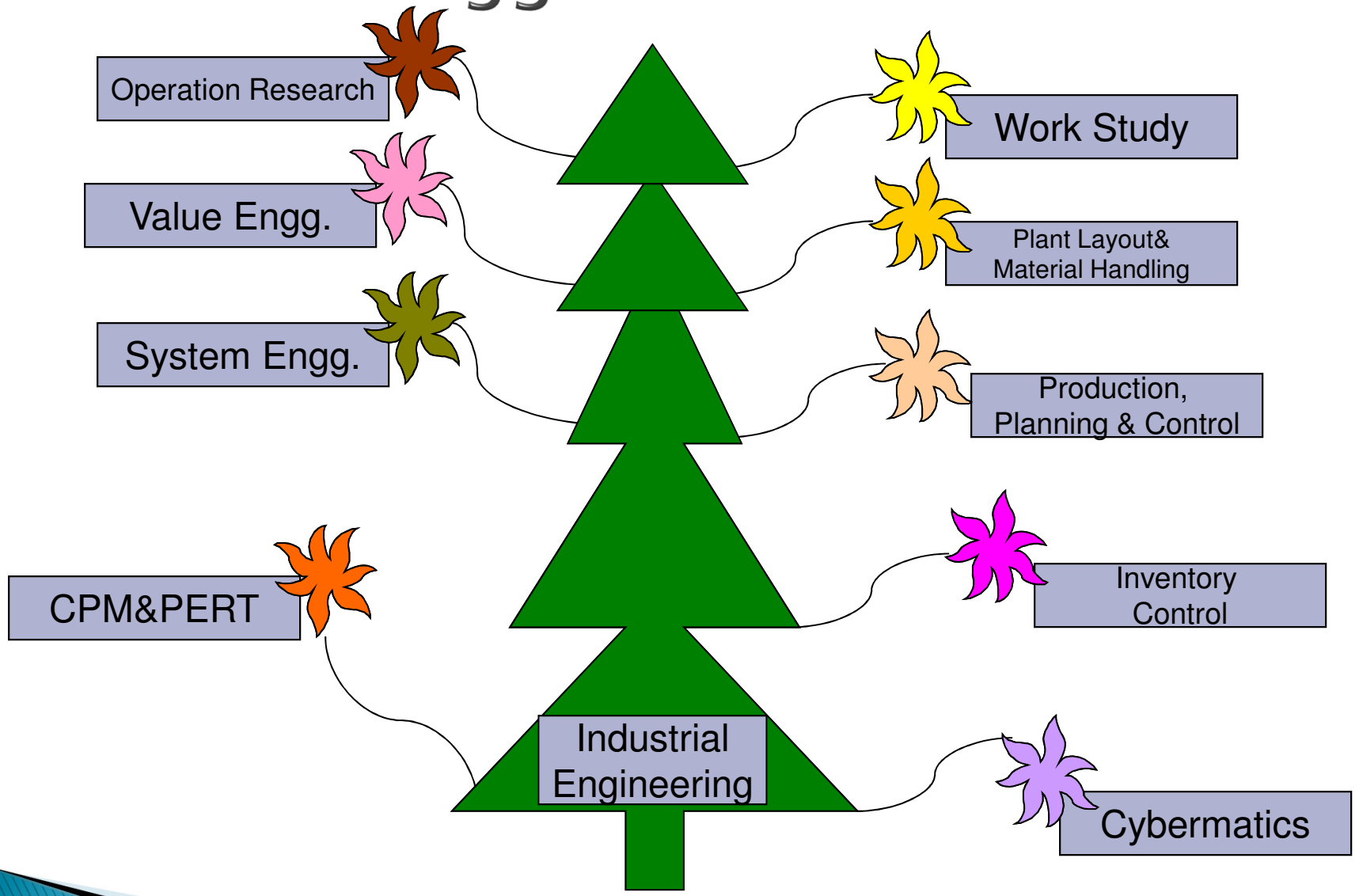
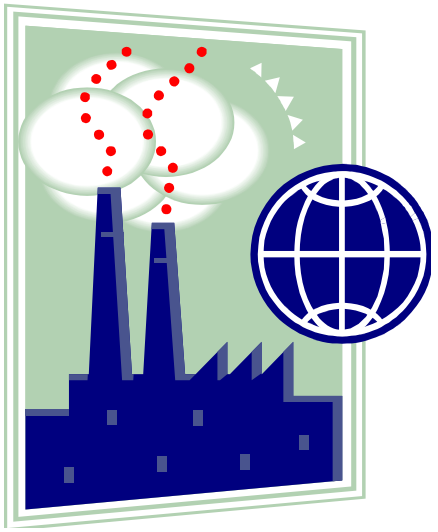
WORK STUDY – METHOD STUDY AND WORKMEASUREMENT

Industrial Engg. Tree

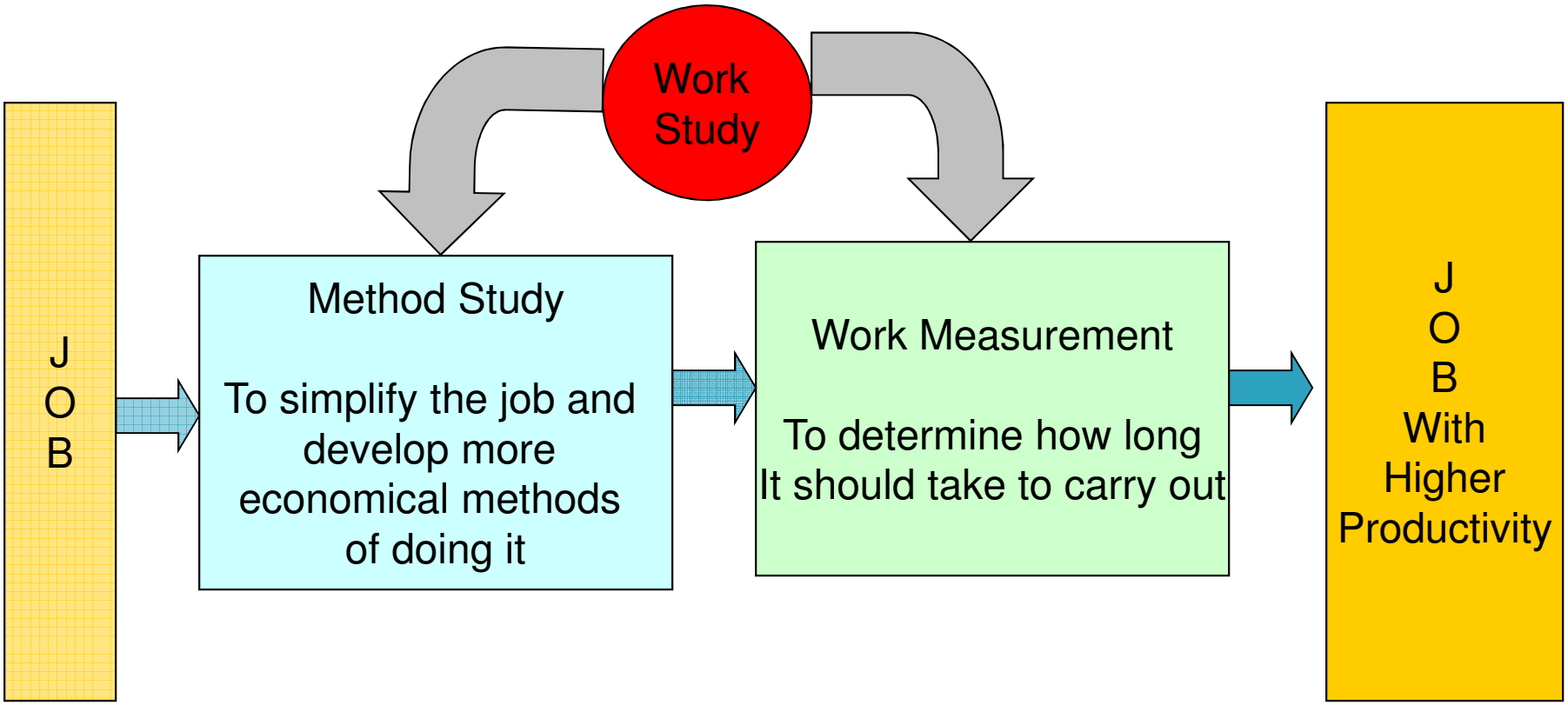


Work study



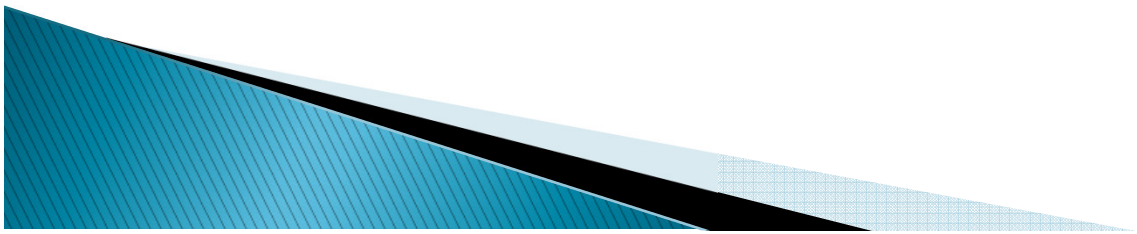
- ILO defines: A Generic term for those techniques particularly 'Method Study' and 'Work Measurement' which are used in examination of human work in all its context and which lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed in order to effect improvement.

WORK STUDY DIAGRAM



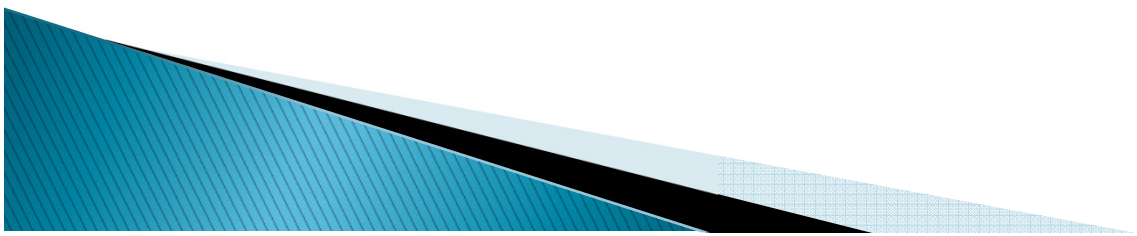
Industrial Engineering

- Emerged in 1881
- Detailed Analysis for use and cost of the resources of Organization.
- Concerned with Productivity.
- Productivity is Measure of Performance.
- Applies W.S. for increased Productivity.



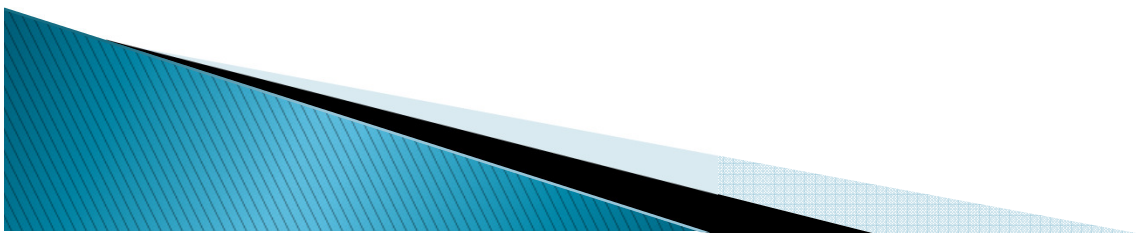
Introduction to Work Study

- Frederick W.Taylor – Father of modern industrial Engineering
- Scientific Management and Work Measurement (1881)
- Work of each person should be planned one day in advance
- Definite work to be allotted.
- Pre-explained method to be adopted.
- Time to be fixed to complete the job
- Training is required.



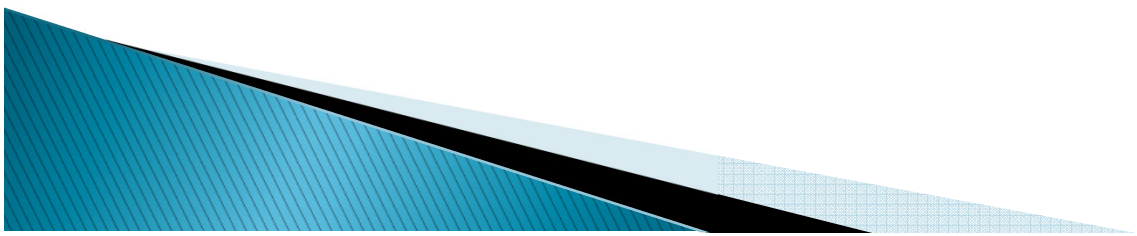
WORK STUDY

- Branch of Industrial engineering
- Combination of 2 Techniques
- Method study, Work measurement



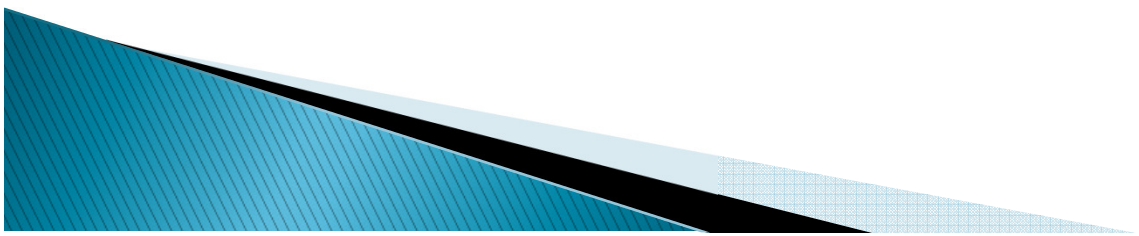
Work Study definition

- Generic term for –Method Study and work measurement, which are used in the examination of human work in all its contexts, and which leads systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement.



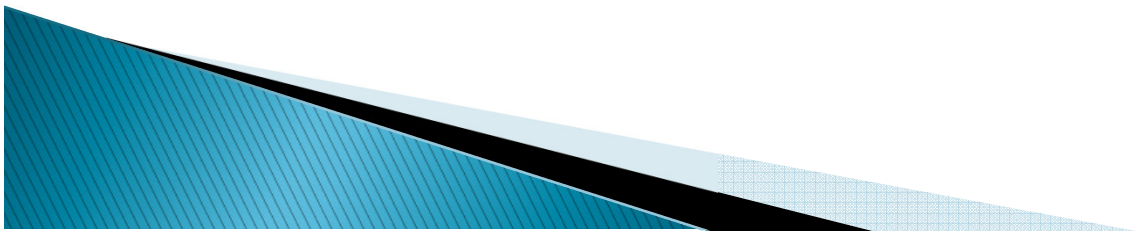
Advantages of workstudy

- Uniform ,improved production flow
- Higher productive efficiency
- Reduced manufacturing costs
- Fast , accurate delivery dates
- Better employee-employer relations
- Better service to customers
- Job security and satisfaction
- Better working conditions
- Higher wagews



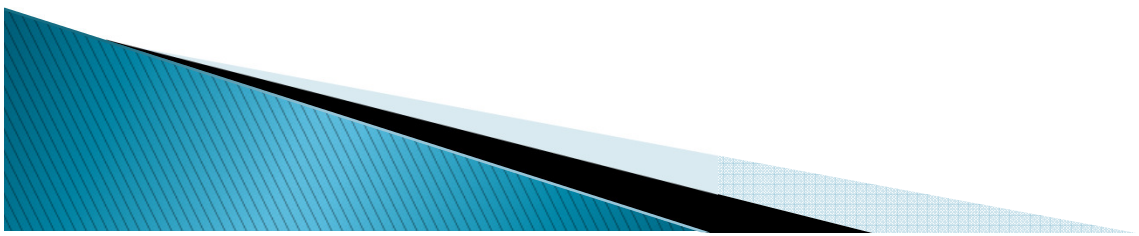
Method Study definition

- Systematic Recording and Critical Examination of Existing and Proposed ways of doing a work, as a means of developing and applying easier and more effective methods and reducing costs.



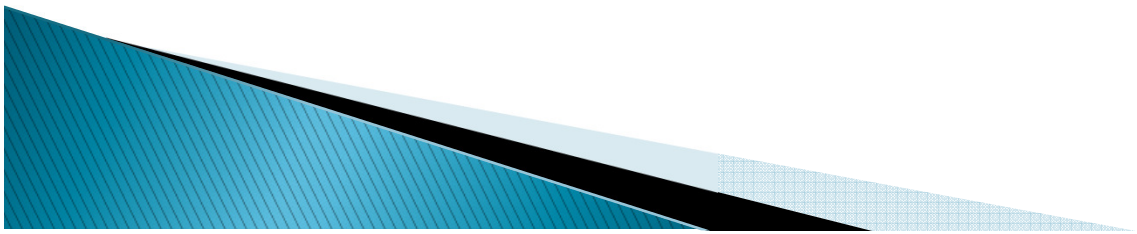
Advantages of method study

- Improved working processes
- Better work place layout
- Less fatigue to workers
- Better product quality
- Effective utilization of resources
- Efficient, fast material handling
- Reduced health hazards
- Efficient planning of section
- Streamlined working proceedures.



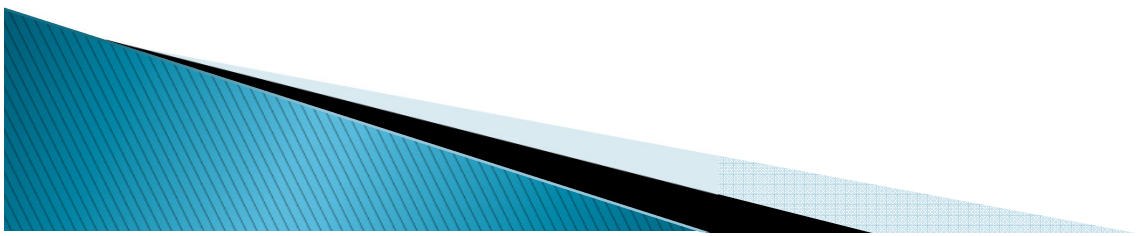
Work Measurement definition

- Application of Techniques Designed to establish the Time for a Qualified Worker to carry out a specified job at a defined level of performance.

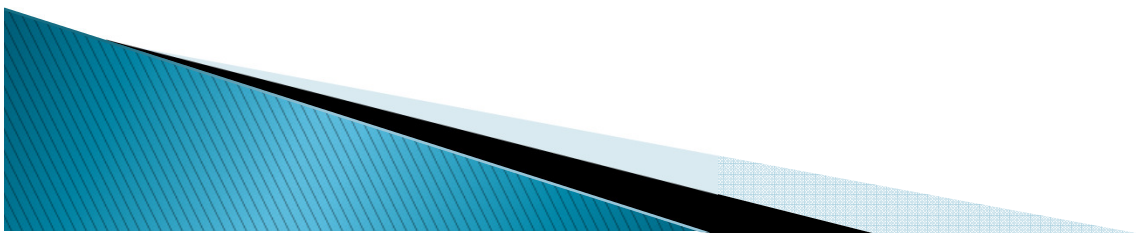


Advantages of work measurement

- Determines time required, establishes fastest method;
- Determines man power required for a job;
- Decides equipments;
- Provides information for effective production planning;
- Aids in calculating exact delivery dates;
- Decides realistic labour budgeting;
- Provides a basis for sound incentive scheme;
- Results in effective labour control.

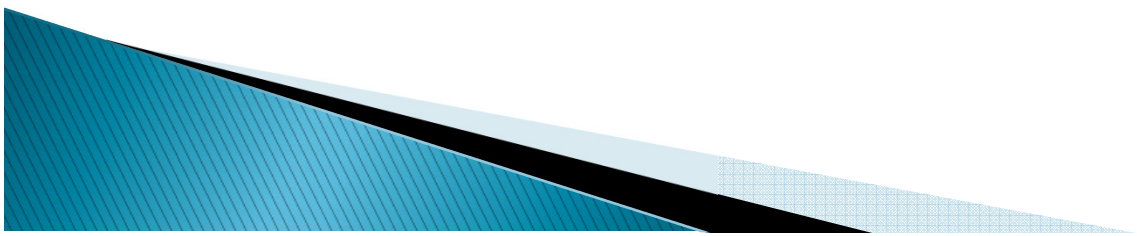


METHOD STUDY



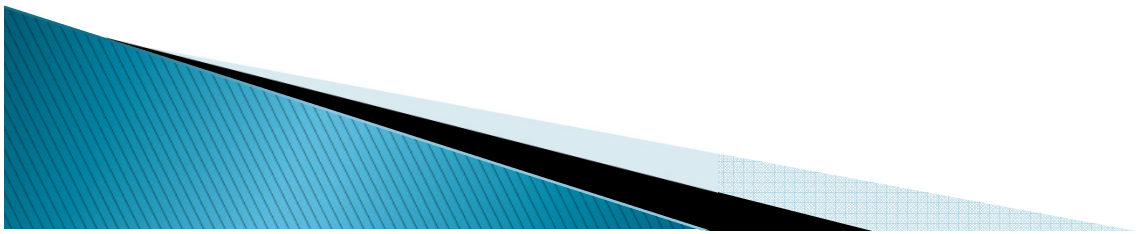
Steps for method study

1. Select.
2. Record.
3. Examine Critically.
4. Develop.
5. Install.
6. Maintain.



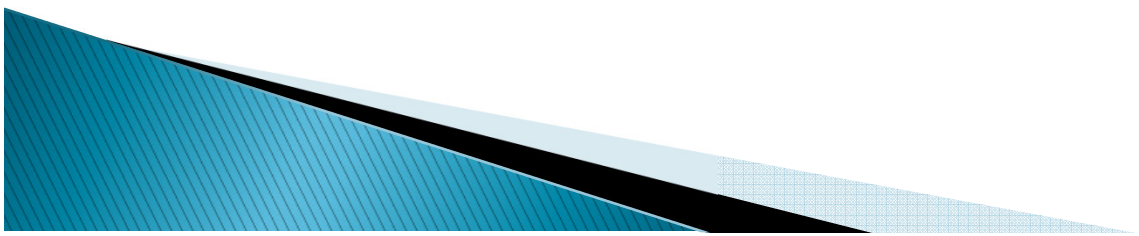
1.Selection

- Economic factor.
- Technical factor.
- Human Reactions



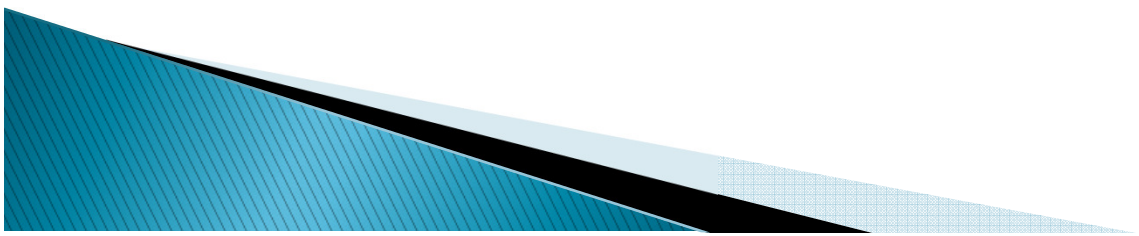
2.Record techniques

- Charts a) out line process b) flow process charts (man, material, equipment) c) two handed d) multiple activity e) travel
- Diagrams a) flow b) string
- Motion and film analysis a) simo chart b)P.M.T.S
- Lay out models.

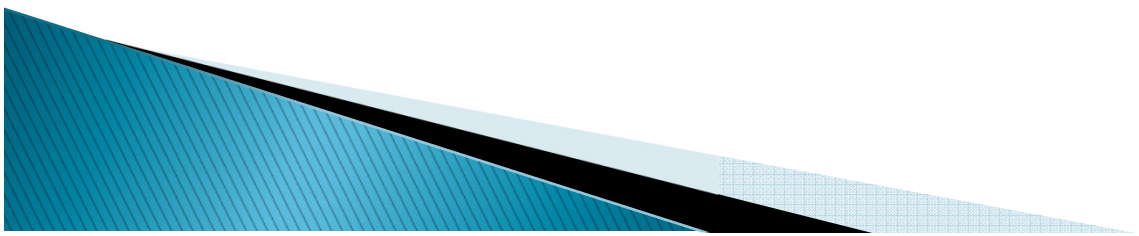


3.CRITICAL EXAMINATION

- Governing Considerations:
  - Purpose
  - Place
  - Sequence
  - Person
  - Means

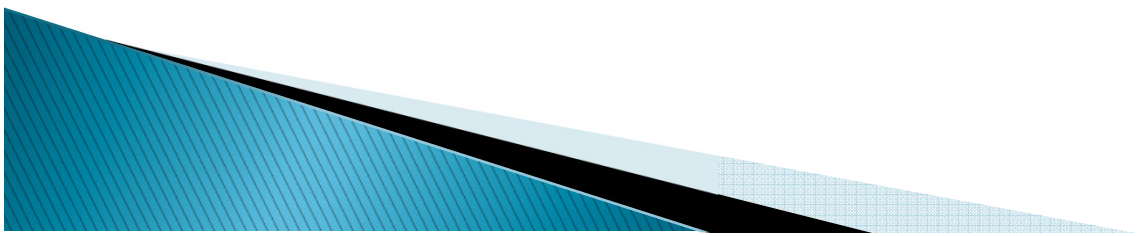


- Primary Questions – Facts, reasons
- Secondary Questions – Possible alternative, Selected alternative (proposed)
- Selected alternative
- Selected for development



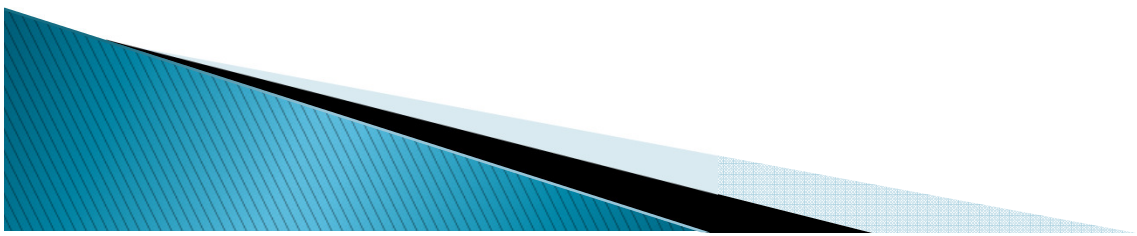
4.Development & Submit

- Technical feasibility & desirability
- Economics such as cost of implementations and expected savigs
- Human factors
- Practicability
- Accessibility to management under limitations imposed
- Training if needed



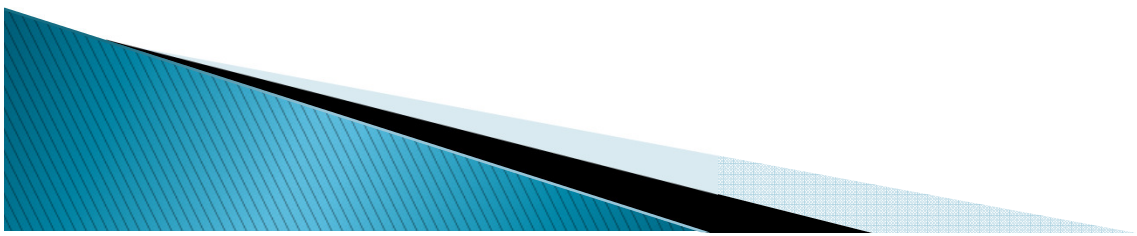
5.INSTALL

- Preparation
  - Plan
  - Arrange
  - Rehearsal
- Installation



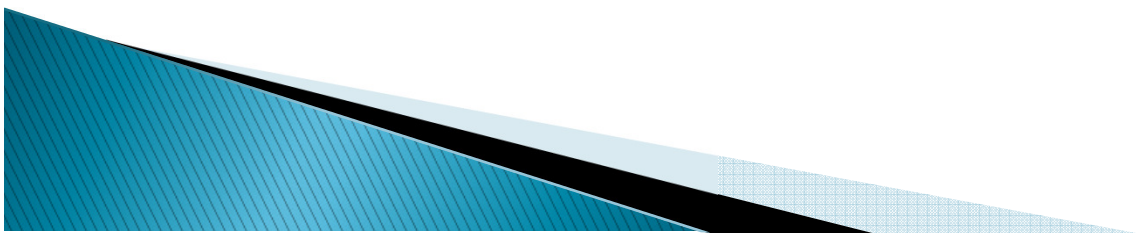
6.MAINTAIN AND REVIEW

- Systematic ad periodic checks
- Deviations to be observed
- Modify or elimination of deviations
- Alterations improvements
- Suggestions and innovations



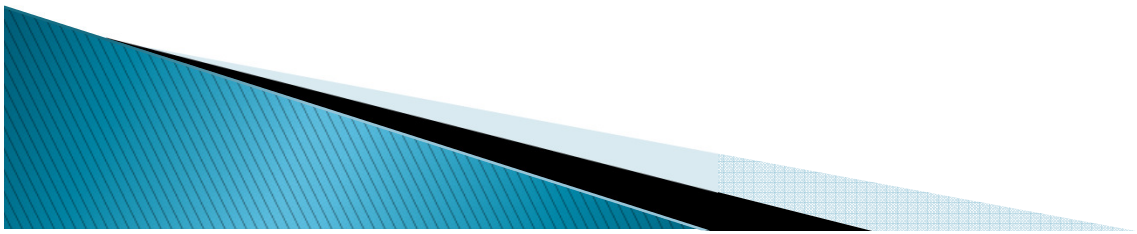
Production

- Transformation of raw materials into finished goods
- Can be increased by increased input.
- Not a measure of performance
- Not much effort required to achieve increased production



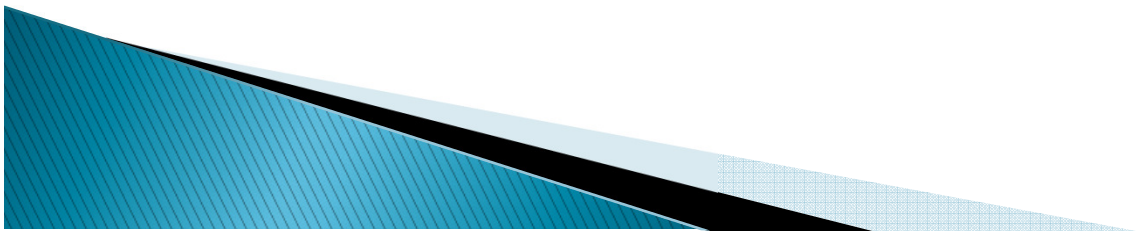
Productivity

- Ratio of output to input
- Output=final goods
- Input=resources
- Measure of performance



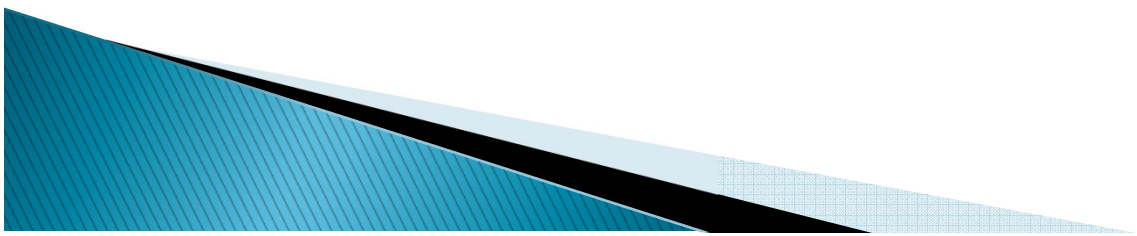
Why productivity measured

- To study performance of a system
- To attain a relative comparison of different systems for a given level.
- To compare actual to planned productivity



Types of productivity

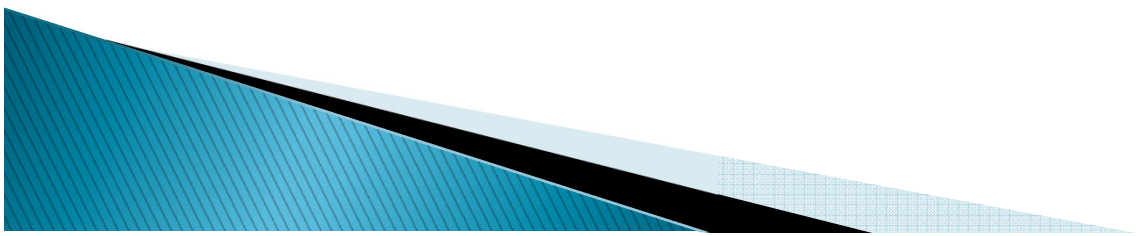
- Aggregate productivity
- a) total productivity
- b) total factor productivity
- c) return on investment.
- Partial productivity
- a) Labor
- b) Capital
- c) material



PRODUCTION Vs PRODUCTIVITY

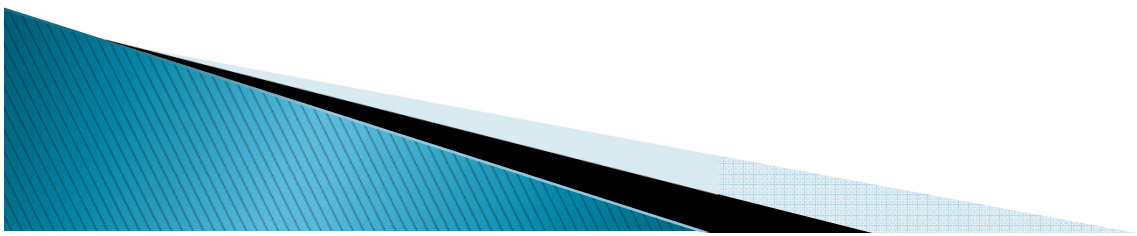
PRODUCTION	PRODUCTIVITY
1. Means output of goods or services.	Means effective utilization of resources.
2. It can, be increased by increasing men, material, machines etc.	It can be achieved by reducing wastage of material, man power and machine hours.
3. By increasing production cost of the product will remain same.	By increase in productivity cost of the product will come down.
4. It does not have impact on standard of living.	It certainly improves the standard of living.
5. It changes the raw material into finished product.	It is the ratio between output to input.

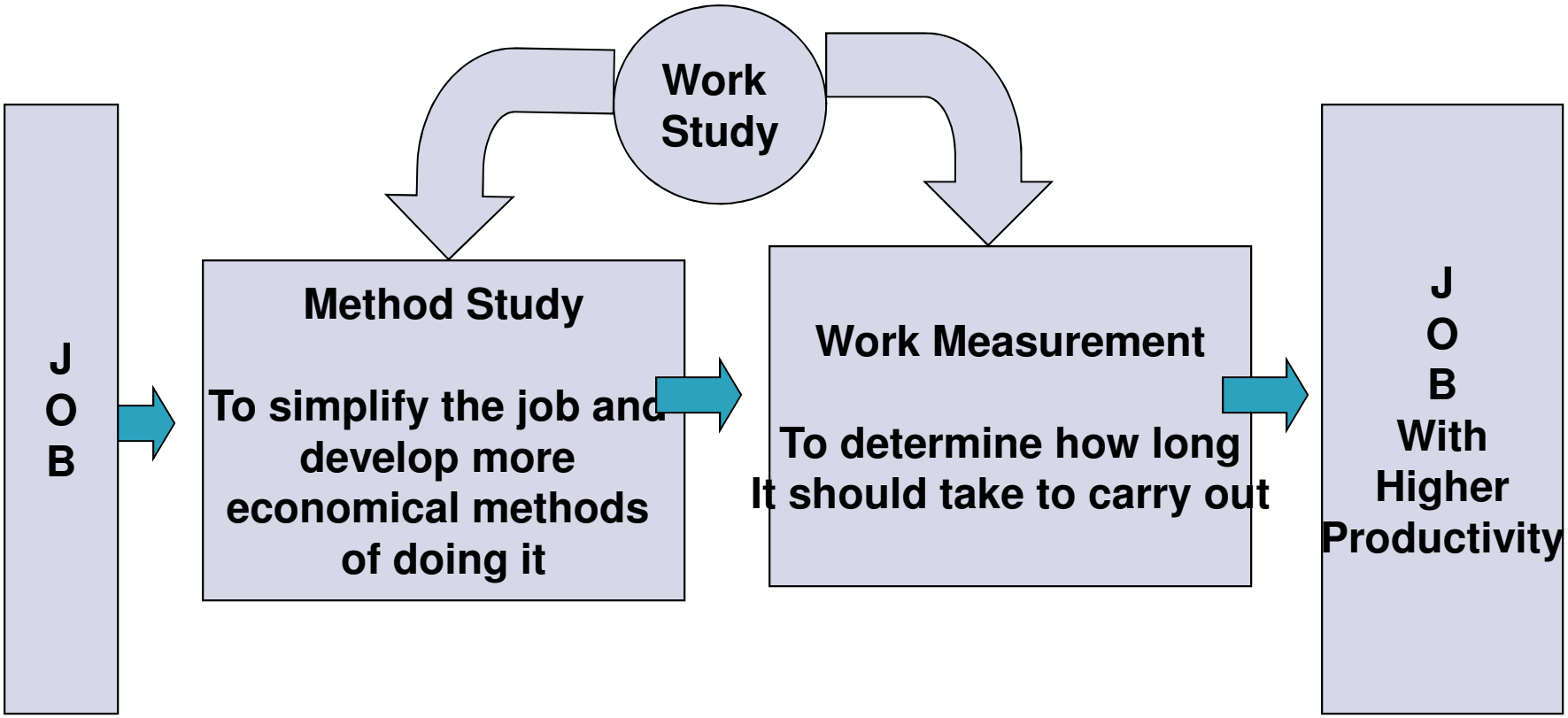
Work Measurement



Definition of Work Measurement

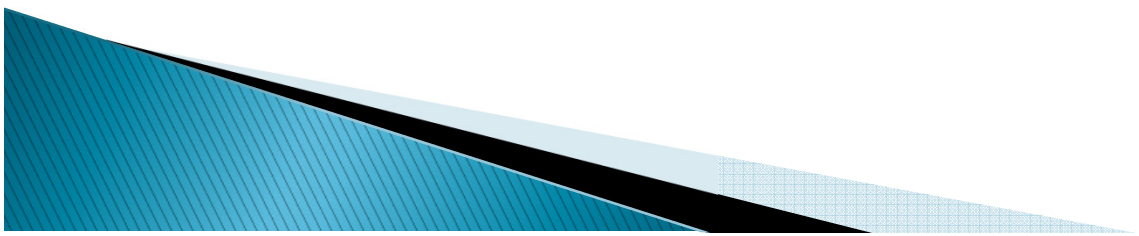
- It is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance.



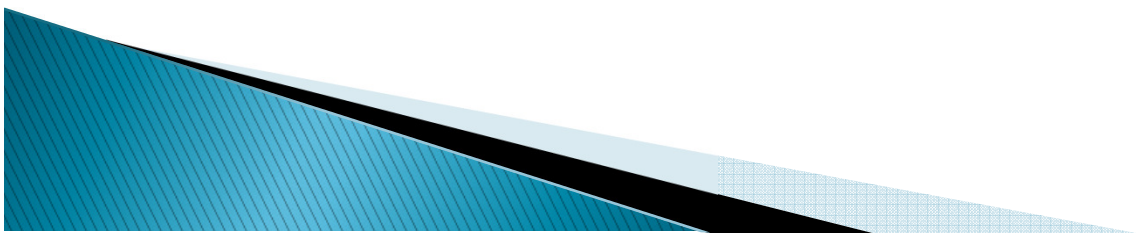

Work
Study
J
O
B
Method Study
To simplify the job and develop more economical methods of doing it
Work Measurement
To determine how long It should take to carry out
J
O
B
With
Higher
Productivity

Reduce Ineffective Time

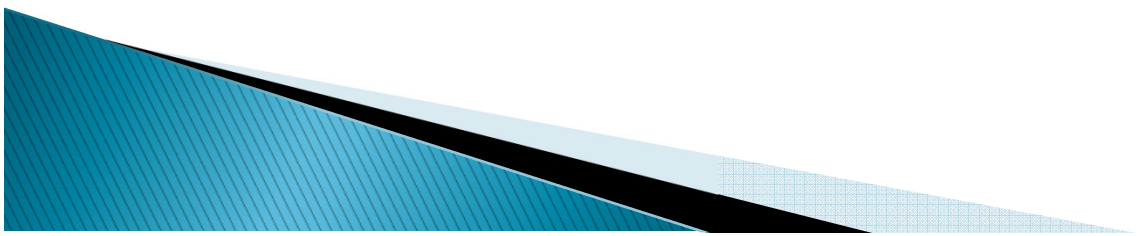
- Areas to cover:
  - Marketing policy
  - Standardisation
  - Product development
  - Production Planning and Control
  - Material Control
  - Planned Maintenance
  - Personnel Policy
  - Improved Working conditions
  - Operator Training
  - Incentive Schemes



- Cost: Low/Moderate
- How quickly can results be achieved?:May start slowly but effect grows quickly
- Extent of improvement in Productivity: Limited, but often of a high order

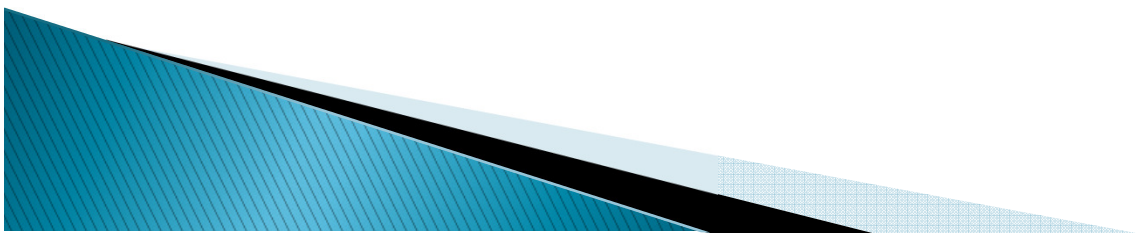


- The role of Work study: Work measurement: to investigate existing practice, locate ineffective time and set standards of performance as a basis for-
  - a) Planning and control
  - b) Utilisation of Plant
  - c) Labour cost control
  - d) Incentive Schemes



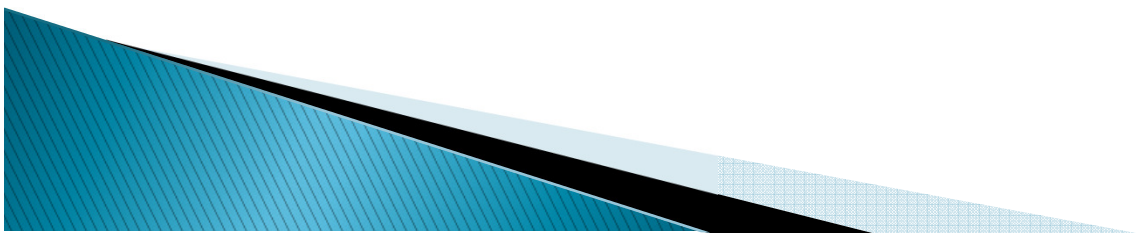
Prerequisites of conducting a Work Study

- Good human relations
  - Management
  - Supervisor
  - Worker
  - Work study man
- working conditions
  - Occupational Safety and Health
  - Fire prevention and Protection
  - Layout and House keeping
  - Lighting and Ventilation
  - Noise and vibration
  - Ergonomics
  - Arrangement of working time



Purpose of Work Measurement

- To evaluate Worker's performance
- To plan work-face needs
- To determine available capacity
- To determine price or cost of a product
- To compare work methods
- To facilitate operations

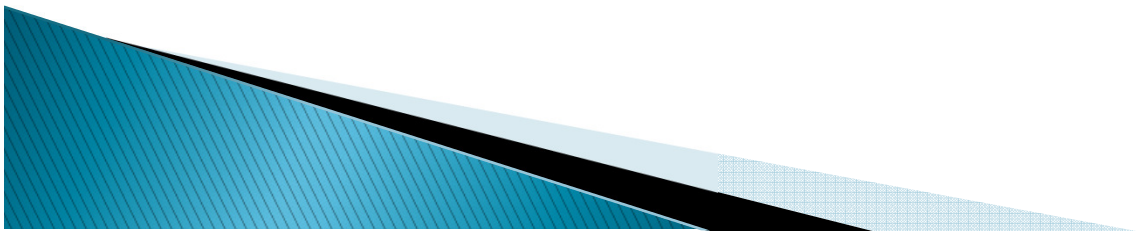


Work Measurement

- It is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance.

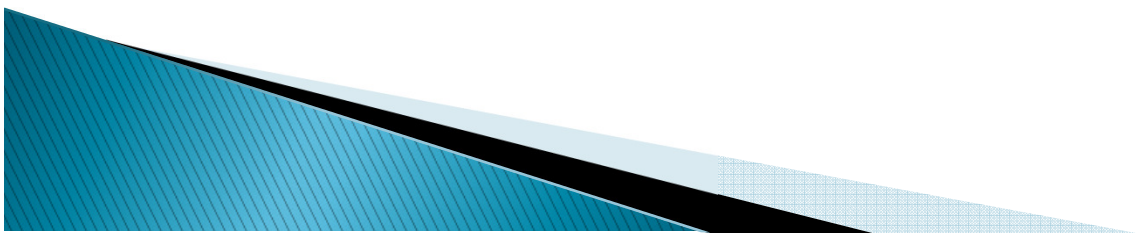
OBJECTIVES

- To evaluate the existence of ineffective time
- To evaluate a worker's performance
- To plan work-face needs
- To determine the available capacity
- To determine price and cost of a product
- To compare work methods
- To facilitate operations scheduling
- To establish wage incentive schemes



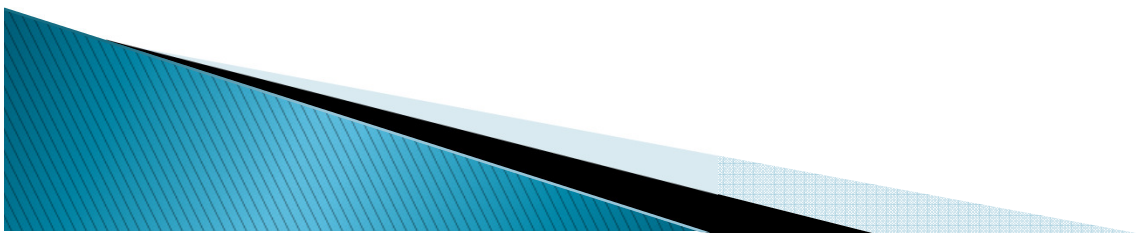
BASIC PROCEDURE

- SELECT
- RECORD
- EXAMINE
- MEASURE
- COMPILE
- DEFINE



TECHNIQUES OF WORK MEASUREMENT

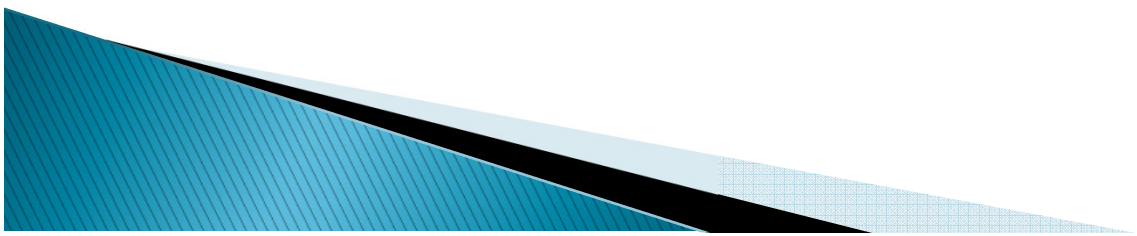
1. Time study technique.
2. Production study technique.
3 Analytical estimating techniques.
4. Activity/ work sampling.
5. Pre-determined time standard systems (PTS)



TIME STUDY

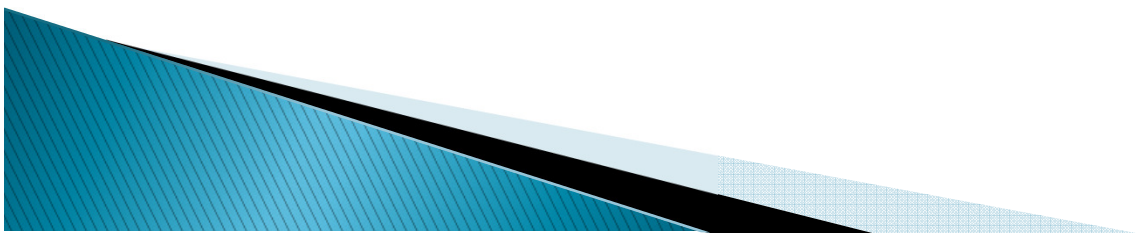
Definition

- It is a technique for determining as accurately as possible, the time required to carry out a specified task by a qualified worker at a defined level of performance.



TIME STUDY PROCEDURE

1. Identify the job to be time studied and the operation to be timed.
2. Obtain the improved procedure of doing the job from the method study department.
3. Select the worker for study.
4. Take the worker as well as shop supervisor into confidence and explain the objectives.
5. Collect the equipments and arrange machinery, jigs and fixtures, etc, required to conduct the time study and ensure their accuracy.
6. Explain to the worker the improved working procedure and use of tools to do the job.

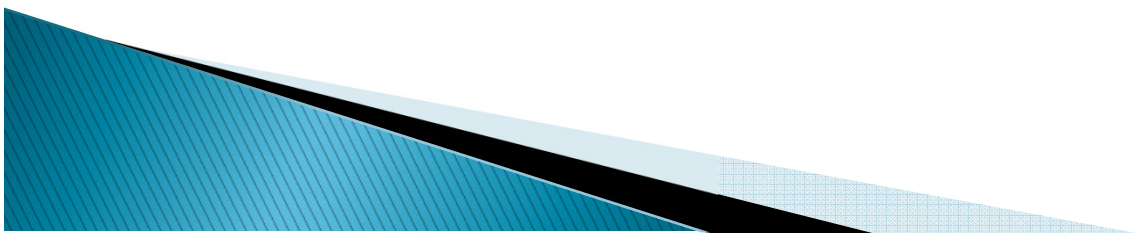


7. Break the job into operations and operations into elements and record. Separate constant elements from variable elements.
8. Determine number of observations to be timed for each elements.\
9. Conduct observations and record time.
10. Rate the performance of worker.
11. Repeat the steps above two for number of observations as determined in earlier steps.
12. Compute observed time from the measure central tendency.
13. Calculate the “normal time” from the observed time by using performance rating factor.
14. Add process allowance, rest and personal allowances to obtain “standard time”.

PROUCTION STUDY TECHNIQUE

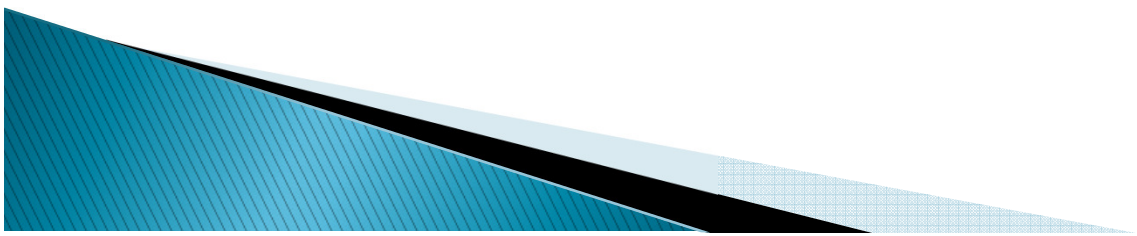
Definition

- It is defined as a continuous study of a relatively lengthy duration extending over a period of one or more shifts.
- It is undertaken with an object of checking the existing or proposed standard time on obtaining other information affecting the rate of output.



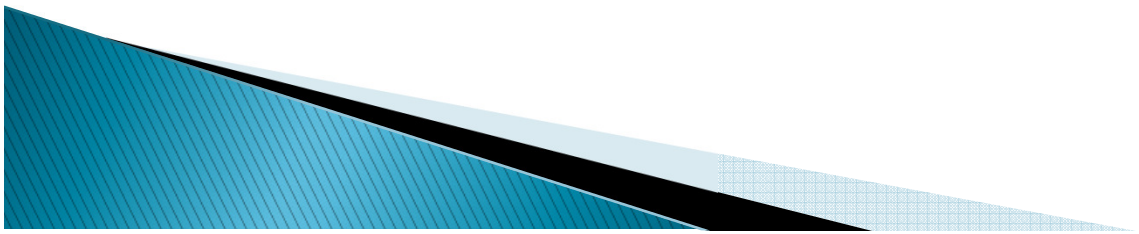
Criteria For Choosing Production Study

- When the job is performed by a group of persons.
- Where awarding of rating is not possible.
- When the process takes more than one shift.
- Where effective and ineffective are to be separated.
- Where ineffective time required to be segregated into avoidable and unavoidable.
- Where time can be converted into man minutes or man hours.



Advantages

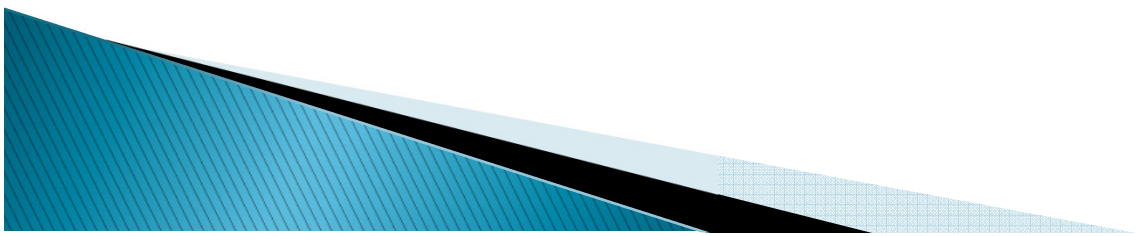
- To obtain a general picture of pre-incentive performance.
- To check output limit on specified item on section or machines.
- To check the corrective ness of standard or allowed time.
- To obtain data for contingency allowance etc.
- To check waiting time and bottlenecks in production.
- To obtain information about various allowances required.



Work Sampling Technique

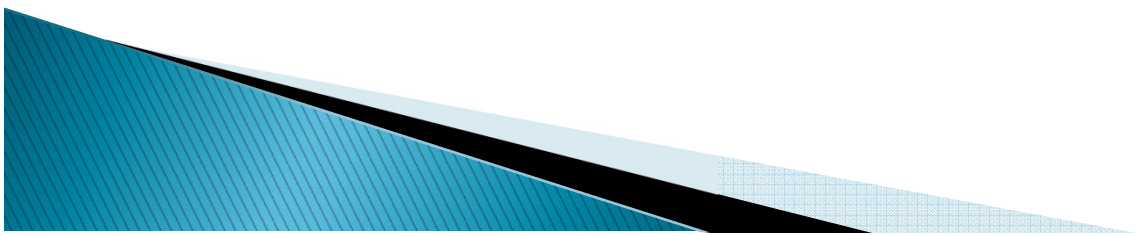
Objectives Of Work Sampling

- To evaluate the operating efficiency.
- To locate the causes of loss of efficiency.
- To reduce the idle time of men and machine.



PROCEDURE

- Classify the strength of activity design in a chart for recording information.
- Make a pilot study.
- From the pilot study made, compute delay/inefficiency percentage.
- Determine accuracy and confidence limit.
- Calculate the number of observations required for fixing the time.
- Plan the schedule of observations.
- Proceed with sampling of observations making note of unusual point if any
- Analyse the data obtained.

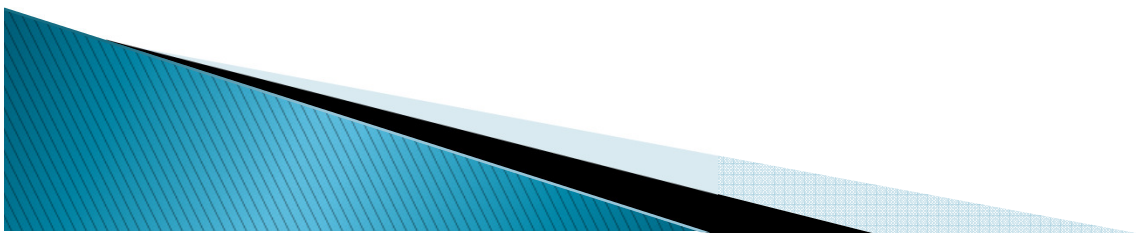


ADVANTAGES

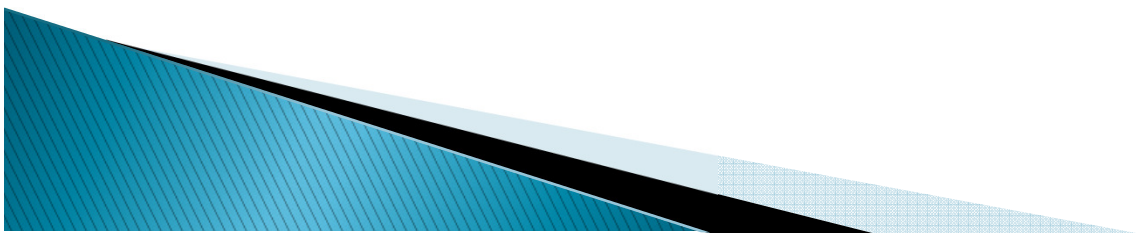
- Generally no equipment is required for gathering data.
- Trained persons are not required to collect the data.
- Study of the number of activities can be done simultaneously.
- Work sampling techniques are not expensive to undertake.
- When it is compared to production study, it is generally liked by workers as an observer does not confront the worker through the day.
- Study can be interrupted at any time without affecting the result.
- Operations which are difficult and expensive to be measured by time study can be subjected to the work sampling techniques.

Disadvantages

- It is not capable of giving elemental data.
- It is not economical for study of single operation or operator.
- When compared to stop watch study the statistical approval of work sampling is difficult to be understood by the worker as well as the management.

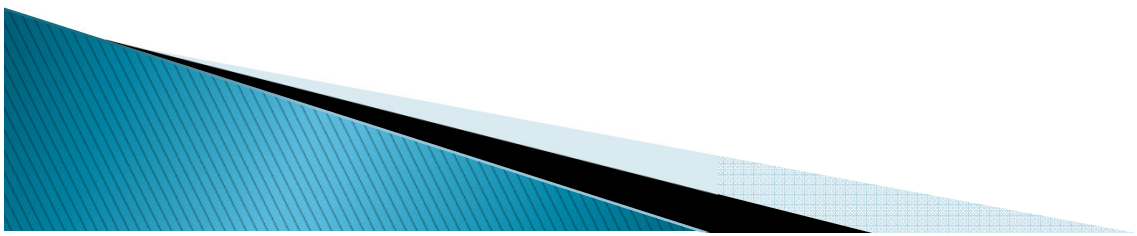


Analytical Estimating Technique (Standard Data)



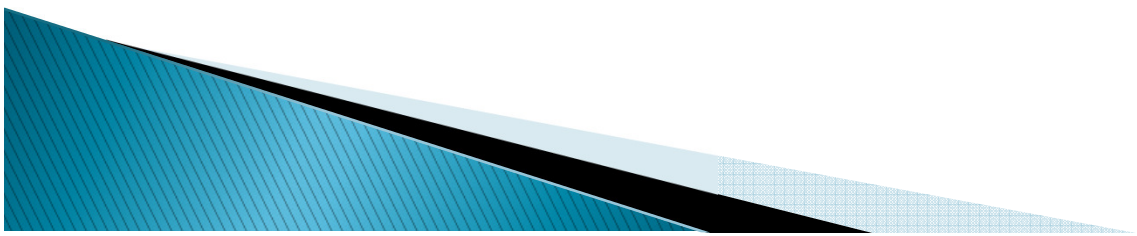
Introduction

- One the work measurement techniques even the time required to carryout the element of the job at defined level of performance is established from the knowledge and practical experience of the observer as far as elements are concerned .
- Almost similar to ‘time study technique’.
- The difference – the time for each element is estimated by an observer who is an expert having the knowledge and practical experience of the element concerned.



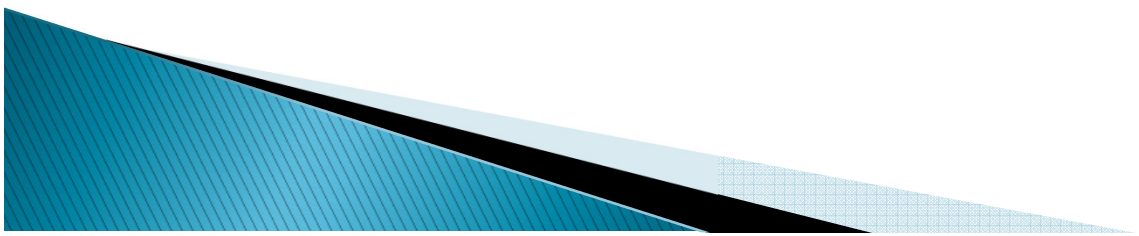
Applications

Most useful in engineering , construction work, erection work and Inspection.



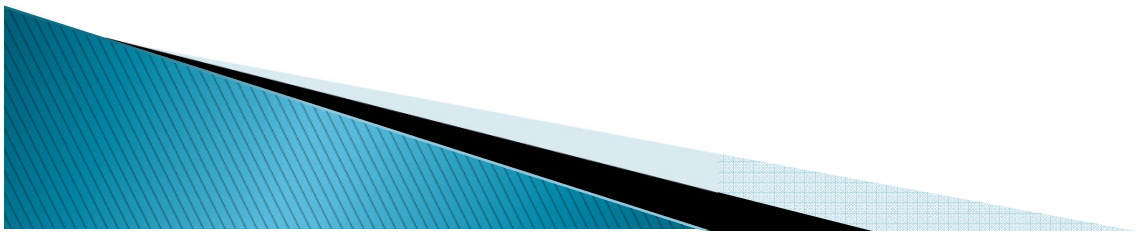
Procedure

1. Collect the full details of job.
2. Analyze the job into its constituents- elements, activity, grouping to enable synthetic data to be applied if relevant.
3. Apply systematic data and estimate basic time for the remaining elements and contingencies.
4. Apply appropriate relaxation allowance.
5. Verify the details of elemental data for job, its method and conditions.
6. Sum up total time and relaxation allowance, etc. to establish standard time form the job.



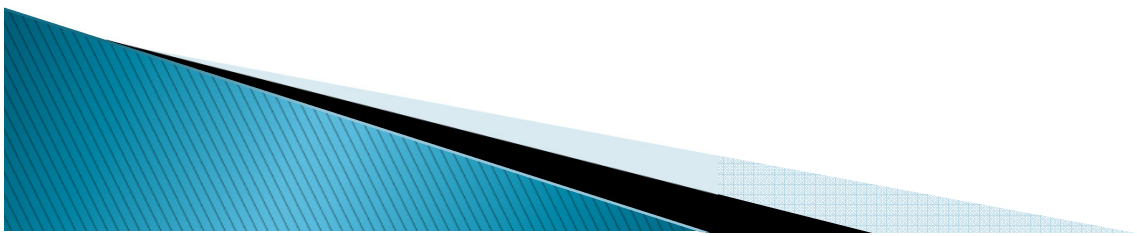
Advantages

- It possess almost the same advantages as enjoyed by synthesis of work measurement.
- It aids in planning and scheduling.
- It provides a basis for rate fixing for non-repetitive works in industries.
- It improves labour control.



Limitations

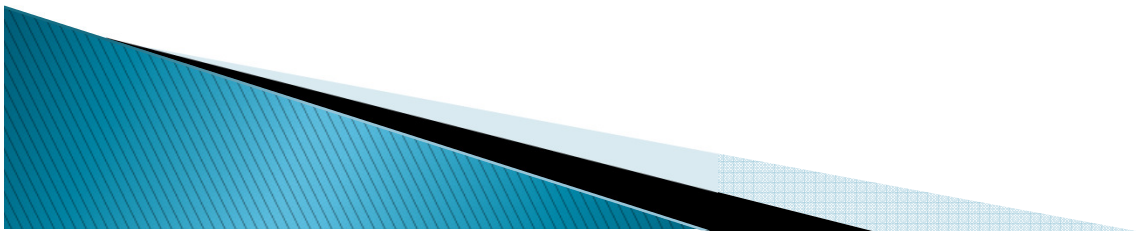
- Since analytical estimating relies upon the judgment of estimator, the time values obtained are not as accurate and reliable as estimated by other work measurement techniques.



Predetermined Time System (PTS)

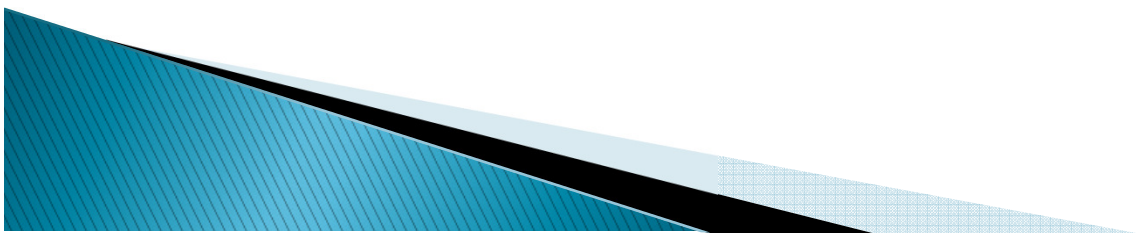
Introduction

- PTS –Pre-determined Time Study.
- Does not measure elements time by a stop watch and thus avoids the inaccuracies being introduced owing to the element of human Judgment.
- It is assumed that all manual tasks in industries are made up of certain basic human movements which one common to almost all jobs.
- The average time taken by the average qualified worker to perform a basic movement to practically constant.



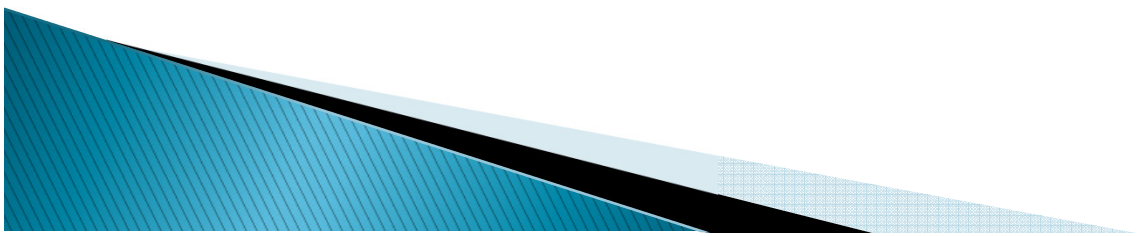
Definition

- A work measurement technique whereby the time is established for basic human motions (Classified according to the nature of the motion and the conditions under which it is made) are used to build up the time for a job at a defined level of performance.



Procedure

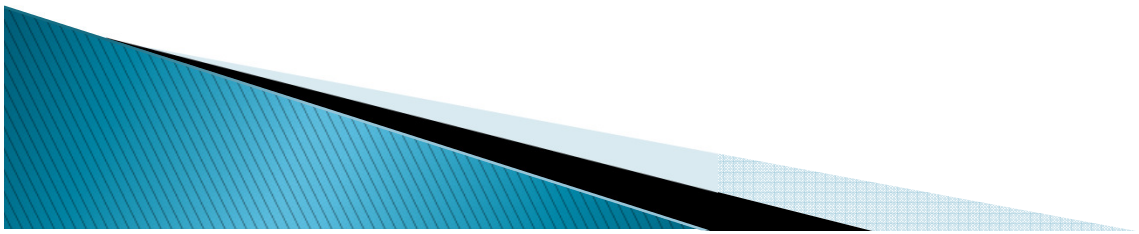
1. Select large number of workers doing variety of jobs under normal working conditions in the workshop.
2. The jobs selected are such that they involve most of the common basic motions and are worked under different set of conditions by workers having different ages and other characteristics.
3. Record the job operations on a movie film (Micro motion study).
4. Analyze the film, note down the time taken to complete each element and compile the data in the form of a table or chart.



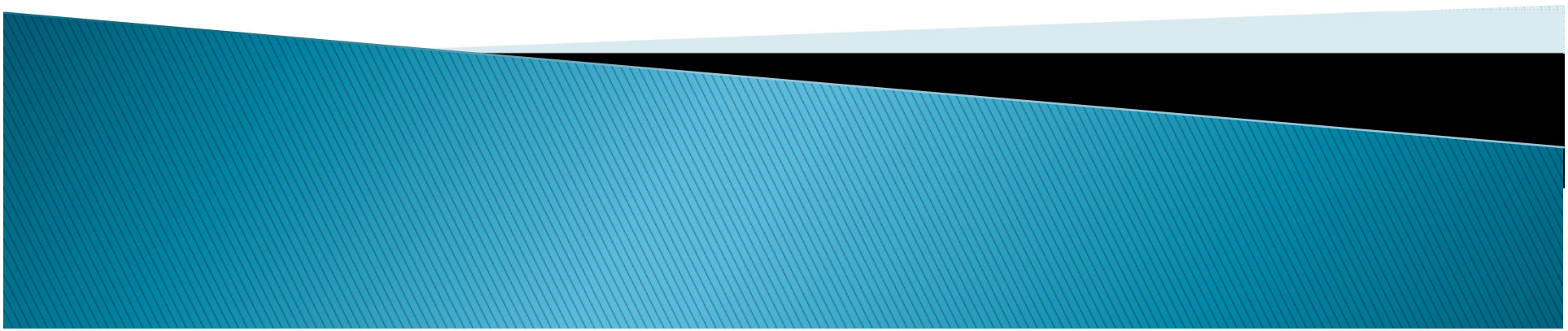
Advantages

- Eliminates in-accuracies associated with stop watch time study.
- Superior to stop watch time study when applied to short cycle highly repetitive operations.
- Time standard for a job can be arrived at without going to the pace of work.
- Unlike stop watch study, no rating factor is employed.
- PTS data is more reliable and accurate as compared to stop watch time study data.
- The time and cost associated with finding the standard time for a job is considerably reduced.

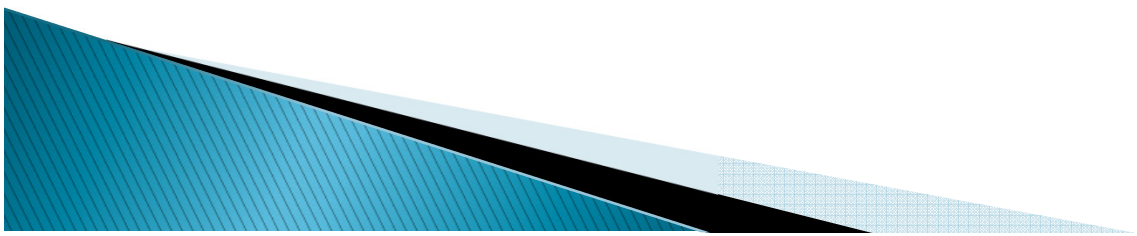
*



Project Management – Network Techniques

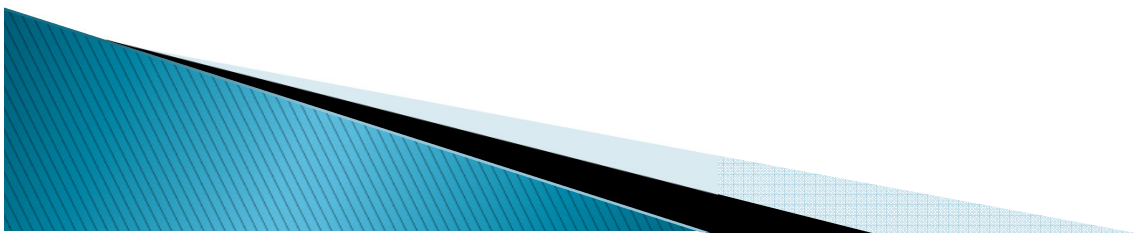


- Scope:
  - Meaning, Need
  - CPM, PERT
  - Practical problems
  - Finding out critical path/slack work sampling

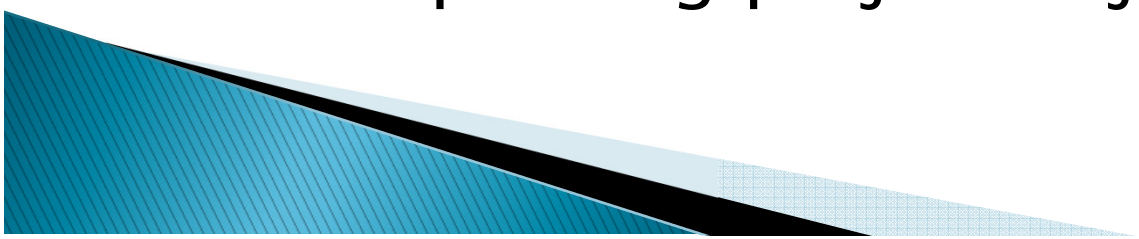


Project

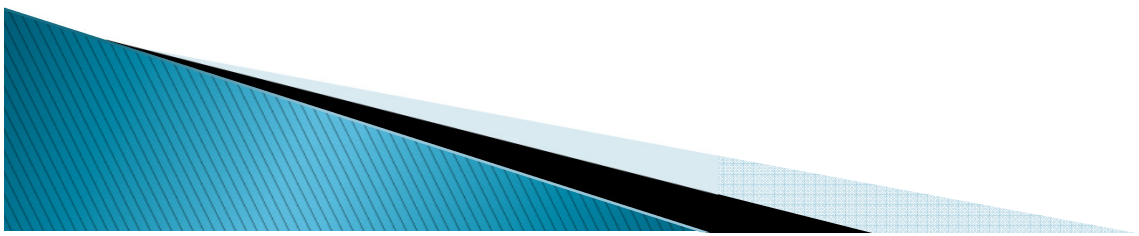
- “A project is a series of activities directed to accomplishment of a desired objective.”
- A project is composed of jobs, activities, functions or tasks that are related to the other in some manner, and all of these should be completed in order to complete the project.



- Every project has one specific purpose:-it starts at some specific moment and it is finished when its objectives have been fulfilled.
- For completion of a project, two basic things are required:
  - Material resources
  - Man power resources
- Availability, quality and use of human resources is a single determinant factor in accomplishing project objectives.

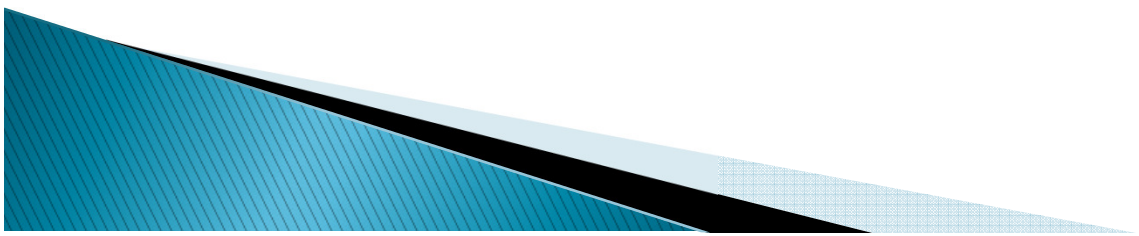


- **Management:**
  - While technology deals with material things, Management deals with both material things as well as human beings.
  - Management increases the productivity through technological innovation taking into account human factors involved in these advances.



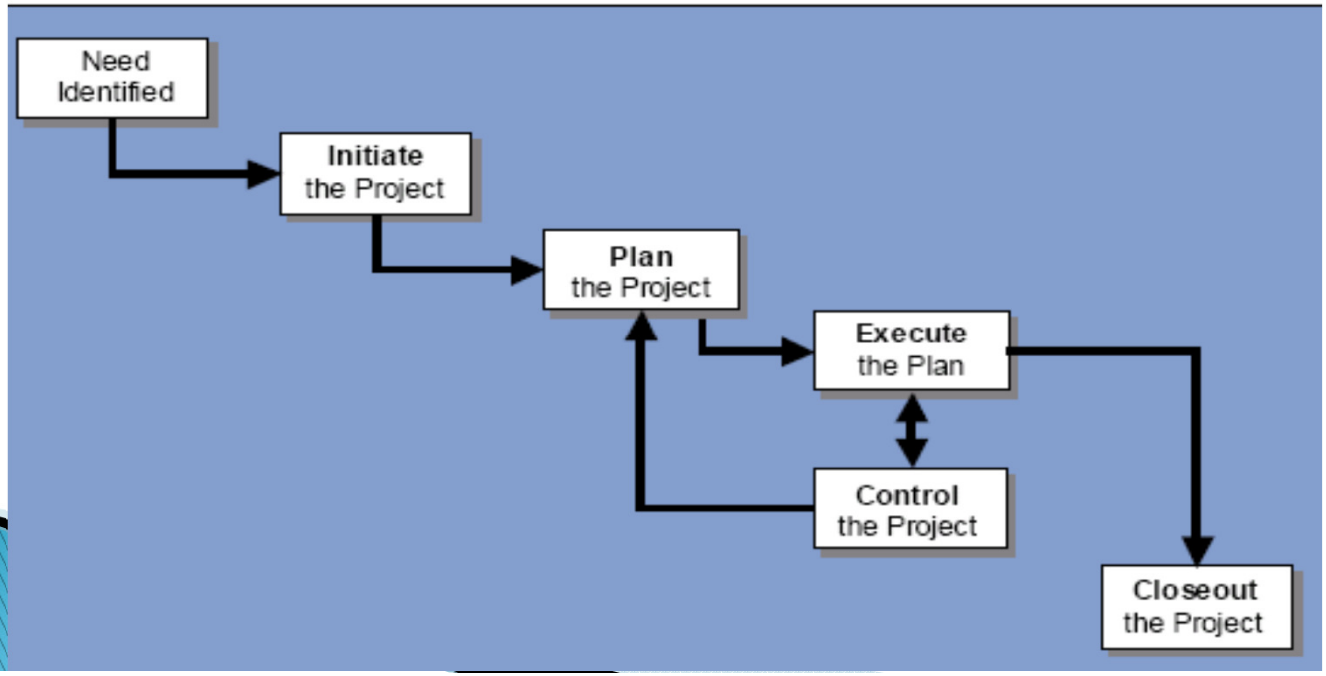
Objectives of a project

1. The project should be *completed with a minimum elapsed time.*
2. It should be available *more power and other resources as sparingly as possible*, without delay.
3. It should be completed with *a minimum of capital investment* without delay.



3 Phases of Project Management

1. Project Planning
2. Project Scheduling
3. Project Controlling



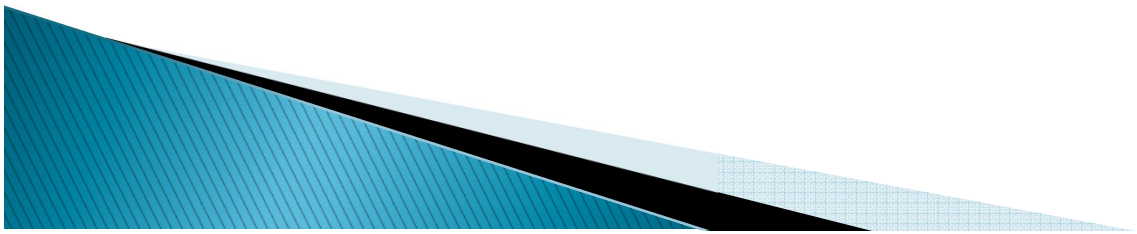
3 Phases of Project Management

Manager at all levels need improved techniques at all stages in a project to:

i. Define the work to be performed.
ii. Develop more realistic schedule and cost estimates based on resources planned to perform the work.
iii. Determine where the resources should be applied to achieve best time, cost and technical performance.
iv. Identify those areas developing potential delays or cost over runs, in time to permit corrective action.

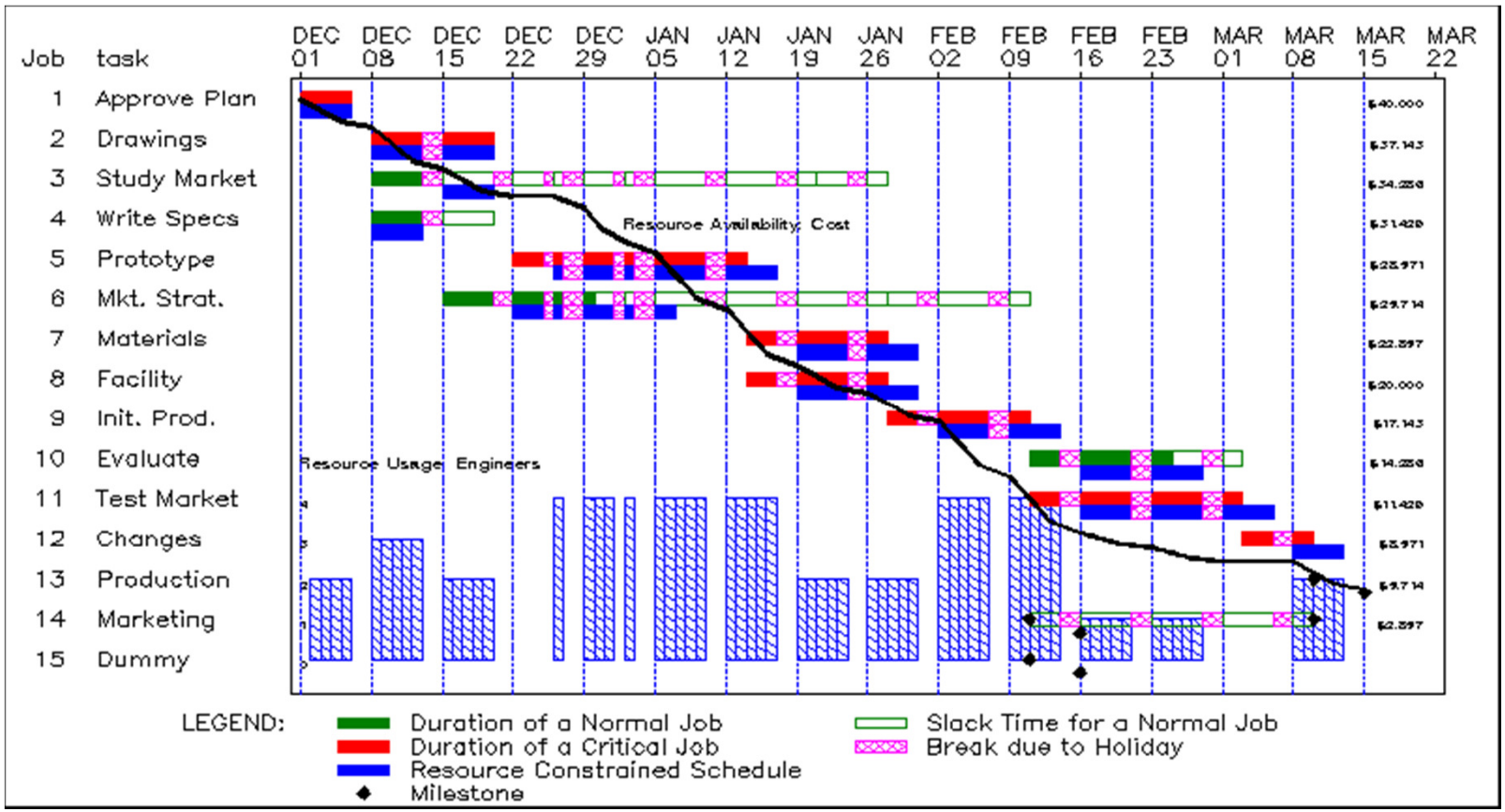
Techniques of Project Management

- Bar charts or Milestone Charts
- Network diagrams or techniques.



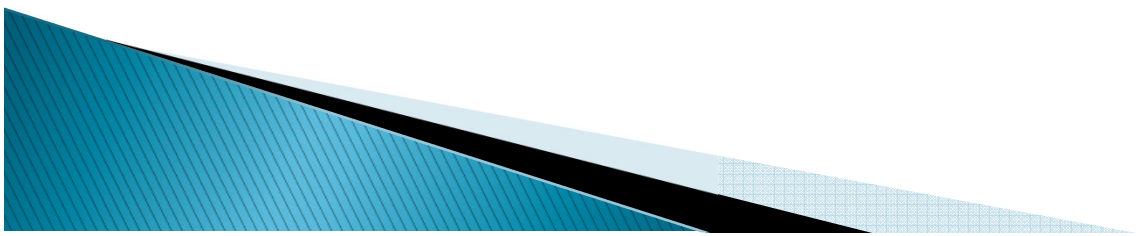
Bar Charts

- Bar charts are introduced by Henry Gannt Around 1900 AD.
- Bar charts represents pictorial representation in two dimensions of a project by breaking it down into a number of manageable units or activities for planning and control shown on one dimension or axis and the durations assigned to these activities on the other dimensions or axes.
- While a bar chart represents the activities, a mile stone chart represents the events which mark either the beginning or the end of an activity.


Job
task
DEC 01
DEC 08
DEC 15
DEC 22
DEC 29
JAN 05
JAN 12
JAN 19
JAN 26
FEB 02
FEB 09
FEB 16
FEB 23
MAR 01
MAR 08
MAR 15
MAR 22
1 Approve Plan
2 Drawings
3 Study Market
4 Write Specs
5 Prototype
6 Mkt. Strat.
7 Materials
8 Facility
9 Init. Prod.
10 Evaluate
11 Test Market
12 Changes
13 Production
14 Marketing
15 Dummy
Resource Availability Cost
Resource Usage: Engineers
$40.000
$37.143
$34.286
$31.429
$28.571
$25.714
$22.857
$20.000
$17.143
$14.286
$11.429
$8.571
$5.714
$2.857
LEGEND:
Duration of a Normal Job
Duration of a Critical Job
Resource Constrained Schedule
Milestone
Slack Time for a Normal Job
Break due to Holiday

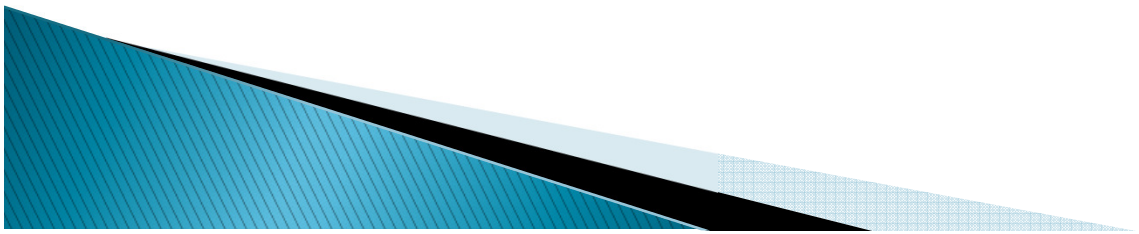
Network Technique

- Network diagram is an outcome of the improvements in the milestone charts.
- This technique is based on the basic characteristics of all projects, that all work must be completed in well defined steps.
- The network technique exploits this characteristics by representing the steps of the project objective graphically in the form of a ‘network’ or ‘arrow’ diagram.



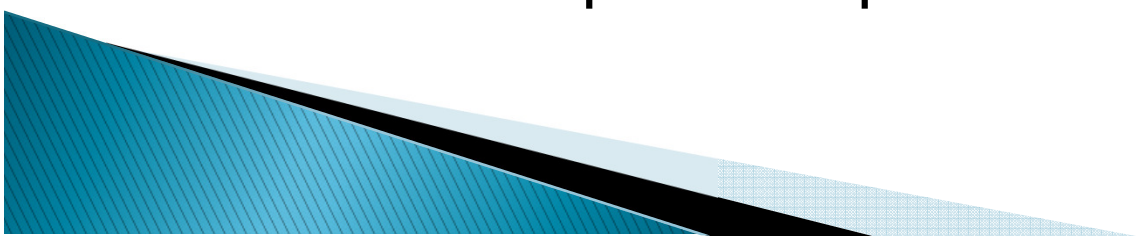
2 kinds of Network Systems

- PERT – Programmed Evaluation and Review Technique.
- CPM – Critical Path Method.



PERT – History

- PERT was developed by the US Navy for the planning and control of the Polaris missile program and the emphasis was on completing the program in the shortest possible time.
- In addition, PERT had the ability to cope with uncertain activity completion times (e.g. for a particular activity the most likely completion time is 4 weeks but it could be anywhere between 3 weeks and 8 weeks).
- USED IN : Project management – for non-repetitive jobs (research and development work), where the time and cost estimates tend to be quite uncertain. This technique uses probabilistic time estimates.

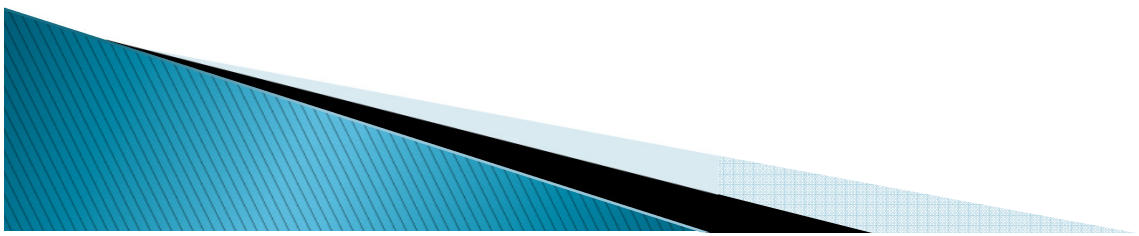


CPM – History

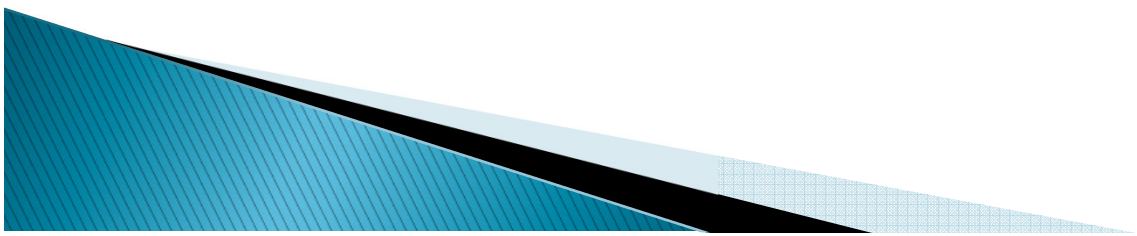
- CPM was developed by Du Pont and the emphasis was on the trade-off between the cost of the project and its overall completion time.
- e.g. for certain activities it may be possible to decrease their completion times by spending more money – how does this affect the overall completion time of the project?.
- USED IN : Production management – for the jobs of repetitive in nature where the activity time estimates can be predicted with considerable certainty due to the existence of past experience.

PERT

- PERT uses a network diagram consisting of events which must be established to reach project objectives.
- An event is that particular instant of time at which some specific part of a plan is to be achieved.
- PERT uses event oriented network diagrams in which successive events are joined by arrows (→).



- PERT system is preferred for those projects or operations which are **non-repetitive nature** or those projects in which precise time determination for various activities cannot be made.
- In such projects, managements cannot be guided by the past experience. They are referred to as ‘once through’ operations or projects.

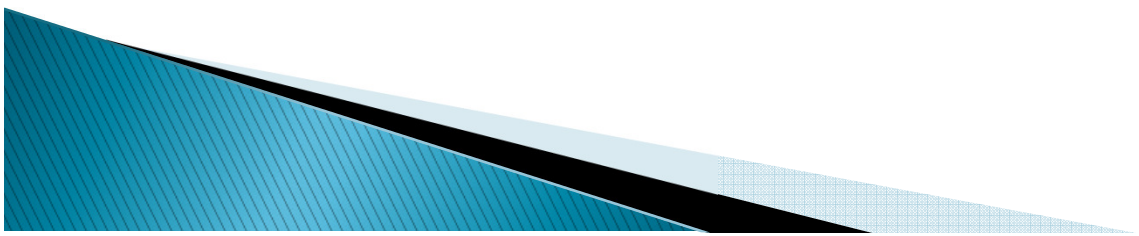


CPM

- In this, the whole project consists of a number of clearly recognizable jobs or operations, called activities.
- Activities are usually operations which take time to carry out, and on which resources are expanded. Functions of two activities are termed as 'Events'.
- The CPM networks are often referred to as 'activity oriented diagrams in which each activity is represented by an arrow, and the sequence in which the activities are performed is shown by the sequence of the arrows.
- CPM network are generally used for **repetitive type projects,** or for those projects for which fairly accurate estimate of time for completion of each activity can be made; and for which cost estimations can be made with fair degree of accuracy.

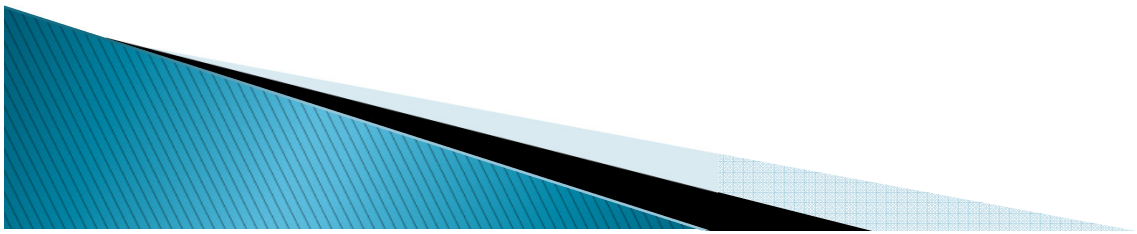
Elements of Networks

- Network technique is one of the most modern tools of project management. It is always possible to break up the entire project into a number of distinct, well defined jobs or tasks (called activities).
- The beginning or end of each such activity constitutes an event of the project. A network is a flow of diagram consisting of activities and events, connected logically and sequentially. In the network diagram, an activity is represented by arrow (→) while events are represented by circles (O).



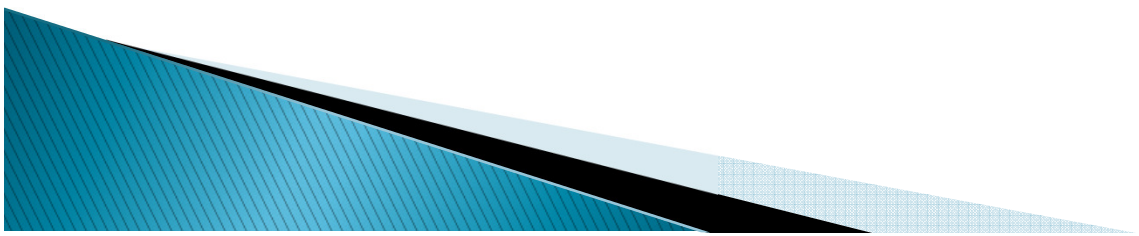
Activity

- An activity is the actual performance of a task.
- It is the work required to complete a specific event.
- An activity is a recognisable part of a work project that requires time and resources for its completion.



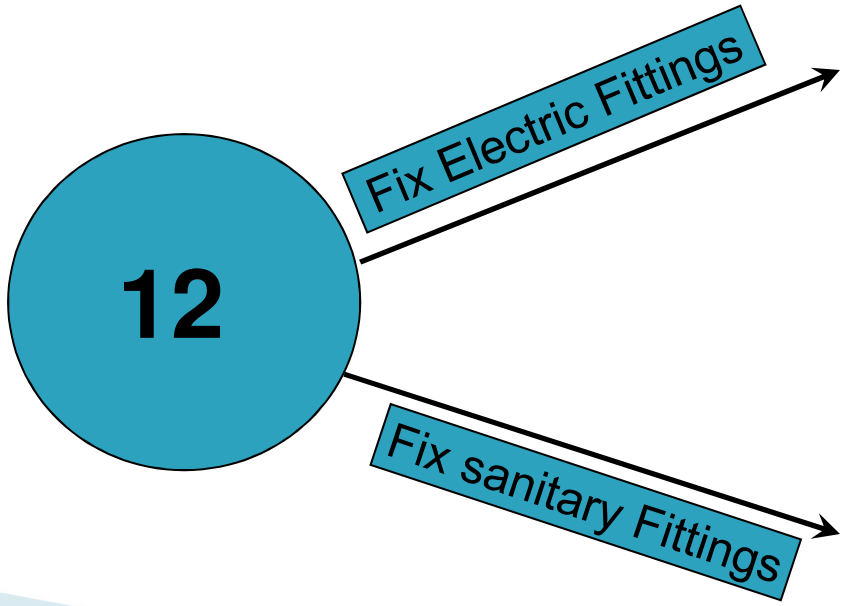
Kinds of Activity

- A project may consist of a number of activities or jobs.
- Depending upon the interdependency, we can categorise activities as:
  - Parallel activities
  - Serial Activities
- Further activities can be classified as
  - Proceeding activity
  - Succeeding activity
  - Dummy Activity



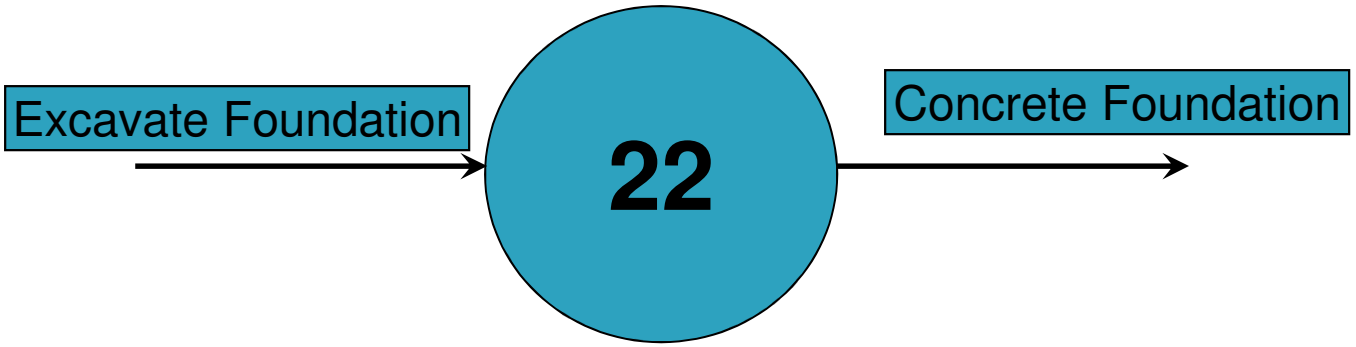
Parallel Activities

- Those activities which can be performed simultaneously and independently to each other are known as parallel activities



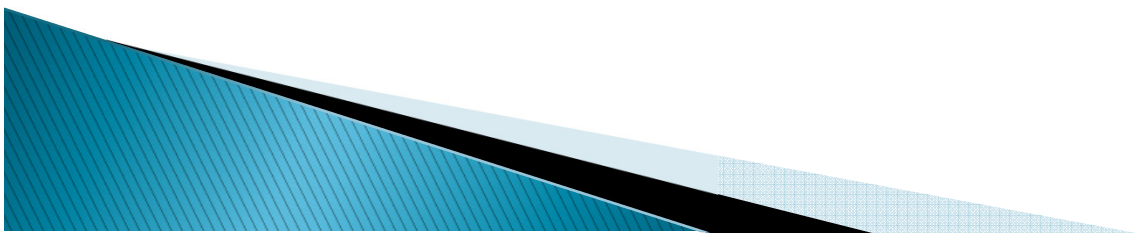
Serial Activities

- Serial activities are those which are to be performed one after other in succession. These activities cannot be performed independently to each other.



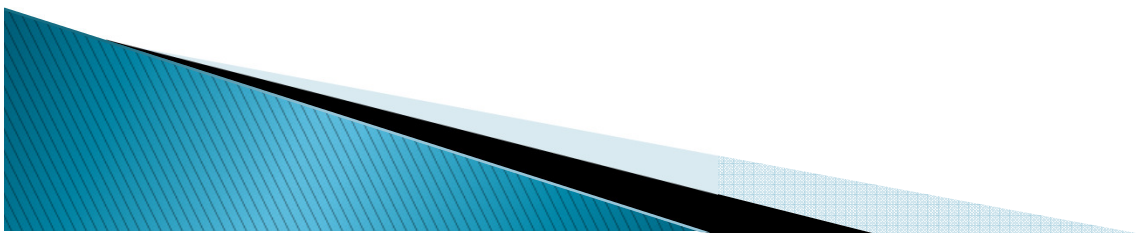
Predecessor Activity

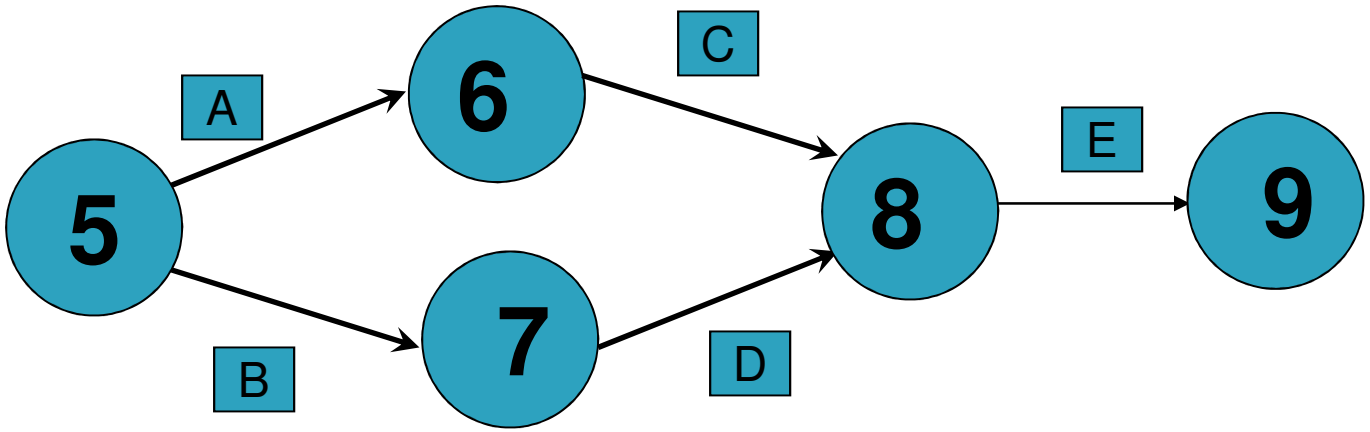
- Activity or activities that are required to be performed before another job or activity can begin are called Predecessor activities to that activity.



Successor Activity

- Activity or activities that can be performed after the performance of other activity are known as Successor activities.

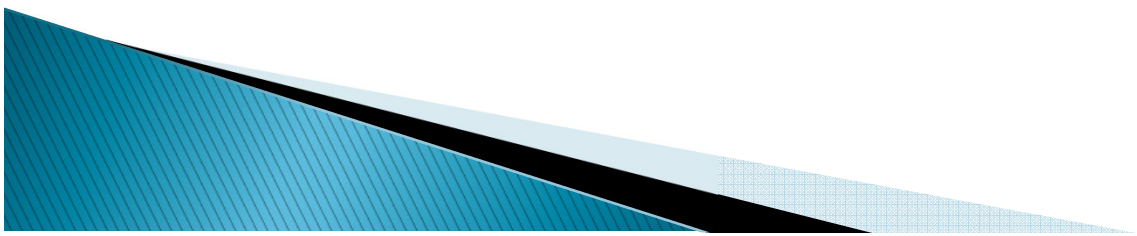


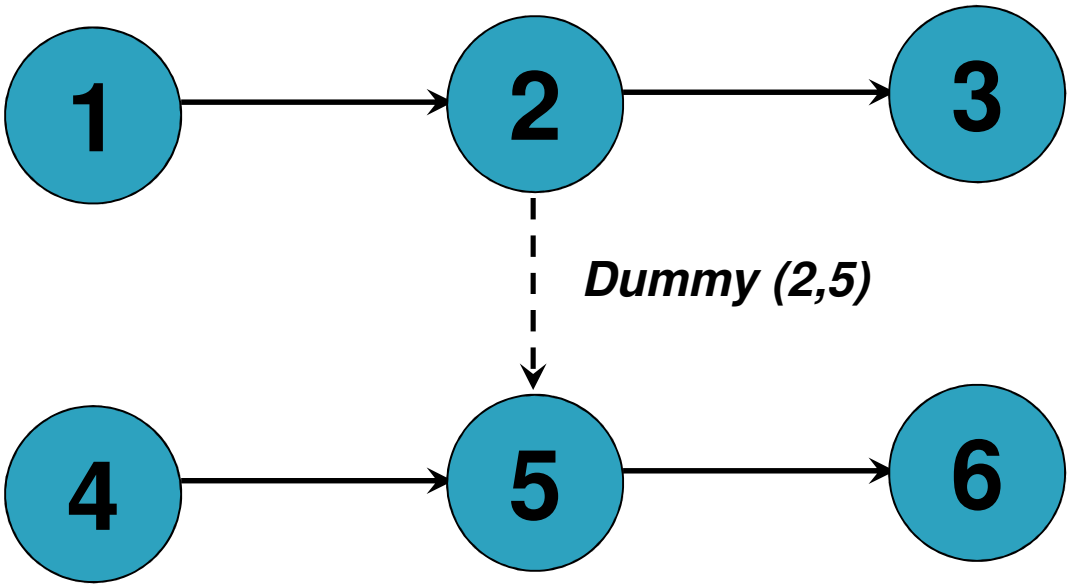


Activity	Predecessor	Successor
A	-	C*; E
B	-	D*; E
C	A*	E*
D	B*	E*
E	A; C*; B; D*	-

Dummy Activity

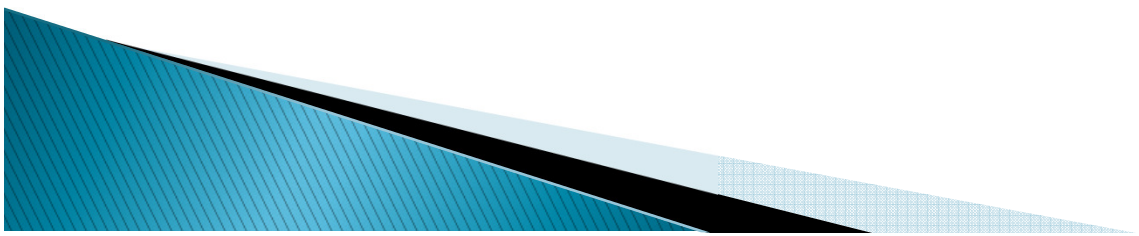
- A dummy activity is a type of operation in the network which neither requires any time nor any resources, but is merely a device to identify a dependence among operations.
- A dummy is a connecting link for control purposes or for maintaining uniqueness of activity.




1
2
3
Dummy (2,5)
4
5
6

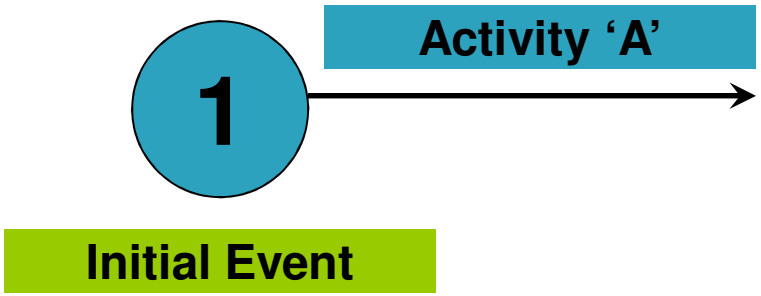
Event

- The commencement of completion of an activity is called an event.
- An event is that particular instant of time at which some specific part of a plan has been or is to be achieved.

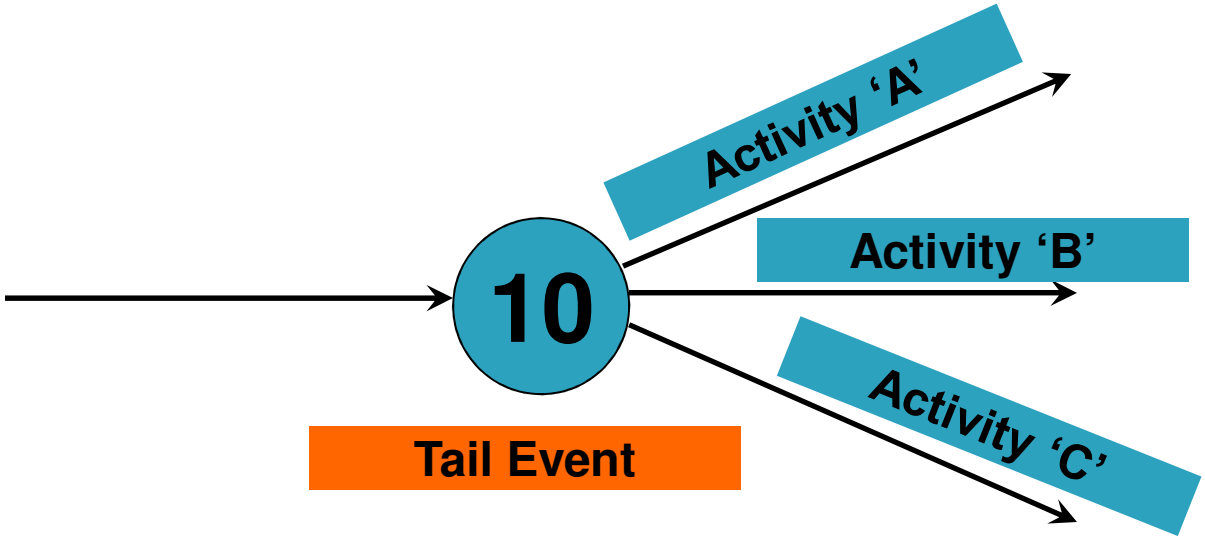


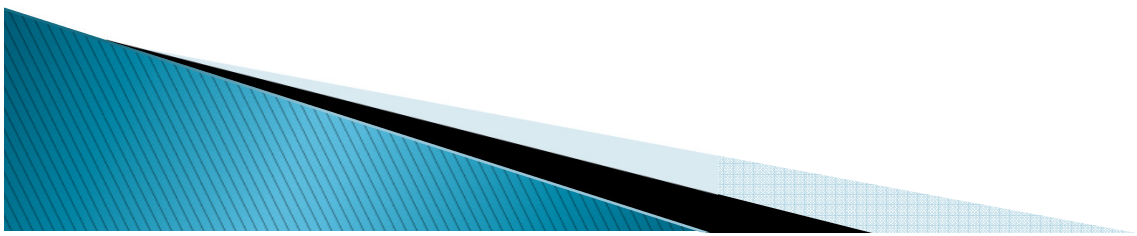
Types of Events

- Initial Event:
  - Initial event is the event which indicates the commencement of project.



- Tail Event:
  - A tail event is the one which marks the beginning of an activity.






Thank You