method (LIFO), the weighted average cost method (AVCO) and the market price method. The LIFO method is usually not allowed when calculating profit for tax purposes and will therefore not be discussed.

2.1 First-in-first-out method (FIFO)

This method values material issued to production in the order in which it was received. It is based on the premise that material that is received first is issued first (to avoid losses due to deterioration or obsolescence). The following example explains the application of the FIFO method:

Example 1

The following transactions of BNM Ltd are expected to take place during April 20.6 in respect of a component to be used in project D:

April		
01	Purchase from supplier	90 units at R10 per unit
07	Issue to production	50 units
10	Purchase from supplier	160 units at R11 per unit
17	Issue to production	30 units
20	Purchase from supplier	60 units at R12 per unit
24	Issue to production	60 units

Required

Using the FIFO method, calculate the expected issue price to production and the value of closing inventory.

	Purchases			Issues			Balance		
Date	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount
01							90	10	900
07				50	10	500	40	10	400
10	160	11	1 760				40 160	10 11	400 1 760
17				30	10	300	10 160	10 11	100 1760
20	60	12	720				10 160 60	10 11 12	100 1 760 720
24				10 50	10 11	100 550	110 60	11 12	1 210 720

2.2 Weighted average cost method (AVCO)

When using the AVCO method, all issues of material and inventory of material are valued at the average price. This average price is re-calculated each time materials are purchased from suppliers. When materials are purchased the quantity and monetary value is added to the previous stock balance and a new average unit price is available for additional issues of

materials. If prices fluctuate greatly, AVCO method provides a good option for dealing with this. For a time all products will be charged at a uniform rate for the same material. However, the disadvantage of this method is that the average price may be fictitious and not be related to the market price.

The following example explains the application of the AVCO method:

Example 2

Required

Refer to the information used in example 1. Using the AVCO method, calculate the expected issue price to production and the value of closing inventory.

	Purchases			Issues			Balance		
Date	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount
01	90	10	900				90	10	900
07				50	10	500	40	10	400
10	160	11	1 760				200	10,80	2 160
17				30	10,80	324	170	10,80	1 836
20	60	12	720				230	11,11	2 556
24				60	11,11	667	170	11,11	1 889

REMARKS

The weighted average per unit for the 10th is calculated as follows:

- (400 + 1 760) ÷ (40 + 160)

  2 160 ÷ 200

  R10,80
- The stock issued on the 7th, 17th and 24th are issued at the latest weighted average per unit.
- The weighted average per unit for the 20th is calculated as follows:

  (1 836 + 720) ÷ (170 + 60)

  2 556 ÷ 230

  11,113043 or R11,11

2.3 Market price method

This method uses the current market price to determine the price at which materials are issued for production.

3. LABOUR COST

Labour may be described as the physical and mental effort of employees in the manufacturing process. Labour costs, as discussed in topic 1, can be divided into direct labour (work that is directly related to the production of goods) and indirect labour (work that is not directly related to the production of goods). Direct labour costs form part of the primary (direct) cost of production while indirect labour forms part of the overhead costs.

Before we go on to the calculation of direct labour cost, let us examine some of the methods of remunerating employees and the terminology used in labour costing.

According to Niemand et al (2004:66) employees may be remunerated by using any of the following methods:

Employees may be paid a fixed salary irrespective of the number of hours worked or the quantity of work done.

Employees may be paid an hourly rate. The amount an employee earns depends on the number of hours worked.

Employees may be paid for the work that he/she has performed (piecework) and not according to the time taken to do the work. The employer thus pays only for work that has been done.

The following terms are used in connection with labour costs:

Normal time refers to remuneration employees receive for working during normal working hours (e.g. 45 hours per week).

Overtime is the remuneration employees receive for work done beyond normal working hours.

Idle time refers to time that is lost because of machine breakdown, power cuts, materials not available etc. Idle time is usually not regarded as an overhead.

Gross wage is the total remuneration (normal time, overtime, bonus etc) before any deductions are made.

Net wage is the gross wage less deductions (e.g. pension, medical aid, income tax etc).

Pension fund is a fund that employees contribute to in order to receive remuneration

(pension) when they retire. The employer may also contribute to the fund on behalf of the employees.

Income tax is a compulsory deduction payable to the state. The employer deducts the money according to the "Pay As You Earn" (PAYE) system.

Unemployment insurance fund is a fund that employees contribute to in order to receive remuneration when they become unemployed. The employer also contributes to the fund on behalf of the employees.

Medical aid fund is a fund employees contribute to in exchange for having their medical expenses (up to certain limits) paid from the fund. The employer may also contribute to the fund on behalf of the employees.

The following example will be used show how direct labour cost is calculated.

Example 2

The following information applies to Mrs J. Tladi, an employee of Dermat Ltd, who is paid weekly. Calculate the labour cost in respect of Mrs J. Tladi as well as the labour rate per hour.

Normal working hours (6 days)		45 hours
Number of hours worked		51 hours
Monday		8 hours
Tuesday		8 hours
Wednesday		9 hours
Thursday		9 hours
Friday		8 hours
Saturday		5 hours
Sunday		4 hours
Normal hourly rate		R20
Overtime:	Normal working week	1½ times normal rate
		double normal rate
		7,5%
Pension fund (calculated on normal pay):		6%
	Employee's deduction	
	Employer's contribution	1% of normal pay

Unemployment insurance fund (UIF):	1% of normal pay
Employee's deduction	15% of taxable income
Employer's contribution	
Income tax (PAYE)	

Solution

	R
Normal pay (45 hours X R20)	900
Overtime:	
2 hours X R20 X 1,5	60
4 hours X R20 X 2	160
Gross wage	1 120
Pension contributions (employer)	54
UIF contributions (employer)	9
Direct labour cost	1 183

$$\text{Labour rate per hour} = \frac{\text{R1 183}}{\text{51 hours}}$$

= R23.20 per hour

3. MANUFACTURING/FACTORY OVERHEAD COST

According to Niemand et al. (2004:82) factory/manufacturing overheads include indirect materials, indirect labour and all other costs incurred during the manufacturing process that cannot be directly traced to the product. In other words in includes all costs excluding direct material and direct labour that are incurred during the production process. Apart from indirect materials and indirect labour, manufacturing overheads include rent (of the factory floor space), insurance (of the factory assets), depreciation of production machinery, electricity, water, repairs and maintenance etc. Since costs behave differently to output, they may be classified as fixed or variable.

Fixed costs are those costs that remain the same irrespective of the level of output or activity e.g. rent. **Variable costs** are those costs that change in proportion to the changes in the level of output or activity e.g. packing material. Some costs e.g. water contain a fixed component (a

fixed monthly charge) plus a variable component (additional charged based on usage). These costs may be termed semi-variable.

By dividing each overhead item into its fixed or variable elements, predicting the expected production volume for the project accurately and paying attention to economic trends, a fairly reliable estimate of overheads can be made.

4. TOTAL PRODUCTION COST

Total production/manufacturing cost is the sum of the direct material cost, direct labour cost and factory overhead costs. It can also be represented as follows:

	Direct material cost
+	Direct labour cost
+	Fixed factory overheads
+	Variable factory overheads
=	Total production cost

5. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

5.1 The following transactions of CAN Manufacturers are expected to take place during June 20.6 in respect of a raw material M321 used in project F:

June		
01	Opening inventory	2 000 units at R30 per unit
08	Issue to production	1 600 units
11	Purchase from supplier	1 800 units at R31 per unit
18	Issue to production	1 900 units
21	Purchase from supplier	2 000 units at R32 per unit
25	Issue to production	1 400 units

Required

Use the FIFO method and weighted average cost methods to complete the tables below that include the expected issue price to production and the value of closing inventory.

FIFO

	Purchases			Issues			Balance		
Date	Quantity	Price	Amt	Quantity	Price	Amount	Quantity	Price	Amount

WEIGHTED AVERAGE COST METHOD

	Purchases			Issues			Balance		
Date	Quantity	Price	Amt	Quantity	Price	Amount	Quantity	Price	Amount

5.2 Dube is employed by Restonic Manufacturers The following details relate to him for the third week of June 20.6.

	Hours worked
Sunday	3
Monday	10
Tuesday	8
Wednesday	8
Thursday	8
Friday	8
Saturday	5

Additional information

1. The income tax (PAYE) deduction is 18% of the taxable income.
2. The unemployment insurance fund deduction is 0,9% of the normal wages. The employer contributes the same amount as the employee to the fund.
3. The employee's deduction for medical aid amounted to R150 for the week. The employer contributes 1,5 times the amount the employees pay to the fund.
4. Employees are remunerated at R24 per hour during normal working hours.
5. Contributions to the pension fund is calculated on the normal time and is made up as follows:
   Employee's deduction 7,5%
   Employer's contribution 11,25%
6. The normal working week is from Monday to Friday for 8 hours per day. Any time worked in addition to this on weekdays and Saturdays is overtime calculated at 1½ times the normal rate. Overtime on Sundays is remunerated at double the normal rate.

7.

Required

Calculate the direct labour cost in respect of Dube for the third week of June 20.6, as well as the labour rate per hour.

5.3 The basic monthly salary of John for March was R5 000. Of the 31 days in March, Saturdays and Sundays made up 8 days. John's normal working day is 8 hours and his normal working week is Monday to Friday. There was one public holiday in March which fell on a Thursday. Mark was also sent for training on the last Friday of the month. John's employer, MN Enterprises, made the following contributions in respect of John for March:

Pension	8% of the basic salary
Medical aid	R500
Training course	R300
Tool allowance	R100
Productivity bonus	R400

Required

Calculate the labour rate per hour in respect of John for March.

5.4 The following information relates to the product expected to be produced from the new project M during May 20.6:

Number of units to be manufactured	9 000
Number of units expected to be sold (at R540 per unit)	7 200
Direct materials cost per unit	R90
Direct labour cost per unit	R180
Variable manufacturing overheads per unit	R90
Variable selling cost per unit	R20
Fixed manufacturing overhead cost	R450 000
Fixed selling and administrative cost	R180 000

Required

Calculate the expected total cost of production for May 20.6.

SOLUTIONS

5.1

FIFO

	Purchases			Issues			Balance		
Date	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount
01							2 000	30	60 000
08				1 600	30	48 000	400	30	12 000
11	1 800	31	55 800				400 1 800	30 31	12000 55 800
18				400 1500	30 31	12 000 46 500	300	31	9 300
21	2 000	32	64 000				300 2 000	31 32	9 300 64 000
25				300 1 100	31 32	9 300 35 200	900	32	28 800

WEIGHTED AVERAGE COST METHOD

	Purchases			Issues			Balance		
Date	Quantity	Price	Amount	Quantity	Price	Amount	Quantity	Price	Amount
01							2 000	30	60 000
08				1 600	30	48 000	400	30	12 000
11	1 800	31	55 800				2 200	30,82	67 800
18				1 900	30,82		300	30,82	9 245
21	2 000	32	64 000				2 300	31,85	73 245
25				1 400	31,85	44 584	900	31,85	28 661

5.2

		R	
Normal pay (40 hours X R24)		960,00	
Overtime:			
	7 hours X R24 X 1,5	252,00	
	3 hours X R24 X 2	144,00	
Gross wage		1 356,00	
Pension contributions		108,00	(R960 X 11,25%)
Medical aid contributions		225,00	(R150 X 1,5)
Unemployment insurance contributions		8,64	(R960 X 0,9%)
Direct labour cost		1 697,64	

Labour rate per hour = $\frac{\text{R1 697,64}}{\text{50 hours}}$

= R33.95 per hour

5.3

	R
Basic salary	5 000
Pension (R5 000 X 8%)	400
Medical aid	500
Training course	300
Tool allowance	100
Productivity bonus	400
Direct labour cost	6 700

Labour rate per hour = $\frac{\text{R6 700}}{\text{168 hours}}$ [(31-8-1-1) X 8 hours]

= R39,88 per hour

5.4

	R	
Direct material cost	810 000	(9 000 X R90)
Direct labour cost	1 620 000	(9 000 X R180)
Fixed factory overheads	450 000	
Variable factory overheads	810 000	(9 000 X R90)
Total production cost	3 690 000	

TOPIC 7

FINANCIAL ESTIMATES AND PROJECTIONS

LEARNING OUTCOMES
Students should be able to: ■ identify and describe the purpose of the statements used to determine financial estimates and projections. ■ prepare a cash budget for a project. ■ determine the expected profitability of a project by preparing a Projected Statement of Comprehensive Income. ■ show the expected effect of a project on the Statement of Financial Position of an enterprise.

CONTENTS

READING
Recommended reading
► **Burke, R. (2006) Project management: Planning and control techniques.5th Edition. China: Burke Publishing. pp 195 - 203** ► **Niemand, A.A., Meyer, L., Botes, V.L. and van Vuuren, S.J. (2004) Fundamentals of Cost and Management Accounting. 5th edition. Durban: Lexisnexis Butterworths. pp 546 - 548**

1. INTRODUCTION

Once the sales revenue and costs of production have been estimated, the next step is to do financial estimates and projections. This involves largely the preparation of a cash budget and projected financial statements. A cash budget shows the expected receipts and payments relating to the project as well as the expected closing bank balance each month. Financial statements report on the financial position of an organisation at a certain point in time and the changes in the financial position over a period of time. The statements and what they are intended to report on are illustrated below:

STATEMENT	REPORTS ON:
Cash budget	Expected receipts and payments each month.
Statement of Comprehensive Income	Profit for a particular period.
Statement of Financial Position	Financial position on a certain date.

2. CASH BUDGET

According to Niemand et al. (2004:546) the cash budget of the project will show the **expected receipts and expected payments** for a certain period of time. In other words it shows the flow of money in and out of the project. It usually depicts the monthly cash position of the project. The cash budget is prepared for the purpose of cash planning and control. It can help in identifying possible cash shortages.

Note that a cash budget only involves amounts that affect the cash balance of the enterprise. Therefore **non-cash items** such as depreciation, bad debts, discount allowed and discount received are not included. Since budgets are used internally by an enterprise, the style may vary from business to business. However, **most cash budgets have the following features**:

- The budget period is broken down into sub-periods usually months.
- Receipts of cash are identified and totalled.
- Payments of cash are identified and totalled.
- The surplus (or shortfall) in cash for each month is calculated (receipts minus payments).
- The closing cash balance is calculated by taking into account the cash surplus (or shortfall) and the opening cash balance.

According to Burke (2006:197) the cash in and out of the project's account may not be the same as the sales figures or expenses for the month because of the timing of payments. The following are examples of cash flow timings:

Part-payment with placement of order for materials.

Stage payments for items that may be completed over many months.

Immediate payment on purchase.

Monthly payments for salaries and wages, rent, telephone etc.

Thirty days to ninety days credit.

Another way of looking at the above cash flow timings is as follows:

Salaries and wages are usually paid in the month in which they are incurred.

Material purchases may vary from up-front purchases, cash on delivery (COD), to 30 to 90 days credit.

Plant-hire costs may be paid within 30 days to 90 days after delivery.

Revenue from customers could be up-front payment, cash on delivery or stage payments.

It is therefore necessary to compile a monthly creditors' and debtors' schedule. The project accountant has the responsibility to follow up on overdue payments.

Let us consolidate the above information by means of an example.

Example 1

Use the following information that relate to Mubeen Enterprises Ltd to draw up a Cash budget for the period 01 January to 30 June 20.9:

1.1 Cash in the bank on 01 January 20.9 is R50 000.

1.2 All the products produced each month are sold in the same month.

Actual sales and expected sales at R100 per unit are as follows:

Actual (20.8):	Units
November	1 000
December	1 500

Expected (20.9):	Units
January	1 600
February	900
March	500
April	1 200
May	1 300
June	1 400

1.3 Fifty percent of sales are on credit and customers pay 2 months after the sale. The balance of the sales is for cash.

1.4 Manufacturing overheads are expected to be R3 000 per month and are paid in the month in which they are incurred.

1.5 Labour costs amount to R10 per unit and are paid in the month that it is incurred.

1.6 Materials cost R20 per unit. The materials used for the goods that are sold each month must be replaced by the end of the same month. All materials are purchased on credit and suppliers allow one month credit.

1.7 A loan was negotiated with BN Bank and an amount of R200 000 is expected to be deposited into the banking account on 02 January 20.9.

Expected loan repayments (20.9):

February	R14 000
April	R16 000
May	R15 000
June	R2 000

1.8 Interest on loan amounting to R15 000 is expected to be paid on 30 June 20.9.

1.9 Selling costs and Administrative costs are expected to be paid as follows:

	Selling costs	Administrative costs (R)
20.9	(R)	
January	1 000	12 500
February	4 000	12 500
March	4 000	12 500
April	4 000	12 500
May	4 000	12 500
June	4 000	12 500

1.10 Preliminary expenses relating to the project are expected to paid during January 20.9, R10 000.

1.11 Machinery is expected to be purchased for cash on 3 January 20.9, R80 000. Depreciation on factory plant and machinery is expected to amount to R2 000 per month. Depreciation on other fixed assets is expected to amount to R2 500 per month.

1.12 Income tax payable to South African revenue services on 30 June 20.9 is expected to be R87 290.

Before examining the solution, attempt the exercise yourself. Complete the budget one step at a time.

Step 1: Use the following format and examine all the column headings and row details.

Mubeen Enterprises Ltd

Cash budget for the period 01 January to 30 June 20.9

	January	February	March	April	May	June
Cash receipts						
Cash sales						
Receipts from debtors						
Total receipts						
Cash payments						
Total payments						
Cash surplus(deficit)						
Bank: opening balance						
Bank: closing balance						

Step 2: Enter the amounts for expected cash sales. Cash sales equal 50% of sales. The cash sales for January amount to R80 000 (1 600 units X R100 X 50%). The cash sales for the remaining months will follow the same type of calculation.

Step 3: The receipts from debtors in January will come from 50% of the sales in November because customers pay 2 months after the sale. The credit sales for November is R50 000 (1 000 units X R100 X 50%). Enter this amount in the "Receipts from debtors" cell. The receipts

from debtors for the remaining months will follow the same type of calculation.

Step 4: The manufacturing overhead costs are R3 000 per month throughout the duration of the project. Enter this in the first line under "Cash payments".

Step 5: Labour expense is paid in the month of use. The labour expense for January is R16 000 (1 600 units X R10). Enter this under "Cash payments" as Labour cost for January and follow the same procedure for the other months.

Step 6: The payment for material for January will be for the purchases made in December since the suppliers allow one month credit. The payment for material for January will be R30 000 (1 500 X R20). Enter this under "Cash Payments" as Payments to suppliers for January. Follow the same procedure for the other months.

Step 7: The amount of the loan that was negotiated with BN Bank must be entered as a Cash Receipt and the R200 000 must be entered in the January column only. The expected loan repayments are given and should be entered under "Cash payments" for each of the four months for which payments are due to be made. In addition, the interest on loan must be recorded as an expected payment for June only, R15 000.

Step 8: Selling costs and administration costs are expected to be paid in the month in which they are incurred. Enter the amounts in respect of these costs for each month in two separate lines.

Step 9: Enter the expected payment for preliminary expenses for January only, R10 000.

Step 10: Enter the expected payment for machinery for January only, R80 000. Note that depreciation is a non-cash item and is therefore not entered in the Cash budget.

Step 11: Enter the income tax payable for June only, R87 290.

Step 12: Insert the bank balance on 01 January 20.9 in the "Bank: opening balance" cell for January.

Step 13: Calculate and enter the total Cash Receipts expected for January (R330 000).

Step 14: Calculate and enter the total Cash Payments expected for January (R152 500).

Step 15: Calculate and enter the expected cash surplus (or shortfall) for January: R330 000 – R152 500 = R177 500 surplus.

Step 16: Add the expected cash surplus for January (R177 500) to the opening bank balance for January (R50 000). The expected closing bank balance for January is now recorded viz. R227 500.

Step 17: The opening bank balance for February is the same as the closing bank balance for January.

Remaining steps: Repeat these calculations for each month of the project. Note that if there is a negative cash flow, this is indicated by bracketing the amount e.g. (R100). A negative cash flow should be avoided or financed by borrowing especially using an overdraft facility.

The solution to example 1 is as follows:

Exhibit 1

Mubeen Enterprises Ltd

Cash budget for the period 01 January to 30 June 20.9

	January	February	March	April	May	June
Cash receipts						
Cash sales	80 000	45 000	25 000	60 000	65 000	70 000
Receipts from debtors	50 000	75 000	80 000	45 000	25 000	60 000
Loan	200 000	-	-	-	-	-
Total receipts	330 000	120 000	105 000	105 000	90 000	130 000
Cash payments						
Overhead costs	3 000	3 000	3 000	3 000	3 000	3 000
Labour costs	16 000	9 000	5 000	12 000	13 000	14 000
Payments to suppliers	30 000	32 000	18 000	10 000	24 000	26 000
Loan repayments	-	14 000	-	16 000	15 000	2 000
Interest on loan	-	-	-	-	-	15 000
Selling costs	1 000	4 000	4 000	4 000	4 000	4 000
Administration costs	12 500	12 500	12 500	12 500	12 500	12 500
Preliminary expenses	10 000	-	-	-	-	-
Equipment	80 000	-	-	-	-	-
Income tax	-	-	-	-	-	87 290
Total payments	152 500	74 500	42 500	57 500	71 500	163 790
Cash surplus(deficit)	177 500	45 500	62 500	47 500	18 500	(33 790)
Bank: opening balance	50 000	227 500	273 000	335 500	383 000	401 500
Bank: closing balance	227 500	273 000	335 500	383 000	401 500	367 710

3. PROJECTED STATEMENT OF COMPREHENSIVE INCOME

The projected Statement of Comprehensive Income will report on the expected profit (or loss) from the project over a certain period of time e.g. one year. It reflects the expected revenue (sales) from the project and then deducts the expenses incurred in generating that revenue.

Following on from the figures used in example 1, the projected Statement of Comprehensive Income (exhibit 2) of Mubeen Enterprises appears below:

Exhibit 2

Mubeen Enterprises Ltd

Projected Statement of Comprehensive Income of for the six months ended 30 June 20.9

		(R)
Sales		690 000
Manufacturing cost		(249 000)
	Direct material	138 000
	Direct labour	69 000
	Manufacturing overheads	18 000
	Depreciation: Factory plant and machinery	24 000
Gross profit		441 000
Other costs		(121 000)
	Selling cost	21 000
	Administrative cost	75 000
	Depreciation: Other	15 000
	Preliminary expenses	10 000
Operating profit		320 000
Interest expense		(15 000)
Profit before tax		305 000
Income tax		(87 290)
Profit after tax		217 710

The statement commences with expected **sales**. Sales reflect the amount an entity expects to earn through selling products that it is to manufacture as a result of the project. Sales is calculated as follows:

(1 600 + 900 + 500 + 1 200 + 1 300 + 1 400 units) X R100 = 6 900 units X R100

= R690 000

Manufacturing cost (see topic 5) is the sum of the direct materials (6 900 units X R20), direct labour (R16 000 + R9 000 + R5 000 + R12 000 + R13 000 + R14 000), manufacturing overheads (R3 000 X 6 months) and depreciation of factory plant and equipment (R2 000 X 12). Depreciation is reported as a separate item as it does not involve the payment of cash.

Gross profit (also called gross margin) is the difference between sales revenue (R690 000) and manufacturing cost (R249 000). **Other costs** are the costs of resources used as part of the operating activities and are not directly associated with the goods manufactured from the project. When preparing the projected Statement of Comprehensive Income, each expense is shown as a separate item instead of being grouped together as selling costs and distribution costs.

Operating profit is the difference between the gross profit and other costs.
Selling costs, according to Chandra (2004:130) include:
Commission payable to dealers
Packing and forwarding charges
Salaries of sales staff
Advertising and sales promotion expenses
Other miscellaneous expenses
Selling costs are 1 000 + R4 000 + R4 000+ R4 000 + R4 000+ R4 000 = R21 000

Administration costs include:
Salaries of the administration staff
Directors' remuneration
Electricity
Postage, fax, internet and telephone
Office supplies e.g. stationery, printing
Insurance
Rates and taxes on office property
Other miscellaneous expenses
In the Projected Statement of Comprehensive Income, administration costs are calculated as follows:
R12 500 X 6 months = R75 000

Depreciation: Other (R2 500 X 6 months) includes depreciation on furniture, equipment and vehicles required by the sales and administration departments. **Preliminary expenses** (explained in topic 3) are usually amortised (expensed) over a period of time. **Interest expense** is disclosed separately on the face of the Statement of Comprehensive Income as

finance costs. Many users of financial statements would be interested in the interest expense as it represents an obligation that must be honoured. The greater the interest expense an entity incurs, the greater the risk will be to shareholders on their investment in the project. **Profit before tax** is the difference between income from project and interest expense. **Income tax** is levied on the company's taxable income as per the relevant income tax legislation of the country. **Profit after tax** is the difference between the profit before tax and income tax. The dividends payable to shareholders depends on this amount.

4. PROJECTED STATEMENT OF FINANCIAL POSITION

A Statement of Financial Position is a financial statement that reflects the financial position of an enterprise at a given point in time. It reports on the assets, equity and liabilities of an enterprise. The following is a simplified format of a Statement of Financial Position:

Exhibit 3

STATEMENT OF FINANCIAL POSITION

ASSETS

Non-current assets

Property, plant and equipment

Current assets

Cash and cash equivalents

Accounts receivable

Inventories

EQUITY AND LIABILITIES

Equity

Ordinary share capital

Retained earnings

Non-current liabilities

Long-term debt

Current liabilities

Accounts payable

Continuing with the information from example1 and subsequently the Cash budget and Forecast Statement of Comprehensive Income, let us examine what the projected Statement of Financial Position would look like. First, however, let us assume that the amounts in the Statement of Financial Position prior to the budgeted period i.e. on 31 December 20.8 are as follows:

Mubeen Enterprises Ltd

Extract of Statement of Financial Position on 31 December 20.8

	R
Property, plant and equipment	400 000
Cash and cash equivalents	50 000
Accounts receivable	125 000
Inventories	60 000
Accounts payable	30 000
Long-term debt	150 000
Ordinary share capital	420 000
Retained earnings	35 000

Exhibit 4

Mubeen Enterprises Ltd

Projected Statement of Financial Position on 30 June 20.9

ASSETS		
Non-current assets		441 000
	Property, plant and equipment (400 000 + 80 000 – 39 000)	441 000
Current assets		562 710
	Cash and cash equivalents	367 710
	Accounts receivable	135 000
	Inventories	60 000
Total assets		1 003 710
EQUITY AND LIABILITIES		
Equity		672 710
	Ordinary share capital	420 000
	Retained earnings (35 000 + 217 710)	252 710
Non-current liabilities		303 000
	Long-term debt (150 000 + 200 000 – 47 000)	303 000
Current liabilities		28 000
	Accounts payable	28 000
Total liabilities and equity		1 003 710

Explanatory notes

Property, plant and equipment include land, buildings, machinery, vehicles, equipment etc that are used for productive purposes. It is calculated as follows:

R400 000 (balance) + R80 000 (purchase) – R24 000 (depreciation)

– R15 000 (depreciation) = R441 000

Cash and cash equivalents includes cash kept at the bank in various accounts (except investment accounts that mature after 12 months) as well as in the business (e.g. petty cash and cash float). In the example above, the bank balance is obtained from the cash budget (June column).

Accounts receivable includes mainly the amount owing by debtors. In the example above, debtors pay two months after sale. It is therefore expected that on 30 June, the credit sales for May (1 300 X R100 X 50% = R65 000) and June (1 400 X R100 X 50%) = R70 000) would be outstanding (R135 000 = R65 000 + R70 000).

Inventories refer to stock of items e.g. materials on hand. In the example above, the materials that are used each month has to be replaced. This means that the inventory level of R60 000 would be maintained at the start of each month.

Ordinary share capital refers to the amount invested by the shareholders in the company. In the example above, this balance remains unchanged. **Retained earnings** refer to profits (after tax) earned by the company that have not been distributed to the shareholders as dividends. In the example above, retained earnings are calculated as follows:
R35 000 + R217 710 (profit after tax) = R252 710

Long-term debt refers to borrowings where the repayment period exceeds one year. In the example above, the long-term debt was increased by the R200 000 new loan but also decreased by the expected repayments during February, April, May and June. The new balance is calculated as follows:
R150 000 + R200 000 – (R14 000 + R16 000 + R15 000 + R2 000) = R303 000

Accounts payable includes mainly the amount owing to creditors. In the example above, creditors are paid after one month. The credit purchases for June (1 400 units X 20 = R28 000) will therefore outstanding on 30 June 20.9.

The total assets must always be equal to total liabilities and equity.

5. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

5.1 Consider the following project of Dladla Enterprises that comprise only the following three activities viz. material, labour and transport. The costs are incurred when the work is performed but the cash flow depends on the timing of the income and expenses. The timing of the expenses are shown below:

Expenses	March (R)	April (R)	May (R)	Cash flow information
Material (delivered to workshop)	8 000	10 000	-	Supplier gives one month credit
Labour	-	5 000	12 000	Pay in the month of use
Transport to site	-	-	4 000	Pay one month before work is performed

The income from the client is a 40% mark-up of the expenses for each month and is received one month after the work is performed.

Required

Draw up a Cash budget of Dladla Enterprises for the period 01 March to 30 June 20.7. **Note**: For the month of June, only the receipts are required.

5.2

The following information relate to Kaunda Enterprises.

1.1 Cash in the bank on 01 January 20.9 is R50 000.

1.2 All the products produced each month are sold in the same month. The selling price per product is R200. The monthly total sales are as follows:

Actual (20.8):	R
December	150 000
Expected (20.9):	R
January	140 000
February	100 000
March	80 000

1.3 Sixty percent of sales are on credit and customers pay 30 days after the sale. The balance of the sales is for cash.

1.4 Manufacturing overheads, which are paid monthly, are expected to be R10 000 for March and are expected to increase by 10% each month thereafter.

1.5 Labour costs amount to R20 per unit and are paid in the month that it is incurred.

1.6 Materials cost R25 per unit. The materials used for the goods that are sold each month must be replaced by the end of the same month. Fifty percent of materials are purchased on credit and the firm pays one month after purchase. The balance of the purchases is for cash.

1.7 A loan for R300 000 negotiated with Ben Bank is expected to be deposited into the banking account on 10 January 20.9. An amount of R50 000 is expected to be repaid on 28 February 20.9. Interest rate is 18% p.a. and is paid monthly.

1.9 Selling costs and Administrative costs are paid monthly and are expected to be R10 000 and R20 000 respectively for January 20.9. Both these costs are expected to increase by 2% each month.

1.10 Preliminary expenses relating to the project are expected to paid during January 20.9, R20 000.

1.11 Machinery is expected to be purchased for cash on 3 January 20.9, R240 000. Depreciation on factory plant and machinery is calculated at 10% p.a. on cost. Depreciation on other fixed assets is expected to amount to R3 000 per month.

1.12 Income tax payable to South African Revenue Services is R21 706 on 31 March 20.9 and will be paid on 30 June 20.9.

REQUIRED

Prepare the Cash budget of Kaunda Enterprises for the period 01 January 20.9 to 31 March 20.9.

5.3 Refer to the information provided in question 5.2

REQUIRED

Prepare the Forecast Statement of Comprehensive Income of Kaunda Enterprises for the period 01 January to 31 March 20.9

5.4 Use the information from question 5. 2 as well as the information below to draw up the Projected Statement of Financial Position of Kaunda Enterprises as at 31 March 20.9.

Information

Kaunda Enterprises

Extract of Statement of Financial Position on 31 December 20.8

	R
Property, plant and equipment	450 000
Cash and cash equivalents	50 000
Accounts receivable	90 000
Inventories	40 000
Accounts payable	9 375
Ordinary shares	600 000
Retained earnings	39 375

SOLUTIONS

5.1

Dladla Enterprises

Cash budget for the period 01 March to 30 June 20.9

	March	April	May	June
Cash receipts				
Receipts from client	0	5 600	21 000	22 400
Total receipts	0	5 600	21 000	22 400
Cash payments				
Material	0	8 000	10 000	
Labour	0	5 000	12 000	
Transport	0	4 000	0	
Total payments	0	17 000	22 000	
Cash surplus(deficit)	0	(11 400)	(1 000)	
Bank: opening balance	0	0	(11 400)	
Bank: closing balance	0	(11 400)	(12 400)	

Explanatory notes:

1. No receipts or payments are expected for March.
2. Material for each month is paid one month later. Thus the material purchase for March (R8 000) will be paid in April and so on.
3. Labour expense is paid in the month of use.
4. Transport for May is paid in April as payment is required one month in advance.
5. The income for March is based on the expenses (not payments) for March and is collected in April (one month after the work is performed). The total expense for March is R4 000. A mark-up of 40% (R4 000 X 40% = R1 600) means that the income is expected to be R5 600 (R4 000 + R1 600). This amount will be collected in April.

   The expense for April is R15 000 (R10 000 + R5 000). A mark-up of 40% is added (R15 000 X 40% = R6 000). The expected income for April is R21 000 and will be collected in May.

   The expense for May is R16 000 (R12 000 + R4 000). A mark-up of 40% is added (R16 000 X 40% = R6 400). The expected income for May is R22 400 and will be collected in June.

5.2

Kaunda Enterprises

Cash budget for the period 01 January to 31 March 20.9

	January	February	March
Cash receipts			
Cash sales	56 000	40 000	32 000
Receipts from debtors	90 000	84 000	60 000
Loan	300 000	-	-
Total receipts	446 000	124 000	92 000
Cash payments			
Manufacturing overheads	10 000	11 000	12 100
Labour costs	14 000	10 000	8 000
Cash purchase of materials	8 750	6 250	5 000
Payments to creditors	9 375	8 750	6 250
Loan repayment	-	50 000	-
Interest on loan	4 500	4 500	3 750
Selling costs	10 000	10 200	10 404
Administrative costs	20 000	20 400	22 440
Preliminary expenses	20 000	-	-
Machinery	240 000	-	-
Total payments	336 625	121 100	67 944
Cash surplus(deficit)	109 375	2 900	24 056
Bank: opening balance	50 000	159 375	162 275
Bank: closing balance	159 375	162 275	186 331

Explanatory notes:

1. **Cash sales** are 40% of total sales.
2. Cash is collected from debtors in the month following the sale. Also credit sales are 60% of total sales. Thus the **cash expected from debtors** in January is 60% of the sales of December 20.8. A same pattern is followed for the other months.
3. **Manufacturing overheads**: February figure is 10% (i.e. R1 000) more than January. March figure is 10% more (i.e. R1 100) than the February amount.

4. **Labour costs** are R20 per unit. The number of units manufactured is calculated by taking the sales amount each month and dividing by the unit price of R200. The number of units produced and thus labour costs are:

   January R140 000 ÷ R200 = 700 units X R20 = R14 000

   February R100 000 ÷ R200 = 500 units X R20 = R10 000

   March R80 000 ÷ R200 = 400 units X R20 = R8 000

5. **Material costs** are also based on the number of units produced. Material costs per month are therefore:

   December 750 units X R25 = R18 750 (50% is paid in January)

   January 700 units X R25 = R17 500 (50% is cash; 50% is paid in February)

   February 500 units X R25 = R12 500 (50% is cash; 50% is paid in March)

   March 400 units X R25 = R10 000 (50% cash)

6. **Interest on loan** is calculated monthly on the loan balance of R300 000 for January and February and on the decreased balance of R250 000 (due to the repayment) for March. Interest on loan amounts are therefore:

   January R300 000 X 18% X 1/12 = R4 500

   February R300 000 X 18% X 1/12 = R4 500

   March R250 000 X 18% X 1/12

7. Selling and administrative costs for February will be 2% more than the January figure and the March figure is 2% more than the February amount.

8. Depreciation is a non-cash expense and is thus not reflected in the cash budget. The income tax payable will not be paid during the budgeted period.

5.3

Kaunda Enterprises

Projected Statement of Comprehensive Income of for the three months ended 31 March 20.9

		R
Sales		320 000
Manufacturing cost		(111 100)
	Direct material	40 000
	Direct labour	32 000
	Manufacturing overheads	33 100
	Depreciation: Factory plant and machinery	6 000
Gross profit		208 900
Other costs		(122 444)
	Selling cost	30 604
	Administrative cost	62 840
	Depreciation: Other	9 000
	Preliminary expenses	20 000
Operating profit		86 456
Interest expense		(12 750)
Profit before tax		73 706
Income tax		(21 706)
Profit after tax		52 000

Explanatory notes:

1. **Sales** = R140 000 + R100 000 + R80 000 = R320 000
2. **Direct material** = R17 500 + R12 500 + R10 000 = R40 000
3. **Direct labour =** R14 000 + R10 000 + R8 000 = R32 000
4. **Manufacturing overheads** = R10 000 + R11 000 + R12 100 = R33 100
5. Depreciation on factory plant and machinery = R240 000 X 10% X 3/12 = R6 000
6. **Selling costs** = R10 000 + R10 200 + R10 404 = R30 604
7. **Administrative cost** = R20 000 + R20 400 + R22 440 = R62 840
8. **Depreciation: Other** = R3 000 X 3 months = R9 000
9. **Interest on loan** = R4 500 + R4 500 + R3 750 = R12 750

Kaunda Enterprises

Projected Statement of Financial Position on 31 March 20.9

ASSETS		
Non-current assets		675 000
	Property, plant and equipment (450 000 + 240 000– 15 000)	675 000
Current assets		274 331
	Cash and cash equivalents	186 331
	Accounts receivable	48 000
	Inventories	40 000
Total assets		949 331
EQUITY AND LIABILITIES		
Equity		672 625
	Ordinary share capital	600 000
	Retained earnings (20 625 + 52 000)	72 625
Non-current liabilities		250 000
	Long-term debt	250 000
Current liabilities		26 706
	Accounts payable	5 000
	South African Revenue Services: Income tax	21 706
Total liabilities and equity		949 331

Explanatory notes

Property, plant and equipment is calculated as follows:

R450 000 (balance) + R240 000 (purchase) – R6 000 (depreciation) – R9 000 (depreciation) = R441 000

Cash and cash equivalents refers to the bank balance that is obtained from the cash budget (March column).

Accounts receivable: Debtors pay one month after sale. It is therefore expected that on 31 March, the credit sales for March would be outstanding (R80 000 X 60% = R48 000).

Inventories: The materials that are used each month have to be replaced. This means that

the inventory level of R40 000 would be maintained at the start of each month.

Ordinary shares remain unchanged.

Retained earnings are calculated as follows:

R20 625 + R52 000 (profit after tax) = R72 625

Long-term debt was created by a new loan of R300 000 but also decreased by the expected repayment during February (R50 000). The new balance is thus R250 000.

Accounts payable: Creditors are paid after one month. The credit purchases for March (400 units X R25 X 50% = R5 000) will therefore outstanding on 31 March 20.9.

Once again check that the total assets are equal to total liabilities and equity.

Master Budget Worked Example

A food manufacturer makes two products, "Tip" and "Top" from raw material "X" and "Y".

The following relates to the 2004 budget

Raw materials: X R2 Per Kg

Raw materials: Y R1 Per Litre

Direct Labour: R4 Per Hour

Note: Factory overheads are apportioned on a basis of direct labour hours

The anticipated stock levels for 2004 are as follows:

	X	Y	Tip	Top
	Kg	Litres	Units	Units
Closing Stock	10 000	5000	200	500
Opening Stock	12000	8000	500	1000

There is no opening stock of work in process and the closing stock is minimal and is therefore excluded.

	Tip	Top
Expected Sales	10000 Units	20000 Units
Selling Price per unit	R150	R210
The composition of the finished product is as follows:		
X	15Kg	25Kg
OL	10 Litres	20 Litres
Direct Labour	12 Hours	18 Hours

Based on the anticipated level of business activity, the following factory overheads will have to be incurred:

Variable	R640380
Fixed	R246300

Required:

Draw up the following:

Sales Budget

Production Budget

Direct Materials Purchases Budget

Direct Labour Expenses Budget

Factory Overheads Budget

Closing Stock Budget

Cost of Sales Budget (The opening stock of finished goods is estimated at R120000)

Answer

	TWO PRODUCTS				
			Tip	Top	
	Sales Budget				
	Sales in units		10000	20000	
	Selling price		R 150.00	R 210.00	
	Total Sales	5,700,000	R 1,500,000.00	R 4,200,000.00	
	Production Budget		Tip	Top	
	Budget Sales in units		10000	20000	
	Add: Close Finished		200	500	
	Less: Open Finished		500	1000	
	Production Needed		9700	19500	

Direct Material Usage X		Tip	Top
Required production		9700	19500
X usage (kg/unit)		15	25
Total kilogram Usage	633000	145500	487500
X Price (R2/kg)		R 2.00	R 2.00
Total X usage price	R 1,266,000.00	R 291,000.00	R 975,000.00
Direct Material Use Y		Tip	Top
Required production		9700	19500
Y usage (L/unit)		10	20
Total kilogram usage	487000	97000	390000
Y Price (R1/litre)		R 1.00	R 1.00
Total OL usage price	R 487,000.00	R 97,000.00	R 390,000.00
Total usage X and Y	R 1,753,000.00	R 388,000.00	R 1,365,000.00

	Direct material purchases budget		Raw material	Raw material
			X	OL
NB Note:	Direct material usage:		633000	487000
	Add: close stock:		10000	5000
	Less: open stock :		12000	8000
	Direct material needed:		631000	484000
	Direct material price		R 2.00	R 1.00
	Cost raw material needed to be purchased	R 1,754,000.00	R 1262000	R 484,000.00
	Labour expense budget		Tip	Top
	Units produced		9700	19500
	Hours needed/unit		12	18
	Labour rate R4/hr		R 4.00	R 4.00
	Total Labour Cost	R 1,869,600.00	R 465,600.00	R 1,404,000.00
	Factory O/H expense budget		Tip	Top
	Units produced		9700	19500
	Hours/unit		12	18
	Total Hours in production	467400	116400	351000

Total Factory Overheads			
640380+246300	R 886,680.00		
Total Hours Worked (Labour Budget)	467400	hours	
Factory overhead per hour	R 1.90	per hour	
		Tip	Top
Labour (R4/hr x hrs)		R 48.00	R 72.00
Materials: X (R2/kg x Kg's)		R 30.00	R 50.00
Materials: Y (R1/lt x ltr's)		R 10.00	R 20.00
Overheads (R1.90/hr x hrs)		R 22.80	R 34.20
Unit Costs	R 287.00	R 110.80	R 176.20

Cost of Sales Budget				
Open stock			R 120,000.00	Given
Add: Production costs			R 4,509,280.00	
Materials used not the materials purchased		1,753,000.00	direct material usage	
	X: 633 000 x R2 =			
	R1'266'000			
	Y: 487 000 x R1 =			
	R487'000			
Labour (From Labour budget)		1,869,600.00	total labour cost	
Factory O/H		886,680.00	overheads	
			R 4,629,280.00	
Less: Total Closing Stock			R 110,260.00	
Less: Closing stock Tip	200 x R110,8	R 22,160		Given
Less: Closing stock Top	500 x R176,2	R 88,100.00		Given
Cost of Sales (Cost of goods produced			R 4,519,020.00	
Budgeted Income Statement				
Sales (From Sales Budget)	R 5,700,000.00			
Less: Cost of Sales	R 4,519,020.00			
Gross Profit	R 1,180,980.00			

Cash Budget Worked Example

Oom Piet Brightspark C.C manufactures small electrical motors. The following estimated figures are provided.

(1)

Month	Sales	Cost of Material	Labour costs	Manufac-turing overheads
2006	R	R	R	R
January	45 000	24 000	7 000	3 850
February	42 000	23 000	8 000	4 400
March	48 000	26 000	9 000	4 950
April	60 000	32 000	9 400	5 170
May	66 000	36 000	9 600	5 280
June	58 000	31 000	10 500	5 775

(1) 50% of the goods sold are sold on credit.

(III) The estimated favourable bank balance at 1 Jan 2006 is R0

(iv) Expense items will be paid for as follows:

Materials and overheads - on average, one month after purchase

Labour costs - during the month in which these are incurred

Selling and administrative expenses - 5% of previous months total sales

(v) An analysis of payments by debtors reveals the following.

During the month of sale5%

During the first month after sale 10%

During the second month after sale 30%

During the third month after sale 50%

Irrecoverable 5%

(vi) It is envisaged that a dividend of R5 000 will be paid during May 2003

(vII) Rent receivable amounts to R500 per month.

(viii) Interest of 10% p.a. on the long-term loan of R10 000 is payable half yearly on
1 June 2003 and 1 December 2003.

(Ix) The purchase of machinery to the value of R31 000 is planned for April 2003, and such amount is payable on 15 May 2003

Prepare a cash budget for January to June 2003

Rough Calculations							
1. Credit and cash sales	J	F	M	A	M	J	
Total sales	45000.00	42000.00	48000.00	60000.00	66000.00	58000.00	
credit - 50%	22500.00	21000.00	24000.00	30000.00	33000.00	29000.00	
cash - 50%	22500.00	21000.00	24000.00	30000.00	33000.00	29000.00	
7 - Rent Received	500.00	500.00	500.00	500.00	500.00	500.00	
4 Expenses	J	F	M	A	M	J	
Material	0.00	24000.00	23000.00	26000.00	32000.00	36000.00	on average, one month after purchase
overheads	0.00	3850.00	4400.00	4950.00	5170.00	5280.00	on average, one month after purchase
Labour	7000.00	8000.00	9000.00	9400.00	9600.00	10500.00	during the month
Selling and admin	0.00	2250.00	2100.00	2400.00	3000.00	3300.00	5% of previous months total sales
6 - Dividend					5000.00		
8 - Interest (10% of						500.00	

10000 / 2)							
9 - Machinery					31000.00		
TOTAL EXPENSES	7000.00	38100.00	38500.00	42750.00	85770.00	55580.00	

5 - Debtors Collection							
Credit Sales	Amount	JAN	FEB	MARCH	APRIL	MAY	JUNE
JAN	22500.00	.05*22500	.5*22500	.3*22500	.1*22500		
FEB	21000.00		.05*21000	.5*21000	.3*21000	.1*21000	
MARCH	24000.00			5%	50%	30%	10%
APRIL	30000.00				5%	50%	30%
MAY	33000.00					5%	50%
JUNE	29000.00						5%
		JAN	FEB	MARCH	APRIL	MAY	JUNE
JAN	22500.00	1125.00	11250.00	6750.00	2250.00	0.00	0.00
FEB	21000.00		1050.00	10500.00	6300.00	2100.00	0.00
MARCH	24000.00			1200.00	12000.00	7200.00	2400.00
APRIL	30000.00				1500.00	15000.00	9000.00
MAY	33000.00					1650.00	16500.00
JUNE	29000.00						1450.00
TOTAL CREDIT SALES COLLECTED		1125.00	12300.00	18450.00	22050.00	25950.00	29350.00

CASH BUDGET							
		JAN	FEB	MARCH	APRIL	MAY	JUNE
OPENING BALANCE		0.00	17125.00	12825.00	17275.00	27075.00	755.00
ADD: RECEIPTS		24125.00	33800.00	42950.00	52550.00	59450.00	58850.00
TOTAL AVAILABLE		24125.00	50925.00	55775.00	69825.00	86525.00	59605.00
LESS: PAYMENT		7000.00	38100.00	38500.00	42750.00	85770.00	55580.00
CLOSING BALANCE		17125.00	12825.00	17275.00	27075.00	755.00	4025.00

TOPIC 8

BREAK-EVEN ANALYSIS

LEARNING OUTCOMES
Students should be able to:
■ understand what is meant by break-even analysis.
■ explain the significance of break-even analysis to project management.
■ calculate break-even quantity and amount.
■ outline the limiting assumptions of break-even analysis.

CONTENTS

READING
Recommended reading
► **Burke, R. (2006) Project management: Planning and control techniques.5th Edition. China: Burke Publishing. pp 71-72** ► **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited. pp 292-293** ► **Niemand, A.A., Meyer, L., Botes, V.L. and van Vuuren, S.J. (2004) Fundamentals of Cost and Management Accounting. 5th edition. Durban: Lexisnexis Butterworths. pp 388-411**

1. INTRODUCTION

As a project manager, you need to ascertain the impact on a project if sales decline or costs increase. According to Chandra (2004: 292) you will also be interested in knowing how much should be produced and sold at a minimum to ensure that the project does not lose profit. Such an exercise is known as **break-even analysis**. The minimum quantity that must be produced and sold to avoid a loss is called **break-even point**.

IMPORTANCE OF BREAK-EVEN ANALYSIS

2. According to Burke (2006: 71) break-even analysis allows the project manager to determine at a glance how profit varies with a change in volume. It puts management in a better position to cope with various short-term planning decisions. Break-even analysis can also be used to show the effect on the cost structure by changing from manual to automatic machinery.

Burke (2006: 72) adds that break-even analysis may be used to aid decision-making where two mutually exclusive projects have different cost structures. Consider a project to install a heating system for an office block. Project A has a high installation cost but maintenance is low. Project B has a low installation cost but maintenance costs are high. A break-even analysis will show which system is more cost effective for a specific period of time.

3. MARGINAL STATEMENT OF COMPREHENSIVE INCOME

Since break-even analysis is based on the marginal income approach, it is necessary to know what marginal income is (Niemand et al., 2004: 389). The traditional Statement of Comprehensive Income that we use in financial accounting does not distinguish between fixed costs and variable costs. The marginal approach to drawing up A Statement of Comprehensive Income is one where fixed and variable costs are available and is more suitable for break-even analysis. Using this approach all expenses are classified as fixed or variable.

The following is an example of a traditional Statement of Comprehensive Income and a Marginal Statement of Comprehensive Income:

Example 1

Traditional Statement of Comprehensive Income	**R**
Sales	90 000
Cost of sales	(45 000)
Gross profit	45 000
Operating expenses:	(37 500)
Marketing costs	23 250
Administration costs	14 250
Net profit	7 500

Marginal Statement of Comprehensive Income	**R**
Sales	90 000
Variable costs:	(22 500)
Production	15 000
Marketing	4 500
Administration	3 000
Marginal income	67 500
Fixed expenses:	(60 000)
Production	30 000
Marketing	18 750
Administration	11 250
Net profit	7 500

4. BREAK-EVEN ANALYSIS USING THE MARGINAL INCOME APPROACH

The following example will be used to illustrate break-even analysis:

Example 2

The following is a budgeted marginal Statement of Comprehensive Income of Thulani Ltd for project Z.

Marginal Statement of Comprehensive Income for July 20.6	**R**
Sales (40 000 units X R40 per unit)	**1 600 000**
Variable cost (40 000 units X R30 per unit)	**(1 200 000)**
Marginal income (R10 per unit)	**400 000**
Fixed costs	**(200 000)**
Net profit	**200 000**

4.1 Marginal income

Marginal income is the excess of sales over the variable costs (Niemand et al., 2004: 390). It refers to the amounts of money available to cover firstly the fixed costs and then to generate profits. If the fixed costs are greater than marginal income, then a loss will result.

Example 3

The Statement of Comprehensive Income for project Z can also be presented as follows:

Marginal Statement of Comprehensive Income for July 20.6	**R**
Sales (1 unit X R40)	**40**
Variable cost (1 unit X R30)	**(30)**
Marginal income	**10**
Fixed costs	**(200 000)**
Net loss	**(199 990)**

For each additional unit that Thulani Ltd sells, an additional R10 marginal income becomes available to cover the fixed costs.

The increase in the total costs as a result of an additional unit being manufactured is called **marginal costs**. Marginal costs may therefore be seen as the total variable costs incurred to manufacture or market a product.

4.2 Calculation of break-even point (using the marginal income method)

The volume of sales at which marginal income is equal to fixed costs is called the **break-even**

point. The break-even point can also be called the point of no profit and no loss. The break-even quantity is the minimum quantity that must be sold to ensure that the fixed costs of the project are covered.

Break-even quantity can be calculated using the marginal income method as follows:

$$\text{Break even quantity} = \frac{\text{Total fixed cost}}{\text{Marginal income per unit}}$$

Example 4

Using the figures from example 3, break-even quantity may be calculated as follows:

$$\text{Break even quantity} = \frac{\text{Total fixed cost}}{\text{Marginal income per unit}}$$

$$= \frac{\text{R200 000}}{\text{R10}}$$

$$= \text{20 000 units}$$

The break-even value (i.e. break-even point in rands) is calculated as follows:

Break even value = Break-even quantity X Selling price per unit

Example 5

Using the figures from example 3, break-even value may be calculated as follows:

Break even value = Break-even quantity X Selling price per unit = 20 000 X R40 = R800 000

To reach break-even point during July 20.6 Thulani Ltd needs to sell 20 000 units from project Z. This can be proven as follows:

Marginal Statement of Comprehensive Income for July 20.6	**R**
Sales (20 000 units X R40 per unit)	**800 000**
Variable cost (20 000 units X R30 per unit)	**(600 000)**
Marginal income (R10 per unit)	**200 000**
Fixed costs	**(200 000)**
Net profit/loss	**0**

5. APPLYING BREAK-EVEN ANALYSIS TO CHANGES IN SELLING PRICE, VARIABLE COSTS AND FIXED COSTS

Thus far it has been assumed that factors such as prices, costs and volumes remained the same. What happens to the break-even point when selling price, variable costs or fixed costs change? To illustrate this the following information from project Z in example 3 (Thulani Ltd) will be utilized.

Selling price per unit	R40
Variable cost per unit	R30
Marginal income per unit	R10
Total fixed costs for July 20.6	R200 000

5.1 Change in selling price

Whenever enterprises increase the selling prices of their products, the result is usually a drop in sales volume (Niemand et al., 2004: 395). The decrease in sales is the result of consumer resistance to the price increase. Break-even analysis can be used by the project manager to determine the level to which sales volume can decline before this impacts negatively on its targeted profit.

Example 6

Thulani Ltd plans to increase the selling price of the product from project Z by 10%. Using the information from example 3 (reproduced above), calculate the quantity that must be sold (rounded off to nearest whole number) to break even.

Solution

	Present situation	After increase in price
Selling price per unit	R40	R44
Variable cost per unit	R30	R30
Marginal income per unit	R10	R14
Break even quantity = Fixed costs / Marginal income per unit	= R200 000 / R10 = 20 000 units	= R200 000 / R14 = 14 286 units

5.2 Change in variable cost

If the project manager can succeed in reducing variable costs, then the sales volume required to break even will decrease. This is illustrated as follows:

Example 7

Using the information from example 3, suppose Thulani Ltd succeeds in reducing variable costs by of project Z by 10% (with the selling price remaining at R40). **Required**

Calculate the quantity that must be sold (rounded off to nearest whole number) to break even

Solution

	Present situation	After a 10% decrease in variable cost
Selling price per unit	R40	R40
Variable cost per unit	R30	R27
Marginal income per unit	R10	R13
Break even quantity = Fixed costs / Marginal income per unit	= R200 000 / R10 = 20 000 units	= R200 000 / R13 = 15 385 units

5.3 Change in fixed costs

If fixed costs (e.g. rent) increase, then the sales volume required to break-even will increase. This is illustrated as follows:

Example 12

Using the information from example 3, suppose the fixed costs increase by R20 000 (with no change to the selling price or variable cost).

Required

Calculate the quantity must be sold (rounded off to nearest whole number) to break even

Solution

	Present situation	After increase in fixed cost
Selling price per unit	R40	R40
Variable cost per unit	R30	R30
Marginal income per unit	R10	R10
Fixed costs	R200 000	R220 000
Break even quantity = Fixed costs / Marginal income per unit	= R200 000 / R10 = 20 000 units	= R220 000 / R10 = 22 000 units

6. LIMITING ASSUMPTIONS OF BREAK-EVEN ANALYSIS

The break-even model discussed above is based on a some limiting assumptions:

All costs are classified as either fixed or variable.

Variable costs are affected only by volume.

The behaviour of both sales income and expenses is linear.

There is only one product.

7. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

7.1 Complete the following sentences with the most appropriate answers.

7.1.1 The difference between sales and variable expenses is called _____.

7.1.2 Break-even point is reached when _____ is equal to _____.

7.1.3 The break-even-point will _____ if there is an increase in fixed costs.

7.1.4 One of the key assumptions underlying break-even analysis is that costs are classified as either _____ or _____.

7.2 Mauri Ltd plans to start project M and the following information is applicable to the project:

Estimated sales for the year 20.6	7 000 units at R40 each
Estimated costs for the year 20.6	
Direct material	R12 per unit
Direct labour	R2 per unit
Factory overheads (all fixed)	R24 000 per annum
Selling expenses	30% of sales
Administrative expenses (all fixed)	R32 000 per annum

Required

7.2.1 Calculate the break-even quantity.

7.2.2 Calculate the break-even value.

7.3 Windhoek (Pty) Ltd started project Y that yields only one product. The budgeted details for 20.7 are as follows:

Sales	150 000 per month
Selling price per unit	R3
Variable cost per unit	R1,40
Total fixed cost	R1 350 000

Required

7.3.1 Calculate the break-even quantity and value.

7.3.2 Suppose Windoek (Pty) Ltd wants to make provision for the following increases to the costs of the project:

- a 10% increase in fixed costs and
- an increase in variable costs by R0,20 per unit.

Taking these increases into account, calculate the new break-even quantity and value

SOLUTIONS

7.1	
7.1.1	marginal income
7.1.2	marginal income; fixed costs
7.1.3	increase
7.1.4	variable; fixed

7.2

	Total (R)	Per unit (R)
Sales (7 000 units)	280 000	R40
Variable cost (R84 000 + R14 000 + R84 000)	182 000	R26
Marginal income	98 000	R14

7.2.1 Break even quantity = Total fixed cost / Marginal income per unit

= R56 000 / R14

= 4 000 units

7.2.2 Break even value = Break-even quantity X Selling price per unit

= 4 000 X R40

= R160 000

7.3

	Per unit (R)
Selling price per unit	R3
Variable cost per unit	R1,40
Marginal income per unit	R1,60

7.3.1 Break even quantity = Total fixed cost / Marginal income per unit

= R1 350 000 / R1,60

= 843 750 units

Break even value = Break-even quantity X Selling price per unit

= 843 750 X R3

= R2 531 250

7.3.2

	Total (R)	Per unit (R)
Sales (150 000 units X 12 months= 1 800 000 units)	5 400 000	R3,00
Variable cost	(2 880 000)	R1,60
Marginal income	2 520 000	R1,40
Fixed costs (R1 350 000 + R135 000)	(1 485 000)	
Net profit	1 035 000	

$$\text{Break even quantity} = \frac{\text{Total fixed cost}}{\text{Marginal income per unit}}$$

$$= \frac{\text{R1 485 000}}{\text{R1,40}}$$

= 1 060 714 units

Break even value = Break-even quantity X Selling price per unit

= 1 060 714 X R3

= R3 182 142

Worked Example on Absorption Costing

Manufacturing companies have two main activities:

Primary manufacturing

Support services to facilitate the manufacturing

A simple example could be:

Manufacturing (direct)	MIXING	BOTTLING

Support services (indirect)	HR	ADMIN	FACILITIES

The employees in manufacturing need to be paid, have disputes mediated, etc, hence HR. The purchase of raw materials, recording deliveries and ensuring invoices etc need to be handled by administration. The general building maintenance etc needs a facilities service. Without these support services one would be unable to run a manufacturing operation.

The problem arises when one tries to allocate the cost of these support services to primary manufacture and particularly to the products made. Materials and labour are reasonably easy to trace to products, but the support departments are more remote and therefore one has to employ the most logical method available.

In the above example one could decide that the drivers of the support departments are:

HR - number of employees

Admin - square metres

Facilities - capital investment in infrastructure.

Now assume that the accountant pulls out the following figures and statistics:

Dept	Rands	No. of employees	Square metres	Capital investment R
Mixing	250,000	20	250	620,000
Bottling	450,000	30	100	850,000
HR	85,000	3	50	50,000
Admin	120,000	4	60	50,000
Facilities	350,000	6	40	100,000

One would then pro-rate the various unit types to spread the support costs.

Direct allocation method (also known as absorption costing)

First one can pro-rate using the "direct" method. This simply spreads support departments directly to each production dept and not over other support depts. The calculations for this method would be:

Mixing	Bottling	HR	Admin	Facilities
250,000	450,000	85,000	120,000	350,000
34,000	51,000	-85,000		
85,714	34,286		-120,000	
147,619	202,381			-350,000
517,333	737,667	1,255,000		

	Basis of spreading HR:		
Employees	20 (Mix)	30 (Bottle)	50 (Total)
	20/50	30/50	
	× R85,000	× R85,000	

	Basis of spreading Admin:		
Sq m	250 (Mix)	100 (Bot)	350 (Total)
	250/350	100/350	
	× R120,000	× R120,000	

	Basis of spreading Facilities:		
Invest R	620 (Mix)	850 (Bot)	1470
	620/1470	850/1470	
	× R350,000	× R350,000	

Case Study based on the direct method:

An example of Activity Based Cost allocation is set out below:

1. Basic allocation of overheads R'000 (The traditional approach)

Product Group	A	B	C	D	TOTAL
Cost driver	<------Volume------>		<---Made to Order--->		
Sales	1,000	2,000	500	800	4,300
Less direct costs	700	1,500	200	300	2,700
	300	500	300	500	1,600
% to sales	30.0%	25.0%	60.0%	62.5%	37.2%
Less overheads **	279	558	140	223	1,200
PBIT	21	-58	160	277	400

** Because overheads are spread on sales - therefore sales (rands) attracts the overhead cost for both "made to order" products C &D as well as "volume" (off the shelf) products A & B.

This "peanut butter smear" type of allocation of overheads is extreme and no doubt an accountant would split the overheads on a more scientific basis. However ABC methodology first establishes what activities make up overhead costs, then costs out the activities and then decides on what drives these activities and from there allocate the activities based on the transactions that drive them. From the above table the overhead allocations could be re-evaluated:

2. Overheads <u>analyzed</u> by Activity Based Costing

		R'000	<u>Basis of Split</u>
Activities identified	- Sales - Planning - Admin		- on orders taken - on jobs processed - on debtors accounts

Transactions	A "Volume"	B "Volume"	C "Made"	D "Made"	Total
Sales orders				150	300
Plan jobs				200	400
Debtor				30	50

Volume lines A & B – are simpler and don't create so many different transactions and therefore

Made to order lines C & D – are more complex and more transactions generate more overheads. because of the higher complexity

3. Overheads value split on transactions

	R'000				
	A	B	C	D	Total
Orders				300	600
Plan jobs				200	400
Accounts				120	200
				620	**1,200**
Compare to sales spread	279	558		223	1,200

The outcome of this allocation is that products A & B are profitable and products C & D are unprofitable. The general view on organizations with high overheads and a multitude of products is that some products, and also some customers, can cause high overhead costs because of the transactions they generate and thus are unprofitable. Without ABC analysis this unprofitability may not be identified.

Now compare the ABC profitability analysis (item 4 below) to the absorption costing analysis (item 1 above).

4. Activity Based Costing (Compared to Absorption Costing)

R'000

Product Group	A	B	C	D	TOTAL
	----------Volume----------		----------MTO----------		
Sales	1,000	2,000	500	800	4,300
Direct costs	700	1,500	200	300	2,700
	300	500	300	500	1,600
	30.0%	25.0%	60.0%	62.5%	37.2%
Overheads	73	99	408	620	1,200
PBIT	227	401	-108	-120	400
Compare to PBIT for absorption costing	21	-58	160	277	400

Therefore by divesting of lines C & D – this may result in the reduction of overhead costs

TOPIC 9

EARNED VALUE MANAGEMENT

LEARNING OUTCOMES
Students should be able to:
■ explain the purpose of earned value management.
■ describe the terms used in earned value management.
■ perform the relevant calculations for each of the earned value management terms.
■ interpret the calculations done for each of the earned value management terms.

CONTENTS

READING
Recommended reading ► **Kloppenborg, T.J. (2009) Project Management: A Contemporary Approach. 1st Edition. Canada: South-Western Cengage Learning pp. 393-397**

1. INTRODUCTION

Since this module focuses on financial management, cost control is an important consideration. Kloppenborg (2009:393) recognises a close link between cost and schedule and therefore recommends that they be monitored and controlled at the same time. Changes to one affect the other. The project manager must keep a track of the actual schedule progress regularly and ensure that no more money is spent than is authorised. Earned value management is one of the methods that exist for controlling costs and schedule.

2. Earned value management and earned value

Earned value management may be defined as "a management methodology for integrating scope, schedule, and resources, and for objectively measuring project performance and progress" (Kloppenborg, 2009:393). ***Earned value*** may be described as the value of work completed expressed in terms of approved budget allocated to that work.

Earned value, according Kloppenborg (2009:393), makes it possible for a project team to understand their project's progress with regard to cost and schedule as well as to make forecasts regarding the project's schedule and cost control until the completion of the project. Earned value is an important decision-making tool. The project manager can do a quick assessment of how the project is doing according to the baseline plan and whether the project would end without any significant cost/schedule impacts. The earned value data permits a project manager to determine the status of a project at any given point in time.

When interpreting earned value management, one must consider cost and schedule independently. Firstly, in terms of planned schedule a project can be either ahead or behind; and in terms of budget a project can be either over or under. Secondly, all earned value terms relate to one of two time frames. Each either represents the current status as of the last date that project data were collected or a forecast for the end of the project. Table 8-1 lists 12 questions and answers that reflect all the earned value management terms (Kloppenborg, 2009:395):

Table 8-1

Question	Timing	Answer	Acronym
How much work *should* be done?	Now	Planned value	PV
How much work *is* done?	Now	Earned value	EV
How much *did* the "is done" work cost?	Now	Actual cost	AC
How much was the total project *supposed* to cost?	End	Budget at completion	BAC
How much *is* the project schedule ahead or behind?	Now	Schedule variance	SV
How much *is* the project over or under budget?	Now	Cost variance	CV
How efficient is the project *so far* with its schedule?	Now	Schedule performance index	SPI
How efficient is the project *so far* with its budget?	Now	Cost performance index	CPI
How much *more* do we expect to spend to finish the project?	End	Estimate to complete	ETC
What do we *now* think the total project will cost?	End	Estimate at completion	EAC

We now learn how to calculate each of the earned value management terms as explained by Kloppenborg (2009:396):

3. CURRENTLY KNOWN VALUES

Suppose the following values are provided:

PV = R250 000 EV = R200 000 AC = R400 000 BAC = R750 000

Planned value (PV) refers to the budget that has been authorised for the scheduled work to be completed. In our case it will be R250 000.

Earned value (EV) may be described as the value of work completed expressed in terms of approved budget allocated to that work, which in our case is R200 000.

Actual cost (AC) reflects the total costs actually incurred to accomplish the work performed during a given time period. In our case R400 000 is owed for the work that was completed.

Budget at completion (BAC) is the sum of all budgeted values determined for the work to be done on a project. In other words it's the total planned value of the project. In our case the approved budget for the entire project is R750 000.

Using the above figures, we can now calculate answers for the remaining questions listed in Table 8-1:

4. VARIANCES

Schedule variance (SV) measures schedule performance on a project. It is the difference between EV and PV. In our example the calculation will be:

EV – PV = R200 000 – R250 000 = –R50 000

The negative value is an indication that the project is behind schedule.

Cost variance (CV) measures the cost performance on a project. It is the difference between EV and AC. In our example the calculation is as follows:

EV – AC = R200 000 – R400 000 = –R200 000

The negative answer shows that the project is over budget.

These two variances shows in monetary terms how well or poorly the project is performing in terms of cost and schedule. Clearly, the performance is poor in terms of both cost and schedule.

5. INDEXES

Some project managers prefer to use efficiency measures in percentage terms to understand how well or poorly the project is performing:

Schedule performance index (SPI) measures schedule efficiency on a project. It is calculated as follows:

$$\frac{EV}{PV} \times 100$$

In our case, SPI will be 80%, calculated as follows:

$$\frac{R200\,000}{R250\,000} \times 100$$

= 80%

Since only 80% of what was planned has been accomplished, the project is behind schedule. When performance indexes are used:

- 100% means right on schedule.
- <100% means less efficient than planned.
- >100% means more efficient than planned.

Cost performance index (CPI) measures cost efficiency on a project. It is calculated as follows:

$$\frac{EV}{AC} \times 100$$

In our case, CPI will be 50%, calculated as follows:

$$\frac{R200\,000}{R400\,000} \times 100$$

= 50%

The project is over budget since only R0.50 of results was received for every Rand that was spent.

6. ESTIMATES

Now that we understand the performance in the project thus far, we now predict performance for the remainder of the project. The easiest way of estimating future performance is to predict that past performance will continue. The following calculations are based on this assumption.

Estimate to complete (ETC) refers to the expected cost required to complete the remaining work for the project. Assuming that future performance will have the same efficiency as past performance, it is calculated as follows:

$$\frac{(BAC - EV)}{CPI}$$

In our case, it will be R1 100 000, calculated as follows:

$$\frac{R750\,000 - R200\,000}{50\%}$$

=R1 100 000

Unless efficiency is improved, the company can expect to pay more for the remaining project work than the original cost of the project.

Estimate at completion (EAC) is the expected total cost of the project when the defined scope of work will be completed. It is calculated as follows:

AC + ETC

In our case, it will be R1 500 000, calculated as follows:

R400 000 + R1 100 000 = R1 500 000

Since cost efficiency is only 50% of plan (refer to CPI), the original estimate will be double unless efficiency improves.

Each term in earned value management helps project managers understand something about the performance of the project. Collectively the terms provide project managers with added insight for monitoring and controlling cost and schedule.

7. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

7.1 Match the terms in Column A (that are used in earned value management) with the descriptions in Column B. Write down the letter of the correct answer only.

	Column A		Column B
7.1.1	Planned value	A	Is the sum of all budgeted values determined for the work to be done on a project.
7.1.2	Earned value	B	Measures the cost performance on a project
7.1.3	Actual cost	C	Measures cost efficiency on a project
7.1.4	Budget at completion	D	Refers to the expected cost required to complete the remaining work for the project.
7.1.5	Schedule variance	E	Refers to the budget that has been authorised for the scheduled work to be completed.
7.1.6	Cost variance	F	Measures schedule efficiency on a project.
7.1.7	Schedule performance index	G	May be described as the value of work completed expressed in terms of approved budget allocated to that work.
7.1.8	Cost performance index	H	Is the expected total cost of the project when the defined scope of work will be completed.
7.1.9	Estimate to complete	I	Measures schedule performance on a project
7.1.10	Estimate at completion	J	Reflects the total costs actually incurred to accomplish the work performed during a given time period.

7.2 The following information is available for Project A:

PV = R250 000

EV = R175 000

AC = R275 000

BAC = R600 000

7.2.1 Calculate the following:

- Schedule variance (SV)
- Cost variance (CV)
- Schedule performance index (SPI)
- Cost performance index (CPI)
- Estimate to complete (ETC)
- Estimate at completion (EAC)

7.2.2 Describe the results of each calculation in question 7.2.1

7.3 The following information is available for Project B:

PV = R50 000

EV = R60 000

AC = R58 000

BAC = R200 000

7.3.1 Calculate the following:

- Schedule variance (SV)
- Cost variance (CV)
- Schedule performance index (SPI)
- Cost performance index (CPI)
- Estimate to complete (ETC)
- Estimate at completion (EAC)

7.3.2 Describe the results of each calculation in question 7.2.1

7.4 A project manager has been informed that the schedule performance index (SPI) for his project is 80%. The calculation of the cost performance index (CPI) is 110%. Describe this project in terms of budget and schedule.

SOLUTIONS

7.1

7.1.1 E

7.1.2 G

7.1.3 J

7.1.4 A

7.1.5 I

7.1.6 B

7.1.7 F

7.1.8 C

7.1.9 D

7.1.10 H

7.2.1 **Schedule variance =** EV – PV = R175 000 – R250 000 = –R75 000

Cost variance = EV – AC = R175 000 – R275 000 = –R100 000

Schedule performance index (SPI)

$$\frac{EV}{PV} \times 100$$

$$\frac{R175\,000}{R250\,000} \times 100$$

= 70%

Cost performance index (CPI)

$$\frac{EV}{AC} \times 100$$

$$\frac{R175\,000}{R275\,000} \times 100$$

= 63.64%

Estimate to complete (ETC)

$$\frac{\text{(BAC – EV)}}{\text{CPI}}$$

$$\frac{\text{R600 000 – R175 000}}{\text{63.64\%}}$$

=R667 819

Estimate at completion (EAC)

AC + ETC

R275 000 + R667 819 = R942 819

7.2.2

- **Schedule variance (SV)**: The project is behind schedule since the variation is negative.
- **Cost variance (CV)**: The project is over budget since the variation is negative.
- **Schedule performance index (SPI)**: The project is behind schedule since only 70% of what was planned was accomplished.
- **Cost performance index (CPI)**: The project is over budget since only R0.64 worth of results was received for every Rand spent.
- **Estimate to complete (ETC)**: The cost to complete the remaining work for the project is R667 819 which is even greater than the original cost of the entire project.
- **Estimate at completion (EAC)**: Since the cost efficiency is only about two thirds of the plan, unless there is greater efficiency, it can be expected that the company would have to pay just over 1½ times the original estimate.

7.3.1 **Schedule variance =** EV – PV = R60 000 – R50 000 = +R10 000

Cost variance = EV – AC = R60 000 – R58 000 = +R2 000

Schedule performance index (SPI)

$$\frac{EV}{PV} \times 100$$

$$\frac{R60\,000}{R50\,000} \times 100$$

= 120%

Cost performance index (CPI)

$$\frac{EV}{AC} \times 100$$

$$\frac{R60\,000}{R58\,000} \times 100$$

= 103.45%

Estimate to complete (ETC)

$$\frac{(BAC - EV)}{CPI}$$

$$\frac{R200\,000 - R60\,000}{103.45\%}$$

=R135 331

Estimate at completion (EAC)

AC + ETC

R58 000 + R135 331 = R193 331

7.3.2

- **Schedule variance (SV)**: The project is ahead of schedule since the variation is positive.
- **Cost variance (CV)**: The project is under budget since the variation is positive.
- **Schedule performance index (SPI)**: The project is ahead of schedule since 120% of what was planned was accomplished.
- **Cost performance index (CPI)**: The project is under budget since R1.03 worth of results was received for every Rand spent.
- **Estimate to complete (ETC)**: The cost to complete the remaining work for the project is R135 331 which would be less than budgeted.
- **Estimate at completion (EAC)**: Since the cost efficiency is good it can be expected that the company would pay R6 669 (R200 000 – R193 331) less than the original estimate.

7.4 **Schedule performance index (SPI)**: The project is behind schedule since only 80% of what was planned was accomplished.

Cost performance index (CPI): The project is under budget since R1.07 worth of results was received for every Rand spent.

TOPIC 10

TIME VALUE OF MONEY

LEARNING OUTCOMES
Students should be able to:
■ understand the present value of money or future value of money.
■ calculate the future value of a single amount.
■ calculate the future value of an annuity.
■ calculate the present value of a single amount.
■ calculate the present value of an annuity.
■ apply the rule of 69 and the rule of 72 to determine doubling period of an amount.

CONTENTS

READING
Recommended reading
► **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited. pp 155-168** ► **Niemand, A.A., Meyer, L., Botes, V.L. and van Vuuren, S.J. (2004) Fundamentals of Cost and Management Accounting. 5th edition. Durban: Lexisnexis Butterworths. pp 480-484** ► **Patel, B. M. (2007) Project Management: Strategic Financial Planning, Evaluation and Control. 1st Edition. New Delhi: Vikas Publishing House PVT Ltd. pp 41-44**

1. INTRODUCTION

Money has a time value. A sum of money today has a greater value than the same amount at any time in the future. This may be due to the effects of inflation, risk and loss of interest. Chandra (2004: 155) adds that individuals generally prefer current consumption to future consumption. According to Patel (2007: 35) the concept of time value of money is applied in all financial management theories including the evaluation of capital projects.

Chandra (2004: 155) observes that most financial problems involve cash flows that occur at different points of time. These cash flows need to be brought to the same point of time for the purpose of comparison. It is therefore necessary to understand the tools of compounding and discounting as they will be used in analysing projects.

2. FUTURE VALUE OF MONEY

The value of a present investment at a future date, due to the time value of money, is known as the future value of money (Patel, 2007: 35)

2.1 Future value of a single amount

Suppose one invests R1 000 for three years in a savings account that pays 10% interest per year. If the interest income is reinvested, the investment will grow as follows:

	Principal at the beginning (R)	Interest for the year (R)	Principal at the end (R)
1st year	1 000	100	1 100
2nd year	1 100	110	1 210
3rd year	1 210	121	1 331

This process of investing money and reinvesting the interest earned on it is called **compounding** (Chandra, 2004: 157). The compounded value or future value (FV) of an investment after *n* years when the interest rate is *r* is:

$FV = PV(1+r)^n$

(Note: PV is Present value)

In the equation, $(1+r)^n$ is called the future value factor. The calculation of this factor becomes cumbersome if the period of investment is long. An easy way to get this factor is to use a calculator as most calculators nowadays perform this function easily. Alternatively you can

use a future value interest factor table (appears at the end of this module as Table 1).

Example 1

Use the future value interest factor table to calculate the future value of an investment of R1 000 that pays 10% interest for 3 years.

Solution

R 1000 X 1,331 = R1 331

We have assumed so far that money is invested at compounded interest (i.e. interest is reinvested to earn further interest in future periods). However, if no interest is earned on interest, the investment earns **simple interest**. In this case the investment grows as follows:

Future value = Present value [1 + number of years X interest rate]

2.2 Future value of an annuity

According to Chandra (2004: 163) an annuity is "a stream of constant cash flow occurring at regular intervals of time". Sometimes an investment is made at regular intervals of time in constant amounts. The maturity value (compound value) of an annuity of an annual series of investments may be calculated as follows:

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

where:

FVA = Future value of an annuity

R = Interest rate

N = Number of years

Once again a future value of an annuity table (see end of this study guide – Table 2) may be used.

Example 2

Transend Ltd has an obligation to redeem a R500 000 bond in six years time. How much money should the company deposit annually in a sinking fund account what provides 14% interest to accumulate R500 000 in six years time.

Solution

Future value = Annual deposit X Interest factor

$$\text{Annual deposit} = \frac{\text{Future value}}{\text{Interest factor}}$$

$$= \frac{\text{R500 000}}{8.5355}$$

$$= \text{R58 592.26}$$

3. PRESENT VALUE OF MONEY

All cash flows can be brought to today's value instead of compounding to a future date (Patel, 2007: 41).

3.1 Present value of a single amount

Just as the future value may be calculated by the process of compounding, the present value is calculated through a process of **discounting**. The process of discounting is the inverse of compounding. By manipulating the future value formula, one can determine the present value formula:

$$PV = FV_n \times \frac{1}{(1+r)^n}$$

In order to eliminate the number of steps to calculate the present value of any amount, present value tables are available. The present value of R1 can be read from Table 3 (at the end of this module). Table 3 shows the present value of R1 at various interest rates receivable after n years (n can represent any number).

Example 3

Use the present value tables at the end of this module to calculate the present values for the following amounts at an interest rate of 12% p.a.:

End of year	Amount
1	R2 000
2	R3 500
3	R4 200

Solution

End of year	Calculation	Present value
1	R2 000 X 0,8929	R1 786
2	R3 500 X 0,7972	R2 790
3	R4 200 X 0,7118	R2 990

3.2 Present value of an annuity

The present value of an annuity is the sum of the present values of all the inflows of this annuity (Chandra, 2004: 167). The present value of an annuity may be calculated by discounting the future value of an annuity. The present value of an annuity may thus be expressed as follows:

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

Where:

PVA = Present value of an annuity

A= constant periodic flow

R = discount rate

Once again, in order to eliminate the number of steps to calculate the present value of any amount, present value tables are available. The present value of an annuity of R1 per period can be read from Table 4 (at the end of this module).

Example 4

Suppose an enterprise expects to receive R10 000 annually for three years with each receipt occurring at the end of each year. If the discount rate is 10%, what is the present value of this annuity (using Table 4)?

Solution

R10 000 X 2.4869

= R24 869

4. DOUBLING PERIOD

Investors often want to know how long it would take to double the amount invested at a specific rate of interest. According to Chandra (2004: 160), one way of doing this is to look at the future value interest factor table. By looking at Table 1 (end of the module), we find that it takes about 6 years to double the amount if the interest rate is 12% and about 12 years when the interest rate is 6% and so on. However, there is a rule of thumb that does away with the need for the future value interest factor table. It is called the **rule of 72**. Using this rule the doubling period is obtained by dividing 72 by the interest rate. If the interest rate is 9%, the doubling period is about 8 years (72÷9). Although the answer is an approximate one, it is a handy rule to remember. A more accurate rule of thumb, however, is the rule of 69. According to this rule of thumb, the doubling period is:

$$0.35 + \frac{69}{\text{Interest rate}}$$

If the interest rate is 9%, the doubling period is:

$$0.35 + \frac{69}{9} = 8.02 \text{ years}$$

5. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

Where applicable, use the present value and future value tables (at the end of this module) to answer the following questions.

5.1 Calculate the value 6 years hence of a deposit of R100 000 made today if the interest rate is:

5.1.1 8%

5.1.2 10%

5.1.3 12%

5.2 Suppose you decided to deposit R800 per year in a Retirement Fund account for 20 years. What will be the accumulated amount in your Retirement Fund account at the end of 20 years if the interest rate is 12%?

5.3 Suppose someone promises to pay you R10 000 three year hence. Calculate the present value of this amount if the interest rate is 10%.

5.4 Suppose you expect to receive R18 000 annually for three years. If the discount rate is 14%, what is the present value of this annuity

5.5 If an enterprise invests R60 000 today at 12% rate of interest, how many years (approximately) will this amount grow to double? Work this problem out using: the rule of 72.

5.5.1 rule of 69

5.5.2

5.6 An enterprise wants to replace its machinery after 10 years. It expects the equipment to cost R1 000 000. How much should the business save annually to have a sum of R1 000 000 at the end of 10 years if the interest rate is 12%.

5.7 At the time of his retirement, Sam was given a choice between two alternatives:
An annual pension of R100 000 as long as he lives
A lump sum of R500 000
If Sam expects to live for 15 years and the interest rate is 15%, which option appears more attractive?

SOLUTIONS

5.1

5.1.1 R100 000 X 1.5869 = R158 690

5.1.2 R100 000 X 1.7716 = R177 160

5.1.3 R100 000 X 1.9738 = R197 380

5.2 R800 X 72.0524 = R57 641.92

5.3 R10 000 X 0.7513 = R7 513

5.4 R18 000 X 3.4396 = R61 912.80

5.5

5.5.1 72 ÷ 12 = 6 years

5.6 Annual amount X 17.5487 = R1 000 000

Annual amount = R1 000 000 / 17.5487

R56 984.28

5.7 R100 000 X 5.8474 = R584 740 (Present value of the annuity of R100 000)

Lump sum = R500 000

Annual pension of R100 000 is therefore more attractive.

TOPIC 11

INVESTMENT CRITERIA

LEARNING OUTCOMES
Students should be able to: ■ understand the importance of capital investment decisions. ■ apply the payback period and accounting rate of return methods to appraise investment decisions in projects. ■ apply discounted cash flow methods such as net present value, benefit cost ratio and internal rate of return to appraise investment decisions in projects. ■ show the effects of income tax, depreciation and scrap value on capital investment decisions in projects.

CONTENTS

READING
Recommended reading
► **Burke, R. (2006) Project management: Planning and control techniques.5th Edition. China: Burke Publishing. pp 56-68** ► **Chandra, P. (2002) Projects: Planning, Analysis, Financing, Implementation, and Review. 5th Edition. New Delhi: Tata McGraw-Hill Publishing Company Limited. pp 183-210** ► **Goodpasture, J.C. (2004) Quantitative Methods in Project Management. 1st Edition. Mumbai: Shroff Publishers. pp 137-141** ► **Niemand, A.A., Meyer, L., Botes, V.L. and van Vuuren, S.J. (2004) Fundamentals of Cost and Management Accounting. 5th edition. Durban: Lexisnexis Butterworths. pp 485-492** ► **Patel, B. M. (2007) Project Management: Strategic Financial Planning, Evaluation and Control. 1st Edition. New Delhi: Vikas Publishing House PVT Ltd. pp 269-282**

1. INTRODUCTION

The selection of the right project for future investment is an important decision for the long-term continuance of a company (Burke, 2006: 56). Capital investments in projects often involve large sums of money and the selection of the wrong project may lead to the liquidation of the company should the project fail. Furthermore it is difficult and/or expensive to cancel the investment in a project once the investment is made.

Therefore it becomes necessary to examine methods that are may be used to appraise investment decisions in projects. Firstly, two techniques that ignore the time value of money i.e. payback period and accounting rate of return will be discussed. Thereafter we will examine three techniques that take into account the time value of money viz. net present value, benefit cost ratio and internal rate of return.

2. PAYBACK PERIOD

Payback period measures the amount of time required to recover the initial cost of the investment in the project from the net cash inflows from the project (Chandra, 2004: 204). The general decision rule to follow is to choose the project with a shorter payback period. The reason for this is that the shorter the payback period, the less risky the project and the greater the liquidity will be. Whilst the payback method is simple and easy to use, it does not recognise the time value of money. It also ignores the influence of cash inflows on profitability after the payback period.

Payback period is calculated as follows if the net cash inflow is the same each year:

$$\frac{\text{Cost of project}}{\text{Net cash inflow (p.a.)}}$$

Example 1

Swazi Ltd obtained information in respect of two projects, one of which it intends choosing. The following details are available:

	Project X	Project Y
Cash outlay	R600 000	R600 000
Economic lifetime	6 years	4 years
Average annual net cash inflow over the economic lifetime	R200 000	R280 000
Depreciation (straight-line method)	100 000	150 000
Average annual profits	100 000	130 000

Required

Calculate the payback period of each project and recommend the project that should be chosen based on the payback period.

Solution

Payback period:			
		Project X	Project Y
Cost of project	=	R600 000	R600 000
Net cash inflow		R200 000	R280 000
		3 years	2,14 years Or 2 years 2 months (0.14 X 12months = 1.68)

According to the calculation above Swazi Ltd should choose project Y since it can recover the cash outlay in a shorter time (2,14 years) than project X (3 years). However, the project manager of Swazi Ltd must also consider that project X will be able to generate an income of R600 000 (R200 000 X 3) for 3 years after the payback period whereas project Y will only be able to generate an income of R520 800 (for 1,86 years) after the payback period.

When the cash inflows are not even, the payback period is determined as follows:

Example 2

Consider two projects whose cash inflows are not even. Assume that the project costs R200 000. The net cash inflows for each year is as follows:

Year	Project X	Project Y
1	R20 000	R100 000
2	R40 000	R80 000
3	R60 000	R60 000
4	R80 000	R20 000
5	R100 000	-
6	R100 200	-

Required

Calculate the payback period of each machine and recommend the project that should be selected based on the payback period.

Solution	Project X	Project Y
Investment	(200 000)	(200 000)
Year 1 Cash flow	20 000	100 000
	(180 000)	(100 000)
Year 2 Cash flow	40 000	80 000
	(140 000)	(20 000)
Year 3 Cash flow	60 000	60 000
	(80 000)	
Year 4 Cash flow	80 000	
	0	
Payback period is	4 years	2 years 4 months Note: 20 000 X 12 mths 60 000 = 4 months

Project Y should be chosen since the payback period (2 years and 4 months) is less than that of project X (4 years).

3. ACCOUNTING RATE OF RETURN (ARR)/RETURN ON INVESTMENT

The accounting rate of return (ARR) measures profitability by relating the average investment in a project to the future annual net profit (Chandra: 207). In other words, ARR uses the average profit an investment will generate and expresses it as a percentage of the average investment over the life of the project.

The accounting rate of return of an investment is calculated as follows:

$$ARR = \frac{\text{Average annual profit}}{\text{Average investment}} \times \frac{100}{1}$$

The average investment in respect of an investment is calculated as follows:

$$\text{Average investment} = \frac{\text{Initial investment + Salvage value of investment at end of project}}{2}$$

Using the ARR method, the project that is expected to realise a higher rate of return is chosen.

Example 3

Use the figures from example 1 to calculate the accounting rate of return for each project.

Solution

Accounting rate of return:		
	Project X	Project Y
Average annual profit X 100 = Average investment	R100 000 X 100 R300 000 = 33.33%	R130 000 X 100 R300 000 = 43.33%

Note: Since there is no salvage value in both projects (depreciation for each project amount to R600 000 over the life of each project), the average investment is

(R600 000 + 0) ÷ 2 = R300 000.

Using ARR, machine Y gives a higher rate of return and appears to be a better investment.

The advantage of the ARR method is that it is easy to calculate and it recognises profitability. However, it does not take into account the time value of money. Also it uses accounting data instead of cash flow data.

4. **Net present value (NPV)**

The NPV method takes into account all the costs and benefits of each investment opportunity and also makes provision for the timing of the costs and benefits. By applying the present value method (discussed in the previous chapter), the present values of future cash flows of a project are calculated using the enterprise's minimum rate of return. The net present value is the difference between the present value of the projected cash inflows and the present value of the cash outflows (Niemand et al., 2004: 487). If the NPV is positive, then the project is considered for acceptance. If the NPV is negative, the project is rejected since it would not be profitable.

Example 4

Excel Ltd has a choice of two projects to invest in. The following details relate to these projects:

		Project A	Project B
Investment required		R75 000	R80 000
Expected economic lifetime		6 years	6 years
Minimum required rate of return		12%	12%
Net annual cash inflows			
	1st year	R20 000	R22 000
	2nd year	R22 000	R22 000
	3rd year	R24 000	R22 000
	4th year	R26 000	R22 000
	5th year	R23 000	R22 000
	6th year	R21 000	R22 000

Required

Use the net present value method to determine which project Excel Ltd should choose.

Solution

Project A

Year	Cash inflow	Discount Factor (see Table 3)	Present value
1	R20 000	0,8929	R17 858
2	R22 000	0.7972	R17 538
3	R24 000	0,7118	R17 083
4	R26 000	0,6355	R16 523
5	R23 000	0.5674	R13 050
6	R21 000	0,5066	R10 639
Total PV			R92 691
Investment			(R75 000)
NPV (positive)			R17 691

Project B

Net inflow	R22 000
Discount factor (see Table 4)	X 4,1114
Total Present value	R90 451
Investment	(R80 000)
NPV (positive)	R10 451

Decision: Project A should be chosen since it has a higher net present value.

5. BENEFIT COST RATIO

The benefit cost ratio shows the relationship between the benefits and the costs (investment value) of the project (Chandra, 2004: 193). Project managers may choose one of the following two ratios:

Benefit cost ratio (BCR) $\frac{PVB}{I}$

Net Benefit Cost Ratio (NBCR)= $\frac{PVB - I}{I} = BCR - 1$

Where:

PBV = Present value of benefits

I = Initial investment

Both benefit cost ratio measures give the same signals. The following decision rules are usually applied when interpreting the ratios:

When BRS is:	*or* When NBCR is:	The rule is:
> 1	> 0	Accept
$= 1$	$= 0$	Indifferent
< 1	< 0	Reject

Example 5

Consider the following project that is being considered by Veto Ltd that has a cost of capital of 12%:

	Year	R
Initial investment		100 000
Benefits:	1	25 000
	2	40 000
	3	40 000
	4	50 000

Calculate the Cost Benefit Ratio and Net Cost Benefit Ratio for this project.

Solution

	Year	R	Discount factor	PVB (R)
Benefits:	1	25 000	0.8929	22 323
	2	40 000	0.7972	31 888
	3	40 000	0.7118	28 472
	4	50 000	0.6355	31 775
				114 458

Benefit cost ratio (BCR) $= \frac{\text{PVB}}{\text{I}}$

$= \frac{\text{R114 458}}{\text{R100 000}}$

$= 1.145$

Net Benefit Cost Ratio (NBCR) = BCR – 1

= 1.145 – 1

= 0.145

The project may be accepted because the BCR (1.145) is greater than 1 or because the NBCR (0.145) is greater than 0.

6. **Internal rate of return (IRR)**

This is the discount rate that will discount the cash flows to a net present value of zero (Burke, 2006: 66). In other words the present value of cash flows minus the initial investment equals a zero NPV. The IRR therefore indicates what a particular project is expected to earn. A project must only be considered if the IRR exceeds the cost of capital. The advantage of the IRR method is that it considers the time value of money and is therefore more realistic than the accounting rate of return (ARR). However, the calculation can be difficult especially when the cash flows are not even.

When the cash flows are not even, the trial-and-error method for calculating IRR may be summarised as follows:

- Calculate the NPV at the cost of capital rate.
- Check if the NPV is positive or negative.
- If the NPV is positive, then pick another rate higher than the cost of capital rate. (If the NPV is negative, pick a smaller rate.) The correct IRR is the one at which the NPV = 0 and lies somewhere between two rates, with one rate indicating a positive NPV and the other rate showing a negative NPV.
- Use interpolation to calculate the exact rate.

Example 6

Use the information in example 4 and determine which project should be selected using the internal rate of return.

Solution

Project A

Step 1

We notice that the NPV is positive, and is far away from zero.

Step 2

We now pick a higher rate e.g. 18%. (Trial-and-error is used to obtain the higher rate.)

Project A							
Year	Cash inflow	Discount factor 18%	Discount factor 19%	Discount factor 20%	Present value 18%	Present value 19%	Present value 20%
1	R20 000	0,8475	0,8403	0,8333	16 950	16 806	R16 666
2	R22 000	0,7182	0,7062	0,6944	15 800	15 536	R15 277
3	R24 000	0,6086	0,5934	0,5787	14 606	14 242	R13 889
4	R26 000	0,5158	0,4987	0,4823	13 411	12 966	R12 540
5	R23 000	0,4371	0,4190	0,4019	10 053	9 637	R9 244
6	R21 000	0,3704	0,3521	0,3349	7 784	7 394	R7 033
Total PV					78 604	76 581	74 649
Investment					(75 000)	(75 000)	(75 000)
NPV					R3 604	R1 581	(R351)

Step 3

Interpolation:

The IRR is between 19% and 20%.

$$\text{IRR} = 19 + \frac{1\,581}{1\,581 + 351}$$

$$= 19 + \frac{1\,581}{1\,932}$$

$$= 19{,}82\%$$

Project B

Step 1

We notice that the NPV is positive, and also far from zero.

Step 2

We now pick a higher rate e.g. 16%. (Trial-and-error is used to obtain the higher rate.)

Project B

Year	Cash inflow p.a.	Discount Factor 16%	Discount Factor 17%	Present value 16%	Present value 17%
1-6	R22 000	3,6847	3,5892	81 063	78 962
Investment				(80 000)	(80 000)
NPV				R1 063	(R1 038)

Step 3

Interpolation:

The IRR is between 16% and 17%.

$$\text{IRR} = 16 + \frac{1\,063}{1\,063 + 1\,038}$$

$$= 16 + \frac{1\,063}{2\,101}$$

$$= 16{,}51\%$$

Decision: Project A should be chosen since the IRR is greater.

7. INFLUENCE OF INCOME TAX, DEPRECIATION AND SCRAP VALUE

According to Niemand et al. (2004: 490) income tax has an influence on capital investment decisions. A project that may be approved on a pre-taxation basis may be rejected on an after-tax basis. Although depreciation is not a cash outflow, it is deducted when calculating taxable income. Scrap value has an influence on the calculation of depreciation.

The following example illustrates the effects of income tax, depreciation and scrap value on capital investment decisions:

Example 7

Dube Ltd is considering buying a machine and has presented the following information:

	Machine A
Purchase price	R130 000
Expected economic lifetime	10 years
Minimum required rate of return	12%
Net annual cash inflows	R25 000
Rate of taxation	30%
Depreciation is calculated using the straight-line method	

Required

Calculate the:

- Net present value (NPV)
- Internal rate of return (IRR)
- Net present value if the machine has a scrap value of R15 000 at the end of 10 years.

Solution

Calculation of net present value

	Calculation of tax	Cash inflow
Net annual cash inflow	R25 000	R25 000
Depreciation (R130 000 ÷ 10)	(R13 000)	
Taxable income	R12 000	
Income tax (30% of R1 200)	(R3 600)	(R3 600)
Income after tax	R840	_____
Net annual cash inflow after tax		R21 400

The present value factor for 10 years at 12% p.a. is 5,6502	
Present value of future cash flows after tax (R21 400 X 5,6502)	R120 914
Present value of investment	(R130 000)
Net present value (negative)	(R9 086)

Internal rate of return

The NPV is negative. We pick a lower rate e.g. 10%. (trial and error)

We now calculate the NPV at 10%.

Machine B

Year	Cash inflow p.a.	Discount Factor 12%	Discount Factor 10%	Present value 12%	Present value 10%
1-10	R21 400	5,6502	6,1446	R120 914	R131 494
Investment				(130 000)	(130 000)
NPV				(R9 086)	R1 494

Interpolation: The IRR is between 10% and 12%.

$$\text{IRR} = 10 + \frac{1\,494}{1\,494 + 9\,086}$$

$$= 10 + \frac{1\,494}{10\,580}$$

$$= 10{,}14\%$$

Net present value if the machine has a scrap value of R15 000 at the end of 10 years.

	Calculation of tax	Cash inflow
Net annual cash inflow	R25 000	R25 000
Depreciation [(130 000 – R15 000) ÷ 10]	(R11 500)	
Taxable income	R13 500	
Income tax (30% of R13 500)	(R4 050)	(R4 050)
Income after tax	R9 450	_____
Net annual cash inflow after tax		R20 950
The present value factor for 10 years at 12% p.a. is 5,6502.		
Present value of future cash flows after tax (R20 950 X 5,6502)		R118 372
Scrap value (R15 000 X 0,3220)		R4 830
		R123 202
Present value of investment		(130 000)
Net present value (negative)		(R6 798)

8. SELF ASSESSMENT ACTIVITIES AND SOLUTIONS

8.1 An investment in a project has the following cash flows:

Year	Cash flow
0	(R60 000)
1	R10 000
2	R12 000
3	R28 000
4	R20 000
5	R30 000

Required:

8.1.1 Calculate the following:

8.1.1.1 Payback period

8.1.1.2 Net present value (NPV) at 12% cost of capital

8.1.1.3 Accounting rate of return (ARR) (Assume that there is no depreciation and that the investment has no salvage value.)

8.1.2 Must the investment be considered positively or negatively? Give reasons for your answer.

8.2 The financial manager at Rico Ltd had to choose between these two projects, Alpha and Beta, which have the following after-tax net cash inflows:

Year	Alpha	Beta
1	0	R36 000
2	R18 500	R36 000
3	R36 200	R36 000
4	R123 000	R36 000

Both projects require an initial investment of R117 700.

Required:

8.2.1 Calculate the payback period for each project. Which project would you choose? Why?

8.2.2 Calculate the net present value (NPV) for each project, using a discount rate of 12%. Which project would you choose? Why?

8.2.3 Calculate the Cost Benefit Ratio and Net Cost Benefit Ratio for both projects. Which project should be chosen? Why?

8.2.4 Calculate the Internal Rate of Return (IRR) for both projects. Which project should be chosen? Why?

8.3 Mica Ltd is considering buying a machine and has presented the following information:

	Machine Y
Purchase price	R100 000
Expected economic lifetime	4 years
Minimum required rate of return	14%
Net annual cash inflows	R35 000
Rate of taxation	30%
Depreciation is calculated using the straight-line method	

Required

Calculate the:

8.3.1 Net present value (NPV)

8.3.2 Internal rate of return (IRR)

8.3.3 Net present value if the machine has a scrap value of R10 000 at the end of 4 years.

SOLUTIONS

8.1.1.1

Investment	(R60 000)
Year 1 Cash flow	R10 000
	(R50 000)
Year 2 Cash flow	R12 000
	(R38 000)
Year 3 Cash flow	R28 000
	(R10 000)
Year 4 Cash flow	R20 000
Payback period is	3 years 6 months Note: R10 000 X 12 mths R20 000 = 6 months

8.1.1.2

Year	Cash inflow	Discount Factor (see Table 3)	Present value
1	R10 000	0,8929	R8 929
2	R12 000	0.7972	R9 566
3	R28 000	0,7118	R19 930
4	R20 000	0,6355	R12 710
5	R30 000	0.5674	R17 022
Total PV			R68 157
Investment			(R60 000)
NPV (positive)			R8 157

8.1.1.3

Accounting rate of return:	
	Machine X
Average annual profit X 100 = Average investment	R20 000 X 100 / R30 000
	= 66,67%

Note:

Average annual profit =

R10 000 + R12 000 + R28 000 + R20 000 + R30 000

= R20 000 p.a.

Average investment $\frac{\text{R60 000 + 0}}{}$

8.1.2 The investment should be considered positively because:

- The **payback period** is only 2 ½ years.
- The **net present value** R8 157 is positive.
- The **accounting rate of return** 66,67% is higher than the cost of capital 12%.

8.2.1

Investment	(R117 700
Year 1 Cash flow	0
	(R117 700)
Year 2 Cash flow	R18 500
	(R99 200)
Year 3 Cash flow	R36 200
	(R63 000)
Year 4 Cash flow	R123 000

Payback period is 3 years 6 months 5 days

Note:

R63 000 X 12 mths

R123 000

= 6,146 months

0,146 X 30 days

= 4,38 days

Project Beta		
Cost of project	=	R117 700
Net cash inflow		R36 000
		3,27 years

Note:

0,27 X 12 = 3,24 months

0,24 X 30 = 7,2 days

The payback period is 3 years 3 months 8 days

Project Beta should be chosen since the payback period (3 years 3 months 7 days) is less than that of Project Alpha (3 years 6 months 5 days)

8.2.2

Year	Cash inflow	Discount Factor (see Table 3)	Present value
1	0	0,8929	0
2	R18 500	0.7972	R14 748
3	R36 200	0,7118	R25 767
4	R123 000	0,6355	R78 167
Total PV			R118 682
Investment			(R117 700)
NPV (positive)			R982

Project Beta

Net inflow	R36 000
Discount factor (see Table 4)	X 3,0373
Total Present value	R109 343
Investment	(R117 700)
NPV (negative)	(R8 357)

Project Alpha should be chosen since the NPV is positive. The NPV for project Beta is negative and is therefore rejected.

8.2.3

		Project Alpha	Project Beta
Benefit cost ratio (BCR)		PVB	PVB
		I	I
		R118 682	R109 343
		R117 700	R117 700
		1.008	0.929

		Project Alpha	Project Beta
Net Benefit Cost Ratio (NBCR)	=	BCR – 1	BCR – 1
	=	1.008 – 1	0.929 – 1
	=	0.008	–0.071

The Project Alpha may be considered for acceptance because the BCR (1.008) is greater than 1 or because the NBCR (0.008) is greater than 0. However, the BCR is too close to 1 and may be rejected. Project Beta will not be accepted because the BCR (0.929) is less than 0 or because the BBCR (–0.071) is less than 0.

8.2.4 Project Alpha

Step 1

We notice that the NPV is positive, and above zero, but not by a large margin.

Step 2

We now pick a higher rate e.g. 13%. (Trial-and-error is used to obtain the higher rate.)

Project Alpha

Year	Cash inflow	Discount Factor 12%	Discount Factor 13%	Present value 12%	Present value 13%
1	0	0,8929	0,8850	0	0
2	R18 500	0.7972	0,7831	R14 748	R14 487
3	R36 200	0,7118	0,6931	R25 767	R25 090
4	R123 000	0,6355	0,6133	R78 167	R75 436
Total PV				R118 682	R115 013
Investment				(R117 700)	(R117 700)
NPV				R982	(R2 687)

Step 3

Interpolation:

The IRR is between 12% and 13%.

$$IRR = 12 + \frac{982}{982 + 2\,687}$$

$$= 12 + \frac{982}{3\,669}$$

$$= 12{,}27\%$$

Project Beta

Step 1

We notice that the NPV is negative.

Step 2

We now pick a lower rate e.g. 10%. (Trial-and-error is used to obtain the higher rate.)

Project Beta

Year	Cash inflow p.a.	Disc. Factor 10%	Disc. Factor 9%	Disc. Factor 8%	Present value 10%	Present value 9%	Present value 8%
1-4	R36 000	3,1699	3,2397	3,3121	114 116	116 629	119 236
Investment					117 700	117 700	117 700
NPV					(R3 584)	(R1 071)	R1 536

Step 3

Interpolation:

The IRR is between 8% and 9%.

$$\text{IRR} = 8 + \frac{1\,536}{1\,536 + 1\,071}$$

$$= 8 + \frac{1\,536}{2\,607}$$

$$= 8{,}59\%$$

Decision: Project Alpha should be chosen as the IRR is greater.

8.3.1 Calculation of net present value

	Calculation of tax	Cash inflow
Net annual cash inflow	R35 000	R35 000
Depreciation (R100 000 ÷ 4)	(R25 000)	
Taxable income	R10 000	
Income tax (30% of R10 000)	(R3 000)	(R3 000)
Income after tax	R7 000	
Net annual cash inflow after tax		R32 000

The present value factor for 4 years at 14% p.a. is 2,9137.	
Present value of future cash flows after tax (R32 000 X 2,9137)	R93 238
Present value of investment	(R100 000)
Net present value (negative)	(R6 762)

8.3.2 Internal rate of return

The NPV is negative and far from zero. We pick a lower rate e.g. 12%. (trial and error)

Machine B

Year	Cash inflow p.a.	Disc. Factor 12%	Disc. Factor 11%	Disc. Factor 10%	Present value 12%	Present value 11%	Present value 10%
1-4	R32 000	3,0373	3,1024	3,1699	97 194	99 277	101 437
Investment					100 000	100 000	100 000
NPV					(R2 806)	(R723)	R1 437

$$\text{IRR} = 10 + \frac{1\,437}{1\,437 + 723}$$

$$= 10 + \frac{1\,437}{2\,160}$$

$$= 10{,}67\%$$

8.3.3 Net present value if the machine has a scrap value of R10 000 at the end of 4 years.

	Calculation of tax	Cash inflow
Net annual cash inflow	R35 000	R35 000
Depreciation [(100 000 – R10 000) ÷ 4]	(R22 500)	
Taxable income	R12 500	
Income tax (30% of R12 500)	(R3 750)	(R3 750)
Income after tax	R8 750	_____
Net annual cash inflow after tax		R31 250
The present value factor for 4 years at 14% p.a. is 2,9137.		
Present value of future cash flows after tax (R31 250 X 2,9137)		R91 053
Scrap value (R10 000 X 0,5921)		R5 921
		R96 974
Present value of investment		(R100 000)
Net present value (negative)		(R3 026)

TOPIC 12

PROJECT PORTFOLIO MANAGEMENT

LEARNING OUTCOMES
Students should be able to:
■ define project portfolio management.
■ explain the role played by portfolio managers.
■ differentiate between project management and project portfolio management.
■ discuss the need for project portfolio management.
■ apply appropriate criteria for project selection.
■ explain the five levels of project portfolio management.

CONTENTS

READING
Recommended reading
► **Cleland, D.I. and Ireland, L.R. (2002) Project Management: Strategic design and implementation. 4th Edition. Singapore: McGraw-Hill. Pp 210-216** ► **Schwalbe, K. (2009) Introduction to Project Management. 2nd Edition. Boston: Course Technology Cengage Learning. pp 15-17; 60**

1. INTRODUCTION

Project portfolio management is described by Schwalbe (2009:15) as strategy of grouping and managing projects as a portfolio of investments that contribute to the entire enterprise's success. Cleland and Ireland (2002:210) consider project portfolio management as a "strategy that moves the selection and implementation of projects from a random process to one with structure and discipline". The aim is to align projects with strategic goals and objectives for a more effective and efficient organisation.

2. ROLE OF PORTFOLIO MANAGERS

Schwalbe (2009:15) states that portfolio managers must understand how projects fit into the bigger picture of the organisation, especially with regard to finances and business risks. They should create portfolios that meet specific organisational goals, such as maximising the portfolio value, or making the best use of available resources. Portfolio managers assist in making wise decisions by selecting and analysing projects from a strategic perspective. They need to have strong financial and analytical skills.

3. DIFFERENCES BETWEEN PROJECT MANAGEMENT AND PROJECT PORTFOLIO MANAGEMENT

Schwalbe (2009:16) provides an illustration of the differences between project management and project portfolio management in Figure 11-1:

Figure 11-1

Project management

- Are we carrying out projects well?
- Are projects on time and on budget?
- Do project stakeholders know what they should be doing?

Project portfolio management

- Are we working on the right projects?
- Are we investing in the right areas?
- Do we have the right resources to be competitive?

One notices that the main difference is a focus on meeting tactical goals or strategic goals.

Strategic goals emphasise the long-term goals for an enterprise whereas tactical goals are usually more specific and short-term in nature. While project portfolio management addresses strategic goals, individual projects usually address tactical goals. Project management addresses issues concerning how well projects are managed in terms of meeting scope, time, and costs goals, and stakeholder expectations. Project portfolio management addresses issues related to what projects are being done and how well they meet organisational goals, such as making good investments and being competitive.

4. EXAMPLES OF PORTFOLIOS

Portfolios can be developed for all types of projects. Schwalbe (2009:16) provides the following examples:

- In a construction firm, strategic goals may include increasing profit margins on major projects, reducing costs on supplies, and improving skill levels of key employees. Projects may then be grouped together into these three categories for portfolio management purposes.
- A government agency for children's services may group projects into a portfolio based on key strategies such as improving health and improving education to help make decisions on the best way to use limited funds and resources.

5. NEED FOR PROJECT PORTFOLIO MANAGEMENT

Schwalbe (2009:16) outlines the following reasons for project portfolio management:

- It assists in making better decisions e.g. increasing, decreasing, discontinuing, or changing specific projects based on financial performance, risks, resource allocation or other factors that influence business value and strategy.
- Enterprises can better tie their projects to meet strategic goals.
- Portfolio management can also assist an enterprise do a better job of managing its human resources by hiring, training, and retaining workers to support the projects in the portfolio.

Cleland and Ireland (2002:210) add that project portfolio management provides the means of assessing the balance of the types of projects especially in terms of them being high-risk or low-risk. Managing project portfolios also provides greater visibility to the enterprise's total projects without focusing on just one project at a time.

6. PROJECT SELECTION CRITERIA

Cleland and Ireland (2002:212) state that an enterprise should ideally select projects that align with the strategic goals and ones that will build on current capacity. Each project chosen should be a building block that promotes the enterprise's purpose and also positions it for improved future capability.

Each enterprise should develop a model for assessing how the project fits within the strategic goals and objectives. Cleland and Ireland (2002:210) suggest the following considerations for developing an enterprise's model for a portfolio of projects:

- Projects are usually approved to develop and deliver new products and services or to effect organisational change. These projects should be used in a balanced manner to advance the enterprise.
- Projects need to have a balance between providing products and services today and as building blocks for the future.
- Projects are the vehicles for action and implementing strategic plans, contributing to success today and in the future.
- Core competencies drive which projects are chosen and successfully implemented.

What variables and characteristics should be considered for developing a balanced portfolio of projects? Cleland and Ireland (2002:212) provide the answer to this in Table 11-1 which shows the critical aspects that should be considered within the context of the strategic goals and objectives of the organisation.

Table 11-1

Variable	Comment
Profit margin	A profit goal is usually set for projects based on risk, type of work, degree of difficulty in completing the project etc.
Project risk	The risk of the project must be assessed in terms of meeting market expectations, project completion within established goals, schedule etc.
Process change	Projects may be used to upgrade or establish new processes leading to better cost- and time-effective methods.
Resources	Human resources with the required qualifications and nonhuman resources may not be available for the project.
Financial considerations	Large capital expenditures on a project may impact negatively on cash flow.
Building block	Question whether the project is a building block for further development of core competencies and contribution to success.
By-product	Question whether there are by-products that may be used in subsequent projects.
Technology	Question whether the technology is one that the business understands.
Project duration	Question whether the project duration fits into the normal work arrangements or whether there are only long- or short-duration projects.
Size	Question whether the size (Rand, resource, duration) is right for the organisation.
Corporate image	Question the image the business will get when taking on the project.
High competition	Question the degree of competition for the project or product.
Client	Question whether the new project is for an existing client or a new one.
Life-cycle phases	Question whether the project's life-cycle phase provides continuity of work or whether there is interrupted flow of work.
Core competency	Question whether the project is within the enterprise's established core competencies or whether it is initiating a new competency.
Urgency of need	Question the urgency of need to determine whether delivery is possible within the time frame required.
R&D	Question R&D projects to see if there are too many or too few and whether the focus is on the right or wrong areas.

7. FIVE LEVELS OF PROJECT PORTFOLIO MANAGEMENT

Project portfolios can be developed and managed in various ways. According to Schwalbe (2009:60) an organisation can view project portfolio management as having five levels, from the simple to the most complex.

7.1 Place all the projects in one list. After stating all the projects, duplicate and unneeded projects may be identified.

7.2 Projects in the list are prioritised. This is important to know so that resources are allocated accordingly.

7.3 Projects are divided into several categories based on types of investment. Categorising helps to see how many projects are supporting a growth strategy, how many are helping to increase profit margins, how many relate to marketing, and how many relate to materials.

7.4 Automate the list. By putting key information in a computerised system (e.g. spreadsheet software such as excel) managers can view project data in many different ways.

7.5 Apply modern portfolio theory, including risk-return tools that map project risks. Many software products are available nowadays to help analyse portfolios.

8. SELF-ASSESSMENT ACTIVITIES AND SOLUTIONS

8.1 Distinguish between project management and project portfolio management in terms of the nature of the goals that are focussed on.

8.2 How does the role played by portfolio managers, program managers, and project managers differ?

8.3 Name some strategic goals for a clothing firm that would also form the basis for its portfolio of projects.

8.4 What advantages to you see for using project portfolio management in your organisation?

8.5 The table below shows what an organisation's ideal project portfolio might be as well as what it actually is:

Item	Target	Actual
Small-sized projects	32	27
Medium-sized projects	12	17
Large-sized projects	4	7
High-risk projects	2	3
Medium-risk projects	6	0
Low-risk projects	40	45
Projects related to competencies	48	29
Number of project customers	>12	7
High-technology projects	2	0
R&D projects	5	3

Source: Cleland and Ireland (2002:215)

Explain why the portfolio is out of balance.

8.6 Use a practical example to show how you would use at least 5 criteria in the project selection process.

Solutions

8.1 While project portfolio management addresses strategic goals, individual projects (project management) usually address tactical goals.

8.2 Portfolio managers help select projects. Program managers oversee groups of related projects. Project managers lead their specific projects.

8.3 Answers will vary.

Strategic goals may include improving the effectiveness of information technology, introducing new product lines, reducing inventory costs, and increasing customer satisfaction. These may be the main categories for the enterprise's portfolio of projects.

8.4 Answers may vary.

Project portfolio management adds a dimension to an organisation's capability and plan for growth.

It provides a means of assessing the balance of the types of projects especially in terms of them being high-risk or low-risk.

Managing project portfolios also provides greater visibility to the enterprise's total projects without focusing on just one project at a time.

8.5

Project size shows a tendency to move towards larger projects. A review is required to determine whether the organisationcan cope with 48 projects at one time with 6 projects moving into the next category (excess of 5 in medium category and 1 in the large category).

Project risk exceeds the high category by one, whereas 5 additional projects fall in the low category. If the high-risk projects are all large projects, this could have an impact on the organisation.

Project-competency connection appears to be out of balance with the goals. A little more than half the projects are within the organisation's core competencies.

The number of project customers does not meet the target goal. A review is needed to determine if this could lead to problems in future.

There are no high technology projects. This may indicate a stagnation of technology growth to meet the marketplace.

R&D projects are not maintaining pace with the target. It could be that resources are being used on existing projects or there is no need for R&D in the current year.

8.6 Answers will vary.

Profitability	Projects will have an expected profitability of more than 20%.
Project risk	Project goals will have at least a 75% chance of success.
Project size	Project mix will consist of small (less than R10m), medium (between R10m and R50m), and large (more than R50m) projects. Small projects will represent 45% of the business, medium projects will represent 35% of the business, and large projects will represent 20% of the business.
Core competencies	Projects will be selected on the basis of fit into one of the organisation's competencies. Exceptions to this would require approval by the board of directors.
Technology	Projects requiring new technology will be compatible with existing core competency growth plans.

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Table 1 - Future value of R1 compounded at i percent for n periods																			
Period	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**	**11%**	**12%**	**13%**	**14%**	**15%**	**16%**	**17%**	**18%**	**19%**
1	1.0100	1.0200	1.0300	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000	1.1100	1.1200	1.1300	1.1400	1.1500	1.1600	1.1700	1.1800	1.1900
2	1.0201	1.0404	1.0609	1.0816	1.1025	1.1236	1.1449	1.1664	1.1881	1.2100	1.2321	1.2544	1.2769	1.2996	1.3225	1.3456	1.3689	1.3924	1.4161
3	1.0303	1.0612	1.0927	1.1249	1.1576	1.1910	1.2250	1.2597	1.2950	1.3310	1.3676	1.4049	1.4429	1.4815	1.5209	1.5609	1.6016	1.6430	1.6852
4	1.0406	1.0824	1.1255	1.1699	1.2155	1.2625	1.3108	1.3605	1.4116	1.4641	1.5181	1.5735	1.6305	1.6890	1.7490	1.8106	1.8739	1.9388	2.0053
5	1.0510	1.1041	1.1593	1.2167	1.2763	1.3382	1.4026	1.4693	1.5386	1.6105	1.6851	1.7623	1.8424	1.9254	2.0114	2.1003	2.1924	2.2878	2.3864
6	1.0615	1.1262	1.1941	1.2653	1.3401	1.4185	1.5007	1.5869	1.6771	1.7716	1.8704	1.9738	2.0820	2.1950	2.3131	2.4364	2.5652	2.6996	2.8398
7	1.0721	1.1487	1.2299	1.3159	1.4071	1.5036	1.6058	1.7138	1.8280	1.9487	2.0762	2.2107	2.3526	2.5023	2.6600	2.8262	3.0012	3.1855	3.3793
8	1.0829	1.1717	1.2668	1.3686	1.4775	1.5938	1.7182	1.8509	1.9926	2.1436	2.3045	2.4760	2.6584	2.8526	3.0590	3.2784	3.5115	3.7589	4.0214
9	1.0937	1.1951	1.3048	1.4233	1.5513	1.6895	1.8385	1.9990	2.1719	2.3579	2.5580	2.7731	3.0040	3.2519	3.5179	3.8030	4.1084	4.4355	4.7854
10	1.1046	1.2190	1.3439	1.4802	1.6289	1.7908	1.9672	2.1589	2.3674	2.5937	2.8394	3.1058	3.3946	3.7072	4.0456	4.4114	4.8068	5.2338	5.6947
11	1.1157	1.2434	1.3842	1.5395	1.7103	1.8983	2.1049	2.3316	2.5804	2.8531	3.1518	3.4785	3.8359	4.2262	4.6524	5.1173	5.6240	6.1759	6.7767
12	1.1268	1.2682	1.4258	1.6010	1.7959	2.0122	2.2522	2.5182	2.8127	3.1384	3.4985	3.8960	4.3345	4.8179	5.3503	5.9360	6.5801	7.2876	8.0642
13	1.1381	1.2936	1.4685	1.6651	1.8856	2.1329	2.4098	2.7196	3.0658	3.4523	3.8833	4.3635	4.8980	5.4924	6.1528	6.8858	7.6987	8.5994	9.5964
14	1.1495	1.3195	1.5126	1.7317	1.9799	2.2609	2.5785	2.9372	3.3417	3.7975	4.3104	4.8871	5.5348	6.2613	7.0757	7.9875	9.0075	10.1472	11.4198
15	1.1610	1.3459	1.5580	1.8009	2.0789	2.3966	2.7590	3.1722	3.6425	4.1772	4.7846	5.4736	6.2543	7.1379	8.1371	9.2655	10.5387	11.9737	13.5895
16	1.1726	1.3728	1.6047	1.8730	2.1829	2.5404	2.9522	3.4259	3.9703	4.5950	5.3109	6.1304	7.0673	8.1372	9.3576	10.7480	12.3303	14.1290	16.1715
17	1.1843	1.4002	1.6528	1.9479	2.2920	2.6928	3.1588	3.7000	4.3276	5.0545	5.8951	6.8660	7.9861	9.2765	10.7613	12.4677	14.4265	16.6722	19.2441
18	1.1961	1.4282	1.7024	2.0258	2.4066	2.8543	3.3799	3.9960	4.7171	5.5599	6.5436	7.6900	9.0243	10.5752	12.3755	14.4625	16.8790	19.6733	22.9005
19	1.2081	1.4568	1.7535	2.1068	2.5270	3.0256	3.6165	4.3157	5.1417	6.1159	7.2633	8.6128	10.1974	12.0557	14.2318	16.7765	19.7484	23.2144	27.2516
20	1.2202	1.4859	1.8061	2.1911	2.6533	3.2071	3.8697	4.6610	5.6044	6.7275	8.0623	9.6463	11.5231	13.7435	16.3665	19.4608	23.1056	27.3930	32.4294
21	1.2324	1.5157	1.8603	2.2788	2.7860	3.3996	4.1406	5.0338	6.1088	7.4002	8.9492	10.8038	13.0211	15.6676	18.8215	22.5745	27.0336	32.3238	38.5910
22	1.2447	1.5460	1.9161	2.3699	2.9253	3.6035	4.4304	5.4365	6.6586	8.1403	9.9336	12.1003	14.7138	17.8610	21.6447	26.1864	31.6293	38.1421	45.9233
23	1.2572	1.5769	1.9736	2.4647	3.0715	3.8197	4.7405	5.8715	7.2579	8.9543	11.0263	13.5523	16.6266	20.3616	24.8915	30.3762	37.0062	45.0076	54.6487
24	1.2697	1.6084	2.0328	2.5633	3.2251	4.0489	5.0724	6.3412	7.9111	9.8497	12.2392	15.1786	18.7881	23.2122	28.6252	35.2364	43.2973	53.1090	65.0320
25	1.2824	1.6406	2.0938	2.6658	3.3864	4.2919	5.4274	6.8485	8.6231	10.8347	13.5855	17.0001	21.2305	26.4619	32.9190	40.8742	50.6578	62.6686	77.3881

TABLE 2 Future value interest factor of an ordinary annuity of R1 per period at i% for n periods															
n	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**	**11%**	**12%**	**13%**	**14%**	**15%**
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600	2.0700	2.0800	2.0900	2.1000	2.1100	2.1200	2.1300	2.1400	2.1500
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836	3.2149	3.2464	3.2781	3.3100	3.3421	3.3744	3.4069	3.4396	3.4725
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746	4.4399	4.5061	4.5731	4.6410	4.7097	4.7793	4.8498	4.9211	4.9934
5	5.1010	5.2040	5.3091	5.4163	5.5256	5.6371	5.7507	5.8666	5.9847	6.1051	6.2278	6.3528	6.4803	6.6101	6.7424
6	6.1520	6.3081	6.4684	6.6330	6.8019	6.9753	7.1533	7.3359	7.5233	7.7156	7.9129	8.1152	8.3227	8.5355	8.7537
7	7.2135	7.4343	7.6625	7.8983	8.1420	8.3938	8.6540	8.9228	9.2004	9.4872	9.7833	10.0890	10.4047	10.7305	11.0668
8	8.2857	8.5830	8.8923	9.2142	9.5491	9.8975	10.2598	10.6366	11.0285	11.4359	11.8594	12.2997	12.7573	13.2328	13.7268
9	9.3685	9.7546	10.1591	10.5828	11.0266	11.4913	11.9780	12.4876	13.0210	13.5795	14.1640	14.7757	15.4157	16.0853	16.7858
10	10.4622	10.9497	11.4639	12.0061	12.5779	13.1808	13.8164	14.4866	15.1929	15.9374	16.7220	17.5487	18.4197	19.3373	20.3037
11	11.5668	12.1687	12.8078	13.4864	14.2068	14.9716	15.7836	16.6455	17.5603	18.5312	19.5614	20.6546	21.8143	23.0445	24.3493
12	12.6825	13.4121	14.1920	15.0258	15.9171	16.8699	17.8885	18.9771	20.1407	21.3843	22.7132	24.1331	25.6502	27.2707	29.0017
13	13.8093	14.6803	15.6178	16.6268	17.7130	18.8821	20.1406	21.4953	22.9534	24.5227	26.2116	28.0291	29.9847	32.0887	34.3519
14	14.9474	15.9739	17.0863	18.2919	19.5986	21.0151	22.5505	24.2149	26.0192	27.9750	30.0949	32.3926	34.8827	37.5811	40.5047
15	16.0969	17.2934	18.5989	20.0236	21.5786	23.2760	25.1290	27.1521	29.3609	31.7725	34.4054	37.2797	40.4175	43.8424	47.5804
16	17.2579	18.6393	20.1569	21.8245	23.6575	25.6725	27.8881	30.3243	33.0034	35.9497	39.1899	42.7533	46.6717	50.9804	55.7175
17	18.4304	20.0121	21.7616	23.6975	25.8404	28.2129	30.8402	33.7502	36.9737	40.5447	44.5008	48.8837	53.7391	59.1176	65.0751
18	19.6147	21.4123	23.4144	25.6454	28.1324	30.9057	33.9990	37.4502	41.3013	45.5992	50.3959	55.7497	61.7251	68.3941	75.8364
19	20.8109	22.8406	25.1169	27.6712	30.5390	33.7600	37.3790	41.4463	46.0185	51.1591	56.9395	63.4397	70.7494	78.9692	88.2118
20	22.0190	24.2974	26.8704	29.7781	33.0660	36.7856	40.9955	45.7620	51.1601	57.2750	64.2028	72.0524	80.9468	91.0249	102.4436
25	28.2432	32.0303	36.4593	41.6459	47.7271	54.8645	63.2490	73.1059	84.7009	98.3471	114.4133	133.3339	155.6196	181.8708	212.7930
30	34.7849	40.5681	47.5754	56.0849	66.4388	79.0582	94.4608	113.2832	136.3075	164.4940	199.0209	241.3327	293.1992	356.7868	434.7451
35	41.6603	49.9945	60.4621	73.6522	90.3203	111.4348	138.2369	172.3168	215.7108	271.0244	341.5896	431.6635	546.6808	693.5727	881.1702
40	48.8864	60.4020	75.4013	95.0255	120.7998	154.7620	199.6351	259.0565	337.8824	442.5926	581.8261	767.0914	1,013.7042	1,342.0251	1,779.0903
50	64.4632	84.5794	112.7969	152.6671	209.3480	290.3359	406.5289	573.7702	815.0836	1,163.9085	1,668.7712	2,400.0182	3,459.5071	4,994.5213	7,217.7163

TABLE 3

Present value of R1: PVFA (*k,n*) = $\frac{1}{(1+k)^n}$

Number of Periods	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	25%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333	0.8000
2	0.9803	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561	0.7432	0.7305	0.7182	0.7062	0.6944	0.6400
3	0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575	0.6407	0.6244	0.6086	0.5934	0.5787	0.5120
4	0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.5337	0.5158	0.4987	0.4823	0.4096
5	0.9515	0.9057	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972	0.4761	0.4561	0.4371	0.4190	0.4019	0.3277
6	0.9420	0.8880	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3898	0.3704	0.3521	0.3349	0.2621
7	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759	0.3538	0.3332	0.3139	0.2959	0.2791	0.2097
8	0.9235	0.8535	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269	0.3050	0.2848	0.2660	0.2487	0.2326	0.1678
9	0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.2434	0.2255	0.2090	0.1938	0.1342
10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0.2080	0.1911	0.1756	0.1615	0.1074
11	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149	0.1954	0.1778	0.1619	0.1476	0.1346	0.0859
12	0.8874	0.7885	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869	0.1685	0.1520	0.1372	0.1240	0.1122	0.0687
13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	0.1452	0.1299	0.1163	0.1042	0.0935	0.0550
14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.1110	0.0985	0.0876	0.0779	0.0440
15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0949	0.0835	0.0736	0.0649	0.0352
16	0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0811	0.0708	0.0618	0.0541	0.0281
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0693	0.0600	0.0520	0.0451	0.0225
18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808	0.0691	0.0592	0.0508	0.0437	0.0376	0.0180
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703	0.0596	0.0506	0.0431	0.0367	0.0313	0.0144
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611	0.0514	0.0433	0.0365	0.0308	0.0261	0.0115
25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923	0.0736	0.0588	0.0471	0.0378	0.0304	0.0245	0.0197	0.0160	0.0129	0.0105	0.0038
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	0.0437	0.0334	0.0256	0.0196	0.0151	0.0116	0.0090	0.0070	0.0054	0.0042	0.0012
40	0.6717	0.4529	0.3066	0.2083	0.1420	0.0972	0.0668	0.0460	0.0318	0.0221	0.0154	0.0107	0.0075	0.0053	0.0037	0.0026	0.0019	0.0013	0.0010	0.0007	0.0001
50	0.6080	0.3715	0.2281	0.1407	0.0872	0.0543	0.0339	0.0213	0.0134	0.0085	0.0054	0.0035	0.0022	0.0014	0.0009	0.0006	0.0004	0.0003	0.0002	0.0001	*
60	0.5504	0.3048	0.1697	0.0951	0.0535	0.0303	0.0173	0.0099	0.0057	0.0033	0.0019	0.0011	0.0007	0.0004	0.0002	0.0001	0.0001	*	*	*	*

TABLE 4

Present value of a regular annuity of R1 per period for n periods : PVFA (*k,n*) =

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

Number of Periods	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1.7125	1.6901	1.6681	1.6467	1.6257	1.6052	1.5852	1.5656	1.5465	1.5278
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4437	2.4018	2.3612	2.3216	2.2832	2.2459	2.2096	2.1743	2.1399	2.1065
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.1024	3.0373	2.9745	2.9137	2.8550	2.7982	2.7432	2.6901	2.6386	2.5887
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908	3.6959	3.6048	3.5172	3.4331	3.3522	3.2743	3.1993	3.1272	3.0576	2.9906
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553	4.2305	4.1114	3.9975	3.8887	3.7845	3.6847	3.5892	3.4976	3.4098	3.3255
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684	4.7122	4.5638	4.4226	4.2883	4.1604	4.0386	3.9224	3.8115	3.7057	3.6046
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988	4.6389	4.4873	4.3436	4.2072	4.0776	3.9544	3.8372
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.5370	5.3282	5.1317	4.9464	4.7716	4.6065	4.4506	4.3038	4.1633	4.0310
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.8892	5.6502	5.4262	5.2161	5.0188	4.8332	4.6586	4.4941	4.3389	4.1925
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869	5.4527	5.2337	5.0286	4.8364	4.6560	4.4865	4.3271
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137	6.4924	6.1944	5.9176	5.6603	5.4206	5.1971	4.9884	4.7932	4.6105	4.4392
13	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4869	7.1034	6.7499	6.4235	6.1218	5.8424	5.5831	5.3423	5.1183	4.9095	4.7147	4.5327
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.9819	6.6282	6.3025	6.0021	5.7245	5.4675	5.2293	5.0081	4.8023	4.6106
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061	7.1909	6.8109	6.4624	6.1422	5.8474	5.5755	5.3242	5.0916	4.8759	4.6755
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466	8.8514	8.3126	7.8237	7.3792	6.9740	6.6039	6.2651	5.9542	5.6685	5.4053	5.1624	4.9377	4.7296
17	15.5623	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.5488	7.1196	6.7291	6.3729	6.0472	5.7487	5.4746	5.2223	4.9897	4.7746
18	16.3983	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.7016	7.2497	6.8399	6.4674	6.1280	5.8178	5.5339	5.2732	5.0333	4.8122
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.8393	7.3658	6.9380	6.5504	6.1982	5.8775	5.5845	5.3162	5.0700	4.8435
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136	7.9633	7.4694	7.0248	6.6231	6.2593	5.9288	5.6278	5.3527	5.1009	4.8696
25	22.0232	19.5235	17.4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	8.4217	7.8431	7.3300	6.8729	6.4641	6.0971	5.7662	5.4669	5.1951	4.9476
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269	8.6938	8.0552	7.4957	7.0027	6.5660	6.1772	5.8294	5.5168	5.2347	4.9789
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7791	8.9511	8.2438	7.6344	7.1050	6.6418	6.2335	5.8713	5.5482	5.2582	4.9966
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148	9.0417	8.3045	7.6752	7.1327	6.6605	6.2463	5.8801	5.5541	5.2623	4.9995

60	44.9550	34.7609	27.6756	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9.9672	9.0736	8.3240	7.6873	7.1401	6.6651	6.2402	5.8819	5.5553	5.2630	4.9999