



Industrial Engineering I

Chapter 1

Introduction to Industrial Engineering



1.1 Definition

- Fierce **Competition** in Economy.
- Customers **demands** are rising.
- **Challenge** for industries to produce goods of **right quantity, quality, in time** and at **minimum cost**.
- **Industrial Engineering** plays a pivotal role in meeting these challenges.
- We have **various techniques** in Industrial Engineering to analyse and improve the work methods, to eliminate waste, proper allocation and utilization of resources.



1.1 Definition

- American Institute of Industrial Engineers (AIIE) defines Industrial Engineering as follows;
- *Industrial Engineering is concerned with the design, improvement and installation of integrated system of men, materials and equipment. It draws upon specialized knowledge and skills in the mathematical, physical sciences together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results to be obtained from such system.*



1.1 Definition

- The prime objective of industrial engineering is;
 - 1- To increase the productivity.
 - 2- Eliminating waste and non-value added activities.
 - 3- Improving the effective utilization of resources.



1.2 History & Development

- It is linked with industrial revolution and passed through many phases to reach present advanced stage.
- **Frederick Taylor** is named as father of scientific management and industrial engineering.
- But before Frederick Taylor, **Adam Smith** gave concept of Division of Labour through his book *The Wealth of Nations*.
- Also **James Watt, Boulton, Mathew and Robinson** obtained a place in the history of Industrial Engineering because of their work related with improvements in the **performance of machines and industries**.



1.2 History & Development

- Period between **1882-1912** was the critical period in the history of Industrial Engineering. **Important works** during this period are;
- Factory system, Owner, Engineer and Manager concept.
- Equal work, equal pay and incentives.
- Scheduling and Gantt Charts.
- Engineers interest in cost control and accounting.



1.3 Contributions to Industrial Engineering

1. **Adam Smith (1776)**: through his book titled Wealth of Nations laid foundation to **scientific manufacturing**. Through his concept of division of labour which included the skill development, time savings and the use of specialized machine was able to influence.
2. **James Watt (1864)**: Steam Engine advanced the use of mechanical power to increase productivity.
3. **Charles Babbage** worked on the same line as Adam Smith.



1.3 Contributions to Industrial Engineering

- 4- **Frederick Taylor (1859-1915)**: was a mechanical engineer and initiated investigations of better work methods and develop an integrated theory of management principles and methodologies. He proposed following actions;
- Data Collection and standards for workers.
 - Scientifically training of workers.
 - Cooperation between management and labour for better production.
 - Divide work between management and labour and assigning to those who are best suited.



1.3 Contributions to Industrial Engineering

- 5- **Henry L. Gantt (1993)**: His contributions are;
 - Work in the area of motivation field, development of task and bonus plan.
 - Measurement of management results by Gantt Charts.
 - Recognition of social responsibility of business and industry.
 - Advocated training of workers by management.
- 6- **Frank and Lillian Gilbreth (1917)**: developed method study as a tool for work analysis.
 - He developed micro-motion study, a breakdown of work into fundamental elements called therbligs.



1.3 Contributions to Industrial Engineering

- 7- **Harrington Emerson(1913)**: Developed his managerial concepts simultaneously with Taylor, Gantt and Gilbreth.
 - Amongst his contributions is the Emerson's Efficiency Bonus Plan, an incentive plan which guarantees the base day rate and pays a graduated bonus.
 - He also proposed twelve principles of efficiency.
- 8- **L.H.C Tippet (1937)**: Developed the concept of work sampling to determine the equipment and manpower utilization and setting performance standards for long cycle, heterogeneous jobs involving team work.



1.4 Activities of Industrial Engineering

- The primary activities as spelled out by AIIE are;



1.5 Industrial Engineering Approach

- In carrying out various activities, the industrial engineer;
- Gathers and analyses facts.
- Prepares the alternative solutions taking in to consideration all the constraints both internal and external.
- Selects the best solution for implementation.



1.5 Industrial Engineering Approach

- At problem identification/definition stage following steps must be taken;
 - 1- All the facts about the operation are collected and recorded using various recording techniques like charts, diagrams or models.
 - 2- Critical Examination of all facts by asking series of questions.
 - 3- Alternative ways are found by techniques like brainstorming.
 - 4- based upon the criteria fixed for evaluation, the best alternative is selected.



1.6 Objectives of Industrial Engineering

- The basic objectives of Industrial Engineering departments are;
 - 1- To establish methods for improving the operations and controlling the production costs.
 - 2- To develop programmes for reducing these costs.



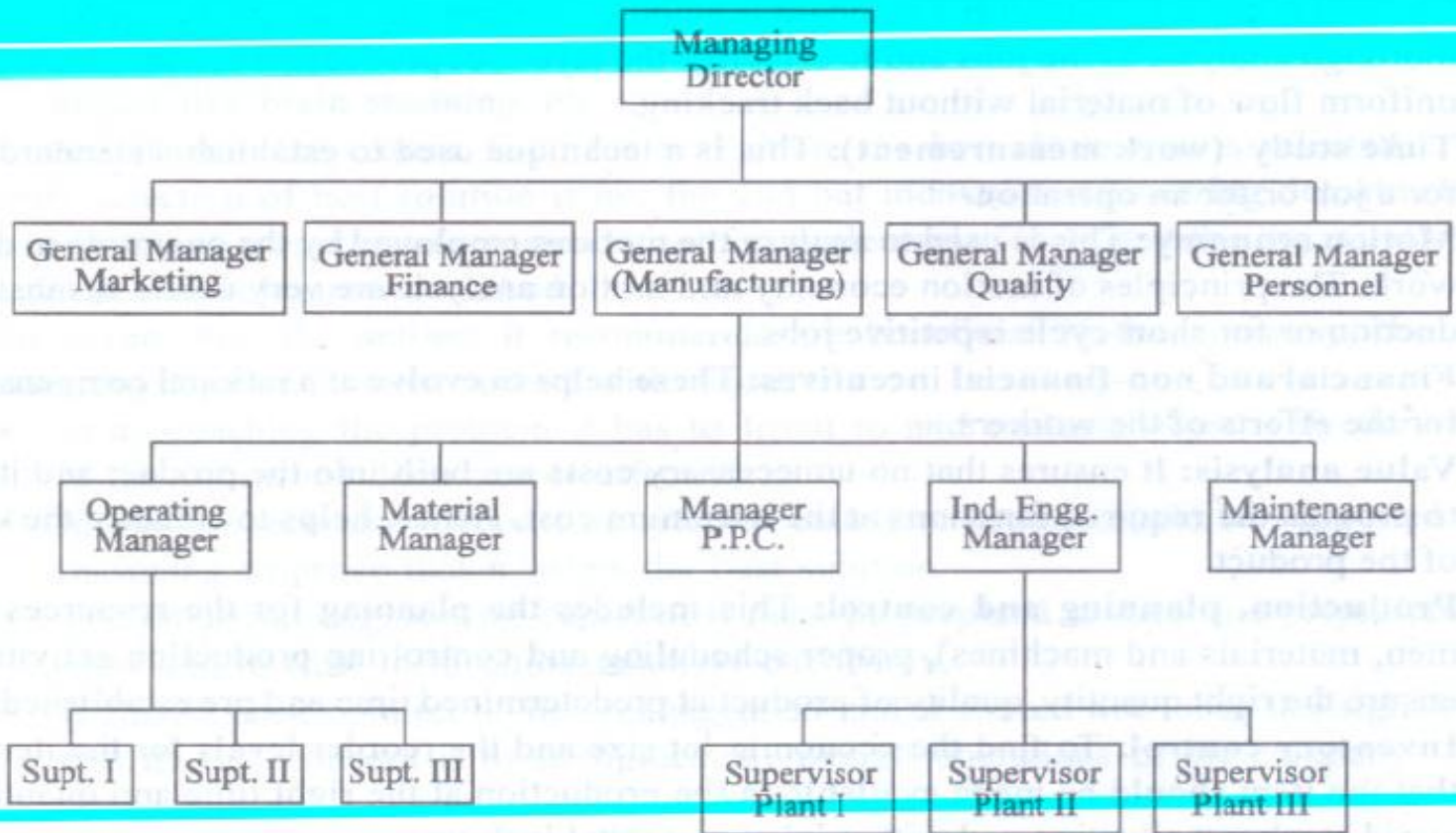
1.7 Functions of An Industrial Engineer



1.8 Techniques of Industrial Engineering

- Following tools and techniques are used to improve productivity of the organization by optimum utilization of resources.
 - 1- Method Study.
 - 2- Time Study (Work Measurement).
 - 3- Motion Economy.
 - 4- Financial and Non Financial Incentives.
 - 5- Value Analysis.
 - 6- Production, Planning and Control.
 - 7- Inventory Control.
 - 8- Job Evaluation.
 - 9- Material Handling Analysis.
 - 10- Ergonomics (Human Engineering).
 - 11- System Analysis.
 - 12- Operations Research Techniques.

1.9 Place of Industrial Engineering in Organization





1.10 Industrial Engineering in Service Sector

- Large number of industrial engineers are in demand and attracted to careers in exciting, challenging and rewarding new fields.
- The various service industries are;
 - 1- Health Service.
 - 2- Government Organizations.
 - 3- Banking.