

**Course No. 404: PROJECT MANAGEMENT**

[Project Management: Aspects of Project Management in forms of project organisation, project control, human aspects of project management. The project Manager's jobs Market Potentiality Analysis Identification of Opportunities, Evaluation of Market and Potential Demand Technical Analysis: Materials and Inputs Production Technology, Product Mix, Plant Capacity, Location and Site Selection, Projection Charts, Layout and work schedules](#)

[MBA. Cost and Profitability: Estimation of cost of Project means of finance. Estimation of Working Capital, estimation of cost of Production, working results and profitability Financial Project: Projection Balance Sheet and Projected Cash Flow Statements Project Appraisal Criteria : Pay Back Period : Accounting Rate of Return.](#)

[Debt Service Coverage Ratio. Net present value, Benefit Cost Ratio, Internal Rate of Return and Annual Capital charge Project Implementation and Management: Project Monitoring and Cost Control System. Network analysis, Resource Scheduling and Levelling Crashing of project cost](#)

**INTRODUCTION**

Projects have a major role to play in the economic development of a country. Since the introduction of planning in our economy, we have been investing large amount of money in projects related to industry, minerals, power, transportation, irrigation, education etc. with a view to improve the socio-economic conditions of the people. These projects are designed with the aim of efficient management, earning adequate return to provide for future development with their own resources. But experience shows that there are several shortcomings in the ultimate success of achieving the objectives of the proposed project.

**CONCEPT OF PROJECT AND PROJECT MANAGEMENT**

The term project has a wider meaning. A project is accomplished by performing asset of activities. For example, construction of a house is a project. The construction of a house consists of many activities like digging of foundation pits, construction of foundation, construction of walls, construction of roof, fixing of doors and windows, fixing of sanitary fitting, wiring etc. Another aspect of project is the non-routine nature of activities. Each project is unique in the sense that the activities of a project are unique and non-routine. A project consumes resources. The resources required for completing a project are men, material, money and time. Thus, we can define a project as an organized programmer of pre-determined group of activities that are non-routine in nature and that must be completed using the available resources within the given time limit. Let us now consider some definitions of 'project'. Newman et. al define that "a project typically has a distinct mission that it is designed to achieve and a clear termination point the achievement of the mission". Gillinger defines "project" as the whole complex of activities involved in using resources to gain benefits. Project management institute, USA defined project as "a system involving the co-ordination of a number of separate department entities throughout organization, in a way it must be completed with prescribed schedules and time constraints".

According to the encyclopedia of management, "project is an organized unit dedicated to the attainment of goal, the successful completion of a development project on time, within budget, in conformance with predetermined programmer specification." Though project management is in the process of getting evolved as a separate branch of study, projects are not new to the earth. One of the seven wonders of the world, the pyramids date back to 2650 B.C. which stand as the hall mark of Egyptian civilization. The period of construction of the Taj Mahal, another wonder of the world is reported to be during 1626-1648 A.D. It is reported that about 20,000 persons worked for nearly 22 years to complete this spectacular structure, which stands today as mankind's proudest creation. One can imagine the extent of resources and expertise that would have been put forth for the completion of such magnificent projects. Project management is an organised venture for managing projects, involves scientific application of modern tools and techniques in planning, financing, implementing, monitoring, controlling and coordinating unique activities or task produce desirable outputs in accordance with the determined objectives with in the

**What is 'Project Management'**- Project management involves planning and organization of a company's resources to move a specific task, event or duty toward completion. It typically involves a one-time project rather than an ongoing activity, and resources managed include human capital and financial capital. A project manager helps to define the goals and objectives of the project and determines when the various project components are to be completed and by whom; he also creates quality control checks to ensure completed components meet a certain standard.

**Project management processes fall into five groups:**

1.Initiating 2.Planning 3.Executing 4.Monitoring and Controlling 5.Closing

**Initiating process group processes**

The initiating processes determine the nature and scope of the project. If this stage is not performed well, it is unlikely that the project will be successful in meeting the business' needs. The key project controls needed here are an understanding of the business environment and making sure that all necessary controls are incorporated into the project. Any deficiencies should be reported and a recommendation should be made to fix them.

The initiating stage should include a plan that encompasses the following areas:

- analysing the business needs/requirements in measurable goals
- reviewing of the current operations
- financial analysis of the costs and benefits including a budget
- stakeholder analysis, including users, and support personnel for the project
- project charter including costs, tasks, deliverables, and schedules

**Planning**

After the initiation stage, the project is planned to an appropriate level of detail (see example of a flow-chart).[32] The main purpose is to plan time, cost and resources adequately to estimate the work needed and to effectively manage risk during project execution. As with the Initiation process group, a failure to adequately plan greatly reduces the project's chances of successfully accomplishing its goals.

Project planning generally consists of determining how to plan (e.g. by level of detail or Rolling Wave planning);

- developing the scope statement;
- selecting the planning team;
- identifying deliverables and creating the work breakdown structure;
- estimating the resource requirements for the activities;
- estimating time and cost for activities;
- developing the schedule;
- developing the budget;
- risk planning;
- Gaining formal approval to begin work.

identifying the activities needed to complete those deliverables and networking the activities in their logical sequence; Additional processes, such as planning for communications and for scope management, identifying roles and responsibilities, determining what to purchase for the project and holding a kick-off meeting are also generally advisable. For new product development projects, conceptual design of the operation of the final product may be performed concurrent with the project planning activities, and may help to inform the planning team when identifying deliverables and planning activities.

**Executing-** The execution/implementation phase ensures that the project management plan's deliverables are executed accordingly. This phase involves proper allocation, co-ordination and management of human resources and any other resources such as material and budgets. The output of this phase is the project deliverables.

**Monitoring and controlling-** Monitoring and controlling consists of those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken, when necessary, to control the execution of the project. The key benefit is that project performance is observed and measured regularly to identify variances from the project management plan.

- Monitoring and controlling includes:
  - Measuring the on-going project activities ('where we are');
  - Monitoring the project variables (cost, effort, scope, etc.) against the project management plan and the project performance baseline (where we should be);
  - Identifying corrective actions to address issues and risks properly (How can we get on track again);
  - Influencing the factors that could circumvent integrated change control so only approved changes are implemented.
- In multi-phase projects, the monitoring and control process also provides feedback between project phases, in order to implement corrective or preventive actions to bring the project into compliance with the project management plan.

1. Project maintenance is an on-going process, and it includes:
2. Continuing support of end-users
3. Correction of errors
4. Updates to the product over time
5. Monitoring and controlling cycle

In this stage, auditors should pay attention to how effectively and quickly user problems are resolved.

Over the course of any construction project, the work scope may change. Change is a normal and expected part of the construction process. Changes can be the result of necessary design modifications, differing site conditions, material availability, contractor-requested changes, value engineering and impacts from third parties, to name a few. Beyond executing the change in the field, the change normally needs to be documented to show what was actually constructed. This is referred to as change management. Hence, the owner usually requires a final record to show all changes or, more specifically, any change that modifies the tangible portions of the finished work. The record is made on the contract documents – usually, but not necessarily limited to, the design drawings. The end product of this effort is what the industry terms as-built drawings, or more simply, "as built." The requirement for providing them is a norm in construction contracts. Construction document management is a highly important task undertaken with the aid an online or desktop software system, or maintained through physical documentation. The increasing legality pertaining to the construction industries maintenance of correct documentation has caused the increase in the need for document management systems.

When changes are introduced to the project, the viability of the project has to be re-assessed. It is important not to lose sight of the initial goals and targets of the projects. When the changes accumulate, the forecasted result may not justify the original proposed investment in the project. Successful project management identifies these components, and tracks and monitors progress so as to stay within time and budget frames already outlined at the commencement of the project.

**Closing-** Closing includes the formal acceptance of the project and the ending thereof. Administrative activities include the archiving of the files and documenting lessons learned.

#### CHARACTERISTICS OF PROJECT

- (1) **Objectives:** A project has a set of objectives or a mission. Once the objectives are achieved the project is treated as completed.
- (2) **Life cycle:** A project has a life cycle. The life cycle consists of five stages i.e. conception stage, definition stage, planning & organizing stage, Implementation stage and commissioning stage.
- (3) **Uniqueness:** Every project is unique and no two projects are similar. Setting up a cement plant and construction of a highway are two different projects having unique features.
- (4) **Team Work:** Project is a team work and it normally consists of diverse areas. There will be personnel specialized in their respective areas and Co-ordination among the diverse areas calls for team work.
- (5) **Complexity:** A project is a complex set of activities relating to diverse areas.
- (6) **Risk and uncertainty:** Risk and uncertainty go hand in hand with project. A risk-free, it only means that the element is not apparently visible on the surface and it will be hidden underneath.
- (7) **Customer specific nature:** A project is always customer specific. It is the customer who decides upon the product to be produced or services to be offered and hence it is the responsibility of any organization to go for projects/services that are suited to customer needs.
- (8) **Change:** Changes occur throughout the life span of a project as a natural Outcome of many environmental factors. The changes may vary from minor changes, which may have very little impact on the project, to major changes which may have a big impact or even may change the very nature of the project.
- (9) **Optimality :** A project is always aimed at optimum utilization of resources for the overall development of the economy.
- (10) **Sub-contracting:** A high level of work in a project is done through contractors. The more the complexity of the project, the more will be the extent of contracting.
- (11) **Unity in diversity:** A project is a complex set of thousands of varieties. The varieties are in terms of technology, equipment and materials, machinery and people, work, culture and others.

#### PROJECT FAMILY TREE

A project normally originates from a plan, national plan or corporate plan. In normal scheme of things, the family tree for a project would be as given below

Plan = National/Corporate plan with target for growth.

Programme = health programme, educational programme, R&D programme.

Project = Power plant, hospital, housing project etc.

Work Package = Water supply, power supply and distribution package.

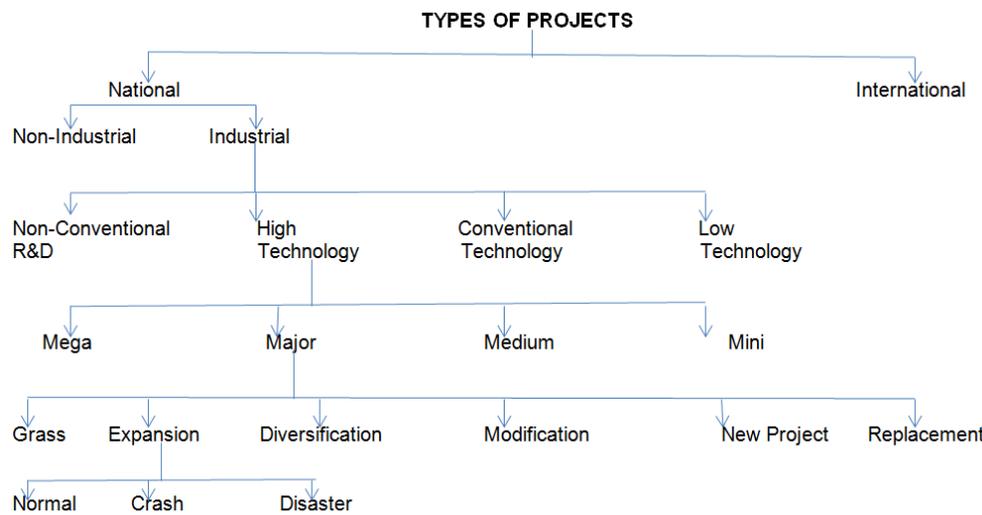
Task = Award of water supply contract, construction & foundation.

Activity = Excavation, laying of cable, preparation of drawing



### CLASSIFICATION OF PROJECTS

The location, type, technology, size, scope and speed are normally the factors which determine the effort needed in executing a project. Project can be classified under different heads, some of which are shown in figure 1.2.



### PROJECT SELECTION PROCESS

Identification of a new project is a complex problem. Project selection process starts with the generation of project ideas. In order to select the most promising project, the entrepreneur needs to generate a few ideas about the possible project one can undertake. The project ideas as a process of identification of a project begins with an analytical survey of the economy (also known as pre-investment surveys). The surveys and studies will give us ideas. The process of project selection consists of following Stages:

- |                           |                                |   |
|---------------------------|--------------------------------|---|
| 1. Idea generation        | 4. Scouting for project ideas. | 7. Sources of positive Net Present Value. |
| 2. Environment appraisal. | 5. Preliminary screening.      | 8. Entrepreneur qualities.                |
| 3. Corporate appraisal    | 6. Project rating index        |   |

**Idea Generation:** - Project selection process starts with the generation of a project idea. Ideas are based on technological breakthroughs and most of the project ideas are variants of present products or services. To stimulate the flow of ideas, the following are helpful:

**SWOT Analysis:** - SWOT is an acronym for strengths, weaknesses, opportunities and threats. SWOT analysis represents conscious, deliberate and systematic effort by an organization to identify opportunities that can be profitably exploited by it. Periodic SWOT analysis facilitates the generation of ideas. Operational objectives of a firm may be one or more of the following.

- |                              |  |
|------------------------------|--|
| 1. Cost reduction.           | 3. Increase in capacity utilization.   |
| 2. Productivity improvement. | 4. Improvement in contribution margin. |

**Fostering a conducive climate :-** To tap the creativity of people and to harness their entrepreneurial skills, a conducive organisation climate has to be fostered. Two conspicuous examples of organization which have been exceptionally successful in tapping the creativity of employees are the Bell Telephone Laboratory and the 3M Corporation. While the former has succeeded in harnessing creativity by providing an unconstrained environment, the latter has effectively nurtured the entrepreneurial skills of its employees as sources of idea generation. The project ideas can be generated from various internal and external sources. These are :-

- |  |  |   |
|--|--|---|
| 1. Knowledge of market, products, and services.      | 4. Scope for producing substitute product. | 9. Ideas given by the experienced person. |
| 2. Knowledge of potential customer choice.           | 5. Market survey & research.               | 10. Ideas by own experience.              |
| 3. Emerging trends in demand for particular product. | 6. Going through Professional magazines.   | 11. SWOT analysis.                        |
|  | 7. Making visits to trade and exhibitions. |   |
|  | 8. Government guidelines & policy.         |   |

**Environment appraisal :-** An entrepreneur or a firm systematically appraise the environment and assess its competitive abilities. For the purposes of monitoring, the business environment may be divided into six broad sectors as shown in fig..

The key elements of the environment are as follow :

#### Economic Sector

- |                           |   |                                 |
|---------------------------|---|---------------------------------|
| 1. State of the economy   | 4. Inflation rate   | 6. Growth rate of world economy |
| 2. Overall rate of growth | 5. Growth rate of primary, secondary and territory sector | 7. Trade surplus and deficits   |
| 3. Cyclical fluctuations  |   | 8. Balance of Payment           |

#### Government Sector

- |                                       |  |                   |
|---------------------------------------|--|-------------------|
| Industrial policy                     | • EXIM policy                          | • Monetary policy |
| • Government programmers and projects | • Financing norms                      |                   |
| • Tax structure                       | • Subsidies incentives and concessions |                   |

#### Technological Sector

- Emergence of new technologies
- Access to technical know-how, foreign as well as indigenous

#### Socio-demographic Sector

1. Population trends
2. Age shifts in population

3. Income distribution

4. Educational profile

**Competition Sector**

1. Number of firms in the industry and the market share of the top few

2. Degree of homogeneity and differentiation among the products

5. Employment of women

6. Attitudes toward consumption and investment

3. Entry barrier

4. Comparison with substitutes in term of quality and price

5. Marketing policies and practices

**Supplier Sector**

• Availability and cost of raw material

1. Socio Economic

2. Technological Environment

• Availability and cost of energy

3. Government

4. Competitor

• Availability and cost of capital

5. Supplier

6. Geographic

**Corporate Appraisal** :- A realistic appraisal of corporate strengths and weaknesses is essential for identifying investment opportunities which can be profitably exploited. The broad areas of corporate appraisal and the important aspects to be considered under them are as follow :

**Marketing and Distribution**

• Market Image

• Product Line

• Product Mix

• Distribution Channels

• Customer loyalty

• Marketing &amp; distribution costs

**Production and Operations**

• Condition and capacity of plant and machinery

• Availability of raw material and power

• Degree of vertical integration

• Locational advantage

• Cost structure

**Research and Development**

• Research capabilities of the firm

• Track record of new product developments

• Laboratories and testing facilities

• Coordination between research and operations.

**Corporate Resources and Personnel**

• Corporate image

• Dynamism of top management

• Relation with government and regulatory agencies

• State of industry relations

**Finance and Accounting****Financial leverage and borrowing capacity**

• Cost of capital

• Tax structure

• Relation with shareholders and creditors

• Accounting &amp; control system

• Cash flow and liquidity

**1.7 PROJECT LIFE CYCLE**

A project is not a one shot activity. Even a shooting star has a time and life span. Project lifecycle is spread over a period of time. There is an unavoidable gestation period for the complex of activities involved to attain the objectives in view. This gestation period, however, varies from project to project but it is possible to describe, in general term, the time phasing of project planning activities common to most projects. The principal stages in the life of a project are :

• Identification

• Initial formulation

• Evaluation (selection or rejection)

• Final formulation (or selection)

• Implementation

• Completion and operation

Development projects are expressly designed to solve the varied problems of the economics whether in the short or long run. The surveys or in depth studies would locate the problems and the project planner will have to identify the projects that would solve the problems most effectively. At this stage, we are concerned with the kind of action and type of project that would be required in rather broad term. In other words the surveys and studies will give us ideas and throw up suggestions which would be worked out in detail later and then evaluated objectively before being accepted for implementation. What types of surveys and studies are to be undertaken? The current sociopolitical economic situation has to be critically assessed. It will also be necessary to review it in its historical perspective necessitating the undertaking of a survey of the behaviour and growth of the economy during the preceding decades. On the basis of past trends, extrapolation may be made of future possible trends and tendencies, short and long term. There are scientific techniques for doing so which can be broadly grouped as forecasting methodology. It is however not sufficient to view the socio-economic panorama on the historical canvas. More detailed investigations from an operational point of view would be called for in respect of each economic sector.

**Initial Formulation** :- Identification is only the beginning in the lifecycle of a project. Having identified the prospective projects, the details of each project will have to be worked out and analyzed in order to determine which of them could be reckoned as suitable for inclusion in the plan, allocate funds and put into execution. As a follow up to the finding of techno-economic surveys, and number of feasibility study group are set up, as the name implies to examine the possibility of formulating suitable projects and to put concrete proposals in sufficient detail to enable authorities concerned to consider the feasibility of the proposal submitted.

**Evaluation or Project Appraisal** :- After the socio-economic problems of an economy have been determined and developments objectives and strategies agreed, concrete steps have to be taken. The main form this takes is that of formulating appropriate development projects to achieve plan objectives and meet the development needs of the economy. Proposals relating to them are then put to the plan authorities for consideration and inclusion in the plan. These proposals as pointed out above take the following forms of feasibility studies:

• Commercial viability

• Economic feasibility

• Financial feasibility

• Technical feasibility

• Management

The scope for scrutiny under each of these five heads would necessarily render their careful assessment and the examination of all possible alternative approaches.

The process almost invariably involves making decision relating to technology, scale, location, costs and benefits, time of completion (gestation period), degree of risk and uncertainty, financial viability, organisation and management, availability of inputs, know-how, labour etc. The detailed analysis is set down in what is called a

**feasibility report.**

**Formulation** :- Once a project has been appraised and approved, next step would logically, appear to that of implementation. This is, however, not necessarily true, if the approval is conditional to certain modifications being affected or for other reasons, such as availability of funds, etc. The implementation stage will be reached only after

these pre-conditions have been fulfilled. Project formulation divides the process of project development into eight distinct and sequential stages. These stages are

- General information
- Project description
- Market potential
- Capital costs and sources of finance
- Assessment of working capital requirement
- Other financial aspect
- Economic and social variables.

**Project Implementation** :- Last but not the least, every entrepreneur should draw an implementation time table for his project. The network having been prepared, the project authorities are now ready to embark on the main task of implementation the project. To begin with successful implementation will depend on how well the network has been designed. However, during the course of implementation, many factors arise which cannot be anticipated or adequately taken note of in advance and built into the initial network. A number of network techniques have been developed for project implementation. Some of them are PERT, CPM, Graphical Evaluation and Review Technique (GERT), Workshop Analysis Scheduling Programme (WRSP) and Line of Balance (LOB).

**Project Completion** :- It is often debated as to the point at which the project life cycle is completed. The cycle is completed only when the development objectives are realized.

**PROJECT REPORT**- In simple words project report or business plan is a written statement of what an entrepreneur proposes to take up. It is a kind of course of action what the entrepreneur hopes to achieve in his business and how he is going to achieve it. In other words, project report serves like a road map to reach the destination determined by the entrepreneur.

#### Contents of Project Report

- General Information
- Promoter
- Location
- Land and Building
- Plant and Machinery
- Production process
- Utilities
- Transport and communication
- Raw material
- Manpower
- Product
- Market

**PROJECT APPRAISAL**- Project appraisal means the assessment of a project. Project appraisal is made for both proposed and executed projects. In case of former project appraisal is called ex-ante analysis and in case of latter 'post-ante analysis'. Here, project appraisal is related to a proposed project. Project appraisal is a cost and benefits analysis of different aspects of proposed project with an objective to adjudge its viability. A project involves employment of scarce resources. An entrepreneur needs to appraise various alternative projects before allocating the scarce resources for the best project. Thus project appraisal helps select the best project among available alternative projects. For appraising a projects its economic, financial, technical market, managerial and social aspect are analysed. Financial institutions carry out project appraisal to assess its creditworthiness before extending finance to a project.

#### Method of Project Appraisal

- 1 Economic analysis
- 2 Financial analyses
- 3 Market analysis
- 4 Technical analysis
- 5 Managerial competence
- 6 Ecological analyses

#### Economic Analysis:

Under economic analysis the aspects highlighted include

- Requirements for raw material
- Level of capacity utilization
- Anticipated sales
- Anticipated expenses
- Proposed profits
- Estimated demand.

It is said that a business should have always a volume of profit clearly in view which will govern other economic variable like sales, purchase, expenses and alike.

**Financial Analysis**- Finance is one of the most important prerequisites to establish an enterprise. It is finance only that facilitates an entrepreneur to bring together the labour, machines and raw materials to combine them to produce goods. In order to adjudge the financial viability of the project, the following aspects need to be carefully analysed :

- Cost of capital
- Means of finance
- Estimates of sales and production
- Cost of production
- Working capital requirement and its financing
- Estimates of working results
- Break-even point
- Projected cash flow
- Projected balance sheet.

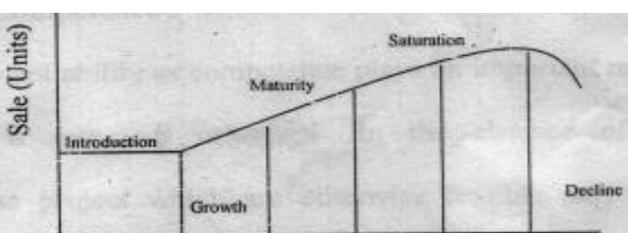
The activity level of an enterprise expressed as capacity utilization needs to be well spelled out. However the enterprise sometimes fails to achieve the targeted level of capacity due to various business vicissitudes like unforeseen shortage of raw material, unexpected disruption in power supply, instability to penetrate the market mechanism etc.

**Market Analysis**- Before the production actually starts, the entrepreneur needs to anticipate the possible market for the product. He has to anticipate who will be the possible customer for his product and where his product will be sold. This is because production has no value for the producer unless it is sold. In fact, the potential of the market constitutes the determinant of possible reward from entrepreneurial career. Thus knowing the anticipated market for the product to be produced become an important element in business plan. The commonly used methods to estimate the demand for a product are as follows. :

**1 Opinion polling method**- In this method, the opinion of the ultimate users. This may be attempted with the help of either a complete survey of all customers or by selecting a few consuming units out of the relevant population.

**2. Life Cycle Segmentation Analysis**- It is well established that like a man, every product has its own life span. In practice, a product sells slowly in the beginning. Barked by sales promotion strategies over period its sales pick up. In the due course of time the peak sale is reached. After that point the sales begins to decline. After sometime, the product loses its demand and dies. This is natural death of a

product. Thus, every product passes through its life cycle. The product life cycle has been divided into the following five stage : Introduction, Growth, Maturity, Saturation and Decline. The sales of the product varies from stage to stage as shown in figure No. 1.4



**Time Period**  
**Fig. 1.4 Product Life Cycle**

Considering the above five stages of a product life cycle, the sale at different

stages can be anticipated.

**Technical Analysis-** Technical analysis implies the adequacy of the proposed plant and equipment to prescribed norms. It should be ensured whether the required know how is available with the entrepreneur. The following inputs concerned in the project should also be taken into consideration.

1. Availability of Land and site
2. Availability of Water Power, transport, communication facilities.
3. Availability of servicing facilities like machine shop, electric repair shop etc.
4. Coping with anti pollution law
5. Availability of work force
6. Availability of required raw material as per quantity and quality.

**Management Competence-** Management ability or competence plays an important role in making an enterprise a success. In the absence of Managerial Competence the project which are otherwise feasible may fail. On the contrary, even a poor project may become a successful one with good managerial ability. Hence, while doing project appraisal, the managerial competence or talent of the promoter should be taken into consideration.

**Ecological Analysis-** In recent years, environmental concerns have assumed great deal of significance. Ecological analysis should also be done particularly for major projects which have significant implication like power plant and irrigation schemes, and environmental pollution industries like bulk-drugs, chemical and leather processing. The key factors considered for ecological analysis are :

- ☐ Environmental damage
- ☐ Restoration measure

### TOOLS AND TECHNIQUES FOR PROJECT MANAGEMENT

There are several tools and techniques which would contribute significantly towards effective project management these can be broadly grouped under the following heads :

- 1. Project selection techniques**
  - (a) Cost benefit analysis and
  - (b) Risk and sensitivity analysis
- 2. Project execution planning techniques**
  - (a) Work breakdown structure (WBS)
  - (b) project execution plan (PEP)
  - (c) Project responsibility matrix and
  - (d) Project management manual.
- 3. Project scheduling and coordinating techniques**
  - (a) Bar charts
  - (b) Life cycle curves
  - (c) Line of balance (LOB) and
  - (d) Networking techniques (PERT/CPM)
- 4. Project monitoring and progressing techniques**
  - (a) Progress measurement technique (PROMPT)
  - (b) Performance monitoring technique (PERMIT) and
  - (c) Updating, reviewing and reporting technique (URT)
- 5. Project cost and productivity control techniques**
  - (a) Productivity budgeting techniques
  - (b) Value engineering (VE) and
  - (c) COST/WBS
- 6. Project communication and clean-up techniques**
  - (a) Control room and
  - (b) Computerized information systems

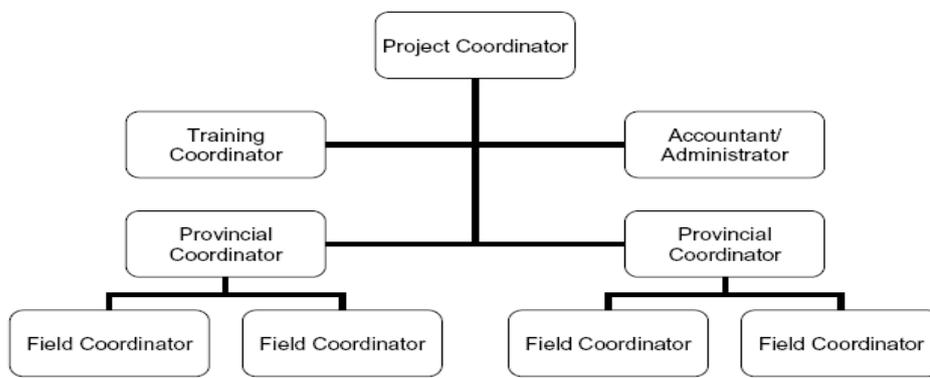
### THE PROJECT MANAGER'S ROLES & RESPONSIBILITIES

As things stand today, none of the present generation project manager, including the very successful ones, comes from any of our management schools. They were just given the job-some succeeded and others did not. Those who succeeded are not many, because only a handful of projects in India were ever completed on time, within budget and performed to expectations. While the failures of these projects had been analyzed in many seminars and workshops, the role of project managers and their development did not form the subject of any serious discussion. There could be two reasons for this: (a) Perhaps no one thinks that success or failure of a project depends on the project manager; and (b) It may also be that no one considers them as a special breed of managers. Surprisingly, even some of the practicing project managers themselves subscribe to these views. The basic roles and responsibilities of a project manager that we are referring to could be grouped under twelve heads :

- 1 Defining and maintaining the integrity of a project;
- 2 Development of project execution plan;
- 3 Organization for execution of the plan;
- 4 Setting of targets and development of systems and procedures for accomplishment of project objectives and targets;
- 5 Negotiation for commitments;
- 6 Direction, coordination and control of project activities;
- 7 Contract management;
- 8 Non-human resource management including fiscal matters;
- 9 Problem-solving;
- 10 Man management;
- 11 Satisfaction of customer, Government and the public; and
- 12 Achievement of project objectives, cash surplus and higher productivity.

### THE PROJECT ORGANIZATION STRUCTURE

A project organization is a structure that facilitates the coordination and implementation of project activities. Its main reason is to create an environment that fosters interactions among the team members with a minimum amount of disruptions, overlaps and conflict. One of the important decisions of project management is the form of organizational structure that will be used for the project. Each project has its unique characteristics and the design of an organizational structure should consider the organizational environment, the project characteristics in which it will operate, and the level of authority the project manager is given. A project structure can take on various forms with each form having its own advantages and disadvantages. One of the main objectives of the structure is to reduce uncertainty and confusion that typically occurs at the project initiation phase. The structure defines the relationships among members of the project management and the relationships with the external environment. The structure defines the authority by means of a graphical illustration called an organization chart. A properly designed project organization chart is essential to project success. An organization chart shows where each person is placed in the project structure. An organization chart is drawn in pyramid form where individuals located closer to the top of the pyramid have more Authority and responsibility than members located toward the bottom. It is the relative locations of the individuals on the organization chart that specifies the working relationships, and the lines connecting the boxes designate formal supervision and lines of communication between the individuals.



### Project Organization Chart

Creating the project structure is only a part of organizing the project; it is the actual implementation and application that takes the most effort. The project organization chart establishes the formal relationships among project manager, the project team members, the development organization, the project, beneficiaries and other project stakeholders. This organization must facilitate an effective interaction and integration among all the major project participants and achieve open and effective communication among them.

The project manager must create a project structure that will meet the various project needs at different phases of the project. The structure cannot be designed too rigid or too loose, since the project organization's purpose is to facilitate the interaction of people to achieve the project ultimate goals within the specified constraints of scope, schedule, budget and quality. The objective in designing a project structure is to provide a formal environment that the project manager can use to influence team members to do their best in completing their assignment and duties. The structure needs to be designed to help develop collaboration among individual team members; all in a cost effective way with a minimum of duplication of effort and overlaps.

### FACTORS IN DESIGNING A PROJECT STRUCTURE

There are two design factors that significantly influence the process of developing a project management structure. These are the level of specialization, and the need for coordination. The project manager should consider these factors at the moment of designing the project organization in order to maximize the effectiveness of the structure.

**Specialization-** affects the project structure by the degree of specialty in technical areas or development focus; projects can be highly specialized and focus on a specific area of development, or have different broad specializations in many areas of development. For large projects that have multiple specializations or technical areas, each area may have a different need; from differences in goals, approaches and methodologies, all of which influence the way the project will implement its activities. A project that has two components, a reconstruction and education, will need to manage different approaches based on the specialization of each one. In the education component, the needs is for a structure more open and informal, where the time horizon is longer, with more emphasis on sharing and generation of new ideas in order to achieve innovation and creativity. In a reconstruction component, there are specific goals, a need for a rigid, hierarchical structure, and there is a defined time horizon with little sharing of ideas. While specialization allows each project component to maximize their productivity to attain their departmental goals, the dissimilarities may lead to conflict among the members or leads of each component. In general, the greater the differences, the more problems project managers have in getting them to work together.

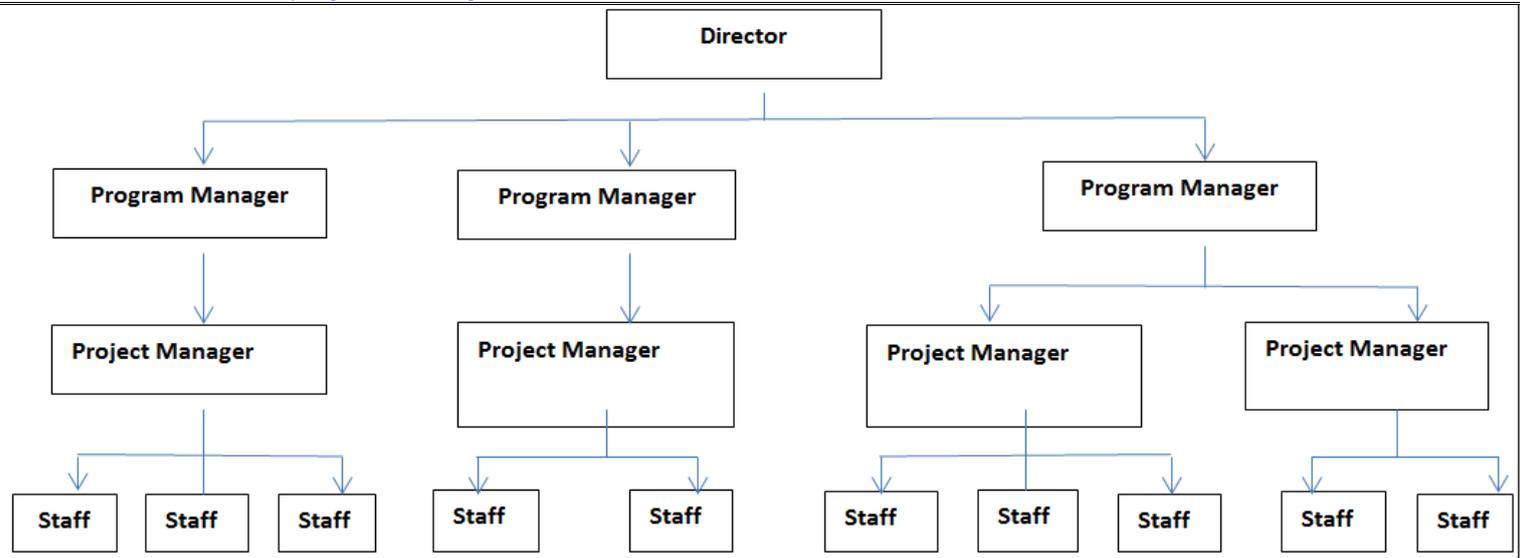
**Coordination-** is required to bring unity to the various elements that make up a project. The project work is organized around a work breakdown structure (WBS) that divides the overall project goals into specific activities or tasks for each project area or component; the project manager must design an organizational structure that ensure that the various components are integrated so that their efforts contribute to the overall project goal. Integration is the degree of collaboration and mutual understanding required among the various project components to achieve project goals. Most projects are characterized by the division of labor and task interdependencies, creating the need for integration to meet project objectives. This need is greatest when there are many project components that have different specializations. The goal of the project management structure is the achievement of harmony of individual efforts toward the accomplishment of the group goals. The project manager's principal responsibility is to develop integrating strategies to ensure that a particular component or activity is organized in a way that all of the components, parts, subsystems, and organizational units fit together as a functioning, integrated whole according to the project master plan.

### TYPES OF PROJECT ORGANIZATIONS STRUCTURES

Of the several factors to consider when deciding on the design of project organizational structures, especially within an existing organization, the factor that has a significant is the extent of authority and responsibility top management is prepared to delegate to the project manager. An important function of the organizations' top management is to design an organization that fully supports project management. This is done by redesigning the organization to emphasize the nature of the projects and adapting how roles and responsibilities are assigned. The organization needs to define the project manager's job, degree of authority and autonomy, and relationship to both the organization, other projects and to other units in the organization. Upper management also should specify communication channels, methods of conflict resolution between the project and the rest of the organization. Development organizations are usually organized around programmatic focus areas such as health or education. These areas are usually called program units and are centered on a specific development field. In this environment a project has three organization structures available for design and all are defined by the level of organizational authority given to the project manager:

- **Programmatic based,** in which project managers have authority only within the program focus or area
- **Matrix based,,** in which the project manager shares responsibility with other program unit managers
- **Project based,** in which project managers have total authority.

**Programmatic Based-** The programmatic focus refers to a traditional structure in which program sector managers have formal authority over most resources. It is only suitable for projects within one program sector. However, it is not suitable for projects that require a diverse mix of people with different expertise from various program sectors. In a programmatic based organization, a project team is staffed with people from the same area. All the resources needed for the project team come from the same unit. For instance, if the project is related to the health area, the project resources come from the health unit.

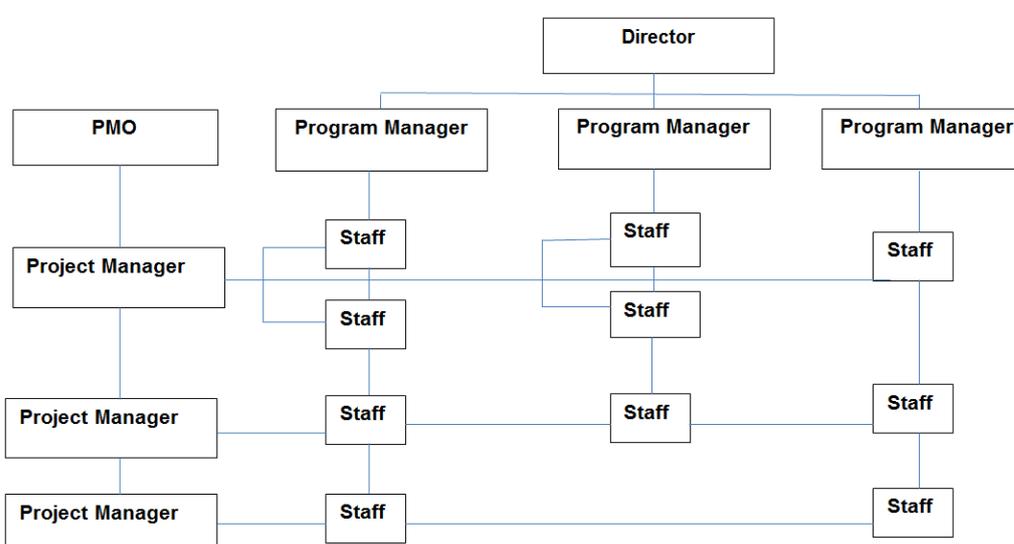


The most obvious advantage of programmatic based projects is that there are clear lines of authority, in large projects the project managers tend to also be the program unit manager. There is not need to negotiate with other program units for resources, since all of the staff needed for the project will come from the same program area. Another advantage of this type of organization is that the team members are usually familiar with each other, since they all work in the same area. The team members also tend to bring applicable knowledge of the project. A major disadvantage of the programmatic based organization is that the program area may not have all of the specialists needed to work on a project. A nutrition project with a water component, for instance, may have difficulty acquiring specialty resources such as civil engineers, since the only people available will work in their own program unit. Another disadvantage is that project team members may have other responsibilities in the program unit since they may not be needed fulltime on a project. They may be assigned to other projects, but it is more typical that they would have support responsibilities that could impact their ability to meet project deadlines.

**Advantages** of this structure: First, the use of personnel with greater flexibility, as long as the choice of a suitable functional departments as the project supervisor, the department will be able to provide professional and technical personnel required by the project, and technology experts can also be used by different projects and after completion of the work can go back to his original work; Second, when the project team members leave or leave the company, the functions can be used as the basis for maintaining the continuity of the project; third, functional department can provide a normal career path for professionals.

**The disadvantage** of this structure is: First, projects often lack of focus, each unit has its own core functions of general business, sometimes in order to meet their basic needs, responsibility for the project will be ignored, especially when the interest taken in the project brought to the unit not the same interest; Second, such organization has certain difficulties in the inter-departmental cooperation and exchanges; Third motivation is not strong enough for project participants, they think the project is an additional burden, and not directly related to their career development and upgrading; Fourth, in such organizational structure, sometimes no one should assume full responsibility for the project, often the project manager is only responsible for part of the project, others are responsible for the other parts of the project, which leads to difficulties in coordination situation.

**Matrix Based-** Matrix based project organizations allow program units to focus on their specific technical competencies and allow projects to be staffed with specialists from throughout the organization. For instance, nutrition specialists may report to one program unit, but would be allocated out to work on various projects. A health specialist might report to the health unit, but be temporarily assigned to a project in another project that needs health expertise. It is common for people to report to one person in the programmatic unit, while working for one or two project managers from other projects in different programmatic units



The main advantage of the matrix based organization is the efficient allocation of all resources, especially scarce specialty skills that cannot be fully utilized by only one project. For instance, monitoring and evaluation specialists may not be utilized full-time on a project, but can be fully leveraged by working on multiple projects. The matrix based organization is also the most flexible when dealing with changing programmatic needs and priorities. Additional advantages to matrix management are: it allows team members to share information more readily across the unit boundaries, allows for specialization that can increase depth of knowledge and allow professional

development and career progression to be managed. It is easier for a program unit manager to loan an employee to another manager without making the change permanent. It is therefore easier to accomplish work objectives in an environment when task loads are shifting rapidly between programmatic units. The main disadvantage is that the reporting relationships are complex. Some people might report to programmatic unit managers for whom little work is done, while actually working for one or more project managers. It becomes more

important for staff members to develop strong time management skills to ensure that they fulfill the work expectations of multiple managers. This organization also requires communication and cooperation between multiple programmatic unit managers and project managers since that all be competing for time from the same resources. Matrix management can put some difficulty on project managers because they must work closely with other managers and workers in order to complete the project. The programmatic managers may have different goals, objectives, and priorities than the project managers, and these would have to be addressed in order to get the job done. An approach to help solve this situation is a variation of the Matrix organization which includes a coordinating role that either supervises or provides support to the project managers. In some organizations this is known as the Project Management Office (PMO), dedicated to provide expertise, best practices, training, methodologies and guidance to project managers.

The PMO unit also defines and maintains the standards of project management processes within the organization. The PMO strives to standardize and introduce economies of scale in the implementation of projects. The PMO is the source of documentation, guidance and metrics on the practice of project management and implementation. The PMO can also help in the prioritization of human resources assigned to projects

**The advantages** of this organizational structure: First, it is the same as functional structure that resources can be shared in multiple projects, which can significantly reduces the problem of redundant staff; Second, project is the focus of work, with a formal designated project manager will make him give more attention to the project, and responsible for the coordination and integration work between different units; Third, when there are multiple projects simultaneously, the company can balance the resources to ensure that all the projects can progress to complete their respective costs and quality requirements; Fourth, the anxiety of project members is reduced greatly after the end of the project, while they are strongly associated with the project, on the other hand, they have a "home" feeling about their functions.

**The disadvantage** is that this organizational structure: First, the matrix structure has exacerbated the tensions between functional manager and project manager; Second, under any circumstances, sharing equipment, resources and personnel among different projects will lead to conflict and competition for scarce resources; Third, in the process of project implementation, the project manager must negotiate and consult with the department managers on various issues, which leads to the delay in decision making; Fourth, matrix management is not according to the principles of unified management, project members have two bosses, the project manager and functional managers, when their commands are divided, it will make members at a loss.

Three different forms of the matrix organizational structure does not necessarily have the advantages and disadvantages described above: Project Matrix can increase the project's integration, reduce internal power struggle, its weakness is poor control of their functional areas and prone to "project inflammation"; Functional Matrix can provide a better system for managing the conflict between different projects, but maintaining the control of functions is at the cost of inefficient integration of projects; Balanced Matrix can achieve the balance between technology and project requirements better, but its establishment and management is very subtle, is likely to encounter many problems related to matrix organization

### Project Base

In this type of organization project managers have a high level of authority to manage and control the project resources. The project manager in this structure has total authority over the project and can acquire resources needed to accomplish project objectives from within or outside the parent organization, subject only to the scope, quality, and budget constraints identified in the project. In the project based structure, personnel are specifically assigned to the project and report directly to the project manager. The project manager is responsible for the performance appraisal and career progression of all project team members while on the project. This leads to increased project loyalty. Complete line authority over project efforts affords the project manager strong project controls and centralized lines of communication. This leads to rapid reaction time and improved responsiveness. Moreover, project personnel are retained on an exclusive rather than shared or part-time basis. Project teams develop a strong sense of project identification and ownership, with deep loyalty efforts to the project and a good understanding of the nature of project's activities, mission, or goals.

Pure project based organizations are more common among large and complicated projects. These large projects can absorb the cost of maintaining an organization whose structure has some duplication of effort and the less than cost-efficient use of resources. In fact, one major disadvantage of the project based organization is the costly and inefficient use of personnel. Project team members are generally dedicated to one project at a time, even though they may rarely be needed on a full-time basis over the life cycle of the project. Project managers may tend to retain their key personnel long after the work is completed, preventing their contribution to other projects and their professional development. In this type of organization, limited opportunities exist for knowledge sharing between projects, and that is a frequent complaint among team members concerning the lack of career continuity and opportunities for professional growth. In some cases, project personnel may experience a great deal of uncertainty, as organization's or donor's priorities shift or the close of the project seems imminent. One disadvantage is duplication of resources, since scarce resources must be duplicated on different projects. There can also be concerns about how to reallocate people and resources when projects are completed. In a programmatic focus organization, the people still have jobs within the program unit. In a project-based organization it is not always clear where everyone is reassigned when the project is completed. Another disadvantage is that resources may not be needed as a full time for the entire length of the project, increasing the need to manage short term contracts with consultants and other subject matter Experts. A variety of this pure project approach is temporarily project-based organizations. This organization consists of a project team pulled together temporarily from their program unit and led by a project manager that does not report to a programmatic unit. The project manager has the full authority and supervision of the project team. Another design is based on a mixed structure that includes a matrix, programmatic focus and project based; this mix reflects the need for more flexibility in a development organization to accommodate different requirements. For example a health program may have a couple of projects short term and long term all reporting to the program manager. An education project may be organized on a matrix using resources part-time from other units, and a large water project organized as a fully project-based were all staff report to the project manager. It is not unusual to find this type of mixed designs on development organizations.

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### Project controlling and project control systems

Project controlling (also known as Cost Engineering) {{Citation needed reason=Project Controls cover a number of elements such as Design, Cost, Schedule, Quality and Risk. A number of disciplines cover this area. Date=March 2017}} should be established as an independent function in project management. It implements verification and controlling function during the processing of a project in order to reinforce the defined performance and formal goals. The tasks of project controlling are also:

The creation of infrastructure for the supply of the right information and its update

The establishment of a way to communicate disparities of project parameters

The development of project information technology based on an intranet or the determination of a project key performance indicator system (KPI) divergence analyses and generation of proposals for potential project regulations the establishment of methods to accomplish an appropriate project structure, project workflow organization, project control and governance creation of transparency among the project parameters. Fulfilment and implementation of these tasks can be achieved by applying specific methods and instruments of project controlling. The following methods of project controlling can be applied:

- |                           |                            |                             |                              |
|---------------------------|----------------------------|-----------------------------|------------------------------|
| 1. Investment analysis    | 4. Expert surveys          | 7. Surcharge calculations   | 10. Target/actual-comparison |
| 2. Cost–benefit analysis  | 5. Simulation calculations | 8. Milestone trend analysis |                              |
| 3. Value benefit analysis | 6. Risk-profile analysis   | 9. Cost trend analysis      |                              |

Project control is that element of a project that keeps it on track, on-time and within budget.[35] Project control begins early in the project with planning and ends late in the project with post-implementation review, having a thorough involvement of each step in the process. Projects may be audited or reviewed while the project is in progress. Formal audits are generally risk or compliance-based and management will direct the objectives of the audit. An examination may include a comparison of approved project management processes with how the project is actually being managed.[40] Each project should be assessed for the appropriate level of control needed: too much control is too time consuming, too little control is very risky. If project control is not implemented correctly, the cost to the business should be clarified in terms of errors and fixes

Control systems are needed for cost, risk, quality, communication, time, change, procurement, and human resources. In addition, auditors should consider how important the projects are to the financial statements, how reliant the stakeholders are on controls, and how many controls exist. Auditors should review the development process and procedures for how they are implemented. The process of development and the quality of the final product may also be assessed if needed or requested. A business may want the auditing firm to be involved throughout the process to catch problems earlier on so that they can be fixed more easily. An auditor can serve as a controls consultant as part of the development team or as an independent auditor as part of an audit.

Businesses sometimes use formal systems development processes. These help assure systems are developed successfully. A formal process is more effective in creating strong controls, and auditors should review this process to confirm that it is well designed and is followed in practice. A good formal systems development plan outlines:

Saving time and money during project planning and execution is akin to eating when you are hungry; it’s something you plainly need to do to grow and survive. If you are unfamiliar with how project controls are vital concerning the use of cloud-based project management software (PM software), fear not: we are here to help you wrap your head around it. According to the omniscient Project Management Body of Knowledge (PMBOK), project controls are defined as the following:

“Project controls are the data gathering, management and analytical processes used to predict, understand and constructively influence the time and cost outcomes of a project or program; through the communication of information in formats that assist effective management and decision making.”

But, what does that mean in simple terms beyond the vagueness of words like “management” and “analytical processes”? Thanks, PMBOK, we appreciate everything you do for us, but we need a little bit more clarification and maybe a couple examples...

To begin with a simple explanation (we will get into the details soon), project controls are the tools that help you save time and stay on schedule during your project planning and execution, cutting costs. They vary in terms of specific project requirements, but these tools are the essentials of cloud project management software, which is widely understood as a necessity for boosting the following performance factors for many companies, like yours:

project controls So, let us now go into the details concerning the value of project controls, and how they can save you time and money.

Overview of project controls

Project controls are all-encompassing for project definition, planning, execution, and completion; assisting in the entire lifecycle of your project. As we said before, the use of controls will vary according to individual project demands, but project controls address, organize, and of course control the following aspects of your project management system:

1. Developing your project strategy; defining methods that will enhance the future PM software use and project outcomes

2. Development, updates, and maintenance scheduling for the PM software
3. Estimating project costs; engineering and controlling costs and assessing project value
4. Managing risks; assessing and analyzing project risks, and cataloging past risks and how to avoid future risks
5. Earned schedule and earned value management, including both work and organizational breakdown structures
6. Controlling project documentation
7. Diagnosing project scheduling and costs with forensic assessment procedures
8. Oversight and quality assessment of supplied materials
9. Comprehensive integration of the elements of control and other domains of project management

### **The importance of project controls**

Now that you know the scope of what project controls provide for your PM software, let us go over why these controls are important. The opposite of control is chaos, disorganization, bedlam, which are plain anathema to successful project management.

Successful project execution first begins with planning the process of execution. So how do project controls fit in?

To craft a well thought-out plan for executing your projects can only happen if you have a sufficient set of controls in place for your project scheduling methods. A project control system that will work for your company goals is essential to take full advantage of your PM software, and guarantee smooth sailing.

### **How to set your project controls in 10 simple steps**

Setting smart, effective project controls begins well before the execution stage of your project. Monitoring and control go hand in hand with each other for every stage of your project. Controls and monitoring should be solidified by using each of the following steps:

1. Determining the scope of the project; explaining and communicating every aspect of the project to all members of the team.
2. Team structure and assigning tasks; determining who is best suited for each required task, how many members are assigned to each team, and planning on how to monitor progress.
3. Predetermined risk factors; knowing which risks are worth taking, and which are guaranteed to sabotage project success. Setting a risk management plan to mitigate risks before they can become real project threats will save you a boundless amount of pain when risks are managed,
4. Adaptability contingencies; both internal and external factors can demand that a project must change its course. Plan for the unexpected, but possible factors that would demand change to your project process, and set contingencies to adapt to change.
5. Monitoring of project status; set a schedule and determine a method (i.e. whether in person regular meetings, or the submission of written reports) for monitoring how well or poorly your project is progressing. Also, if the project is moving along ahead of schedule, investigate and find what is facilitating the rapid progress. Apply the factors to future projects. The same rings true in the opposite scenario, when your status is behind schedule. You will then know what to monitor for and avoid in future projects, saving valued time and money.
6. Plans for effective communication; obviously your lines of communication should be efficient and transparent, but pay equal care to your plans for communicating with both customers and project stakeholders alike.
7. Deadlines and budgeting; set in place a plan for establishing the initial project costs, keeping track of changes to the budget by regular communication with the accounting department, and ensuring that deadlines are met. Also, develop a contingency plan for if and when a deadline is not met, how to avoid future deadline failures.
8. Analysis/evaluation; set a system for evaluating and analyzing how well each element of the project planning and execution is contributing to the overall project success within the scope of the project. Is anything missing? Do you need to allocate more resources or reassign personnel? A system should be in place to solve questions (and all others) like these during both execution and planning.
9. Corrective contingencies; following step 8, if there are indicators that corrections should be made to the project or, that you discovered that some of your bases are not covered, plan not only for a system to implement changes, but also for contingencies in case the corrections also include their own set of complications. You cannot predict the future, but you can imagine it and set plans to do your best to control the future.
10. Planning for project presentation; determine the people that will be responsible for presenting the final product, the required supplies if any, and whom to present to. Also, plan for how to address handling status.

### **Human aspects of project management**

**Introduction** In today's world of management, despite of project managers' technical and technological domains becoming more complicated and extended, the focus of project managers is mostly tended to human aspect. Thus, nowadays the need for developing soft skills in project managers is considered more than before by organization. One of the most important influencing factors on increasing job satisfaction and as a result increasing the efficiency of human resource is increasing motivation. The way of keeping and increasing employees' motivation in project-based organizations regarding to special properties of projects is different from activities of other organization. The aim of this research, in the first step, is identifying and measuring motivating factors in project-based organizations, and in the second step, is ranking of these factors using Multi Criteria Decision-Making techniques (MCDM). For this reason, project-based traditional organizations were primarily compared with each other. Six fundamental criteria and 21 indicators in order to increase project team motivation were identified and finally ranking of these factors in order to increase motivation as well as improving project management system in two state of dependent and independent to main criteria was made . In this research we concluded the most important effective criteria in improving employees' motivation in project-based organizations in turn, justice – based, leadership method, work environment conditions, work objectively and employees' development. Project provides special conditions for project team members whom these conditions can have different effects on them, because it has special properties it has a given beginning and limited resources. These effects in some cases can cause human resource efficiency reduction during performing the project. For example, work pressure and abundant stress resulting from performing project activities are not comparable to work pressure of current activities in organization On the other hand, increasing and decreasing of human resource during the project is so variable, whereas the effort level of human resource in non-project activities of organization is almost monotonous. In addition, to these differences, there are other differences between current and project activities which cause differences in organization members' morale and requirements of in project team and staff

3. Role of human resources in project In most of the projects in spite of non-project activities, human resource plays a more important role than other work factors like machines, approaches, materials etc. in a productive

factory, it is possible that according to producing automation, Job dissatisfaction of workers has no much effect production volume, but during executing a project job dissatisfaction of welding technician will have a high effect on the amount of project progression; and in current activities of organization negative effects resulting from changing personnel will be less than negative effects resulting from changing a work resource in the middle of executing a project. 4. Role of motivation in project According the above cases, the necessity of effort for change keeping or increasing human resource productively in project will be very large. One of the most effective factors on increasing job satisfaction and consequently increasing efficiency of human resource is increasing motivation. The way of retention and increasing employees' motivation in project activities regarding to special features of projects is different from non-project activities. Effective factors on reducing motivation But what happened that people's motivation is reduced for executing activities in the project environment? As we said, a project has unique properties which can effect on project team members' motivation. The main cases which cause motivation decrease are Losing the support of chief officer by project team member Individual conflicts between project team members Consecutive current and indifference to human resources Not conducive working environment for Not using expertise in jobs Not obligatory according to the needs of employees Job insecurity Injustice in rewarding system Time conflicts (project resources timing) Time and cost increase of project The fear of being fired after finishing the project High fluctuation in individuals activities level. we can cause motivation in project team member. Some of motivating methods in project and non -project organizations are equal, such as cash and non-cash rewarding, etc. but there are some methods which have more importance in project organization than other non-project organizations. Most of the motivation increase methods in project team are focused on communications. Sufficient authority to the staff, so they have more responsibility in their work . Trying to staff participation in decision making and setting goals and programs that; This will result in the employee performance in achieving organizational goals and feel responsible to do more updates Establishing an appropriate system of performance-based pay system and to establish discipline and encouragement. Increasing communications between project team members and providing a transparent environment and without ambiguity happen to increase people's motivation in project team. This environment will cause to reduce conflicts between project team members and positive feedbacks in respect to efficiency increase to be represented. On the other hand, contributing project team members to discussions and decision makings will help people to represent their inner abilities and skills. The point that should be taken into account about project team motivation is the amount of people's motivation during the length of the project. Researches have showed that people's motivation is high at the beginning of the project and by elapsing time and approaching to the end of is reduced. This can have several reasons, such as work volume increase of project team, concerns about job status after the project being finished, time project becoming long and concerns about its failure. In addition, over time most of the project managers allocate more time to technical and executive activities of the project and they less deal with soft activities like motivation, communications etc. thus, it is important that project managers consider final steps more. 5. Conclusion Unfortunately, in our country there is not much attention to soft skills of project managers and project managers often spend their time on financial and technical problems of the project during executing it, while they are unaware of that the source of all problems in the project is related to the human issues of the project. Therefore, it is necessary for project managers in our country to learn soft skills which today are one of the most needs of the project manager in the international level; and they apply them in order to increase job satisfaction and eventually develop project team members' efficiency

### **Recruiting project managers**

This research addresses the competencies organizations use through project manager job advertisements. We develop a list of project manager job competencies; break down the competency components into knowledge, skills, and abilities; and conduct a comparative analysis of the use of these competencies. We examine the online contents of project manager job advertisements in the public domain. Analysis shows that industry job advertisements emphasize "soft skills" and competencies in a manner different than that in the literature. Additionally, differences are found across countries and between industries. Implications from the findings highlight the incongruent dissemination of project manager competencies, regional and industrial demands, and the recruitment of project managers. Recruiting the right project manager is an important challenge for organizations. According to A Guide to the Project Management Body of Knowledge (PMBOK® Guide) (Project Management Institute, 2008), the project manager is the person responsible for accomplishing project objectives. The project manager manages the project through identifying project requirements; establishing clear and achievable objectives; balancing the competing demands for quality, scope, time and cost; adapting plans and approaches to the different concerns and expectations of the various stakeholders; and managing projects in response to uncertainty. The project manager's role is one of the most challenging jobs in any organization, because it requires a broad understanding of the various areas that must be coordinated and requires strong interpersonal skills. It is widely acknowledged that the final outcome of the project depends mainly on the project manager; therefore, the selection of the project manager is one of the two or three most important decisions concerning the project (Meredith & Mantel, 2006, p. 139). How to attract the "right" project managers, therefore, is an important organizational imperative; however, there is a lack of research on which recruitment "signals" or messages are used to attract potential applicants to the project manager role and whether these signals reflect project management prescriptions from professional bodies and standards. In this study, we examine the recruitment of project managers from job advertisements, and address how organizations describe the competencies of project managers. This study provides a systematic approach to understanding how project manager competencies are utilized from both the "supply" and "demand" sides. The competencies used in project manager job advertisements are compared with the competencies from both the academic literature and project management professional body of standards.

This study addresses the following questions: What are the most frequently used competencies to attract potential project managers to organizations? Do the competencies sought by recruitment job advertisements reflect the competencies prescribed by the project management literature and from professional bodies? Finally, we examine whether there are differences regionally and between industries in the use of project manager competencies to attract potential project managers. The contributions of this research are threefold: This study provides a systematic approach to identifying and comparing project manager competencies from both the supply side and demand side; second, it provides a framework for understanding the recruitment of project managers, including the signals that organizations communicate to potential candidates through job advertisements; and, last, this study provides a look into the utilization of project manager competencies from theoretical, regional, and industry perspectives. The organization of this paper is as follows: we provide a research rationale for the importance of this research, including highlighting the research gaps; we present data on our systematic content analysis of project manager competencies from the supply side (including the academic literature and project management professional bodies); we then compare this with a content analysis of project manager job advertisements from 762 online job advertisements from Australasia (demand side). Last, we report the findings from this study, including the implications of the results.

## The Project Management Profession and Role of the Project Manager-

The last four to five decades have seen a rise in the use of project management in various industries, such as education and healthcare services, as a reaction to increasing modes of employment flexibility and accountability (Hodgson, 2000, 2005). Such growth has seen its practitioners organize and develop the field as a “professional” practice and form project management as a legitimate occupation (Hodgson, 2002). Much like the development of other professions (e.g., law), project management has attempted to adopt the strategies and practices of more established professions in order to claim legitimacy vis à vis the organization and promotion of accredited training programs and collection of a universal body of knowledge and recognized credentials in job markets (Hodgson, 2002). As a result, the number of project management practitioners is growing. Although the evolution and development of project-based organizations have received some attention in theory and practice (Sydow, Lindkvist, & DeFillippi, 2004; Turner & Keegan, 1999; Turner & Keegan, 2001), less research has been done on the project manager role (Hölzle, 2010). The project manager role is changing; in an early article, Gaddis (1959) described the role of a project manager who functioned as a focal point for the management of resources being applied to managing ad hoc activities across organizational boundaries. The project manager's role starts with set responsibilities; however, he or she ends up with additional roles that are not parts of his or her job description (Shenhar, Levy, & Dvir, 1997). The project manager role must be supplemented with other knowledge and skills, in addition to the traditional functions, to meet the changing needs of modern projects they are hired to manage (Edum-Fotwe & McCaffer, 2000; Russell, Jaselski, & Lawrence, 1997). Overall, the role of the project manager evolves from being the administrator of the project toward a much more managerial and leadership position, to fulfilling an organizational strategic need. Hence, the project manager needs a completely different set of capabilities and competencies; therefore, there is the need to look at a broad spectrum of requested project management competencies (Edum-Fotwe & McCaffer, 2000). Despite project management being common in many industries, the project manager can be considered as an accidental profession for many individuals. According to Pinto and Kharbanda (1997, p. 216), “few individuals grow up with the dream of one day becoming a project manager. It is neither a welldefined nor a well-understood career path in most modern organizations. Generally, the role is thrust upon people rather than being sought.” Few project managers, therefore, would have started out in the project management role fully trained. In fact, there is considerable evidence to suggest that the transition into a project manager position is a complex interaction of influence and experiential progression at the individual, organizational, and project levels (El-Sabaa, 2001; Hölzle, 2010). El-Sabaa (2001) adds that such individualistic approaches to the project manager role puts the project manager's development in terms of his or her career expectations and acquisition of specific competencies and knowhow at the forefront. In tracing the decision to follow the project manager role, several authors have noted that the personality of the individual is a strong indicator of those choosing a project manager career (Tremblay, Wils, & Proulx, 2002). Within individual preferences for project management work, studies have also shown the critical place of career orientations for project managers.

The organization itself plays a significant part in the needs and requirements of the project manager, thus showing a need to take into account how organizations ‘manage’ these industry professionals. Organizations are implicated in project manager development as they provide a context for what, how, and where projects are carried out. The traditional view of project manager development is often described as organizational careers that follow a hierarchical, upward-oriented promotion of the individual within the organization; however, Hodgson traces the development of the project management role in organizations. From an organizational point of view, the professionalization of project managers still remains largely discrepant, and divergences in the conceptualization of the field as an occupation and profession in regions such as the United States and United Kingdom exist. Thus, commentators (Styhre, 2006) have described project managers as “pseudo-professionals. These tensions are embodied by the disagreements on the conceptualizations and forms of project management work and the absence of an agreed-on form of mandatory qualifications (Hodgson, 2002). This has led to the observation that the nexus of control for the management of projects is subjected to organizational influence, rationalization, and bureaucratization of project work. Such balancing of professional and organizational tensions appears to contribute to the changing nature of project management through work redesign, temporal work units and cooperation, work tasks, relations, and responsibilities (Räsänen & Linde, 2004). These organizational variables have spurred conceptual and practical impetus to examine the characteristics of the project and how it impacts on the performance of projects

Research has shown that the features of the project and its complexity require specific competencies from the project manager (Crawford, Hobbs, & Turner, 2006; Huemann, Keegan, & Turner, 2007; Müller & Turner, 2007). Aspects of the project, such as technology (Anantatmula, 2008), direct managerial support (Kelley & Lee, 2010), and the structure of the project (Lechler & Dvir, 2010) influence the right project manager competencies for successful project completion. While project and organizational variables are important, individual factors are still critical for project success. Thus, one key question that allows us to investigate how project manager competencies influence project management would be to examine what makes a competent project manager.

### Market Potentiality Analysis

A market analysis studies the attractiveness and the dynamics of a special market within a special industry. It is part of the industry analysis and thus in turn of the global environmental analysis. Through all of these analyses, the strengths, weaknesses, opportunities and threats (SWOT) of a company can be identified. Finally, with the help of a SWOT analysis, adequate business strategies of a company will be defined.<sup>[1]</sup> The market analysis is also known as a documented investigation of a market that is used to inform a firm's planning activities, particularly around decisions of inventory, purchase, work force expansion/contraction, facility expansion, purchases of capital equipment, promotional activities, and many other aspects of a company.

### Market segmentation

Market segmentation is the basis for a differentiated market analysis. Differentiation is important. One main reason is the saturation of consumption, which exists due to the increasing competition in offered products. Consumers ask for more individual products and services and are better informed about the range of products than before. As a consequence, market segmentation is necessary. Segmentation includes a lot of market research, since a lot of market knowledge is required to segment the market. Market research about market structures and processes must be done to define the “relevant market”. The relevant market is an integral part of the whole market, on which the company focuses its activities. To identify and classify the relevant market, a market classification or segmentation has to be done.

Market segmentation is an important way to find competitive advantage with its differentiation in market analysis. Market segmentation concentrates on market energy and power to gain competitive advantage. In other words, market segmentation is the concept tool to get the force (Thomas, 2007). In market analysis, market knowledge is required to analyze market structure and process. Since segmentation requires a lot of market research, various information can be extracted from it. Market segmentation can identify customer needs and wants and develop products to their satisfaction. Market segmentation can identify different products for different groups, better match customer wants and product benefits, maximize the use of available resources and focus marketing expenditures and competitive advantages.

There is no specific way to segment market. However, businesses can follow generalized rules like geographic, demographic, psychographic, and behavioral. A good market segmentation should be sustainable, accessible, actionable, measurable, and differentiable.

**Dimensions of market analysis** David A. Aaker outlined the following dimensions of a market analysis:

- Market size (current and future)
- Market growth rate
- Industry cost structure
- Key success factors
- Market trends
- Market profitability
- Distribution channels
- Key success details

Market analysis strives to determine the attractiveness of a market, currently and in the future. Organizations evaluate future attractiveness of a market by understanding evolving opportunities, and threats as they relate to that organization's own strengths and weaknesses.

Organizations use these findings to guide the investment decisions they make to advance their success. The findings of a market analysis may motivate an organization to change various aspects of its investment strategy. Affected areas may include inventory levels, a work force expansion/contraction, facility expansion, purchases of capital equipment, and promotional activities.

### Market size

The market size is defined through the market volume and the market potential. The market volume exhibits the totality of all realized sales volume of a special market. The volume is therefore dependent on the quantity of consumers and their ordinary demand.

Furthermore, the market volume is either measured in quantities or qualities. The quantities can be given in technical terms, like GW for power capacities, or in numbers of items. Qualitative measuring mostly uses the sales turnover as an indicator. That means that the market price and the quantity are taken into account. Besides the market volume, the market potential is of equal importance. It defines the upper limit of the total demand and takes potential clients into consideration. Although the market potential is rather fictitious, it offers good values of orientation. The relation of market volume to market potential provides information about the chances of market growth. The following are examples of information sources for determining market size:

- Government data
- Trade association data
- Financial data from major players
- Customer surveys

### Market trends

Market trends are the upward or downward movement of a market, during a period of time. The market size is more difficult to estimate if one is starting with something completely new. In this case, you will have to derive the figures from the number of potential customers, or customer segments. Besides information about the target market, one also needs information about one's competitors, customers, products, etc. Lastly, you need to measure marketing effectiveness. A few techniques are:

- Customer analysis
- Competitor analysis
- Product research
- Marketing mix modeling
- Choice modelling
- Risk analysis
- Advertising the research
- Simulated Test Marketing Changes in the market are important because they often are the source of new opportunities and threats. Moreover, they have the potential to dramatically affect the market size.

Examples include changes in economic, social, regulatory, legal, and political conditions and in available technology, price sensitivity, demand for variety, and level of emphasis on service and support.

### Market growth rate

A simple means of forecasting the market growth rate is to extrapolate historical data into the future. While this method may provide a first-order estimate, it does not predict important turning points. A better method is to study market trends and sales growth in complementary products. Such drivers serve as leading indicators that are more accurate than simply extrapolating historical data. Important inflection points in the market growth rate sometimes can be predicted by constructing a product diffusion curve. The shape of the curve can be estimated by studying the characteristics of the adoption rate of a similar product in the past. Ultimately, many markets mature and decline. Some leading indicators of a market's decline include market saturation, the emergence of substitute products, and/or the absence of growth drivers.

### Market opportunity

A market opportunity product or a service, based on either one technology or several, fulfills the need(s) of a (preferably increasing) market better than the competition and better than substitution-technologies within the given environmental frame (e.g. society, politics, legislation, etc.).

Market profitability While different organizations in a market will have different levels of profitability, they are all similar to different market conditions. Michael Porter devised a useful framework for evaluating the attractiveness of an industry or market. This framework, known as Porter five forces analysis, identifies five factors that influence the market profitability:

- Buyer power
- Supplier power
- Barriers to entry
- Threat of substitute products
- Rivalry among firms in the industry

### Industry cost structure

The cost structure is important for identifying key factors for success. To this end, Porter's value chain model is useful for determining where value is added and for isolating the costs. The cost structure also is helpful for formulating strategies to develop a competitive advantage. For example, in some environments the experience curve effect can be used to develop a cost advantage over competitors.

### Distribution channels

Examining the following aspects of the distribution system may help with a market analysis:

- Existing distribution channels - can be described by how direct they are to the customer.

- Trends and emerging channels - new channels can offer the opportunity to develop a competitive advantage.
- Channel power structure - for example, in the case of a product having little brand equity, retailers have negotiating power over manufacturers and can capture more margins.

### Success factors

The key success factors are those elements that are necessary in order for the firm to achieve its marketing objectives. A few examples of such factors include:

- Access to essential unique resources
- Ability to achieve economies of scale
- Access to distribution channels
- Technological progress

It is important to consider that key success factors may change over time, especially as the product progresses through its life cycle.

### Environmental analysis

The environmental analysis can be divided into two parts which are external and internal factors. External factors. Political issues, social potential force, and local economy called external environmental factors. Internal environmental factors belong to company's internal position such as employees, department structure, budget and so forth. How environmental effect markets. According to the Parry, the government limit pollution emission, they mention environmental taxes to prevent company which produce pollution substance. In other words, the government drives the organization. On the contrary, the cost of products increases due to the environmental taxes. It means that company may take measure of reducing production which may grow unemployment rate by emission tax. Therefore, the environmental taxes lead a income equality. It is not an excuse ignore our serious environmental problem. Even though the higher income group also can benefit from windfall gains.

### Competitive analysis

According to the Christina, competitive analysis is that company must know their competitors which have the same common services and products. The business can use like product cost, operational efficiency, brand recognition and market Dimensions of market analysis Except for David A. Asker's 7 main dimension of a market analysis including market size, market growth rate, market profitability, industry cost structure, distribution channel, market trends, and key success factor, there is another analysis of dimension market analysis. Based on Christina Callaway, dimension of market analysis can be divided into four parts which is environmental analysis, competitive analysis, target audience analysis, and SWOT analysis. The market analysis is to help company to illustrate current trend in the market and may affect the profitability. At the same time, market analysis is also to determine the attractiveness in the market. A good marketing analysis can improve organization investment decision accurately; they can based on the attractiveness to change investment tactical.

The market analysis is to help company to illustrate current trend in the market and may affect the profitability for the business. It can be seen as a part of industry analysis with using global environmental analysis. Company can identify strengths, weakness, opportunities and threats so that the business can define the business strategy. The market analysis is also reference for company's activity, like decisions of inventory, purchase, work force, facility expansion and many aspects of company.

Penetration to find the difference or competitive advantages between two similarly companies. How can we find he competitive advantage? Kevin says that "Anticipating and reading market needs can help business leaders take significant steps towards changing the game and obtaining competitive advantage. How can we sustain competitive advantages? In terms of Richard research, The Company should focus on sustaining competitive advantage due to the swift growth global competition. Therefore, Business practice management is the follow principle to maintain competitive advantage.

### Target audience analysis

In the Christina contribution, target audience is for company to target their customer group who most likely to buy their products. The group can be classified with location, age, gender, income, ethnicity, and behaviors. And people who make a decision of purchase can also be divided in the target audience. How identify market in accordance with Women's enterprise center the market can be classified in three types which are consumer market, industrial market, and reseller market. The company segments their market, research market, and identify why customer would like to buy their products.

### SWOT analysis

SWOT is strengths, weakness, opportunities, and threats. It matches internal strengths and weaknesses up against opportunities and threats. Strengths and weakness are internal factors which we can control. And opportunities and threats are external factors that businesses can't control, but can however impact on. When using strengths and weakness, businesses need to collect raw data to get information. Businesses can get information by customer feedback, employee surveys. Furthermore, businesses also can identify the capability if it is weakness or strengths, resources and process. Opportunities and threats are the external factors. Business can get information from secondary data like environmental information, industry information and competitive data. The purpose of the business use the SWOT analysis is to get the information from it and match each other to develop the ideas and get into goal statement to form strategic development.

Market communication has significant impact on building and maintaining the relationship of stakeholders. Market analysis elements are to form a strategic planning and the information is responsiveness, intelligence generation, and dissemination. Besides, market communication provides the information focus on the customer needs and competitive advantage. At the same time, these information spread to customers means the company spread its brand value so that customer can make awareness of the company's products. It is the communication channel between business and customers.

### Identification of Opportunities

Risk management can be described as the process of proactively working with stakeholders to minimise the risks and maximise the opportunity associated with project decisions. Risks are about the possibility of an adverse consequence. Good risk management does not have to be expensive or time consuming but relies on adaptability in response to change. Risk management ensures that an

organization identifies and understands the risks to which it is exposed. Organisations continuously face environments in which uncertainty is constantly challenging the existing ways of doing business and the way that risk needs to be managed. However, the upside to risk, that is often overlooked, is that the feared uncertain event could have a desired outcome. TAP University's blog notes that this is a positive risk or opportunity and needs to be managed to ensure a good result. Having a clear understanding of all risks allows an organization to measure and prioritize them and take the appropriate actions to reduce losses. Where risk management seeks to understand what might go badly in a project, opportunity management looks for what might go better.

**Opportunity management** is the process that converts the chance to decisiveness and is increasingly becoming embedded in the culture of organisations as they mature and broaden their understanding of the value that managing uncertainty can bring. For positive risk or opportunity management to be effective in creating or protecting value it must be an integral part of the management processes, be embedded in the culture and practices of the organisation, be tailored to the business process of the organisation, and comply with the risk management principles outlined in ISO 31000. An opportunity management process has required elements that need to be evaluated before advancing and allocating scarce resources to any project. All organisations have limited resources and it is important that they are used sensibly.

The first step that an organisation should take in order to improve decision making and reduce risk is identifying potential opportunities. It is advised that a business takes the necessary time and considers numerous ways of identifying opportunities for initiatives. Organisations could implement processes like "organizational catch ball" which would help them to develop plans and strategies for economic growth in the community. As Conti notes, "the interactive catch ball process from management level to the next is necessary for correct planning and alignment of goals". They could also implement brainstorming activities, hold stakeholder meetings, hold focus group interviews and hold jurisdictional reviews. This would help the organisation generate ideas to include in the initiative funnel. The firm should proceed to evaluate and prioritize initiatives to enable more effective courses of action to be taken in the future. This would involve ranking criteria in order of importance to ensure the correct alignment of targets for the projects. It is vital that the firm includes many opportunities in the decision making funnel to be effective. This will allow for a more comprehensive scope of ideas to be included in the decision making.

### Evaluation of Market and Potential Demand Technical Analysis

A forecast of total-market demand won't guarantee a successful strategy. But without it, decisions on investment, marketing support, and other resource allocations will be based on hidden, unconscious assumptions about industry wide requirements, and they'll often be wrong. By gauging total-market demand explicitly, you have a better chance of controlling your company's destiny. Merely going through the process has merit for a management team. Instead of just coming out with pat answers, numbers, and targets, the team is forced to rethink the competitive environment. Total-market forecasting is only the first stage in creating a strategy. When you've finished your forecast, you're not done with the planning process by any means.

There are four steps in any total-market forecast:

1. Define the market.
2. Divide total industry demand into its main components.
3. Forecast the drivers of demand in each segment and project how they are likely to change.
4. Conduct sensitivity analyses to understand the most critical assumptions and to gauge risks to the baseline forecast.

**1. Defining the Market-** At the outset, it's best to be overly inclusive in defining the total market. Define it broadly enough to include all potential end users so that you can both identify the appropriate drivers of demand and reduce the risk of surprise product substitutions. The factors that drive forecasts of total-market size differ markedly from those that determine a particular product's market share or product-category share. For example, total-market demand for office telecommunications products nationally depends in part on the number of people in offices and their needs and habits, while total demand for PBX systems depends on how they compare on price and benefits with substitute products like the local telephone company's central office switching service. Beyond this, demand for a particular PBX is a function of price and benefit comparisons with other PBXs. In defining the market, an understanding of product substitution is critical. Customers might behave differently if the price or performance of potential substitute products changes. One company studying total demand for industrial paper tubes had to consider closely related uses of metal and plastic tubes to prevent customer switching among tubes from biasing the results.

Understand, too, that a completely new product could displace one that hitherto had comprised the entire market—like the electronic calculator, which eliminated the slide rule. For a while after AT&T's divestiture, the Bell telephone companies continued to forecast volume of long-distance calls by using historical trend lines of their revenues—as if they were still part of a monopoly. Naturally, these forecasts grew more inaccurate with time as end users were presented with new choices. The companies are now broadening their market definitions to take account of heightened competition from other long-distance carriers.

### 2. Dividing Demand into Component Parts

The second step in forecasting is to divide total demand into its main components for separate analysis.

There are two criteria to keep in mind when choosing segments: make each category small and homogeneous enough so that the drivers of demand will apply consistently across its various elements; make each large enough so that the analysis will be worth the effort. Of course, this is a matter of judgment. You may find it useful in making this judgment to imagine alternative segmentations (based on end-use customer groups, for example, or type of purchase). Then hypothesize their key drivers of demand (discussed later) and decide how much detail is required to capture the true situation. As the assessment continues, managers can return to this stage and reexamine whether the initial decisions still stand up. Managers may wish to use a "tree" diagram like the accompanying one constructed by a management team in 1985 to study demand for paper. In this disguised example, industry data permitted the division of demand into 12 end-use categories. Some categories, like business forms and reprographic paper, were big contributors to total consumption; others, such as labels, were not. One (other converting) was fairly large but too diverse for deep analysis. The team focused on the four segments that accounted for 80% of 1985 demand. It then developed secondary branches of the tree to further dissect these categories and to determine their drivers of demand. It analysed the remaining segments less completely (that is, via a regression against broad macroeconomic trends).

**3. Forecasting the Drivers of Demand-** The third step is to understand and forecast the drivers of demand in each category. Here you can make good use of regressions and other statistical techniques to find some causes for changes in historical demand. But this is only a start. The tougher challenge is to look beyond the data on which regressions can easily be based to other factors where data are much harder to find. Then you need to develop a point of view on how those other factors may themselves change in the future. An end-use analysis from the commodity paper example, reprographic paper, is shown in the accompanying chart. The management team, using available data, divided reprographic paper into two categories: plain-paper copier paper and nonimpact page printer paper. Without this important differentiation, the drivers of demand would have been masked, making it hard to forecast effectively

**4. Conducting Sensitivity Analyses-** Managers who rely on single-point demand forecasts run dangerous risks. Some of the macroeconomic variables behind the forecasts could be wrong. Despite the best analysis, moreover, the assumptions behind the other demand drivers could also be wrong, especially if discontinuities loom on the horizon. Imaginative marketers who ask questions like “What things could cause this forecast to change dramatically?” produce the best estimates. They are more likely to identify potential risks and discontinuities—developments in competing technologies, in customer industry competitiveness, in supplier cost structures—than those who do not. So once a baseline forecast is complete, the challenge is to determine how far it could be off target.

At one level, such a sensitivity analysis can be done by simply varying assumptions and quantifying their impact on demand. But a more targeted approach usually provides better insight. Begin such an analysis by thinking through and quantifying the areas of greatest strategic risk. One company’s strategy decision may be affected only if demand is well below the baseline forecast; in another case, big risks may result from small forecasting error.

#### **What is Technical Analysis?**

Technical Analysis is the forecasting of future financial price movements based on an examination of past price movements. Like weather forecasting, technical analysis does not result in absolute predictions about the future. Instead, technical analysis can help investors anticipate what is “likely” to happen to prices over time. Technical analysis uses a wide variety of charts that show price over time. Technical analysis is applicable to stocks, indices, commodities, futures or any tradable instrument where the price is influenced by the forces of supply and demand. Price refers to any combination of the open, high, low, or close for a given security over a specific time frame. The time frame can be based on intraday (1-minute, 5-minutes, 10-minutes, 15-minutes, 30-minutes or hourly), daily, weekly or monthly price data and last a few hours or many years. In addition, some technical analysts include volume or open interest figures with their study of price action.

**The Basis of Technical Analysis-** At the turn of the century, the Dow Theory laid the foundations for what was later to become modern technical analysis. Dow Theory was not presented as one complete amalgamation, but rather pieced together from the writings of Charles Dow over several years. Of the many theorems put forth by Dow, three stand out:

1. Price Discounts Everything
2. Price Movements Are Not Totally Random
3. “What” Is More Important than “Why”

**Price Discounts Everything-** This theorem is similar to the strong and semi-strong forms of market efficiency. Technical analysts believe that the current price fully reflects all information. Because all information is already reflected in the price, it represents the fair value, and should form the basis for analysis. After all, the market price reflects the sum knowledge of all participants, including traders, investors, portfolio managers, buy-side analysts, sell-side analysts, market strategist, technical analysts, fundamental analysts and many others. It would be folly to disagree with the price set by such an impressive array of people with impeccable credentials. Technical analysis utilizes the information captured by the price to interpret what the market is saying with the purpose of forming a view on the future.

**Prices Movements are not Totally Random-** Most technicians agree that prices trend. However, most technicians also acknowledge that there are periods when prices do not trend. If prices were always random, it would be extremely difficult to make money using technical analysis. In his book, *Schwager on Futures: Technical Analysis*, Jack Schwager states: “One way of viewing it is that markets may witness extended periods of random fluctuation, interspersed with shorter periods of nonrandom behavior. The goal of the chartist is to identify those periods.

A technician believes that it is possible to identify a trend, invest or trade based on the trend and make money as the trend unfolds. Because technical analysis can be applied to many different time frames, it is possible to spot both short-term and long-term trends. The IBM chart illustrates Schwager's view on the nature of the trend. The broad trend is up, but it is also interspersed with trading ranges. In between the trading ranges are smaller uptrends within the larger uptrend. The uptrend is renewed when the stock breaks above the trading range. A downtrend begins when the stock breaks below the low of the previous trading range.

#### **"What" is More Important than "Why"**

In his book, *The Psychology of Technical Analysis*, Tony Plummer paraphrases Oscar Wilde by stating, “A technical analyst knows the price of everything, but the value of nothing”. Technicians, as technical analysts are called, are only concerned with two things:

#### **General Steps to Technical Evaluation**

Many technicians employ a top-down approach that begins with broad-based macro analysis. The larger parts are then broken down to base the final step on a more focused/micro perspective. Such an analysis might involve three steps:

1. Broad market analysis through the major indices such as the S&P 500, Dow Industrials, NASDAQ and NYSE Composite.
2. Sector analysis to identify the strongest and weakest groups within the broader market.
3. Individual stock analysis to identify the strongest and weakest stocks within select groups.

#### **Chart Analysis**

Technical analysis can be as complex or as simple as you want it. The example below represents a simplified version. Since we are interested in buying stocks, the focus will be on spotting bullish situations.

**Overall Trend:** The first step is to identify the overall trend. This can be accomplished with trend lines, moving averages or peak/trough analysis. For example, the trend is up as long as price remains above its upward sloping trend line or a certain moving average. Similarly, the trend is up as long as higher troughs form on each pullback and higher highs form on each advance.

**Support:** Areas of congestion and previous lows below the current price mark the support levels. A break below support would be considered bearish and detrimental to the overall trend.

**Resistance:** Areas of congestion and previous highs above the current price mark the resistance levels. A break above resistance would be considered bullish and positive for the overall trend.

**Momentum:** Momentum is usually measured with an oscillator such as MACD. If MACD is above its 9-day EMA (exponential moving average) or positive, then momentum will be considered bullish, or at least improving.

### Strengths of Technical Analysis

**Focus on Price-** If the objective is to predict the future price, then it makes sense to focus on price movements. Price movements usually precede fundamental developments. By focusing on price action, technicians are automatically focusing on the future. The market is thought of as a leading indicator and generally leads the economy by 6 to 9 months. To keep pace with the market, it makes sense to look directly at the price movements. More often than not, change is a subtle beast. Even though the market is prone to sudden knee-jerk reactions, hints usually develop before significant moves. A technician will refer to periods of accumulation as evidence of an impending advance and periods of distribution as evidence of an impending decline.

#### Supply, Demand, and Price Action

Many technicians use the open, high, low and close when analyzing the price action of a security. There is information to be gleaned from each bit of information. Separately, these will not be able to tell much. However, taken together, the open, high, low and close reflect forces of supply and demand.

### Weaknesses of Technical Analysis

**Analyst Bias-** Just as with fundamental analysis, technical analysis is subjective and our personal biases can be reflected in the analysis. It is important to be aware of these biases when analyzing a chart. If the analyst is a perpetual bull, then a bullish bias will overshadow the analysis. On the other hand, if the analyst is a disgruntled eternal bear, then the analysis will probably have a bearish tilt.

**Open to Interpretation-** Furthering the bias argument is the fact that technical analysis is open to interpretation. Even though there are standards, many times two technicians will look at the same chart and paint two different scenarios or see different patterns. Both will be able to come up with logical support and resistance levels as well as key breaks to justify their position. While this can be frustrating, it should be pointed out that technical analysis is more like an art than a science, somewhat like economics. Is the cup half-empty or half-full? It is in the eye of the beholder.

**Too Late-** Technical analysis has been criticized for being too late. By the time the trend is identified, a substantial portion of the move has already taken place. After such a large move, the reward to risk ratio is not great. Lateness is a particular criticism of Dow Theory.

**Always Another Level-** Even after a new trend has been identified, there is always another "important" level close at hand. Technicians have been accused of sitting on the fence and never taking an unqualified stance. Even if they are bullish, there is always some indicator or some level that will qualify their opinion.

**Trader's Remorse-** Not all technical signals and patterns work. When you begin to study technical analysis, you will come across an array of patterns and indicators with rules to match. For instance: A sell signal is given when the neckline of a head and shoulders pattern is broken. Even though this is a rule, it is not steadfast and can be subject to other factors such as volume and momentum.

## Materials and Inputs Production Technology,

**Production theory** is the study of production, or the economic process of converting inputs into outputs. Production uses resources to create a good or service that is suitable for use, gift-giving in a gift economy, or exchange in a market economy. This can include manufacturing, construction,<sup>[1]</sup> storing, shipping, and packaging. Some economists define production broadly as all economic activity other than consumption. They see every commercial activity other than the final purchase as some form of production. Production is a process, and as such it occurs through time and space. Because it is a flow concept, production is measured as a "rate of output per period of time". There are three aspects to production processes:

1. the quantity of the good or service produced,
2. the form of the good or service created,
3. the temporal and spatial distribution of the good or service produced.

A production process can be defined as any activity that increases the similarity between the pattern of demand for goods and services, and the quantity, form, shape, size, length and distribution of these goods and services available to the market place. Production is a process that combines various material inputs and immaterial inputs (plans, know-how) to make something for consumption (the output). It is the act of creating output, a good or service that has value and contributes to the utility of individuals.

Economic well-being is created in a production process, meaning all economic activities that aim directly or indirectly to satisfy human needs. The degree to which the needs are satisfied is often accepted as a measure of economic well-being. In production, two features explain increasing economic well-being. They are improving quality-price-ratio of commodities and increasing incomes from growing and more efficient market production.

### The most important forms of production are

- market production
- public production
- household production

To understand the origin of the economic well-being, we must understand these three production processes. All of them produce commodities that have value and contribute to well-being of individuals.

The satisfaction of needs originates from the use of the commodities produced. The need satisfaction increases when the quality-price-ratio of the commodities improves and more satisfaction is achieved at less cost. Improving the quality-price-ratio of commodities is to a producer an essential way to improve the competitiveness of products but this kind of gains distributed to customers cannot be measured with production data. To the producer, improving product competitiveness often means lower product prices, and therefore losses in incomes, which the producer hopes sales growth will offset. Economic well-being also increases due to the growth of incomes that are gained from the growing and more efficient market production. Market production is the only one production form that creates and distributes incomes to stakeholders. Public production and household production are financed by the incomes generated in market production. Thus market

production has a double role in creating well-being, i.e., the role of producing developing commodities and the role to creating income. Because of this double role market production is the “primus motor” of economic well-being and therefore here under review.

### **Production as a source of economic well-being**

In principle there are two main activities in an economy, production and consumption. Similarly there are two kinds of actors, producers and consumers. Well-being is made possible by efficient production and by the interaction between producers and consumers. In the interaction, consumers can be identified in two roles both of which generate well-being. Consumers can be both customers of the producers and suppliers to the producers. The customers’ well-being arises from the commodities they are buying and the suppliers’ well-being is related to the income they receive as compensation for the production inputs they have delivered to the producers.

The three groups are

- Customers
- Suppliers
- Producers

The interests of these stakeholders and their relations to companies are described briefly below. Our purpose is to establish a framework for further analysis.

#### **Customers**

The customers of a company are typically consumers, other market producers or producers in the public sector. Each of them has their individual production functions. Due to competition, the price-quality-ratios of commodities tend to improve and this brings the benefits of better productivity to customers. Customers get more for less. In households and the public sector this means that more need satisfaction is achieved at less cost. For this reason the productivity of customers can increase over time even though their incomes remain unchanged.

#### **Suppliers**

The suppliers of companies are typically producers of materials, energy, capital, and services. They all have their individual production functions. The changes in prices or qualities of supplied commodities have an effect on both actors’ (company and suppliers) production functions. We come to the conclusion that the production functions of the company and its suppliers are in a state of continuous change. The inputs or resources used in the production process are called factors of production by economists. The inputs are usually grouped into four categories. These factors are:

- Raw material
- Labour services
- Capital goods
- Land

In the “long run”, all of these factors of production can be adjusted by management. The “short run”, however, is defined as a period in which at least one of the factors of production is fixed.

A fixed factor of production is one whose quantity cannot readily be changed. Examples include major pieces of equipment, suitable factory space, and key managerial personnel.

A variable factor of production is one whose usage rate can be changed easily. Examples include electrical power consumption, transportation services, and most raw material inputs. In the short run, a firm’s “scale of operations” determines the maximum number of outputs that can be produced. In the long run, there are no scale limitations.

#### **Producer community**

The incomes are generated for those participating in production, i.e., the labour force, society and owners. These stakeholders are referred to here as producer communities or, in shorter form, as producers. The producer communities have a common interest in maximizing their incomes. These parties that contribute to production receive increased incomes from the growing and developing production.

#### **Main processes of a producing company**

1. Real process
2. Income distribution process
3. Production process
4. Monetary process
5. Market value process

**1.Real process-** Production output is created in the real process, gains of production are distributed in the income distribution process and these two processes constitute the production process. The production process and its sub-processes, the real process and income distribution process occur simultaneously, and only the production process is identifiable and measurable by the traditional accounting practices. The real process and income distribution process can be identified and measured by extra calculation, and this is why we must analyze them separately to understand the logic of production and its performance. Real process generates the production output from input, and it can be described by means of the production function. It refers to a series of events in production in which production inputs of different quality and quantity are combined into products of different quality and quantity. Products can be physical goods, immaterial services and most often combinations of both. The characteristics created into the product by the producer imply surplus value to the consumer, and on the basis of the market price this value is shared by the consumer and the producer in the marketplace. This is the mechanism through which surplus value originates to the consumer and the producer likewise. It is worth noting that surplus values to customers cannot be measured from any production data. Instead the surplus value to a producer can be measured. It can be expressed both in terms of nominal and real values. The real surplus value to the producer is an outcome of the real process, real income, and measured proportionally it means productivity.

**2.Income distribution process** of the production refers to a series of events in which the unit prices of constant-quality products and inputs alter causing a change in income distribution among those participating in the exchange. The magnitude of the change in income distribution is directly proportionate to the change in prices of the output and inputs and to their quantities. Productivity gains are distributed, for example, to customers as lower product sales prices or to staff as higher income pay.

**3.The production process** consists of the real process and the income distribution process. A result and a criterion of success of the owner is profitability. The profitability of production is the share of the real process result the owner has been able to keep to himself in the income distribution process. Factors describing the production process are the components of profitability, i.e., returns and costs. They differ from the factors of the real process in that the components of profitability are given at nominal prices whereas in the real process the factors are at periodically fixed prices.

**4.Monetary process** refers to events related to financing the business.

**5.Market value process** refers to a series of events in which investors determine the market value of the company in the investment markets.

**Features of Production Function:**

- 1. Substitutability:-** The factors of production or inputs are substitutes of one another which make it possible to vary the total output by changing the quantity of one or a few inputs, while the quantities of all other inputs are held constant. It is the substitutability of the factors of production that gives rise to the laws of variable proportions.
- 2. Complementarity:-** The factors of production are also complementary to one another, that is, the two or more inputs are to be used together as nothing will be produced if the quantity of either of the inputs used in the production process is zero. The principles of returns to scale is another manifestation of complementarity of inputs as it reveals that the quantity of all inputs are to be increased simultaneously in order to attain a higher scale of total output.
- 3. Specificity:-** It reveals that the inputs are specific to the production of a particular product. Machines and equipment's, specialized workers and raw materials are a few examples of the specificity of factors of production. The specificity may not be complete as factors may be used for production of other commodities too. This reveals that in the production process none of the factors can be ignored and in some cases ignorance to even slightest extent is not possible if the factors are perfectly specific. Production involves time; hence, the way the inputs are combined is determined to a large extent by the time period under consideration. The greater the time period, the greater the freedom the producer has to vary the quantities of various inputs used in the production process.

**Product Mix**

Product mix is the variety of products a company sells.

1. Difference Between Product Line & Product Mix
2. Why Is the Concept of a Product Mix Important?

3. The Classification of Products in Marketing
4. Product Mix Pricing Strategies

Product mix, also known as product assortment, refers to the total number of product lines that a company offers to its customers. For example, a small company may sell multiple lines of products. Sometimes, these product lines are fairly similar, such as dish washing liquid and bar soap, which are used for cleaning and use similar technologies. Other times, the product lines are vastly different, such as diapers and razors. The four dimensions to a company's product mix include **width, length, depth and consistency**.

**Width-** The width of a company's product mix pertains to the number of product lines that a company sells. For example, if a company has two product lines, its product mix width is two. Small and upstart businesses will usually not have a wide product mix. It is more practical to start with some basic products and build market share. Later on, a company's technology may allow the company to diversify into other industries and build the width of the product mix.

**Length-** Product mix length pertains to the number of total products or items in a company's product mix, according to Philip Kotler's textbook "Marketing Management: Analysis, Planning, Implementation and Control." For example, ABC company may have two product lines, and five brands within each product line. Thus, ABC's product mix length would be 10. Companies that have multiple product lines will sometimes keep track of their average length per product line. In the above case, the average length of an ABC Company's product line is five.

**Depth-** Depth of a product mix pertains to the total number of variations for each product. Variations can include size, flavor and any other distinguishing characteristic. For example, if a company sells three sizes and two flavors of toothpaste, that particular brand of toothpaste has a depth of six. Just like length, companies sometimes report the average depth of their product lines; or the depth of a specific product line.

**Consistency-** Product mix consistency pertains to how closely related product lines are to one another--in terms of use, production and distribution. A company's product mix may be consistent in distribution but vastly different in use. For example, a small company may sell its health bars and health magazine in retail stores. However, one product is edible and the other is not. The production consistency of these products would vary as well.

**Plant Capacity**

The net **capacity factor** is the unit less ratio of an actual electrical energy output over a given period of time to the maximum possible electrical energy output over the same amount of time.<sup>[1]</sup> The capacity factor is defined for any electricity producing installation, i.e. a fuel consuming power plant or one using renewable energy, such as wind or the sun. The capacity factor is thus defined also for any class of such installations, and can be used to compare different types of electricity production. The maximum possible energy output of a given installation assumes its continuous operation at full nameplate capacity over the relevant period of time. The actual energy output over the same period of time and with it the capacity factor varies greatly depending on a range of factors. As such, the capacity factor can never exceed the availability factor, i.e. the fraction of downtime due to for example reliability issues and maintenance both scheduled and unscheduled. Other factors include the design of the installation, its location, the overall type of electricity production and with it either the fuel being used or for renewable energy the local weather conditions. Additionally, the capacity factor can be subject to regulatory constraints and market forces potentially affecting both its fuel purchase and its electricity sale. To gain insight into seasonal fluctuations the capacity factor can be computed on a monthly basis, see the illustration. Otherwise it is often computed over a timescale of a year averaging out most temporal fluctuations. Alternatively, it be computed over the lifetime of the power source, both while operational and after decommissioning.

**Sample calculations****1. Nuclear power plant**

**Nuclear power plant-** Nuclear power plants are at the high end of the range of capacity factors, ideally reduced only by the availability factor, i.e. maintenance and refueling. The largest nuclear plant in the US, Palo Verde Nuclear Generating Station has between its three reactors a nameplate capacity of 3,942 MW. As of 2010 its annual generation was 31,200,000 MWh, leading to a capacity factor of. Each of Palo Verde's three reactors is refueled every 18 months, with one refueling every spring and fall. In 2014, a refueling was completed in a record 28 days, compared to the 35 days of downtime that the 2010 capacity factor corresponds to.

**Wind farm-** The Danish offshore wind farm Horns Rev 2, the world's largest at its inauguration in 2009, has a nameplate capacity of 209.3 MW. As of January 2017 it has since its commissioning 7.3 years ago produced 6416 GWh, i.e. an average annual production of 875 GWh/year and a

capacity factor of Sites with lower capacity factors may be deemed feasible for wind farms, for example the onshore 1 GW Fosen Vind which as of 2017 is under construction in Norway has a projected capacity factor of 39%. Certain onshore wind farms can reach capacity factors of over 60%, for example the 44 MW Eolo plant in Nicaragua had a net generation of 232.132 MWh in 2015, equivalent to a capacity factor of 60.2%. Since the capacity factor of a wind turbine measures actual production relative to possible production it is not constrained by Betz's coefficient of 16/27 59.3%, which limits production vs. energy available in the wind.

**Hydroelectric dam-** As of 2017 the Three Gorges Dam in China is with its nameplate capacity of 22,500 MW the largest power generating station in the world by installed capacity. In 2015 it generated 87 TWh, for a capacity factor of Hoover Dam has a nameplate capacity of 2080 MW and an annual generation averaging 4.2 TW·h. (The annual generation has varied between a high of 10.348 TW·h in 1984, and a low of 2.648 TW·h in 1956.) Taking the average figure for annual generation gives a capacity factor of:

**Photovoltaic power station-** At the low range of capacity factors is the photovoltaic power station, which supplies power to the electricity grid from a large-scale photovoltaic system (PV system). An inherent limit to its capacity factor comes from its requirement of daylight, preferably with a sun unobstructed by clouds, smoke or smog, shade from trees and building structures. Since the amount of sunlight varies both with the time of the day and the seasons of the year, the capacity factor is typically computed on an annual basis. The amount of available sunlight is mostly determined by the latitude of the installation, but also influenced by local factors, such as indirect light reflected from a nearby body of water. The actual production is also influenced by local factors such as dust and ambient temperature, which ideally should be low. As for any power station, the maximum possible power production is the nameplate capacity times the number of hours in a year, while the actual production is the amount of electricity delivered annually to the grid. For example, Agua Caliente Solar Project, located in Arizona near the 33rd parallel and awarded for its excellence in renewable energy has a nameplate capacity of 290 MW and an actual, average annual production of 740 GWh/year. Its capacity factor is thus: A significantly lower capacity factor is achieved by Lauingen Energy Park located in Bavaria near the 49th parallel, with a nameplate capacity of 25.7 MW and an actual, average annual production of 26.98 GWh/year for a capacity factor of 12.0%.

### Reasons for reduced capacity

**first reason** is that it was out of service or operating at reduced output for part of the time due to equipment failures or routine maintenance. This accounts for most of the unused capacity of base load power plants. Base load plants have the lowest costs per unit of electricity because they are designed for maximum efficiency and are operated continuously at high output. [Geothermal plants](#), [nuclear plants](#), [coal-fired plants](#) and [bioenergy plants](#) that burn solid material are almost always operated as base load plants.

**The second reason** that a plant would have a capacity factor lower than 100% is that output is curtailed or intentionally left idle because the electricity is not needed or because the price of electricity is too low to make production economical. This accounts for most of the unused capacity of [peaking power plants](#). Peaking plants may operate for only a few hours per year or up to several hours per day. Their electricity is relatively expensive. Many other power plants operate only at certain times of the day or times of the year because of variation in loads and electricity prices. If a plant is only needed during the day, for example, even if it operates at full power output from 8 am to 8 pm every day all year long, it would only have a 50% Capacity factor, e.g.

**A third reason** is that a plant may not have the fuel available to operate all of the time. This can apply to fossil generating stations with restricted fuels supplies, but most notably applies to intermittent renewable resources. When the sun isn't shining, solar PV cannot produce electricity. When the wind is not blowing, wind turbines cannot produce electricity. Solar PV and wind turbines have a capacity factor limited by the availability of their "fuel", sunshine and wind respectively. A hydroelectricity plant may have a capacity factor lower than 100% due to scarcity of water. However, its output may also simply be regulated to match the current power need, conserving its stored water for later usage. A hydroelectricity plant may also be designed for reverse usage so it can pump water up in its reservoir in situations with a power surplus. In both cases the use of the hydroelectricity plant to stabilize the grid reduces its capacity factor. Hydroelectricity may have a higher capacity factor with respect to the turbine size since in some case the amount of stored water fluctuates to account for intermittent availability of water.

**Other reasons** that a power plant may not have a capacity factor of 100% include restrictions or limitations on air permits and limitations on transmission that force the plant to curtail output.

## Projection Charts

This article lists and describes some of the common charts used in project management. Learn about what charts can help you to plan your projects by reading further. There are many useful tools for project management. One of the most useful tools is the chart. There are several different types of charts for project management, and all are intended to help you to visualize the project. You may have already heard of the Gantt Chart or the PERT Chart, but have you heard of the process control chart? How about the Network Diagram or the Pareto Chart? Read on to find out what the most common charts used in project management are, and when they should be used for your project planning success.

### 1.The Gantt Chart

The Gantt chart is often hailed as being the project management staple. This chart for project management is a useful tool for scheduling your project. Gantt charts depict task dependencies, start times and stop times for project tasks, and provide a visual frame of reference for everyone on the project team. Gantt charts help project managers to plan activities, work out a critical path, and communicate activities with team members. They work best on smaller projects, when projects are large or complex, their usefulness wanes due to the limitations of the Gantt chart.

### Why Use Gantt Charts?

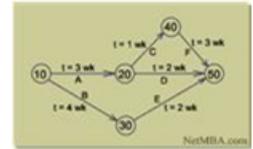
When you set up a Gantt chart, you need to think through all of the tasks involved in your project. As part of this process, you'll work out who will be responsible for each task, how long each task will take, and what problems your team may encounter. This detailed thinking helps you ensure that the schedule is workable, that the right people are assigned to each task, and that you have workarounds for potential problems before you start. They also help you work out practical aspects of a project, such as the minimum time it will take to deliver, and which tasks

need to be completed before others can start. Plus, you can use them to identify the critical path – the sequence of tasks that must individually be completed on time if the whole project is to deliver on time.

Finally, you can use them to keep your team and your sponsors informed of progress. Simply update the chart to show schedule changes and their implications, or use it to communicate that key tasks have been completed.

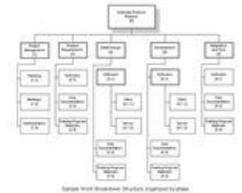
## 2.The PERT Chart

Another project management chart you are likely to have heard of before is the PERT chart. The PERT chart, also sometimes known as a **network diagram**, depicts more complex projects and the relationships between activities. A PERT chart, unlike a Gantt chart, can depict activities that are parallel, activities that must follow one another, and complex task dependencies. This chart can help your team to visualize not only the whole project, but a part of the project you are managing that is particularly complex.



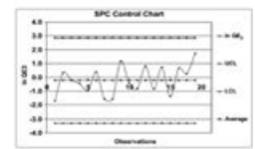
## 3.The Work Breakdown Structure

Another type of chart is the work breakdown structure (WBS). The WBS depicts the hierarchy of tasks that comprise a project. To create a work breakdown structure you must first decompose your project into the component tasks. Next, begin at the top with the project name. Each item of the next level will be the tasks involved in the project (or milestones). The levels under that will contain subtasks and work items. Work items are the smallest, completable actions that will move the project towards completion. The WBS is a helpful tool for you to use in planning your project, because it allows you to visualize the component parts and how they relate *before* they are entered into your project management software.



## 4. Pareto Chart

Pareto charts are most often used with Six Sigma methodologies, but they can be useful in any aspect of project management. Easily created in MS Excel, a Pareto chart can help you to visualize the quality analysis aspects of your products and processes. A Pareto chart generally has percentages running along the left-hand side, and the analyzed products running along the bottom. Process Control Chart



A process control chart depicts variations in data that can be found within a given process. Most often, these charts are utilized in process management and in Six Sigma for monitoring quality. The process control chart has specification limits that have been calculated from the data collected. The points on the chart represent data measurements of quality taken from a process at different times. The center line represents the process characteristic mean. The upper and lower control limits depict thresholds that means that the process data corresponding with that figure is unlikely. This can be helpful when you are trying to improve quality on a process or product

## 5.Cause and Effect Charts

The cause and effect chart is a result of cause and effect analysis performed on a project event. This diagram, also known as an Ishikawa diagram or a fishbone diagram is a useful tool for visualizing the various causes surrounding a particular event. Causes are categorized and are often the products of long brainstorming sessions.



## 6.Stakeholder Analysis Matrix

The stakeholder analysis matrix is a useful tool when you want to determine who has interest and influence in a project you are managing. The matrix provides a visual description of the stakeholders involved - all of them - and their level of involvement with the project. If there is a change, or if something goes wrong, your stakeholder analysis matrix will be the backbone of the risk management plan.

## Project Schedule

Project schedule is a strategic and an important tool in a project manager's portfolio for guiding a project successfully to its target completion date. For simple projects, a project schedule is basically a timeline or calendar which lists tasks and activities with expected start and finish dates. For more complex projects, a project schedule can be layered with different details to enable project managers to direct and manage resources more smoothly, communicate more frequently and effectively with stakeholders, and identify and monitor dependencies and constraints between tasks to avert preventable delays. The project schedule can be expressed in several display forms depending upon the purpose of the schedule, the stage of the development of the project, and the primary user of the schedule.

## Examples of Types of Project Schedules

The three most common types of project schedules are the master project schedule, the milestone schedule, and the detailed schedule.

**1.Master Project Schedule-** Developed in the initial phase of project planning, the master project schedule is a summary level schedule which highlights the principal activities and tasks and their estimated duration. This schedule's strength lies in its ability to aggregate individual activity schedules and display them in one convenient document. The schedule can serve as an early communication tool for building buy-in for the project with upper level management and external stakeholders. The schedule is also useful for facilitating team brainstorming during the initial phrases of the project to work out logistics. For more information on master project schedules, continue reading this article explaining how to create a master project schedule.

**2. Milestone Schedule-** As an advanced schedule, a milestone schedule is often referred to throughout the project's life cycle. The milestone schedule is a summary level schedule that allows the project team leader to review and identify all of the significant and major project related milestones that may surface during the course of a project. A milestone is a significant event in the project usually marked by the completion of a major deliverable. Because of its visually-pleasing format, the milestone schedule is recommended for reporting status reports to top level management and external stakeholders. The milestone schedule is also useful during team assessments, particularly for newly-formed teams to give them an opportunity to take pride in their accomplishments, reflect upon their setbacks, and most importantly bond as a team.

**3. Detailed Project Schedule-** Detailed schedules are operational schedules intended to help front line managers in directing hourly, daily, or weekly project work. The detailed schedule is considered the execution playbook for the project. Analogous to a football playbook that can be

broken down into activities (passes and runs) for the two sides of the game (offense and defense), the detailed project schedule playbook can be broken down into chapters to show the detailed schedule for each activity or each phase of the project as it unfolds.

**Manually scheduled tasks-** You can place a manually scheduled task placed anywhere in your schedule, and Project won't move it. This new feature gives you greater flexibility and control over planning and managing their schedule.

Why would you care? Well, at times project schedules are often very informal. They begin as simple lists of dates from e-mails, meeting with stakeholders, or a hallway conversation. Project managers very often do not have complete information on work items. For example, they may only be aware of when a task needs to be started, but not its duration until they have an estimate from their team members. Also, they may know how long a task will take, but they do not know it can be started until they have approval from the resource manager.

Here are some things to keep in mind with manually scheduled tasks.

- **You'll never be left in the dark.** Manually scheduled tasks have their own indicators and task bars to help you distinguish them from the "classic" automatically scheduled tasks.
- **Anything goes.** When a task is in manually scheduled mode, the Start, Finish, and Duration columns can be blank or include text values in addition to recognizable dates.
- **Switching scheduling modes** You can change a task back and forth from manually scheduled to automatically scheduled. Be careful, though. When you change a task from manually scheduled to automatically scheduled, Project is going to have to make some decisions. If a task's duration was "A fortnight", Project will by default use an estimated duration of "1 day?" if the task is set to automatically scheduled. After all, you can expect project to know that a fortnight is two weeks long.
- **Control slippage** If a manually scheduled task has to be delayed due to a slippage, its successor tasks will not be automatically pushed out. Project managers can decide to keep the original dates if their resources are able to proceed as planned, or delay the successor tasks if there are hard dependencies.
- **Effort-driven impacts** Manually scheduled tasks cannot be set to effort-driven. The duration of a manually scheduled task will not change as resources are assigned to it

The following table shows how Project attributes are defined and used for scheduling manually and automatically scheduled tasks.

Item	Manually Scheduled	Automatically Scheduled
Duration	Can be number, date, or text information, such as "14d" or "fortnight". Not used by Project to Help schedule the project.	Only numbers representing time length and units can be used, such as "14d" or "2 months".
Work	Only numbers representing time length and units can be used, such as "14d" or "2 months".	Only numbers representing time length and units can be used, such as "14d" or "2 months".
Resources	Can be assigned to tasks. Not used by Project to help schedule the project.	Can be assigned to tasks. Used by Project to Help determine best schedule. Will change the duration of tasks if tasks are set to effort-driven, unlike manually scheduled tasks.
Start date	Can be a number, date or text information, such as "Jan 30" or "Sometime soon." Not used by Project to Help schedule the project.	Only date information can be used.
Finish date	Can be a date or text information, such as "Jan 30" or "Sometime soon." Not used by Project to Help schedule the project.	Only date information can be used.
Constraints	Ignored by Project.	Used by Project to Help determine best schedule.
Dependencies (links)	Can be used, but won't change the scheduling of the task.	Can be used, but won't change scheduling of the task.
Project and resource calendars	Ignored by Project.	Used by Project to Help determine best schedule.

**Automatically scheduled tasks-** Automatically scheduled tasks are the classic way Project schedules your tasks. Automatic scheduling provides a highly structured, systematic means of managing project schedules. Based on users' input, such as task duration, planned work, number of resources, and constraint dates, Project calculates the earliest and latest dates for tasks for the optimal schedule.

Project schedules a project from the information that you enter about the following:

- The overall project.
- The individual work items (called tasks) required to complete the project.
- If necessary, the resources needed to complete those tasks.

If anything about your project changes after you create your schedule, you can update the tasks or resources and Project adjusts the schedule for you.

You can enter resources in your project and then assign them to tasks to indicate which resource is responsible for completing each assignment. Not only does this help you plan project staffing, it can also help you to calculate the number of machines needed or the quantity of material to be consume

#### Approaches to Cost Estimation

Cost estimating is one of the most important steps in project management. A cost estimate establishes the base line of the project cost at different stages of development of the project. A cost estimate at a given stage of project development represents a prediction provided by

For each task, you might enter one or all of the following:

- Durations
- Task dependencies
- Constraints

Using this information, Project calculates the start date and finish date for each task.

the cost engineer or estimator on the basis of available data. According to the American Association of Cost Engineers, cost engineering is defined as that area of engineering practice where engineering judgment and experience are utilized in the application of scientific principles and techniques to the problem of cost estimation, cost control and profitability.

Virtually all cost estimation is performed according to one or some combination of the following basic approaches:

**Production function-** In microeconomics, the relationship between the output of a process and the necessary resources is referred to as the production function. In construction, the production function may be expressed by the relationship between the volume of construction and a factor of production such as labor or capital. A production function relates the amount or volume of output to the various inputs of labor, material and equipment. For example, the amount of output  $Q$  may be derived as a function of various input factors  $x_1, x_2, \dots, x_n$  by means of mathematical and/or statistical methods. Thus, for a specified level of output, we may attempt to find a set of values for the input factors so as to minimize the production cost. The relationship between the size of a building project (expressed in square feet) to the input labor (

**Empirical cost inference-** Empirical estimation of cost functions requires statistical techniques which relate the cost of constructing or operating a facility to a few important characteristics or attributes of the system. The role of statistical inference is to estimate the best parameter values or constants in an assumed cost function. Usually, this is accomplished by means of regression analysis techniques.

**Unit costs for bill of quantities-** A unit cost is assigned to each of the facility components or tasks as represented by the bill of quantities. The total cost is the summation of the products of the quantities multiplied by the corresponding unit costs. The unit cost method is straightforward in principle but quite laborious in application. The initial step is to break down or disaggregate a process into a number of tasks. Collectively, these tasks must be completed for the construction of a facility. Once these tasks are defined and quantities representing these tasks are assessed, a unit cost is assigned to each and then the total cost is determined by summing the costs incurred in each task. The level of detail in decomposing into tasks will vary considerably from one estimate to another.

**Allocation of joint costs-** Allocations of cost from existing accounts may be used to develop a cost function of an operation. The basic idea in this method is that each expenditure item can be assigned to particular characteristics of the operation. Ideally, the allocation of joint costs should be causally related to the category of basic costs in an allocation process. In many instances, however, a causal relationship between the allocation factor and the cost item cannot be identified or may not exist. For example, in construction projects, the accounts for basic costs may be classified according to (1) labor, (2) material, (3) construction equipment, (4) construction supervision, and (5) general office overhead. These basic costs may then be allocated proportionally to various tasks which are subdivisions of a project.

### Types of Construction Cost Estimates

Construction cost constitutes only a fraction, though a substantial fraction, of the total project cost. However, it is the part of the cost under the control of the construction project manager. The required levels of accuracy of construction cost estimates vary at different stages of project development, ranging from ball park figures in the early stage to fairly reliable figures for budget control prior to construction. Since design decisions made at the beginning stage of a project life cycle are more tentative than those made at a later stage, the cost estimates made at the earlier stage are expected to be less accurate. Generally, the accuracy of a cost estimate will reflect the information available at the time of estimation. Construction cost estimates may be viewed from different perspectives because of different institutional requirements. In spite of the many types of cost estimates used at different stages of a project, cost estimates can best be classified into three major categories according to their functions. A construction cost estimate serves one of the three basic functions: design, bid and control. For establishing the financing of a project, either a design estimate or a bid estimate is used.

1. **Design Estimates.** For the owner or its designated design professionals, the types of cost estimates encountered run parallel with the planning and design as follows:

- |  |   |
|--|---|
| a) Screening estimates (or order of magnitude estimates) | b) Preliminary estimates (or conceptual estimates)        |
| c) Detailed estimates (or definitive estimates)          | d) Engineer's estimates based on plans and specifications |

For each of these different estimates, the amount of design information available typically increases.

2. **Bid Estimates.** For the contractor, a bid estimate submitted to the owner either for competitive bidding or negotiation consists of direct construction cost including field supervision, plus a markup to cover general overhead and profits. The direct cost of construction for bid estimates is usually derived from a combination of the following approaches.

- |                             |                       |                            |
|-----------------------------|-----------------------|----------------------------|
| a) Subcontractor quotations | b) Quantity take-offs | c) Construction procedures |
|-----------------------------|-----------------------|----------------------------|

3. **Control Estimates.** For monitoring the project during construction, a control estimate is derived from available information to establish:

- |  |  |
|--|--|
| a) Budget estimate for financing                             | c) Estimated cost to completion during the progress of construction. |
| b) Budgeted cost after contracting but prior to construction |  |

**Design Estimates-** In the planning and design stages of a project, various design estimates reflect the progress of the design. At the very early stage, the *screening estimate* or *order of magnitude* estimate is usually made before the facility is designed, and must therefore rely on the cost data of similar facilities built in the past. A *preliminary estimate* or *conceptual estimate* is based on the conceptual design of the facility at the state when the basic technologies for the design are known. The *detailed estimate* or *definitive estimate* is made when the scope of work is clearly defined and the detailed design is in progress so that the essential features of the facility are identifiable. The *engineer's estimate* is based on the completed plans and specifications when they are ready for the owner to solicit bids from construction contractors. In preparing these estimates, the design professional will include expected amounts for contractors' overhead and profits. The costs associated with a facility may be decomposed into a hierarchy of levels that are appropriate for the purpose of cost estimation. The level of detail in decomposing the facility into tasks depends on the type of cost estimate to be prepared. For conceptual estimates, for example, the level of detail in defining tasks is quite coarse; for detailed estimates, the level of detail can be quite fine. As an example, consider the cost estimates for a proposed bridge across a river. A screening estimate is made for each of the potential alternatives, such as a tied arch bridge or a cantilever truss bridge. As the bridge type is selected, e.g. the technology is chosen to be a tied arch bridge instead of some new bridge form, a preliminary estimate is made on the basis of the layout of the selected bridge form on the basis of the preliminary or conceptual design. When the detailed design has progressed to a point when the essential details are known, a detailed estimate is made on the basis of the well

defined scope of the project. When the detailed plans and specifications are completed, an engineer's estimate can be made on the basis of items and quantities of work.

**Bid Estimates-** The contractor's bid estimates often reflect the desire of the contractor to secure the job as well as the estimating tools at its disposal. Some contractors have well established cost estimating procedures while others do not. Since only the lowest bidder will be the winner of the contract in most bidding contests, any effort devoted to cost estimating is a loss to the contractor who is not a successful bidder. Consequently, the contractor may put in the least amount of possible effort for making a cost estimate if it believes that its chance of success is not high. If a general contractor intends to use subcontractors in the construction of a facility, it may solicit price quotations for various tasks to be subcontracted to specialty subcontractors. Thus, the general subcontractor will shift the burden of cost estimating to subcontractors. If all or part of the construction is to be undertaken by the general contractor, a bid estimate may be prepared on the basis of the quantity takeoffs from the plans provided by the owner or on the basis of the construction procedures devised by the contractor for implementing the project. For example, the cost of a footing of a certain type and size may be found in commercial publications on cost data which can be used to facilitate cost estimates from quantity takeoffs. However, the contractor may want to assess the actual cost of construction by considering the actual construction procedures to be used and the associated costs if the project is deemed to be different from typical designs. Hence, items such as labor, material and equipment needed to perform various tasks may be used as parameters for the cost estimates.

**Control Estimates-** Both the owner and the contractor must adopt some base line for cost control during the construction. For the owner, a *budget estimate* must be adopted early enough for planning long term financing of the facility. Consequently, the detailed estimate is often used as the budget estimate since it is sufficient definitive to reflect the project scope and is available long before the engineer's estimate. As the work progresses, the budgeted cost must be revised periodically to reflect the estimated cost to completion. A revised estimated cost is necessary either because of change orders initiated by the owner or due to unexpected cost overruns or savings. For the contractor, the bid estimate is usually regarded as the budget estimate, which will be used for control purposes as well as for planning construction financing. The budgeted cost should also be updated periodically to reflect the estimated cost to completion as well as to insure adequate cash flows for the completion of the project.

**Unit Cost Method of Estimation-** If the design technology for a facility has been specified, the project can be decomposed into elements at various levels of detail for the purpose of cost estimation. The unit cost for each element in the bill of quantities must be assessed in order to compute the total construction cost. This concept is applicable to both design estimates and bid estimates, although different elements may be selected in the decomposition.

For design estimates, the unit cost method is commonly used when the project is decomposed into elements at various levels of a hierarchy as follows:

1. **Preliminary Estimates.** The project is decomposed into major structural systems or production equipment items, e.g. the entire floor of a building or a cooling system for a processing plant.
2. **Detailed Estimates.** The project is decomposed into components of various major systems, i.e., a single floor panel for a building or a heat exchanger for a cooling system.
3. **Engineer's Estimates.** The project is decomposed into detailed items of various components as warranted by the available cost data. Examples of detailed items are slabs and beams in a floor panel, or the piping and connections for a heat exchanger.

For bid estimates, the unit cost method can also be applied even though the contractor may choose to decompose the project into different levels in a hierarchy as follows:

1. **Subcontractor Quotations.** The decomposition of a project into subcontractor items for quotation involves a minimum amount of work for the general contractor. However, the accuracy of the resulting estimate depends on the reliability of the subcontractors since the general contractor selects one among several contractor quotations submitted for each item of subcontracted work.
2. **Quantity Take-offs.** The decomposition of a project into items of quantities that are measured (or *taken off*) from the engineer's plan will result in a procedure similar to that adopted for a detailed estimate or an engineer's estimate by the design professional. The levels of detail may vary according to the desire of the general contractor and the availability of cost data.
3. **Construction Procedures.** If the construction procedure of a proposed project is used as the basis of a cost estimate, the project may be decomposed into items such as labor, material and equipment needed to perform various tasks in the projects.

**Computer Aided Cost Estimation-** Numerous computer aided cost estimation software systems are now available. These range in sophistication from simple spread sheet calculation software to integrated systems involving design and price negotiation over the Internet. While this software involves costs for purchase, maintenance, training and computer hardware, some significant efficiencies often result. In particular, cost estimates may be prepared more rapidly and with less effort.

Some of the common features of computer aided cost estimation software include:

- Databases for unit cost items such as worker wage rates, equipment rental or material prices. These databases can be used for any cost estimate required. If these rates change, cost estimates can be rapidly re-computed after the databases are updated.
- Databases of expected productivity for different components types, equipment and construction processes.
- Import utilities from computer aided design software for automatic quantity-take-off of components. Alternatively, special user interfaces may exist to enter geometric descriptions of components to allow automatic quantity-take-off.
- Export utilities to send estimates to cost control and scheduling software. This is very helpful to begin the management of costs during construction.
- Version control to allow simulation of different construction processes or design changes for the purpose of tracking changes in expected costs.
- Provisions for manual review, over-ride and editing of any cost element resulting from the cost estimation system
- Flexible reporting formats, including provisions for electronic reporting rather than simply printing cost estimates on paper. Archives of past projects to allow rapid cost-estimate updating or modification for similar designs.

### Determinants of Cost Function

The cost of production depends on many factors and these factors vary from one firm to another firm in the same industry or from one

industry to another industry. The main determinants of a cost function are:

- |                 |   |                          |
|-----------------|---|--------------------------|
| a) plant size   | c) prices of inputs used in production, | e) managerial efficiency |
| b) output level | d) nature of technology                 |                          |

We will discuss briefly the influence of each of these factors on cost.

a) **Plant size:** Plant size is an important variable in determining cost. The scale of operations or plant size and the unit cost are inversely related in the sense that as the former increases, unit cost decreases, and vice versa. Such a relationship gives downward slope of cost function depending upon the different sizes of plants taken into account. Such a cost function gives primarily engineering estimates of cost.

b) **Output level:** Output level and total cost are positively related, as the total cost increases with increase in output and total cost decreases with decrease in output. This is because increased production requires increased use of raw materials, labour, etc., and if the increase is substantial, even fixed inputs like plant and equipment, and managerial staff may have to be increased.

c) **Price of inputs:** Changes in input prices also influence cost, depending on the relative usage of the inputs and relative changes in their prices. This is because more money will have to be paid to those inputs whose prices have increased and there will be no simultaneous reduction in the costs from any

other source. Therefore, the cost of production varies directly with the prices of production.

d) **Technology:** Technology is a significant factor in determining cost. By definition, improvement in technology increases production leading to increase in productivity and decrease in production cost. Therefore, cost varies inversely with technological progress. Technology is often quantified as capital-output ratio. Improved technology is generally found to have higher capital-output ratio.

e) **Managerial efficiency:** This is another factor influencing the cost of production. The managerial efficiency less the cost of production. It is difficult to measure managerial efficiency quantitatively. However, a change in cost at two points of time may explain how organisational or managerial changes within the firm have brought about cost efficiency, provided it is possible to exclude the effect of other factors.

**ESTIMATION OF COST FUNCTION**-Several methods exist for the measurement of the actual cost-output relation for a particular firm or a group of firms, but the three broad approaches -accounting, engineering and econometric - are the most important and commonly used.

**Accounting Method**- This method is used by the cost accountants. In this method, the cost-output relationship is estimated by classifying the total cost into fixed, variable and semi-variable costs. These components are then estimated separately. The average variable cost, the semi-variable cost which is fixed over a certain range of output, and fixed costs are determined on the basis of inspection and experience. The total cost, the average cost and the marginal cost for each level of output can then be obtained through a simple arithmetic procedure. Although, the accounting method appears to be quite simple, it is a bit cumbersome as one has to maintain a detailed breakdown of costs over a period to arrive at good estimates of actual cost-output relationship. One must have experience with a wide range of fluctuations in output rate to come up with accurate estimates.

**Engineering Method**- The engineering method of cost estimation is based directly on the physical relationship of inputs to output, and uses the price of inputs to determine costs. This method of estimating real world cost function rests clearly on the knowledge that the shape of any cost function is dependent on: (a) the production function and (b) the price of inputs. We have seen earlier in this Unit while discussing the estimation of production function that for a given the production function and input prices, the optimum input combination for a given output level can be determined. The resultant cost curve can then be formulated by multiplying each input in the least cost combination by its price, to develop the cost function. This method is called engineering method as the estimates of least cost combinations are provided by engineers. The assumption made while using this method is that both the technology and factor prices are constant. This method may not always give the correct estimate of costs as the technology and factor prices do change substantially over a period of time. Therefore, this method is more relevant for the short run. Also, this method may be useful if good historical data is difficult to obtain. But this method requires a sound understanding of engineering and detailed sampling of the different processes under controlled conditions, which may not always be possible.

**Econometric Method** This method is also sometimes called statistical method and is widely used for estimating cost functions. Under this method, the historical data on cost and output are used to estimate the cost-output relationship. The basic technique of regression is used for this purpose. The data could be a time series data of a firm in the industry or of all firms in the industry or a cross-section data for a particular year from various firms in the industry. Depending on the kind of data used, we can estimate short run or long run cost functions. For instance, if time series data of a firm whose output capacity has not changed much during the sample period is used, the cost function will be short run. On the other hand, if cross-section data of many firms with varying sizes, or the time series data of the industry as a whole is used, the estimated cost function will be the long run one. The procedure for estimation of cost function involves three steps. First, the determinants of cost are identified. Second, the functional form of the cost function is specified. Third, the functional form is chosen and then the basic technique of regression is applied to estimate the chosen functional form.

#### **Variable Cost of Production**

Variable costs of production are dependent primarily on plant output and rate of production. There are many variables to consider when costing a plant.

- |  |  |
|--|--|
| 1. Raw materials consumed                                  | 3. Consumables - acids, bases, solvents, catalysts, etc. |
| 2. Utilities-steam, electricity, cooling water, fuel, etc. | 4. Disposal  |
| 5. Shipping  |  |

The majority of the variable costs for a production plant are the raw materials and utilities costs. Variable costs can be greatly cut through optimization techniques and intelligent plant design.

**Raw Materials Cost**- Calculating the annual cost of a raw material is calculated by simply multiplying the feed rate of the process by the appropriate price per volume or mass. These are the costs of chemical feed stocks required by the process. Feed stocks flow rates are obtained from PFD. There are several ways to optimize this cost to ensure that a process is not costing more than it should. First one should assess the actual consumption of a plant to see if it is significantly different from what should be expected based on process stoichiometry and selectivity's. Finding may prove that a process is less efficient than it originally claimed. It is smart to benchmark a new plant design against an

existing plant or pilot plant. Raw materials are typically the largest contributor to overall variable costs. For bulk chemicals and petrochemicals, raw materials represent 80-90% of the total cash cost of production (CCOP).

**Utilities Cost**-These are the costs of the various utilities streams required by the process. The flowrates for the utilities streams are located on the PFD .This includes:

- Fuel gas, oil, or coal
- Electric power
- Steam
- Cooling water
- Process water
- Boiler feed water
- Air
- Inert gas
- Refrigeration

Utility streams are excellent ways to streamline a process and are often indicative of how efficient of a process the project is. Process methods such as steam generation and pinch analysis can be used to greatly reduce utility costs across a plant. Further analysis of pinch analysis techniques and optimizing heat exchanger networks can be found in plant design texts such as first reference from Gavin Towler. The determination of process utility costs is often more difficult than the determination of raw material costs; however, the utilities are typically between 5-10% of CCOP .The cost of heating a process can be reduced by using process waste streams as fuel which consequently also reduces the need for waste disposal.

**Waste Disposal Costs**- These are defined as the cost of waste treatment to protect the environment.These are materials that cannot be recycled or sold off as by-products. Often times these streams require additives or additional treatment to meet governmental regulations. Hydrocarbon waste can often be incinerated directly to the atmosphere or used as process fuel to heat other streams in the system. Using the stream as process fuel allows the fuel value of the stream to be recovered into the system. The substituted value can be calculated by multiplying the conventional fuel price by the heat of combustion of the waste stream.Dilute aqueous streams must be sent to wastewater treatment typically prior to purging from the plant. Acidic or basic wastes are neutralized prior to treatment by salting out the acid or base. The cost of wastewater treatment is typically about \$6 per 1000 gal but this is only an estimate that doesn't account for regional charges. Solid waste treatment can typically be sent to a landfill at a cost of approximately \$50/ton.Hazardous wastes arise from the production of concentrated liquid streams that cannot be incinerated. Hazardous wastes should be avoided if possible, but that is not always feasible for some processes. The cost of hazardous waste disposal is strongly dependent on the location of the plant, the plants proximity to waste disposal plants and the degree of hazard of the waste.

#### Fixed Cost of Production

Fixed costs are those whose amounts are independent of production rates. Much of these costs are personnel salaries, taxes, insurance, and legal payments.

**Labor Costs**-These are the costs attributed to the personnel required to operate the process plant

$N_{OL} = (6.29 + 31.7P^2 + 0.23N_{np})^{0.5}$  The number of operators required per shift,  $N_{OL}$  can be estimated by

where  $P$  is the number of processing steps involving particulate solids and  $N_{np}$  is the number of other processing steps (Turton et al., 2013). For each of the  $N_{OL}$  operators per 8-hour shift, approximately 4.5 operators must be hired for a plant that runs 24 hours per day, to account for the 3 shifts per day and the 3 weeks of leave typically taken by each operator per year .The salary for a chemical plant operator varies by location, and the estimator should look up the average value for the area.

**Maintenance Costs**- These are the costs associated with labor and materials necessary to maintain plant production. An estimate of these are 6% of the fixed capital investment.

**Research and Development** These are the costs of research done in developing the process and/or products. This includes salaries for researchers as well as funds for research related equipment and supplies. An estimate of these costs are 5% of the total manufacturing cost.

**Taxes and Insurance** Taxes vary by location, but a first estimate of property taxes and liability insurance is 3% of the fixed capital investment.

**Plant Overhead costs**- are the miscellaneous but necessary costs of running a business, including payroll, employee benefits, and janitorial services. This may be estimated as 70% of the operating labor costs, added to 4% of the fixed capital costs.

**Licensing and Royalties** The costs of paying for the use of intellectual property clearly varies, but an estimate that may be used is 3% of the total manufacturing cost.

#### Revenues

The revenues of a process are the income earned form sales of the main products and the by-products. Revenue can be impacted by market fluctuations and production rates.

**By-Product Revenues**- Besides selling the main product from a process, by-products from separations and reactions can also be valuable in the market. Often it is more difficult to decide which by-products to recover and purify than it is to make decisions on the main product.

By-products made in stoichiometric ratios from reactions must be either sold off or managed through waste disposal. Other by-products are sometimes produced through feed impurities or by nonselective reactions. There are several potential valuable by-products from a process:

1. Materials produced in stoichiometric quantities by the reactions that create the main product. If they are not recovered then the waste disposal expenses will be large.
2. Components that are produced in high yield by side reactions.
3. Components formed in high yield from feed impurities. Many sulfurs are produced as a by-product of fuels manufacture.
4. Components that are produced in low yield but have high value. An example includes acetophenone which is recovered as a by-product of phenol manufacture.
5. Degraded consumables (e.g. solvents, etc.) that have reuse value.

A rule of thumb that can be used for preliminary screening of by-products for large plants is that for by-product recovery to be economically feasible the net benefit must be greater than \$200,000 a year. A net benefit can be calculated by adding the possible resale value of the by-product and the avoided waste disposal cost

#### Understanding Profitability-

Profitability is the primary goal of all business ventures. Without profitability the business will not survive in the long run. So measuring current and past profitability and projecting future profitability is very important. Profitability is measured with income and expenses. Income is money generated from the activities of the business. For example, if crops and livestock are produced and sold, income is generated. However, money coming into the business from activities like borrowing money do not create income. This is simply a cash transaction between the business and the lender to generate cash for operating the business or buying assets.

Expenses are the cost of resources used up or consumed by the activities of the business. For example, seed corn is an expense of a farm business because it is used up in the production process. Resources such as a machine whose useful life is more than one year is used up over a period of years. Repayment of a loan is not an expense, it is merely a cash transfer between the business and the lender.

Profitability is measured with an "income statement". This is essentially a listing of income and expenses during a period of time (usually a year) for the entire business. Information File Your Net worth Statement includes - a simple income statement analysis. An Income Statement is traditionally used to measure profitability of the business for the past accounting period. However, a "pro forma income statement" measures projected profitability of the business for the upcoming accounting period. A budget may be used when you want to project profitability for a particular project or a portion of a business.

### Reasons for Computing Profitability

Whether you are recording profitability for the past period or projecting profitability for the coming period, measuring profitability is the most important measure of the success of the business. A business that is not profitable cannot survive. Conversely, a business that is highly profitable has the ability to reward its owners with a large return on their investment.

Increasing profitability is one of the most important tasks of the business managers. Managers constantly look for ways to change the business to improve profitability. These potential changes can be analyzed with a pro forma income statement or a Partial Budget. Partial budgeting allows you to assess the impact on profitability of a small or incremental change in the business before it is implemented. A variety of Profitability Ratios (Decision Tool) can be used to assess the financial health of a business. These ratios, created from the income statement, can be compared with industry benchmarks. Also, Income Statement Trends (Decision Tool) can be tracked over a period of years to identify emerging problems.

### Estimation of Working Capital

**Estimating working capital needs**, different people adopt different approaches. Some experts suggest that the working capital should be greater than the minimum requirements of the firm. The management should feel safety. It would be able to meet its obligations even in adverse circumstances. However, the excessive capital may lead to waste and inefficiency. On the other hand, some experts suggest that the working capital should be lower than the requirement so that no idle funds shall be invested in the current assets and it ultimately leads to increase in profitability of the company. However, in such case the firm always have risk of technical insolvency as it may not meet its obligations as and when they falls due for payment. So the question is what the proper amount of working capital is?. It is not an absolute amount. It depends upon the needs and circumstances available in the firm. There are various approaches which have been applied in practice for the **estimation of working capital requirements** of a firm. Let's discuss some of them in brief.

**1. Conservative Approach**-The conservative approach states that the proportion of current assets to current liabilities should be kept at 2:1. Is this proportion is to be kept the firm would be able to meet its obligations on time and hence its financial solvency would not be in trouble. However, the limitation of this approach is that it suggests only quantitative measure. It does not suggest as to what type of assets are to be included in current assets. If the current assets contain stock, which is outdated or receivable which are not collectable, than the amount of current assets has no meaning. Further, in the present scenario no firm maintains this ratio, as it's too difficult for them to maintain such a high level of current assets.

**2. Components Approach**-Here we take up one of the planning models of working capital to estimate working capital. The method adopted here attempts at estimation of working capital and its components by taking into account, the period for which the various items remain as stock or as outstanding, the cost structure of production and annual production. It assumes even production and even sales, throughout and what is produced is completely sold.

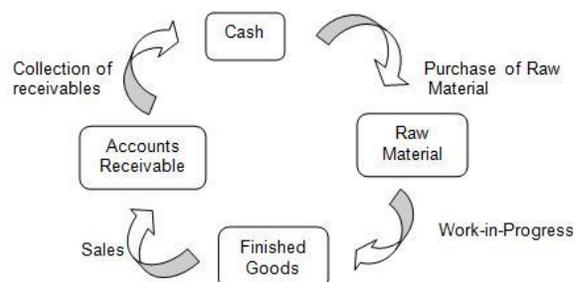
**3. Operating Cycle Approach**-It was earlier referred to that working capital is also known as revolving capital. That is, a circular path of conversion/re-conversion takes place. Consider this example. You start your business operation with an initial investment. With credit extended by expense creditors (labor, employees, utilities, etc.) you start production process. Goods of varying levels of finish result. This is what we call as work-in-process or work-in-progress. Once complete processing is done, you get finished goods. Until these goods are sold, they remain in stock. Sales may be for cash and/or on credit basis. You need to wait a little to realize cash from the credit customers. The realized cash is used to pay creditors. You need to maintain a cash balance for day-to-day transactions as well as for meeting sudden spurt in payment obligations accompanied by sluggish cash collections from debtors. Thus a revolution or cycle from cash to raw materials to Work in

Progress (WIP), to finished goods, to debtors, and back to cash is taking place. This revolution or cycle is known as operating cycle.

Efficient working capital management is one which ensures continuous flow without any interruptions/holdups at any of the stages referred to above and involves as for as possible a rapid completion of the revolutions. In other words, when raw materials remain in store pending issue for production for a less duration, when raw materials get converted into WIP in short duration, when WIP is converted into finished goods in short duration, when finished goods remain in dept pending sales for a short while

**Table 1. Income statement.**

Income	
Sale of Crop Products	\$50,000
Sale of Livestock Products	\$25,000
Government Payments	\$10,000
<b>Total Income</b>	<b>\$85,000</b>
Expenses	
Seed	\$10,000
Fertilizer	\$20,000
Feed	\$10,000
Processing	\$10,000
Marketing	\$5,000
Interest	\$5,000
Depreciation	\$10,000
<b>Total Expenses</b>	<b>\$70,000</b>
<b>Net Income</b>	<b>\$15,000</b>



only, and when cash realizations out of sales are made quickly and finally when payment to creditors is made slowly, the operating cycle would be smaller and consequently the working capital will also be reasonable.

There should be neither too little nor too much investment in working capital. Efficient handling of the operating cycle would make possible the above. Note, what is suggested is optimization, and not minimization of current assets and maximization of current liabilities. That will affect your liquidity and your profitability. Too little means more illiquid, but more profitability, but not more absolute profits. We want both high profitability and high profits. Too much current liability means illiquid but more profitability as it is assumed short-term funds are less expensive for they can be redeemed the moment you don't need thus saving interest. The reverse is true with too little current liability. Actually the business has to trade-off between risk and return. If it wants less risk it has to carry more current assets and less current liability. This will lead to lower profits. Low risk means low profits. If the business takes more risk, i.e., it carries less working capital, it might make more profits. There is no guarantee however that higher level of risk yields higher profits. In terms of operating cycle concept, too long an operating cycle gives more liquidity but only low returns and vice versa. The optimum operating cycle has to be worked out taking into account the costs and benefits and levels of risk and levels of return for varying lengths of operating cycle

#### Five methods for estimating working capital requirements-

1. Percentage of Sales Method
2. Regression Analysis Method
3. Cash Forecasting Method
4. Operating Cycle Method
5. Projected Balance Sheet Method

**1. Percentage of Sales Method:-** This method of estimating working capital requirements is based on the assumption that the level of working capital for any firm is directly related to its sales value. If past experience indicates a stable relationship between the amount of sales and working capital, then this basis may be used to determine the requirements of working capital for future period.

Thus, if sales for the year 2007 amounted to Rs 30,00,000 and working capital required was Rs 6,00,000; the requirement of working capital for the year 2008 on an estimated sales of Rs 40,00,000 shall be Rs 8,00,000; i.e. 20% of Rs 40,00,000. The individual items of current assets and current liabilities can also be estimated on the basis of the past experience as a percentage of sales. This method is simple to understand and easy to operate but it cannot be applied in all cases because the direct relationship between sales and working capital may not be established.

**Illustration 1:-** The following information has been provided by a company for the year ended 30.6.2008:

Liabilities	₹	Assets	₹
Equity share capital	2,00,000	Fixed assets less depreciation	3,00,000
8% Debentures	1,00,000	Inventories	1,00,000
Reserves and surplus	50,000	Sundry debtors	70,000
Long-term loans	50,000	Cash and bank	10,000
Sundry creditors	80,000		
	<u>4,80,000</u>		<u>4,80,000</u>

Sales for the year ended 30.6.2008 amounted to ₹ 10,00,000 and it is estimated that the same will amount to ₹ 12,00,000 for the year 2008-09.

You are required to estimate the working capital requirements for the year 2008-09 assuming a linear relationship between sales and working capital.

**Solution :**

Estimation of Working Capital Requirements			
	Actual 2007-2008 (₹)	Percentage to Sales 2007-08	Estimate 2008-09 (₹)
Sales	<u>10,00,000</u>	<u>100</u>	<u>12,00,000</u>
Inventories	1,00,000	10	1,20,000
Sundry debtors	70,000	7	84,000
Cash and bank	10,000	1	12,000
Total Current Asset (CA)	<u>1,80,000</u>	<u>18</u>	<u>2,16,000</u>
<b>Current Liabilities :</b>			
Sundry creditors	80,000	8	96,000
Total Current Liabilities (CL)	<u>80,000</u>	<u>8</u>	<u>96,000</u>
Working Capital (CA – CL)	<u>1,00,000</u>	<u>10</u>	<u>1,20,000</u>

$$y = a + bx$$

Where, y = Working capital (dependent variable)

a = Intercept of the least square

b = Slope of the regression line

x = Sales (independent variable)

For determining the values 'a' and 'b' two normal equations are used which can be solved simultaneously :

$$\begin{aligned} \sum y &= na + b \sum x \\ \sum xy &= a \sum x + b \sum x^2 \end{aligned}$$

#### 2. Regression Analysis Method- (Average Relationship between Sales and Working Capital):

This method of forecasting working capital requirements is based upon the statistical technique of estimating or predicting the unknown value of a dependent variable from the known value of an independent variable. It is the measure of the average relationship between two or more variables, i.e.; sales and working capital, in terms of the original units of the data.

#### 3. Cash Forecasting Method:-

estimating working capital requirements involves forecasting of cash receipts and disbursements during a future period of time. Cash forecast will include all possible sources from which cash will be received and the channels in which payments are to be made so that a consolidated cash position is determined. This method is similar to the preparation of a cash budget. The excess of receipts over payments represents surplus of cash and the excess of payments over receipts causes deficit of cash or the amount of working capital required.

$$\text{Working Capital Required} = \text{Cost of goods sold} \times \frac{\text{Operating cycle (days)}}{365 \text{ or } 360 \text{ days}} + \text{Desired cash balance}$$

**Illustration 8.** Details of X Ltd. for the year 2007-08, are given as under :

Cost of goods sold	₹ 48,00,000
Operating cycle	60 days
Minimum desired level of cash balance	₹ 75,000

You are required to calculate the expected working capital requirement by assuming 360 days in a year.

**Solution :**

$$\begin{aligned} \text{Expected Working Capital requirement} &= \text{Cost of goods sold} \times \frac{\text{Operating cycle (days)}}{365 \text{ or } 360 \text{ days}} + \text{Desired cash balance} \\ &= 48,00,000 \times \frac{60}{360} + 75,000 \\ &= ₹ 8,75,000 \end{aligned}$$

**4. Operating Cycle Method:-**This method of estimating working capital requirements is based upon the operating cycle concept of working capital. The cycle starts with the purchase of raw material and other resources and ends with the realization of cash from the sale of finished goods. It involves purchase of raw materials and stores, its conversion into stock of finished goods through work-in-process with progressive increment of labour and service costs, conversion of finished stock into sales, debtors and receivables, realization of cash and this cycle continues again from cash to purchase of raw material and so on. The speed/time duration required to complete one cycle determines the requirement of working capital – longer the period of cycle, larger is the requirement of working capital and vice-versa.

The requirements of working capital be estimated as follows:

For proper computation of working capital under this method, a detailed analysis is made for each individual component of working capital. The value of each individual item of current assets and current liabilities is determined on the basis of estimated sales or budgeted production or activity level as follows:

**(a) Stock of Raw Material:-**The amount of working capital funds to be invested in holding stock of raw material can be estimated on the basis of budgeted units of production, estimated cost of raw material per unit and the average duration for which the raw material is held in stock by using the following formula:

$$\frac{\text{Budgeted annual units of production} \times \text{Estimated cost of raw material per unit} \times \text{Average raw material holding period in days/months/weeks}}{\text{No. of days/months/weeks in a year}}$$

(Note. 360 days in a year may be assumed in place of 365 to simplify calculations in some cases)

**(b) Stock of Work-in-Process:-**In manufacturing/processing industries the production is carried on continuous basis. At the end of the period, some work remains incomplete even though all or some expenses have been incurred, this work is known as work-in-progress or partly completed or semi-finished goods. The work-in-process consists of direct material, direct labour and production overheads locked up in these semi-finished goods.

The amount of funds estimated to be invested in work-in-process may be computed as:

$$\frac{\text{Budgeted annual units of production} \times \text{Estimated WIP cost per unit} \times \text{Average WIP holding period in days/months/weeks}}{\text{No. of days/months/weeks in a year}}$$

**(c) Stock of Finished Goods:-**The amount of funds to be invested in holding stock of finished goods can be estimated on the basis of annual budgeted units of production, estimated cost of production per unit and the average holding period of finished goods stock by using the following formula:

$$\frac{\text{Budgeted annual units of production} \times \text{Estimated cost of production per unit} \times \text{Average holding period of finished goods in days/months/weeks}}{\text{No. of days/months/weeks in a year}}$$

**(d) Investment in Debtors/Receivables.** When the sales are made by a firm on cash basis, the amount is realized immediately and no funds are blocked for after sale period. However, in case of credit sales, there is a time lag between sales and realization of cash. Thus, funds are to be invested in receivables, i.e. debtors and bills receivables. However, actual amount of funds locked up in receivables is only to the extent of cost of sales and not the actual sales which include profit. It would, therefore, be more appropriate to ascertain the amount of funds to be invested

in debtors/receivables at cost of sales and not the selling price. But in case, total approach is followed for estimation of working capital then receivables may be computed on the basis of selling price.

$$\frac{\text{Budgeted units of credit sales} \times \text{Cost of sales per unit} \times \text{Average collection period of receivables in days/months/weeks}}{\text{No. of days/months/weeks in a year}}$$

(e) **Cash and Bank Balance**:-Cash is one of the current assets of a business. It is needed at all times to keep the business going. A business firm has to always keep sufficient cash to meet its obligations. Thus, a minimum desired cash and bank balance to be maintained by a firm should be considered as an important component of current assets while estimating the working capital requirements.

(f) **Prepaid Expenses**:-Some of the expenses like wages, manufacturing overheads, office and administrative expenses and selling and distribution expenses etc. may have to be paid in advance. Such prepayment of expenses should also be estimated while computing working capital requirements of a firm.

(g) **Trade Creditors**:-The term trade creditor refers to the creditors for purchase of raw material, consumables, stores etc. The suppliers of goods, generally, extend some period of credit in the normal course of business. The trade credit arrangement of a firm with its suppliers is an important source of short-term finance. It reduces the amount of net working capital required by a firm.

The amount of funds to be provided by creditors can be estimated as follows:

$$\frac{\text{Budgeting annual units of production} \times \text{Estimated raw material cost per unit} \times \text{Average payment period of creditors in days/months/weeks}}{\text{No. of days/months/weeks in a year}}$$

(h) **Creditors for Wages and Other Expenses**:

Wages and salaries are usually paid on monthly, fortnightly or weekly basis for the services already rendered by employees. The longer the payment – period, the greater is the amount of current liability towards employees or the funds provided by them. In the same manner, other expenses may also have to be paid after the lag of a certain period. The amount of such accrued or outstanding expenses reduces the level of net working capital requirements of a firm.

The creditors for wages and other overheads may be computed as follows:

$$\frac{\text{Budgeted annual production in units} \times \text{Estimated labour/overheads cost per unit} \times \text{Average time lag in payment of wages/overheads in days/months/weeks}}{\text{No. of days/months/weeks in a year}}$$

Factors Requiring Consideration While Estimating Working Capital:

#### Factors Requiring Consideration While Estimating Working Capital

1.	Total costs incurred on material, wages and overheads.
2.	The length of time for which raw materials are to remain in stores before they are issued for production.
3.	The length of the production cycle or work-in-process, <i>i.e.</i> , the time taken for conversion of raw material into finished goods.
4.	The length of sales cycle during which finished goods are to be kept waiting for sales.
5.	The average period of credit allowed to customers.
6.	The amount of cash required to pay day-to-day expenses of the business.
7.	The average amount of cash required to make advance payments, if any.
8.	The average credit period expected to be allowed by suppliers.
9.	Time-lag in the payment of wages and other expenses.
10.	The average amount of advances received, if any

Approaches to Estimation of Working Capital Requirements:

While studying the valuation of each individual item of current assets or current liabilities under the operating cycle method, that there are two approaches which are followed in the estimation of working capital requirements:

(a) Total Approach

(b) Cash Cost Approach

(a) **Total Approach**:-Under this approach of estimation of working capital requirements, all costs including depreciation and profit margin are included. Thus, production overhead inclusive of depreciation is considered for calculation of the cost of work-in-progress. In the same manner, cost of goods produced includes depreciation. Further, the computation of funds invested in debtors is done on the basis of selling price including profit margin.

(b) **Cash Cost Approach**:-Under this approach, the amount of working capital is estimated on the basis of only cash costs incurred. Thus, depreciation being non-cash is excluded while calculating the cost of work-in-process, cost of goods produced and cost of goods sold. In the same manner, debtors are computed on the basis of cash cost of sales excluding profit margin.

**5. Projected Balance Sheet Method**:-Under this method, projected balance sheet for future date is prepared by forecasting of assets and liabilities by following any of the methods stated above. The excess of estimated total current assets over estimated current liabilities, as shown in the projected balance sheet, is computed to indicate the estimated amount of working capital required.

Illustration 8:

A proforma cost sheet of a company provides the following particulars:

Elements of Cost: Material 40% Direct Labour 20% Overheads 20%

The following further particulars are available:

(a) It is proposed to maintain a level of activity of 2, 00,000 units.

(b) Selling price is Rs 12/- per unit.

(c) Raw materials are expected to remain in stores for an average period of one month.

(d) Material will be in process, on averages half a month and is assumed to be consisting of 100% raw material, wages and overheads.

(e) Finished goods are required to be in stock for an average period of one month.

(f) Credit allowed to debtors is two months. (g) Credit allowed by suppliers is one month.

You may assume that sales and production follow a consistent pattern.

You are required to prepare a statement of working capital requirements, a forecast Profit and Loss Account and Balance Sheet of the company

assuming that:

	₹
Share Capital	15,00,000
8% Debentures	2,00,000
Fixed Assets	13,00,000

Solution :

Statement of Working Capital		₹	₹
<b>Current Assets :</b>			
Stock of Raw Materials (1 month)	$\frac{24,00,000 \times 40}{100 \times 12}$		80,000
Work-in-process (1/2 month) :			
Materials	$\frac{24,00,000 \times 40}{100 \times 12} \times \frac{1}{2}$	40,000	
Labour	$\frac{24,00,000 \times 20}{100 \times 12} \times \frac{1}{2}$	20,000	
Overheads	$\frac{24,00,000 \times 20}{100 \times 12} \times \frac{1}{2}$	<u>20,000</u>	
			80,000
Stock of Finished Goods (1 month)			
Materials	$\frac{24,00,000 \times 40}{100 \times 12}$	80,000	
Labour	$\frac{24,00,000 \times 20}{100 \times 12}$	40,000	
Overheads	$\frac{24,00,000 \times 20}{100 \times 12}$	<u>40,000</u>	
			1,60,000
Debtors (2 months) at cost:			
Material		1,60,000	
Labour		80,000	
Overheads		<u>80,000</u>	
			<u>3,20,000</u>
<b>Less : Current Liabilities :</b>			
Creditors (1 month) for raw materials	$\frac{24,00,000 \times 40}{100 \times 12}$		80,000
Net Working Capital Required :			<u>5,60,000</u>

(Note : Sales = 2,00,000 × 12 = ₹ 24,00,000)

Forecast Profit and Loss Account			
for the year ended .....			
	₹		₹
To Materials	9,60,000	By Cost of Goods Sold	19,20,000
To Wages	4,80,000		
To Overheads	4,80,000		
	<u>19,20,000</u>		<u>19,20,000</u>
To Cost of Goods Sold	19,20,000	By Sales	24,00,000
To Gross Profit c/d	4,80,000		
	<u>24,00,000</u>		<u>24,00,000</u>
To Interest on Debentures	16,000	By Gross Profit b/d	4,80,000
To Net Profit	4,64,000		
	<u>4,80,000</u>		<u>4,80,000</u>

Forecast Balance Sheet			
as at .....			
Liabilities	₹	Assets	₹
Share capital	15,00,000	Fixed Assets	13,00,000
8% Debentures	2,00,000	Stocks :	
Net Profit	4,64,000	Raw materials	80,000
Creditors	80,000	Work-in-process	80,000
		Finished Goods	1,60,000
		Debtors	4,00,000
		Cash & bank balance	
		(balancing figure)	2,24,000
	<u>22,44,000</u>		<u>22,44,000</u>

### Key Elements of Your Financial Projection

All financial projections should include three types of financial statements:

#### Income Statement

An Income Statement shows your revenues, expenses and profit for a particular period. If you are developing these projections prior to starting your business, this is where you will want to do the bulk of your forecasting. The key sections of an income statement are: The Income Statement is one of the three financial statements that you need to include in the Financial Plan section of the business plan. The Income Statement shows your Revenues, Expenses, and Profit for a particular period. It's a snapshot of your business that shows whether or not your business is profitable at that point in time; Revenue - Expenses = Profit/Loss. While established businesses normally produce an Income Statement each fiscal quarter, or even once each fiscal year, for the purposes of the business plan, an Income Statement should be generated more frequently - monthly for the first year.

- **Revenue** – This

is the money you will earn from whatever goods or services you provide.

- **Expenses** – Be sure to account for all of the expenses you will encounter, including **Direct Costs** (i.e. materials, equipment rentals, employee wages, your salary, etc.) and **General and Administrative Costs** (i.e. accounting and legal fees, advertising, bank charges, insurance, office rent, telecommunications, etc.).
- **Total Income** – Your revenue minus your expenses, before income taxes.
- **Income Taxes**
- **Net Income** – Your total income without income taxes.

### Cash Flow Projection

A Cash Flow Projection will demonstrate to a loan officer or investor that you are a good credit risk and can pay back a loan if it's granted. The three sections of a Cash Flow Projection are:

The Cash-Flow Projection shows how cash is expected to flow in and out of your business. For you, it's an important tool for cash flow management, letting you know when your expenditures are too high or when you might want to arrange short term investments to deal with a cash flow surplus. As part of your business plan, a Cash Flow Projection will give you a much better idea of how much capital investment your business idea needs. For a bank loans officer, the Cash Flow Projection offers evidence that your business is a good credit risk and that there will be enough cash on hand to make your business a good candidate for a line of credit or short term loan. Do not confuse a Cash Flow Projection with a Cash Flow Statement. The Cash Flow Statement shows how cash has flowed in and out of your business. In other words, it describes the cash flow that has occurred in the past. The Cash Flow Projection shows the cash that is anticipated to be generated or expended over a chosen period of time in the future. While both types of Cash Flow reports are important business decision-making tools for businesses, we're only concerned with the Cash Flow Projection in the business plan. You will want to show Cash Flow Projections for each month over a one year period as part of the Financial Plan portion of your business plan.

#### There are three parts to the Cash Flow Projection.

1. **Cash Revenues.** Enter your estimated sales figures for each month. Remember that these are Cash Revenues; you will only enter the sales that are collectible in cash during the specific month you are dealing with.
2. **Cash Disbursements.** Take the various expense categories from your ledger and list the cash expenditures you actually expect to pay that month for each month.
3. **The Reconciliation of Cash Revenues to Cash Disbursements.** As the word "reconciliation" suggests, this section starts with an opening balance which is the carryover from the previous month's operations. The current month's Revenues are added to this balance; the current month's Disbursements are subtracted, and the adjusted cash flow balance is carried over to the next month.

Once you have your Cash Flow Projections completed, it's time to move on to the Balance Sheet.

### Balance Sheet

This overview will present a picture of your business' net worth at a particular time. It is a summary of all your business' financial data in three categories: assets, liabilities and equity.

- **Assets** – These are the tangible objects of financial value owned by your company.
- **Liabilities** – These are any debts your business owes to a creditor.
- **Equity** – The net difference between your organization's total liabilities minus its total assets.
- **Note** – You will want to be sure that the information contained in the balance sheet is a summary of the information you previously presented in the Income Statement and Cash Flow Projection. This is the place to triple-check your work – investors and creditors will be looking for any inconsistencies, and that can greatly impact their willingness to extend your company a line of credit.

To complete your financial projections, you'll want to provide a quick overview and analysis of the included information. Think of this overview as an executive summary, providing a concise overview of the figures you've presented. While preparing your financial projections, it's most important to be as realistic as possible. You don't want to over- or underestimate the revenue your business will generate. It's a good idea to have a trusted friend or business partner review your financial projections. Also, be sure to avail yourself of all the online resources available – it's best to learn from people who have created projections before.

The Balance Sheet is the last of the financial statements that you need to include in the Financial Plan section of the business plan. The Balance Sheet presents a picture of your business' net worth at a particular point in time. It summarizes all the financial data about your business, breaking that data into 3 categories; assets, liabilities, and equity.

Some definitions first:

- Assets are tangible objects of financial value that are owned by the company.
- A liability is a debt owed to a creditor of the company.
- Equity is the net difference when the total liabilities are subtracted from the total assets.
- Retained earnings are earnings kept by the company for expansion, i.e. not paid out as dividends.
- Current earnings are earnings for the fiscal year up to the balance sheet date (income - cost of sales and expenses).
- All accounts in your General Ledger are categorized as an asset, a liability or equity. The relationship between them is expressed in this equation: **Assets = Liabilities + Equity.**
- For the purposes of your business plan, you'll be creating a pro forma Balance Sheet intended to summarize the information in the Income Statement and Cash Flow Projections. Normally a business prepares a Balance Sheet once a year.

### Project Appraisal Criteria

The basic purpose of systematic appraisal is to achieve better spending decisions for capital and current expenditure on schemes, projects and programmers. This document provides an overview of the main analytical methods and techniques which should be used in the appraisal

process. These techniques can also be used in the evaluation process. More detailed information on individual techniques can found in financial and economic textbooks, examples of which are listed at the end of this document and in other guidance material on the VFM portal. An understanding of discounting and Net Present Value (NPV) calculations is fundamental to proper appraisal of projects and programmers. A good understanding of Cost Benefit Analysis (CBA), Internal Rate of Return (IRR), Multi Criteria Analysis (MCA) and Cost Effectiveness Analysis (CEA) is also essential for economic appraisal purposes.

#### Four major criteria in project appraisal

There are four major criteria which have to be studied in project appraisal to ascertain its feasibility. They are:

1. Technical feasibility
2. Economic feasibility
3. Financial feasibility
4. Managerial feasibility

#### 1. Technical feasibility of projects

1. To find out whether the various factors of production are available.
2. Suitable location of the project.
3. Adopting appropriate technology.
4. Providing suitable training to manpower.
5. Erection of plant and equipment.
6. Technical know-how.
7. Suitable plant lay-out.
8. Clearance for pollution from the pollution control board.
9. Environment clearance under Environment Protection Act.
10. Protection under the Patent Right and Trademark Act.
11. Disposal of wastage.

#### 2. Economic feasibility of projects

1. Market share of the product.
2. Demand for the product.
3. Competition prevailing in the market.
4. Product life cycle and stage of the product.
5. Future demand of the product.
6. Fulfillment of social objectives such as employment generation, development of backward areas, etc.
7. Scope for the product [Strength, Weakness Opportunity and Threat (SWOT Analysis)].

#### 3. Financial feasibility of projects

1. Financial soundness of the project which is based on return on investment.
2. Various sources of finance available and their costs.
3. Expected cash inflow and outflow.
4. Cost of the project.
5. Profit margin.
6. Cost of production.
7. Future growth of the project.
8. Gross and net earnings.
9. Future prospect

#### 4. Managerial feasibility of projects

1. Competence of the Board.
2. Experience of the staff.
3. Technical competence.
4. Problems that are likely to be encounter in industrial relations.
5. Experience in the field.

#### 1. Analytical methods

The recommended analytical methods for appraisal are generally discounted cash flow techniques which take into account the time value of money. People generally prefer to receive benefits as early as possible while paying costs as late as possible. Costs and benefits occur at different points in the life of the project so the valuation of costs and benefits must take into account the time at which they occur. This concept of time preference is fundamental to proper appraisal and so it is necessary to calculate the present values of all costs and benefits.

### Net Present Value Method (NPV)

In the NPV method, the revenues and costs of a project are estimated and then are discounted and compared with the initial investment. The preferred option is that with the highest positive net present value. Projects with negative NPV values should be rejected because the present value of the stream of benefits is insufficient to recover the cost of the project. Compared to other investment appraisal techniques such as the IRR and the discounted payback period, the NPV is viewed as the most reliable technique to support investment appraisal decisions. There are some disadvantages with the NPV approach. If there are several independent and mutually exclusive projects, the NPV method will rank projects in order of descending NPV values. However, a smaller project with a lower NPV may be more attractive due to a higher ratio of discounted benefits to costs (see BCR below), particularly if there affordability constraints. Using different evaluation techniques for the same basic data may yield conflicting conclusions. In choosing between options A and B, the NPV method may suggest that option A is preferable, while the IRR method may suggest that option B is preferable. However in such cases, the results indicated by the NPV method are more reliable. The NPV method should be always be used where money values over time need to be appraised. Nevertheless, the other techniques also yield useful additional information and may be worth using. The key determinants of the NPV calculation are the appraisal horizon, the discount rate and the accuracy of estimates for costs and benefits.

#### **Discount rate**

The discount rate is a concept related to the NPV method. The discount rate is used to convert costs and benefits to present values to reflect the principle of time preference. The calculation of the discount rate can be based on a number of approaches including, among others:

- The social rate of time preference
- The opportunity cost of capital
- Weighted average method

The same basic discount rate (usually called the test discount rate or TDR) should be used in all cost-benefit and cost-effectiveness analyses of public sector projects.

The current recommended TDR is 5%. However, if a commercial State Sponsored Body is discounting projected cash flows for commercial projects, the cost of capital should be used or even a project-specific rate.

### Internal Rate of Return (IRR)

The IRR is the discount rate which, when applied to net revenues of a project sets them equal to the initial investment. The preferred option is that with the IRR greatest in excess of a specified rate of return. An IRR of 10% means that with a discount rate of 10%, the project breaks even. The IRR approach is usually associated with a hurdle cost of capital/discount rate, against which the IRR is compared. The hurdle rate

corresponds to the opportunity cost of capital. In the case of public projects, the hurdle rate is the TDR. If the IRR exceeds the hurdle rate, the project is accepted. There are disadvantages associated with the IRR as a performance indicator. It is not suitable for the ranking of competing projects. It is possible for two projects to have the same IRR but have different NPV values due to differences in the timing of costs and benefits. In addition, applying different appraisal techniques to the same basic data may yield contradictory conclusions.

### **Benefit / Cost ratio (BCR)**

The BCR is the discounted net revenues divided by the initial investment. The preferred option is that with the ratio greatest in excess of 1. In any event, a project with a benefit cost ratio of less than one should generally not proceed. The advantage of this method is its simplicity. Using the BCR to rank projects can lead to suboptimal decisions as a project with a slightly higher BCR ratio will be selected over a project with a lower BCR even though the latter project has the capacity to generate much greater economic benefits because it has a higher NPV value and involves greater scale.

### **Payback and Discounted payback**

The payback period is commonly used as an investment appraisal technique in the private sector and measures the length of time that it takes to recover the initial investment. However this method presents obvious drawbacks which prevent the ranking of projects. The method takes no account of the time value of money and neither does it take account of the earnings after the initial investment is recouped. For example, a project requires a €3 million investment and Option 1 returns €2 million in the first year and Option 2 returns €3 million for the same year. On this basis Option 2 is the preferred option as the payback period is shorter but if the cash flows changed in subsequent years and Option 1 returned €2 million annually while Option 2 only earned €1 million annually, the chosen option would have been incorrect. The ordinary payback period should not be used as an appraisal technique for public investment projects. A variant of the payback method is the discounted payback period. The discounted payback period is the amount of time that it takes to cover the cost of a project, by adding the net positive discounted cash flows arising from the project. It should never be the sole appraisal method used to assess a project but is a useful performance indicator to contextualize the project's anticipated performance.

$$\text{Payback period} = \frac{\text{Investment required for a project}}{\text{Net annual cash inflow}}$$

**Advantages** of payback period are:

1. Payback period is very simple to calculate.
2. It can be a measure of risk inherent in a project. Since cash flows that occur later in a project's life are considered more uncertain, payback period provides an indication of how certain the project cash inflows are.
3. For companies facing liquidity problems, it provides a good ranking of projects that would return money early.

**Disadvantages** of payback period are:

1. Payback period does not take into account the time value of money which is a serious drawback since it can lead to wrong decisions. A variation of payback method that attempts to remove this drawback is called discounted payback period method.
2. It does not take into account, the cash flows that

### **Sensitivity analysis**

An important feature of a comprehensive CBA is the inclusion of a risk assessment. The use of sensitivity analysis allows users of the CBA methodology to challenge the robustness of the results to changes in the assumptions made (i.e. discount rate, time horizon, estimated value of costs and benefits, etc). In doing so, it is possible to identify those parameters and assumptions to which the outcome of the analysis is most sensitive and therefore, allows the user to determine which assumptions and parameters may need to be re-examined and clarified. Sensitivity analysis is the process of establishing the outcomes of the cost benefit analysis which is sensitive to the assumed values used in the analysis. This form of analysis should also be part of the appraisal for large projects. If an option is very sensitive to variations in a particular variable (e.g. passenger demand), then it should probably not be undertaken. If the relative merits of options change with the assumed values of variables, those values should be examined to see whether they can be made more reliable. It can be useful to attach probabilities to a range of values to help pick the best option. Sensitivity analysis requires a degree of exploratory analysis to ascertain the most sensitive variables and should lead to a risk management strategy involving risk mitigation measures to ensure the most pessimistic values for key variables do not materialise or can be managed appropriately if they do materialize. It is important to take into account the level of disaggregation of project inputs and benefits – sensitivity analysis based on a mix of highly aggregated and disaggregated variables may be misleading.

### **Scenario analysis**

The scenario analysis technique is related to sensitivity analysis. Whereas the sensitivity analysis is based on a variable by variable approach, scenario analysis recognizes that the various factors impacting upon the stream of costs and benefits are inter-independent. In other words, this approach assumes that that altering individual variables whilst holding the remainder constant is unrealistic (i.e. for a tourism project, it is unlikely that ticket sales and café-souvenir sales are independent). Rather, scenario analysis uses a range of scenarios (or variations on the option under examination) where all of the various factors can be reviewed and adjusted within a consistent framework. A number of scenarios are formulated – best case, worst case, etc – and for each scenario identified, a range of potential values is assigned for each cost and benefit variable. When formulating these scenarios, it is important that appropriate consideration is given to the sources of uncertainty about the future (i.e. technical, political, etc). Once the values within each scenario have been reviewed, the NPV of each scenario can then be recalculated.

### **Switching values**

This process of substituting new values on a variable-by-variable basis can be referred to as the calculation of switching values. These can provide interesting insights such as what change(s) would make the NPV equal zero or alternatively, by how much must costs or benefits fall or rise, respectively, in order to make a project worthwhile. The switching value is usually presented as a % i.e. a 20% increase in investment costs reduces project NPV to 0. This is very useful information and should be afforded a prominent place in any decision-making process. Moreover, given the importance of this information the switching values chosen should be carefully considered and should be realistic and justifiable. For example, for capital projects requiring an Exchequer commitment over the medium to long-term, operating and maintenance

costs should always be examined. Similarly, any project reliant upon user charges should always examine the impact of changes in volumes and the level of charges. Finally, the European Commission have suggested that when undertaking a sensitivity analysis a useful determinant of the most critical variables is those for which a 1 per cent variation (+/-) produces a corresponding variation of 5 per cent or more in the NPV.

**Distributional Analysis** The calculation of NPV's makes no allowance for the distribution of costs and benefits among members of society. This is an important drawback if the intended objectives of a programme/project aimed at specific income groups. Differential impact may arise because of income, gender, ethnicity, age, geographical location or disability and any distributional effects should be explicit and quantified where appropriate. A common approach to take account of distributional issues is to divide the relevant population into different income groups and analyse the impact of the programme/project on these groups. Weights can be attached to the different groups to reflect Government policy. Carrying out a distributional analysis can be a difficult task because costs and benefits are redistributed in unintended ways.

## 2. Economic appraisal techniques

Economic analysis aims to assess the desirability of a project from the societal perspective. This form of appraisal differs from financial appraisal because financial appraisal is generally done from the perspective of a particular stakeholder e.g. an investor. Sponsoring Authority or the Exchequer. Economic analysis also considers non-market impacts such as externalities.

### CBA

The general principle of cost benefit analysis is to assess whether or not the social and economic benefits associated with a project are greater than its social and economic costs. To this end, a project is deemed to be desirable where the benefits exceed the costs. However, should the benefits exceed the costs, this does not necessarily imply that a projects will proceed as other projects with a higher net present value (NPV) may be in competition for the same scarce resources. In addition, there are affordability constraints which mean that projects should not proceed even if the NPV is positive. In cost-benefit analysis all of the relevant costs and benefits, including indirect costs and benefits, are taken into account. Cash values, based on market prices (or shadow prices, where no appropriate market price exists) are placed on all costs and benefits and the time at which these costs/benefits occur is identified. The analytic techniques outlined above (i.e. NPV method, IRR method, etc.) are applied using the TDR. The general principle of cost-benefit analysis is that a project is desirable if the economic and social benefits are greater than economic and social costs. It is vital that cost-benefit analysis is objective. Its conclusions should not be prejudged. It should not be used as a device to justify a case already favoured for or against a proposal. Factors of questionable or dubious relevance to a project should not be introduced into an analysis in order to affect the result in a preferred direction. A more detailed guide on how to carry out a CBA is set out in *Public Spending Code D.03 – Guide to Economic Appraisal: Carrying out a CBA*.

### Cost Effectiveness Analysis (CEA)

It is difficult to measure the value to society of public investment in social infrastructure because the outputs may be difficult to specify accurately and to quantify, and are not frequently marketed. In cases like these, the cost of the various alternative options should be first determined in monetary terms. A choice can then be made as to which of the options (if they all achieve the same effects) is preferable. CEA is not a basis for deciding whether or not a project should be undertaken. Rather, it is concerned with the relative costs of the various options available for achieving a particular objective. CEA will assist in the determination of the least cost way of determining the capital project objective. A choice can then be made as to which of these options is preferable.

Evaluating options in CEA is best done by applying the principles of the NPV method to the stream of cash outflows or costs. The recurring costs of using facilities as well as the capital costs of creating them should be taken into account, particularly if they differ between alternative options. Usually, the aim will be to select the option which minimizes the net present cost. There is a particular need for consistency in the assumptions and parameters adopted for CBA and CEA appraisals. CEA is most applicable to healthcare, scientific and educational projects where benefits can be difficult to evaluate.

### Cost Utility Analysis (CUA)

CUA is a variant of CEA that measures the relative effectiveness of alternative interventions in achieving two or more objectives. It is often used in health appraisals. In a CUA, costs are expressed in monetary terms and outcomes/ benefits are expressed in utility terms e.g. outcomes are often defined in quality adjusted life years (QALYs). This outcome measure is a combination of duration of life and health related quality of life. Whereas in a CBA, there is a requirement to attempt to place a monetary value on all benefits, CUA allows for a comparison of the benefits of health interventions without having to place a financial value on health states.

### Multi Criteria Analysis (MCA)

Multi-criteria analysis (MCA) establishes preferences between project options by reference to an explicit set of criteria and objectives. These would normally reflect policy/programmer objectives and project objectives and other considerations as appropriate, such as value for money, costs, social, environmental, equality, etc. MCA is often used as an alternative to appraisal techniques because it incorporates multiple criteria and does not focus solely on monetary values. MCAs often include "scoring and weighting" of the relevant criteria reflecting their relative importance to the objectives of the project. Care should be taken to try and minimize the subjectivity of decision making in an MCA as this is a common problem with carrying out MCA's. The relative importance of objectives and criteria to achievement of the project will vary from sector to sector. The Sponsoring Agency should agree these with the Sanctioning Authority. In constructing a multi criteria analysis scorecard and determining the weightings to be given to criteria the aim should be to achieve an objective appraisal of project options and consistency in decision making. Judgments regarding the scoring of investment options should be based on objective, factual information. The justification for scoring and weighting decisions must be documented in detail. In this regard, the system should be capable of producing similar results if the selection criteria were applied by different decision makers.

The main steps in the MCA process include:

1. Identify the performance criteria for assessing the project
2. Devise a scoring scheme for marking a project under each criterion heading
3. Devise a weighting mechanism to reflect the relative importance of each criterion
4. Allocate scores to each investment option for each of the criteria
5. Document the rationale for the scoring results for each option

6. Calculate overall results and test for robustness

7. Report and interpret the findings

The importance of explaining the weights and scores fully, and interpreting the results carefully, cannot be over-stressed.

### Accounting Rate of Return (ARR)

Accounting rate of return (also known as simple rate of return) is the ratio of estimated accounting profit of a project to the average investment made in the project. ARR is used in investment appraisal.

#### What is the 'Accounting Rate of Return - ARR'

The accounting rate of return (ARR) is the amount of profit, or return, an individual can expect based on an investment made. Accounting rate of return divides the average profit by the initial investment to get the ratio or return that can be expected. ARR does not consider the time value of money, which means that returns taken in during later years may be worth less than those taken in now, and does not consider cash flows, which can be an integral part of maintaining a business.

**BREAKING DOWN 'Accounting Rate of Return - ARR'** Accounting rate of return is also called the simple rate of return and is a metric useful in the quick calculation of a company's profitability. ARR is used mainly as a general comparison between multiple projects as it is a very basic look at how a project is doing.

**Calculation of Accounting Rate of Return**-The accounting rate of return is calculated by dividing the average annual accounting profit by the initial investment of the project. The profit is calculated using the appropriate accounting framework including generally accepted accounting principles (GAAP) or international financial reporting standards (IFRS). The profit calculation includes depreciation and amortization of project assets. The initial investment is the fixed asset investment plus any changes to working capital due to the asset. If the project spans multiple years, an average of total revenue per year or investment per year is used Formula

Accounting Rate of Return is calculated using the following formula:

$$\text{ARR} = \frac{\text{Average Accounting Profit}}{\text{Average Investment}}$$

Average accounting profit is the arithmetic mean of accounting income expected to be earned during each year of the project's life time.

Average investment may be calculated as the sum of the beginning and ending book value of the project divided by. Another variation of ARR formula uses initial investment instead of average investment.

#### Advantages

1. Like payback period, this method of investment appraisal is easy to calculate.
2. It recognizes the profitability factor of investment.
3. Accounting rate of return is simple and straightforward to compute.
4. It focuses on accounting net operating income. Creditors and investors use accounting net operating income to evaluate the performance of management.

#### Disadvantages

1. It ignores time value of money. Suppose, if we use ARR to compare two projects having equal initial investments. The project which has higher annual income in the latter years of its useful life may rank higher than the one having higher annual income in the beginning years, even if the present value of the income generated by the latter project is higher.
2. It can be calculated in different ways. Thus there is problem of consistency.
3. It uses accounting income rather than cash flow information. Thus it is not suitable for projects which having high maintenance costs because their viability also depends upon timely cash inflows.
4. Accounting rate of return method does not take into account the time value of money. Under this method a dollar in hand and a dollar to be received in future are considered of equal value.
5. Cash is very important for every business. If an investment quickly generates cash inflow, the company can invest in other profitable projects. But accounting rate of return method focus on accounting net operating income rather than cash flow.
6. The accounting rate of return does not remain constant over useful life for many projects. A project may, therefore, look desirable in one period but undesirable in another period.

### Debt-Service Coverage Ratio (DSCR)

In corporate finance, the Debt-Service Coverage Ratio (DSCR) is a measure of the cash flow available to pay current debt obligations. The ratio states net operating income as a multiple of debt obligations due within one year, including interest, principal, sinking-fund and lease payments. In government finance, it is the amount of export earnings needed to meet annual interest and principal payments on a country's external debts. In personal finance, it is a ratio used by bank loan officers to determine income property loans. A DSCR greater than 1 means the entity – whether a person, company or government – has sufficient income to pay its current debt obligations. A DSCR less than 1 means it does not. In general, it is calculated by:

$$\text{DSCR} = \text{Net Operating Income} / \text{Total Debt Service}$$

$$\text{Debt Service Coverage Ratio (DSCR)} = \frac{\text{Net Operating Income}}{\text{Total Debt Service}}$$

#### BREAKING DOWN 'Debt-Service Coverage Ratio (DSCR)'

A DSCR of less than 1 means negative cash flow. A DSCR of .95 means that there is only enough net operating income to cover 95% of annual debt payments. For example, in the context of personal finance, this would mean that the borrower would have to delve into his or her personal funds every month to keep the project afloat. In general, lenders frown on a negative cash flow, but some allow it if the borrower has strong outside income.

Net operating income is a company's revenue minus its operating expenses, not including taxes and interest payments. It is often considered equivalent to earnings before interest and tax (EBIT). Some calculations include non-operating income in EBIT, however, which is never the case for net operating income. As a lender or investor comparing different companies' credit-worthiness – or a manager comparing different years' or quarters' – it is important to apply consistent criteria when calculating DSCR. As a borrower, it is important to realize that lenders

may calculate DSCR in slightly different ways. Total debt service refers to current debt obligations, meaning any interest, principal, sinking-fund and lease payments that are due in the coming year. On a balance sheet, this will include short-term debt and the current portion of long-term debt. Income taxes complicate DSCR calculations, because interest payments are tax deductible, while principle repayments are not. A more accurate way to calculate total debt service is therefore:

**Interest + (Principle / [1 - Tax Rate])** Lenders will routinely assess a borrower's DSCR before making a loan. If the ratio is less than 1, the borrower is unable to pay current debt obligations without drawing on outside sources—without, in essence, borrowing more. If it is too close to 1, say 1.1, the entity is vulnerable, and a minor decline in cash flow could make it unable to service its debt. Lenders may in some cases require that the borrower maintain a certain minimum DSCR while the loan is outstanding. Some agreements will consider a borrower who falls below that minimum to be in default. The minimum DSCR a lender will demand can depend on macroeconomic conditions. If the economy is growing, credit is more readily available, and lenders may be more forgiving of lower ratios. A broad tendency to lend to less-qualified borrowers can in turn affect the economy's stability, however, as happened leading up to the 2008 financial crisis. Subprime borrowers were able to obtain credit, especially mortgages, with little scrutiny. When these borrowers began to default en masse, the financial institutions that had financed them collapsed.

**How to Calculate the DSCR for a Business**-The debt service coverage ratio is also helpful when analyzing business financial statements. This could come in handy when analyzing tenant financials, when securing a business loan, or when seeking financing for owner occupied commercial real estate.

How does the DSCR work for a business? The general concept of taking cash flow and dividing by debt service is the same. However, instead of looking at NOI for a commercial property, we need to substitute in some other measure of cash flow from the business available to pay debt obligations. But which definition of cash flow should be used? Given the importance of debt service coverage, there is surprisingly no universal definition used among banks and sometimes there is even disagreement within the same bank. This is why it's important to clarify how cash flow will be calculated.

With that said, typically Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA) or some form of adjusted EBITDA will be used. Common adjustments include adding back an appropriate capital expenditure amount required to replace fixed assets (which would offset the depreciation add back), and also taking into account working capital changes (to cover investments in receivables and inventory

**How Do I Improve My Debt Service Coverage Ratio?**- If you need a higher DSCR to qualify for a business loan, you can either increase your business revenues, lower your business expenses, or lower the amount of outstanding debt that you have. Doing all of these things together has the highest impact.

To bump up your business revenues, you might try selling more products or services or increasing prices. Freshour suggests bringing on a co-owner with high income and low debt if the lender you're working with considers personal income when calculating DSCR. This can improve the overall DSCR of the business.

Another suggestion is to reduce your business' operating costs. Charles N. Persing, a CPA and Partner at Bederson LLP, says there is a long list of things a small business owner can do to make a business more efficient and profitable! For example, you can ask your suppliers for better deals or put off big capital expenditures unless absolutely necessary. Automating as many things as you can also reduce costs. Direct Capital has put together a great list of 28 Ways to Cut Business Operating Expenses.

You should also focus on reducing your debt as much as you can. If you have existing business loans, pay them down before seeking a new loan. Fresh our says you might also want to consider reducing the loan amount that you're seeking. "If the new loan is pushing your DSCR below 1, then a smaller loan amount may help get your DSCR where it needs to be for approval."

**Keeping Your Debt Service Coverage Ratio High**- Having a good DSCR can certainly help you get approved for a loan, but it doesn't stop there. As part of your loan agreement, lenders may require you to keep your debt service coverage ratio at a certain level year over year. If your DSCR declines below that level, the lender may call the balance due. Calling the balance due means you have a very short amount of time (90-120 days) to pay off the full balance. If you don't, you'll be considered delinquent, and the lender can initiate collection proceedings. For obvious reasons, you don't want to be in this position. Make sure that you keep an eye on your business' operating expenses, incoming revenues, and overall debt level each month so that **you're in compliance with the loan agreement at year end.**- Despite your best efforts, if your DSCR keeps declining, Parsing says small business owners can consider refinancing the loan. Restructuring the loan so that there are lower monthly payments can get your Debt Service Coverage back in the clear.

**Bottom Line**-Debt Service Coverage Ratio is an important financial yardstick that lenders use to decide if you qualify for a business loan. Make sure you calculate it before approaching lenders, take steps to improve it if necessary, and monitor it on an ongoing basis. This will help ensure that you can get financing you need to grow your small business

### Net Present Value

The net present value rule, a logical outgrowth of net present value theory, refers to the idea that company managers or investors should only invest in projects or engage in transactions that have a positive net present value (NPV), and should avoid investing in projects that have a negative net present value. According to the net present value rule theory, investing in something that has a net present value greater than zero should logically increase a company's earnings; or in the case of an investor, increase a shareholder's wealth.

### BREAKING DOWN 'Net Present Value Rule'

Although most companies generally follow the net present value rule, there are occasional circumstances that require them to depart from it. For example, a company with significant debt issues may have to abandon or postpone undertaking a project with a positive NPV, instead committing its capital to resolving the immediately pressing debt issue. A company may disregard the net present value rule if it purposely chooses to engage in a project with a negative NPV in order to create an illusion for shareholders that the company is engaged in continuously ongoing corporate investment. There is also the possibility that a company's poor corporate governance leads it to ignore net present value theory.

Use the formula to calculate Present Value of **\$900 in 3 years**:

$$PV = FV / (1+r)^n$$

$PV = \$900 / (1 + 0.10)^3 = \$900 / 1.10^3 = \$676.18$  (to nearest cent).

### What is net present value?

"Net present value is the present value of the cash flows at the required rate of return of your project compared to your initial investment," says Knight. In practical terms, it's a method of calculating your return on investment, or ROI, for a project or expenditure. By looking at all of the money you expect to make from the investment and translating those returns into today's dollars, you can decide whether the project is worthwhile.

### What do companies typically use it for?

When a manager needs to compare projects and decide which ones to pursue, there are generally three options available: internal rate of return, payback method, and net present value. Knight says that net present value, often referred to as NPV, is the tool of choice for most financial analysts. There are two reasons for that. One, NPV considers the *time value of money*, translating future cash flows into today's dollars. Two, it provides a concrete number that managers can use to easily compare an initial outlay of cash against the present value of the return.

## Benefit Cost Ratio

### What is a 'Benefit Cost Ratio - BCR'

A benefit cost ratio (BCR) attempts to identify the relationship between the cost and benefits of a proposed project. Benefit cost ratios are most often used in corporate finance to detail the relationship between possible benefits and costs, both quantitative and qualitative, of undertaking new projects or replacing old ones.

### BREAKING DOWN 'Benefit Cost Ratio - BCR'

The ratio is used to measure both the quantitative and the qualitative factors, since sometimes the benefits and the costs cannot be measured exclusively in financial terms. When possible, the qualitative factors should be translated into quantitative terms for the results to be easily understandable and tangible.

Benefit Cost Ratio Calculation the BCR is calculated by dividing the total discounted value of the benefits by the total discounted value of the costs. To calculate the discounted values of each, use the net present value (NPV) formula, in which the values are divided by the sum of 1 and the discount rate raised to the number of periods.

### BENEFIT COST RATIO ANALYSIS

Using the benefit cost ratio allows businesses and governments to make decisions on the negatives and positives of investing in different projects. In other words, using benefit cost ratio analysis allows an entity to decide whether or not the benefits of a given project or proposal outweighs the actual costs that go into the creation of the project or proposal. Benefit cost ratio is simple enough to figure out, however, there are benefit cost ratio calculators available that take into consideration other factors that make the calculation a bit more complex. Factors such as actual employee production or production line breakdowns can cause the benefit cost ratio to change dramatically and so they must be accounted for when delving into the details of a particular proposal or project. Businesses and governments can benefit greatly by figuring out the cost of a project versus its returns. For this reason alone, the benefit cost ratio is an important formula to be used in the decision making process for any project that might be presented.

## Project Monitoring and Cost Control System

During the execution of a project, procedures for project control and record keeping become indispensable tools to managers and other participants in the construction process. These tools serve the dual purpose of recording the financial transactions that occur as well as giving managers an indication of the progress and problems associated with a project. The problems of project control are aptly summed up in an old definition of a project as "any collection of vaguely related activities that are ninety percent complete, over budget and late. The task of project control systems is to give a fair indication of the existence and the extent of such problems. In this chapter, we consider the problems associated with resource utilization, accounting, monitoring and control during a project. In this discussion, we emphasize the project management uses of accounting information. Interpretation of project accounts is generally not straightforward until a project is completed, and then it is too late to influence project management. Even after completion of a project, the accounting results may be confusing. Hence, managers need to know how to interpret accounting information for the purpose of project management. In the process of considering management problems, however, we shall discuss some of the common accounting systems and conventions, although our purpose is not to provide a comprehensive survey of accounting procedures. The limited objective of project control deserves emphasis. Project control procedures are primarily intended to identify deviations from the project plan rather than to suggest possible areas for cost savings. This characteristic reflects the advanced stage at which project control becomes important. The time at which major cost savings can be achieved is during planning and design for the project. During the actual construction, changes are likely to delay the project and lead to inordinate cost increases. As a result, the focus of project control is on fulfilling the original design plans or indicating deviations from these plans, rather than on searching for significant improvements and cost savings. It is only when a rescue operation is required that major changes will normally occur in the construction plan. Finally, the issues associated with integration of information will require some discussion. Project management activities and functional concerns are intimately linked, yet the techniques used in many instances do not facilitate comprehensive or integrated consideration of project activities. For example, schedule information and cost accounts are usually kept separately. As a result, project managers themselves must synthesize a comprehensive view from the different reports on the project plus their own field observations. In particular, managers are often forced to infer the cost impacts of schedule changes, rather than being provided with aids for this process. Communication or integration of various types of information can serve a number of useful purposes, although it

Products & Services

**Project Management Services-** Project management services specialize in planning, coordinating, and executing projects according to requirements and constraints. They perform some or all of the activities related to project work, from conceptualization to completion. Emphasis is placed on creating and maintaining project milestones and the project schedule.

**Project Management Software-** Project management software is a term covering many types of software, including scheduling, cost control and budget management, resource allocation, collaboration software, communication, quality management and documentation or administration systems

**Engineering Consulting Services-** Engineering consulting firms provide engineering services and expertise to companies in need of a specialized skill-set. Professionals in this category work with clients to define solutions to problems or to help determine and recommend the best course of action for a given initiative.

**Research and Development Services-** Research and development services perform original investigation to gain new knowledge (research) and/or apply research findings to create or improve products and processes (development).

**Collaborative Applications Software-** Collaborative applications software allows networked computer users to work together on related tasks via local or remote servers.

### **Project communication tool and technique**

**Pulse Meetings-** Pulse meetings are short team status meetings where the project management team is able to gather project performance information about the activities that are underway. These meetings should occur frequently and can either be face-to-face or virtual. Normally they are only a few minutes in duration. During the meeting, the beginning and completion of project activities is reported. In addition, the status of any activities that are underway is communicated to the rest of the project management team. Issues on any of the ongoing activities are identified, however, the issue resolution occurs at a separate meeting with the appropriate individuals present. The issue resolution meeting may immediately follow the Pulse meeting, but it is clearly a separate meeting and those project team members who are not needed for issue resolution do not need to attend. The frequency of the Pulse meeting is determined based upon the status of the project. When in an [Extreme](#) mode, the Pulse meeting may be happening several times a day. Projects that are running smoothly may only need to have a Pulse meeting once a week.

**Variance Reports-** Variance reports are formal reports generated by the [PMIS](#), by the [Earned Value Management System](#), one of the other business management systems - such as the quality control system, or by a project supplier. Variance reports compare what has actually happened on a project against what was expected to have happened on the project. A variance report typically indicates both the absolute value of the difference and a percentage representation of the difference.

The actual performance achieved on a project activity (such as cost or duration) seldom precisely matches the estimated performance set at the time of project planning. The page on [Estimating](#) explains why project estimates are seldom precisely accurate. However, since the estimates often aren't accurate, it is imperative for the project management team to identify the variances in order to know what is actually happening on the project. The variances can uncover both positive and negative project risk. Project variance reports often are expressed with two references. The first reference is what was supposed to have happened since the last reporting cycle. This is often called the "Current Period" variance. It is an indication of how well the project resources were able to conduct project activities in accordance with the project plan in the recent past. The second reference is what was supposed to have been done on the project since it started. This is often called the "Cumulative" variance. It is an indication of how well the project resources have been able to conduct project activities throughout the project lifecycle. The cumulative variance will have embedded in it any previous variances - either positive or negative. The current period variance provides a clear representation of what is happening right now on the project. The cumulative variance eliminates the effects of any short term conditions, either good or bad, that effected the project during the most recent reporting period. Both variances provide useful information.

**Program Reviews-** Program Reviews are meetings with the project team members and sub-project leaders that review the current status of the program as compared to the original program plan. These are most often used on [Full-scale](#) and [Complex](#) projects. Unlike the Pulse Meetings which focus on day-to-day activities, the Program Reviews focus on the big picture and emphasize the integration between activities and between sub-projects encompassed within the program. The question being asked is whether the program activities and the sub-projects are likely to interfere with each other. In addition, when I have a supplier who is a major contributor on the program and is performing customized work on this program, I will conduct Program Reviews with the supplier for their portion of the program. Program Reviews are sometimes combined with Management Reviews. I do not recommend this approach. The danger with this approach is that key stakeholders and managers may intimidate some project team members from providing a frank and honest appraisal of the status of program work.

**Technical Reviews-** Technical Reviews are formal meetings conducted with subject matter experts who are not members of the project team. These are in-depth reviews focused upon a technical aspect of the project. Examples would be Design Reviews, Code Reviews, Security Reviews, or Production Readiness Reviews. The reviewers should perform an in-depth analysis of the project deliverables and activities to determine whether the project work has been accomplished completely and correctly. These reviews will normally generate a list of actions that must be completed. These actions may require additional testing or analysis. In some cases it may even require redesigns of systems, software, processes or products. The results of these reviews are normally reported to senior management at the next Management Review. In many cases, the technical review must be completed before a project can proceed to a toll-gate meeting. When the Technical Review is linked to a toll-gate meeting, the action items do not need to be completed prior to the toll-gate. However, any open action item is listed on the risk register and the plan for resolving that action item is included in the project plan for the next phase.

**Project Forecasting-** Project Forecasting consists of taking the project status information and extrapolating the current project performance to the end of the project. Forecasts can be made with respect to project duration, overall project cost, performance/quality level of project deliverables, or any combination of these. A key element in forecasting is to review the risk events that occurred and the remaining risk triggers. A deeper discussion of this is found on the [Project Risk Management](#) page. A caution when doing forecasting, ensure you have adequate information to realistically forecast performance. My personal rule of thumb is that I wait until an activity, phase, or deliverable is at least 25% complete before I try to forecast. Prior to that point I stick with the original estimate, modified by any appropriate risk mitigation activities that have occurred.

When forecasting project duration, the key is to understand the schedule performance and schedule risk of the activities on the critical path.

Those activities will be the ones that drive the project completion date. On a resource constrained project, or a project with unpredictable resource availability, this can be very difficult because the lack of resources causes the critical path to vary. I have not found a good robust tool for forecasting schedule in this condition. It generally comes down to expert judgment and gut feel. When it is vital for the project to complete by a certain date, I often will convert my schedule tracking to a countdown mode where everything is measured in terms of how many days before project completion. Also, I will Pulse the project more frequently in order to quickly assess when I believe we are falling behind. If that sounds like micro-management it is because that is micro-management.

When forecasting total project cost, I prefer to use the forecasting methods that are embedded in the [Earned Value Management](#) system. Unfortunately, many organizations do not have the financial systems in place that enable earned value management. When that is the case, I am forced to rely on trend forecasting - which is sometimes called "straight-line" forecasting. Trend forecasting takes the current project spending and extrapolates that rate of spending until the end of the project. This provides a rough forecast, but it does not take into account the effect that different activities may require resources that spend at different levels. The resources that perform the remaining activities may be higher or lower cost than the preceding resources. Also, it does not take into account that the project may be ahead or behind schedule. If the project is ahead of schedule, the spending done to achieve that condition inflates the extrapolated value of the project final cost. If the project is behind schedule, the lack of spending creates an extrapolated value of total project cost that is too low.

When forecasting the performance or quality of project deliverables, I rely heavily on prototypes and preliminary analysis. When the project does not have these, the risk that the project will not achieve the desired performance or quality established at the time of project planning is higher. If performance is the most important attribute of the project deliverables, then the risk of missing the forecast project duration or cost is much higher. The principle involved is the "Rule of Ten's." According to this principle, the cost to correct a technical issue goes up by a factor of 10 as the project moves from one phase to the next. Therefore it is imperative that performance issues be identified as early as possible.

**Problem Solving Problem Solving is a very broad topic.** There are dozens of approaches to problem solving. My rule of thumb with respect to this technique is that if you have a process that works for you, use it! I recommend you have an agreement with your project core team members or key project stakeholder concerning the problem solving process that will be used. Will it be team-based or individually driven? Will you use a process that relies on data from past projects or only on data from this project? Once a root cause is determined, how will recovery actions be identified and approved? As I said, there are many problem solving methods and their answer for these questions and others is different. From my standpoint, the most important point is that you have a process to address issues, rather than jumping to conclusions or worse yet, ignoring the problem until it is a crisis.

If you don't already have a problem solving process, may I suggest this one that I refer to as CIV2:

- 1. Clarify:** Clarify the problem. In which part of the project did it occur? Who was involved? When did it happen?
- 2. Investigate:** Investigate the details about what happened. Gather data from both the project activity and the surrounding environment. Determine the root cause(s) of the problem.
- 3. Evaluate:** Evaluate the options to address the problem. Consider the impact on the project objectives that each potential solution would likely have. What new risks are associated with each potential solution?
- 4. Choose:** Choose among the viable solution/recovery paths. If necessary, coordinate the decision with key stakeholders. This must be done whenever the solution will impact a boundary condition of the project.
- 5. Implement:** Implement the selected solution/recovery path. Modify the project plan with respect to any changes in scope, resources, or scheduled dates of any activities. Update the risk register.
- 6. Validate:** Validate that the solution/recovery path is achieving the desired results.

#### Project Management Information System

The Project Management Information System (PMIS) was discussed in detail on the [Executing Tools and Techniques](#) page. The PMIS is the set of communicating methods used by the project team to share plans and results of project activities. The PMIS can either be a physical system or an electronic system. Either way, the PMIS is used as the clearing house of information on the project including; project plans, project status, project risks, project changes, project meetings, and any other information that project management team believes is relevant to the project team.

**Management Reviews-** Project Management Reviews are formal documented meetings with the project team and key stakeholders that review the current status of the project as compared to the original project plan. Unlike the Pulse Meetings and Program Reviews which are data gathering meetings that focus on understanding the current status of the project, the Management Reviews are with key stakeholders with the emphasis being on whether the project performance is adequate for the project to deliver on the overall project objectives. Often if the project has encountered issues, such as resource constraints or scope creep, the stakeholders conducting the review are able to provide assistance to the project team to overcome these issues. The format for these reviews is usually set by the stakeholders and addresses the topics that are most important to them. The review may be a formal stand-up meeting; it may be an informal discussion setting, a written report, or an update to an electronic dashboard. Regardless of the method used, these are formal status reporting meetings and need to be treated as such. The project manager should keep an Action Item list or Stakeholder Issue log for any questions that arise in these reviews. Also minutes from these meetings should be maintained as part of the project records.

**Project Dashboards-** Dashboards have proliferated as more organizations start to manage projects within the context of a portfolio of

projects. A dashboard is a great method for capturing a snapshot of a project and presenting that to stakeholders. Dashboards contain a small subset of project status information that is used as indicators of whether the entire project is on track. The dashboard information is used to make decisions concerning changes to projects or to the project portfolio.

Within a project team, Dashboards were used by project managers to focus the project team on the few key items that would drive project performance. Therefore the current critical path activity is tracked for schedule status, the current activity with the most uncertainty in resource requirements is tracked for cost status, and the most challenging activities are tracked for project

Project	Project A	Project B	Project C	Project D	Project E	Project F
Charter Approved	Green	Green	Green	Green	Green	Green
Plan Approved	Green	Green	Green	Yellow	Green	Yellow
Schedule Status	Green	Green	Red	Yellow	Red	Yellow
Cost Status	Green	Yellow	Green	Green	Yellow	Yellow
Performance	Green	Green	Green	Green	Red	Yellow
Completion Date	Green	Green	Red	Yellow	Red	Yellow

performance/quality. This is an excellent use of dashboards, especially when working with a virtual project team. As more organizations decided to manage their projects as a portfolio of projects, they have recognized the need to have a means of measuring the projects in the portfolio both against each other and with respect to their objectives. The dashboard offers that mechanism as each of the projects report on key metrics that are used by the senior management or [Project Management Office](#) to check the status of the projects. Often the dashboard measures the status through the "Red light - Green light" method. This type of scoring uses colors to indicate project status on the key measures. A "Green light" indicates that everything on the project is going according to plan. A "Yellow light" indicates that there are some problems, but the project team is working the situation and should be able to contain the problem. A "Red light" indicates that the problem is so severe, the project team cannot resolve the problem and achieve the project objectives without help from the stakeholders. The senior management team and PMO use the Dashboard to make resource allocation decisions and to call special Project Management Reviews.

### **Resource Scheduling and Levelling Crashing of project cost**

Resource leveling is a technique in project management that overlooks resource allocation and resolves possible conflict arising from over-allocation. When project managers undertake a project, they need to plan their resources accordingly. This will benefit the organization without having to face conflicts and not being able to deliver on time. Resource leveling is considered one of the key elements to resource management in the organization. An organization starts to face problems if resources are not allocated properly i.e., some resource may be over-allocated whilst others will be under-allocated. Both will bring about a financial risk to the organization.

As the main aim of resource leveling is to allocate resource efficiently, so that the project can be completed in the given time period. Hence, resource leveling can be broken down into two main areas; projects that can be completed by using up all resources, which are available and projects that can be completed with limited resources. Projects, which use limited resources, can be extended for over a period of time until the resources required are available. If then again, the number of projects that an organization undertakes exceeds the resources available, then it's wiser to postpone the project for a later date.

Many organizations have a structured hierarchy of resource leveling. A work-based structure is as follows:

- Stage
- Phase
- Task/Deliverable

All of the above-mentioned layers will determine the scope of the project and find ways to organize tasks across the team. This will make it easier for the project team to complete the tasks.

In addition, depending on the three parameters above, the level of the resources required (seniority, experience, skills, etc.) may be different. Therefore, the resource requirement for a project is always a variable, which is corresponding to the above structure.

#### **Establishing Dependencies**

The main reason for a project manager to establish dependencies is to ensure that tasks get executed properly. By identifying correct dependencies from that of incorrect dependencies allows the project to be completed within the set timeframe.

Here are some of the constraints that a project manager will come across during the project execution cycle. The constraints a project manager will face can be categorized into three categories.

- **Mandatory** - These constraints arise due to physical limitations such as experiments.
- **Discretionary** - These are constraints based on preferences or decisions taken by teams.
- **External** - Often based on needs or desires involving a third party.

#### **The Process of Assigning Resources**

For resource leveling to take place, resources are delegated with tasks (deliverables), which needs execution. During the starting phase of a project, idealistically the roles are assigned to resources (human resources) at which point the resources are not identified.

Later, these roles are assigned to specific tasks, which require specialization.

**Leveling of Resources**- Resource leveling helps an organization to make use of the available resources to the maximum. The idea behind resource leveling is to reduce wastage of resources i.e., to stop over-allocation of resources. Project manager will identify time that is unused by a resource and will take measures to prevent it or making an advantage out of it.

By resource conflicts, there are numerous disadvantages suffered by the organization, such as:

- Delay in certain tasks being completed
- Difficulty in assigning a different resource
- Unable to change task dependencies
- To remove certain tasks
- To add more tasks
- Overall delays and budget overruns of projects

#### **Resource leveling Techniques**

Critical path is a common type of technique used by project managers when it comes to resource leveling. The critical path represents for both the longest and shortest time duration paths in the network diagram to complete the project.

However, apart from the widely used critical path concept, project managers use fast tracking and crashing if things get out of hand.

- **Fast tracking** - This performs critical path tasks. This buys time. The prominent feature of this technique is that although the work is completed for the moment, possibility of rework is higher.
- **Crashing** - This refers to assigning resources in addition to existing resources to get work done faster, associated with additional cost such as labor, equipment, etc

<b>Resource Leveling</b>	<b>Resource Smoothing</b>
A schedule network analysis technique.	A schedule network analysis technique.
A resource optimization technique.	A resource optimization technique.
Improves resource utilization.	Improves resource utilization.

**Differences**

<b>Resource Leveling</b>	<b>Resource Smoothing</b>
Aim is to adjust start and end dates of a project with resource constraints while balancing resource requirements and resource availability.	Aim is to achieve optimal resource usage by avoiding peaks and valleys in the resource usage profile. Hence the name smoothing.
Used in resource-constrained scheduling.	Used in time-constrained scheduling.
Critical path of the project will be affected, and usually the length of critical path will increase.	Critical path of the project won't change
Can be applied to resources on critical path.	Doesn't apply to resources on critical path.
Free and total float (or slack) may be used.	Free and total float (or slack) are used.
Will optimize all the resources and may change the duration of the project.	May not be able to optimize all the resources if sufficient slack (or float) isn't available, but does not change the duration of the project.
Risk: May change the critical path and hence the duration.	Risk: Loss of flexibility due to reduction in slack. Hence chances of increase in number of near-critical activities.