INDUSTRIAL ENGINEERING AND MANAGEMENT

CHAPTER ONE : INTRODUCTION

BME III/II

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Lecture overview

- **Historical Development**
- **System Concept**

1.Historical development

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 people, materials, equipment and energy. It draws upon specialized knowledge and skill in the mathematical, physical and social sciences together with the principles and method of engineering analysis and design, predict and evaluate the results obtained from such systems.

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.Historical 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*.

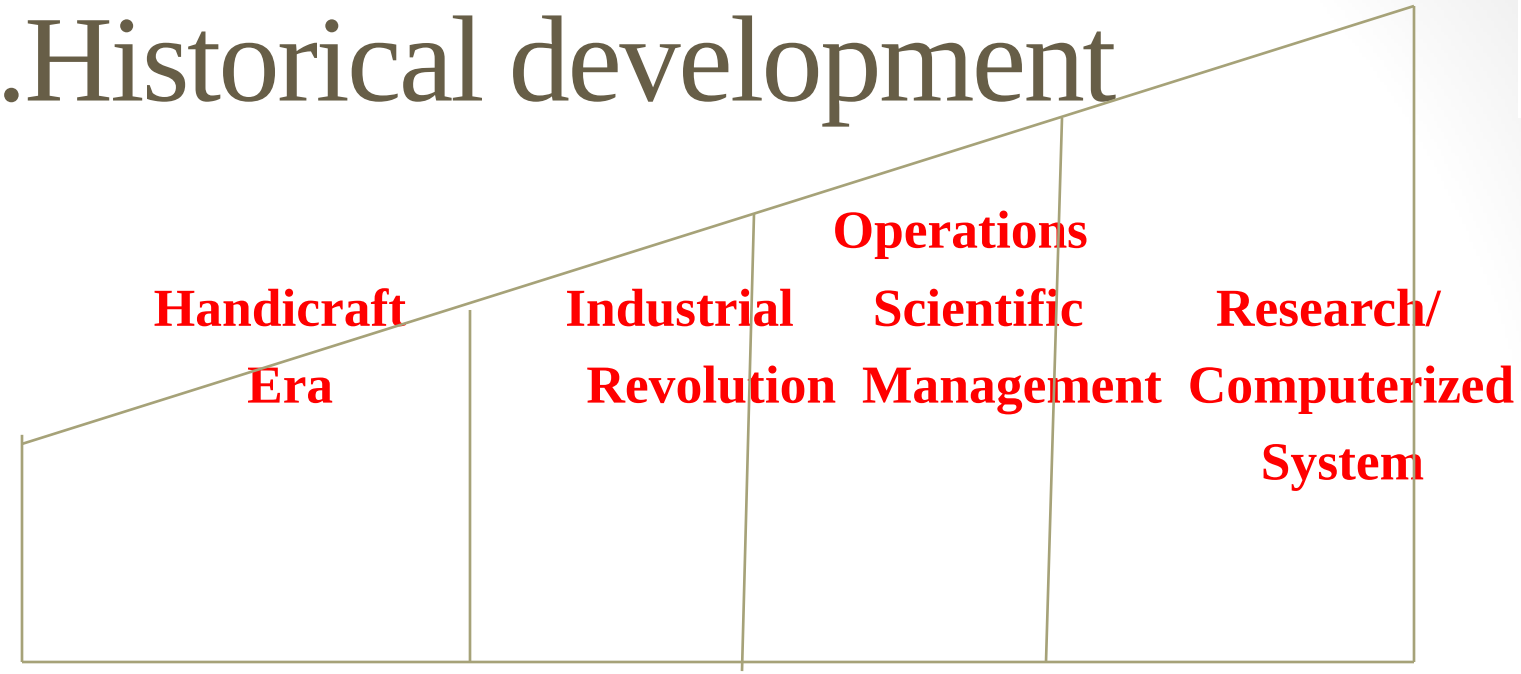
- Also James Watt, Boultin Mathew and Robinson obtained a place in the history of Industrial Engineering because of their work related with improvements in the performance of machines and industries.

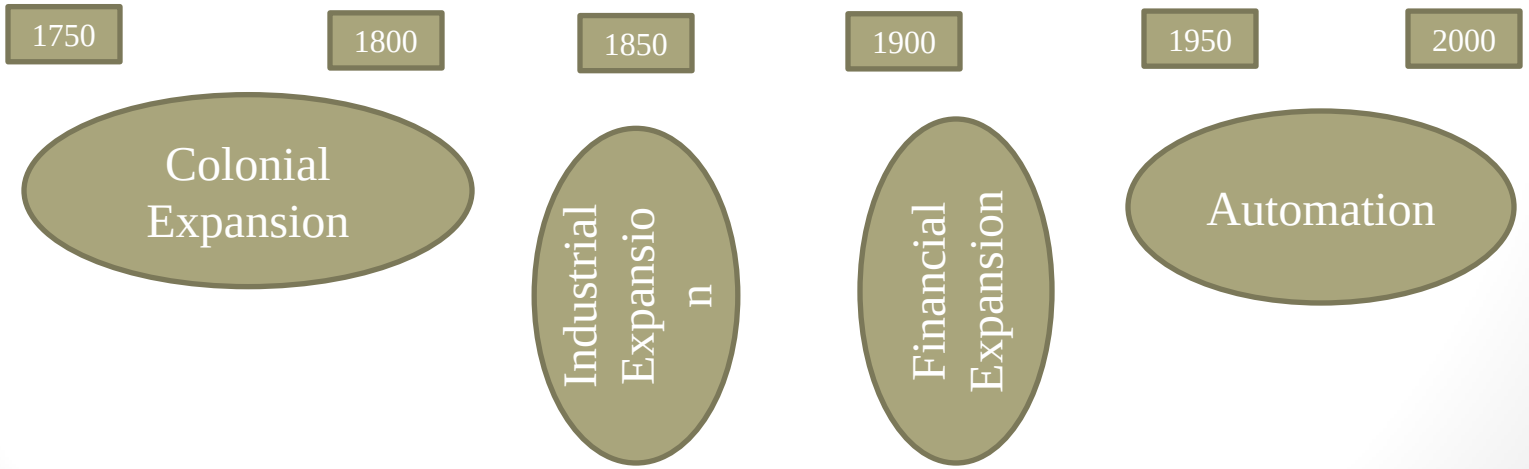
1.Historical development

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.Historical development





1.Historical development

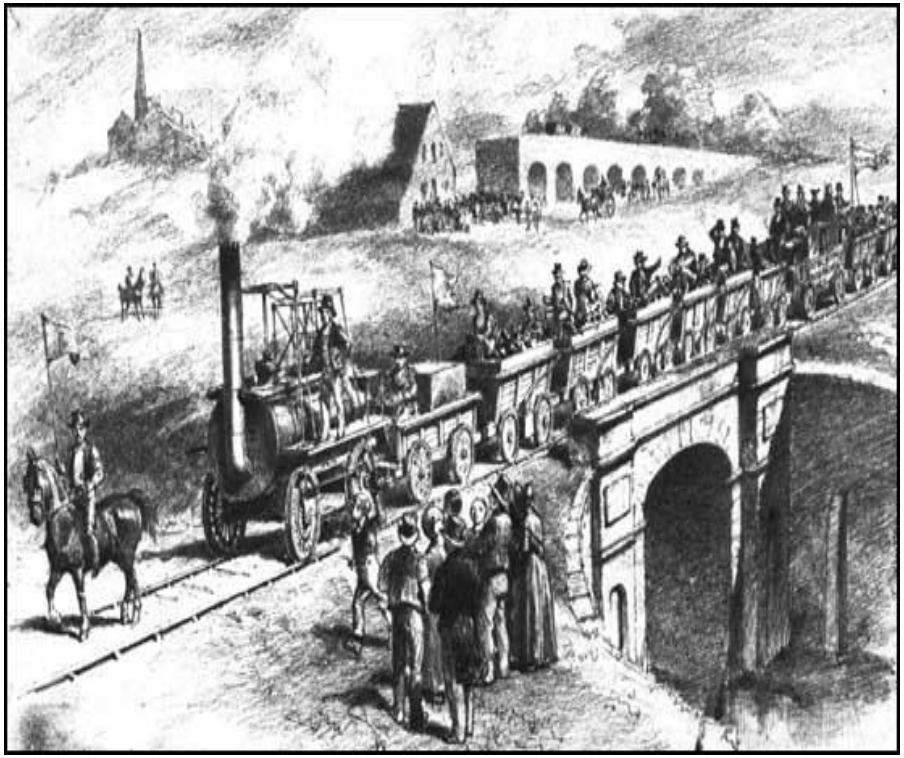
TRANSPORTATION

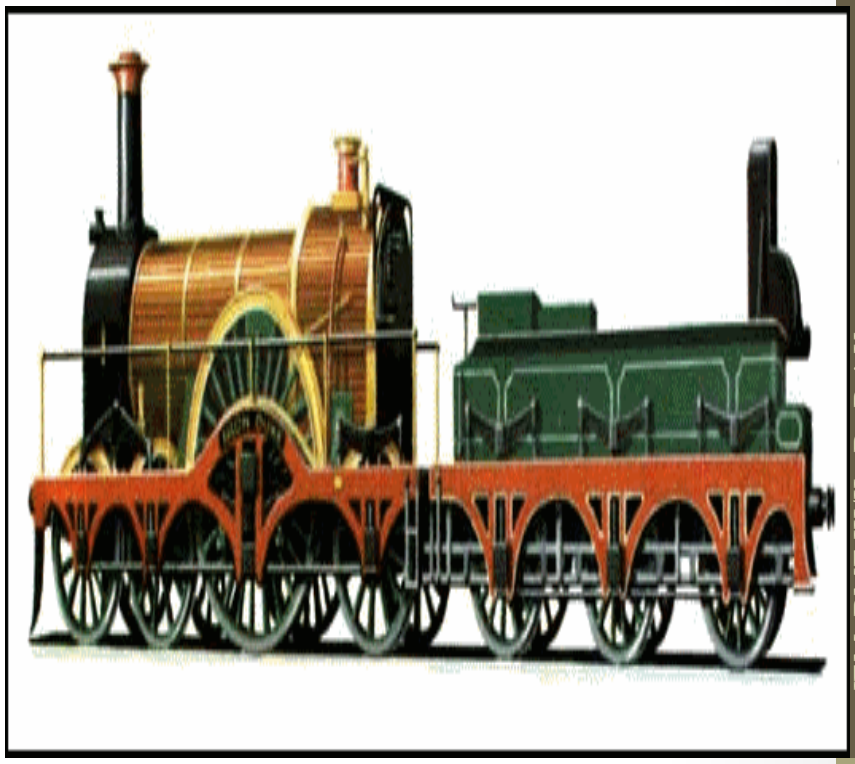
- *Before the Industrial Revolution, people relied on the horse and their own feet to get around.*
- *With the invention of the steam locomotive, transportation took a huge step forward.*
- *The first two major railroad companies were the Union Pacific and Central Pacific Railroads.*

An original steam engine

1.Historical development

PASSENGER CARRIERS





1.Historical development

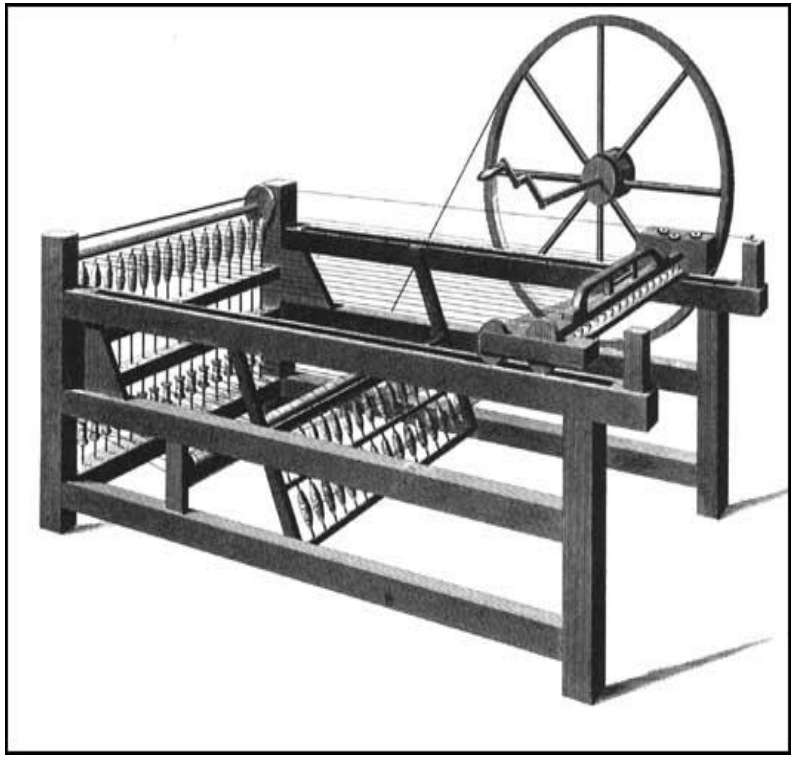
TEXTILES

- *With the invention of the spinning jenny and the power loom, the textile industry took off.*
- *Clothes could now be made far faster than ever before.*
- *The spinning wheel was the first invention, but it was very slow.*
- *Threads were spun one at a time, by hand.*

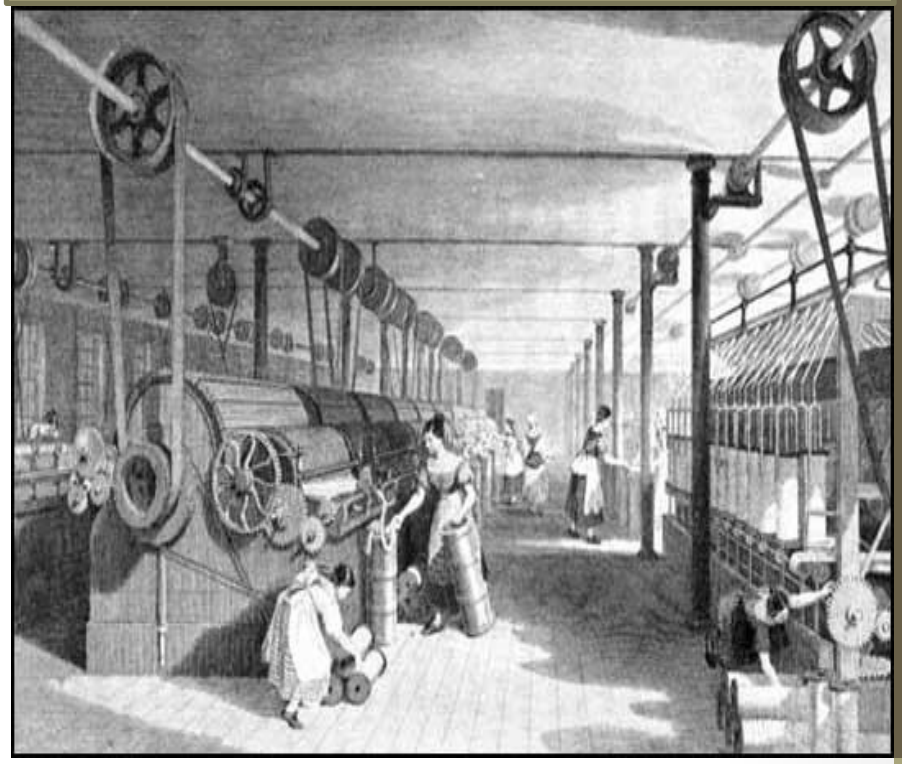
SPINNING WHEEL

1.Historical development

SPINNING JENNY



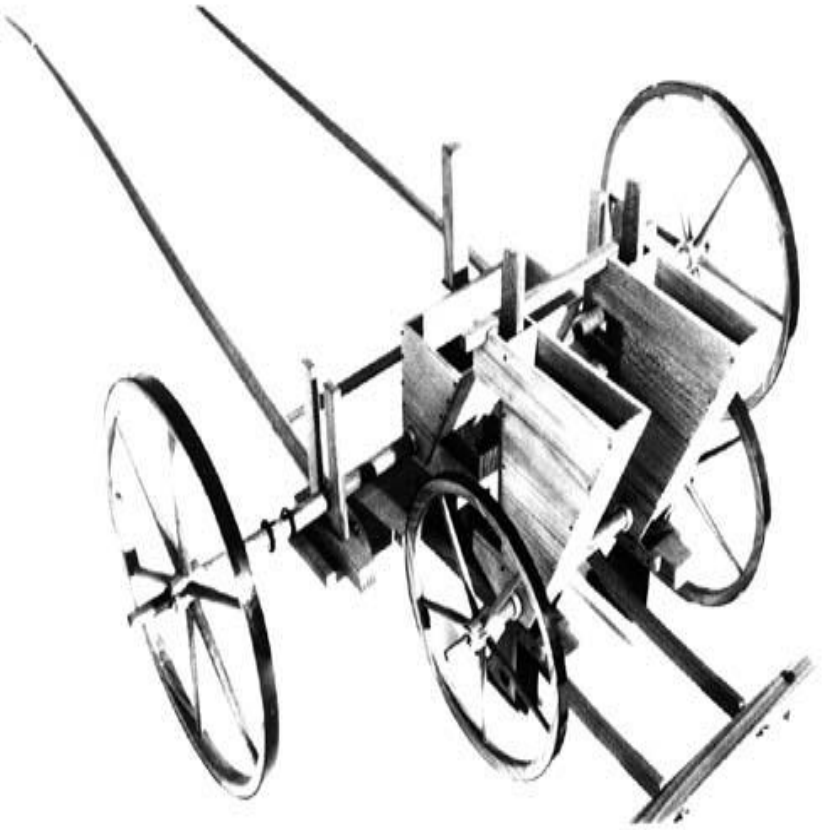
COTTON FACTORY



1.Historical development

AGRICULTURE

- *Advances in agriculture were also made.*
- *The invention of the seed drill allowed farmers to plant many more seeds much more quickly.*
- *The reaper allowed farmers to harvest their crops more efficiently.*
- *More crops could now be grown feeding an increasing population.*



THE SEED DRILL

1.Historical development

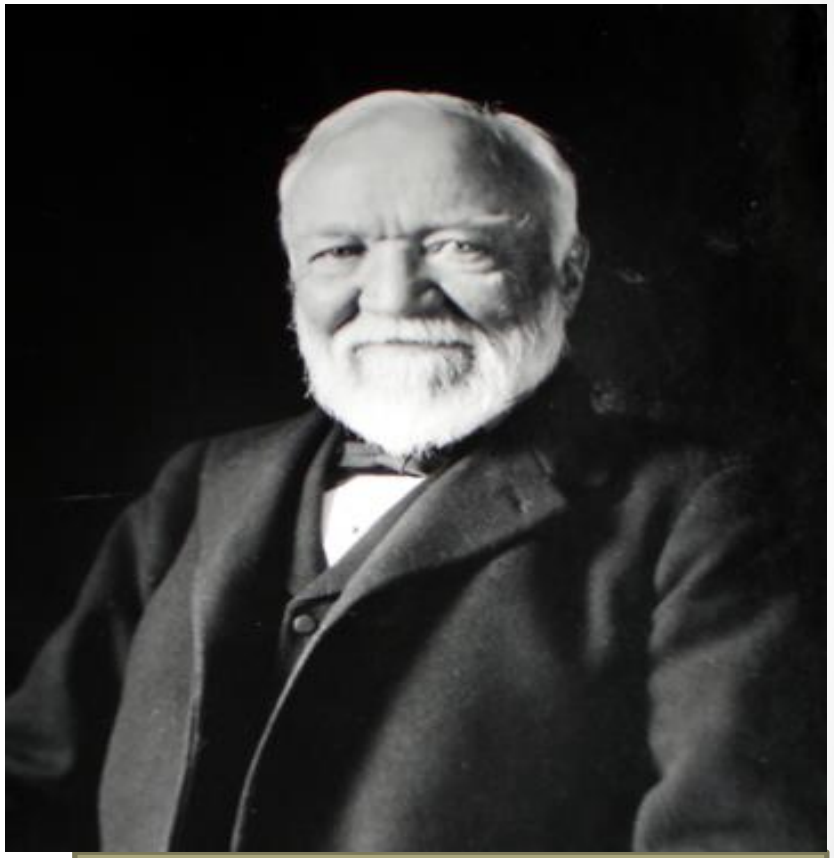
HAND REAPER

MECHANICAL REAPER

1.Historical development

STEELS

- *With the invention of steel, buildings could be made much taller.*
- *Steel was much harder than iron, which would bend if made too tall.*
- *The steel industry created many new products, and led to the invention of the car.*
- *Andrew Carnegie became a millionaire in the steel business by putting all his competitors out of business.*
- *He created U.S. Steel in Pittsburg.*

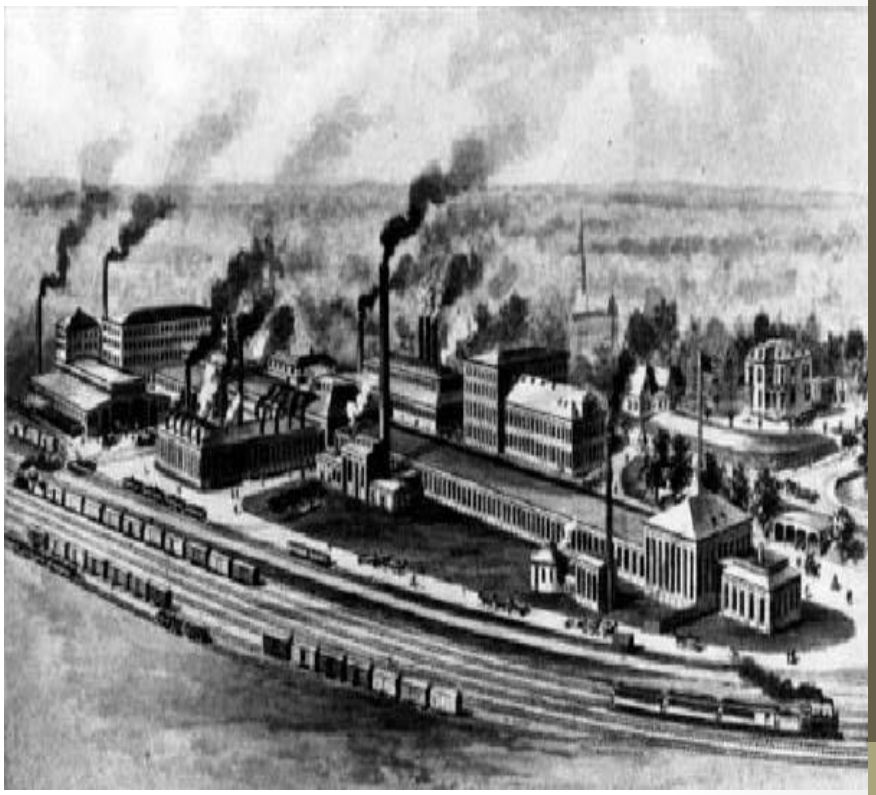


Andrew Carnegie

1.Historical development

A melting plant

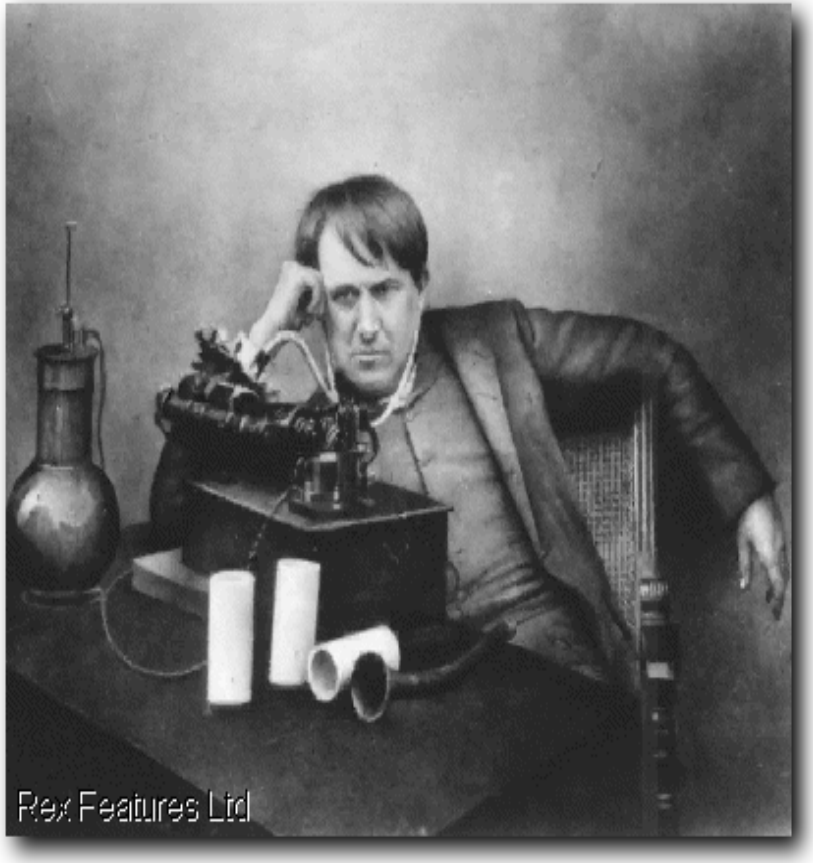
Smoke stacks of a factory



1.Historical development

THE ELECTRIC LIGHT

- *Can you imagine what life would be like without the electric light?*
- *Thomas Edison invented the electric light.*
- *Thomas Edison also invented many other things, like the phonograph.*



THOMAS EDISON

1.Historical development

The Phonograph

Telegraph

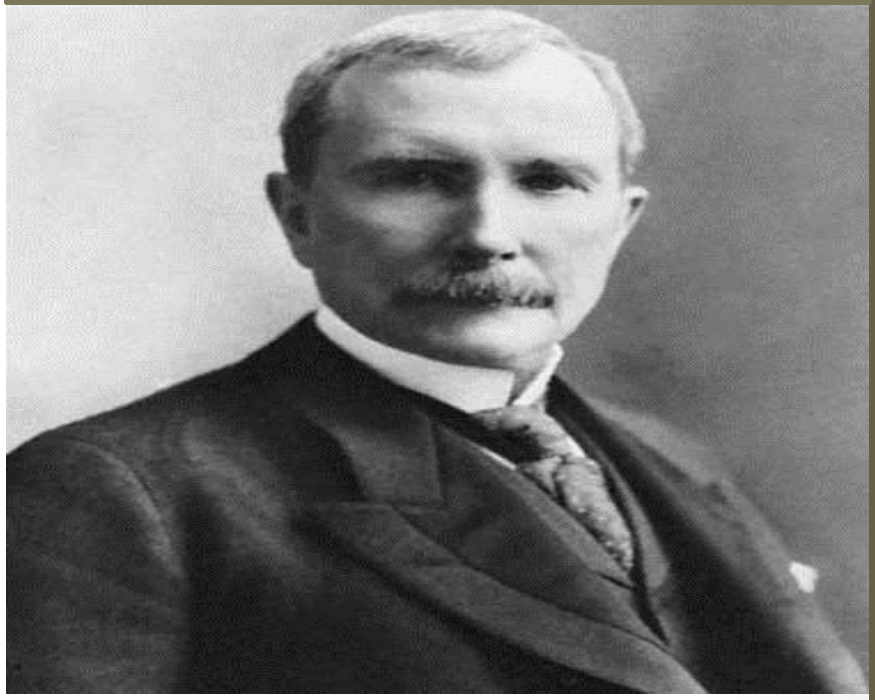
- *In 1844, Samuel Morse demonstrates his telegraph by sending a message to Baltimore from the chambers of the Supreme Court in Washington, DC. The message, "What hath God wrought?," marks the beginning of a new era in communication.*
- *The telegraph used dots and dashes to send messages over electric lines. These dots and dashes became known as Morse Code.*

1.Historical development

TELEPHONE

Alexander Graham Bell patented the first telephone in 1876.

OIL BUSSINESS



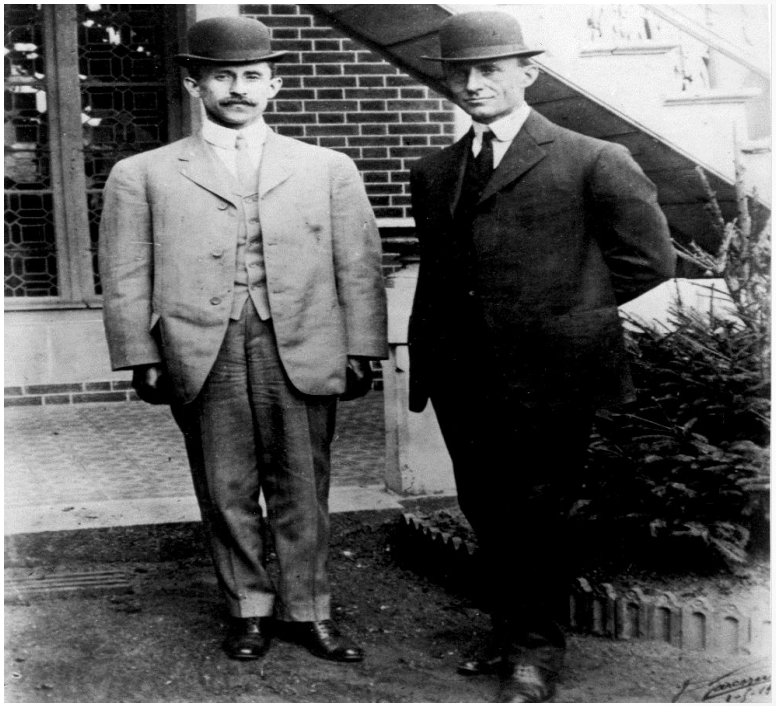
- John D. Rockefeller became the richest man in the world in the oil business.
- He created Standard Oil Company.
- Oil began being used in all types of machines, like cars.

1.Historical development

AUTOMOBILE

- Henry Ford invented the first practical car, the Model T.
- The car had been invented earlier, but Ford was the first to make the car affordable.

AIRPLANE



- The Wright brothers were the first men to successfully fly an airplane.
- The flight lasted only twelve seconds, but it proved men could fly.

1.Historical development

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.Historical development

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.Historical development

Contributions to Industrial Engineering

5. Henry L. Gantt (1893): 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.Historical development

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.*

2. System concept

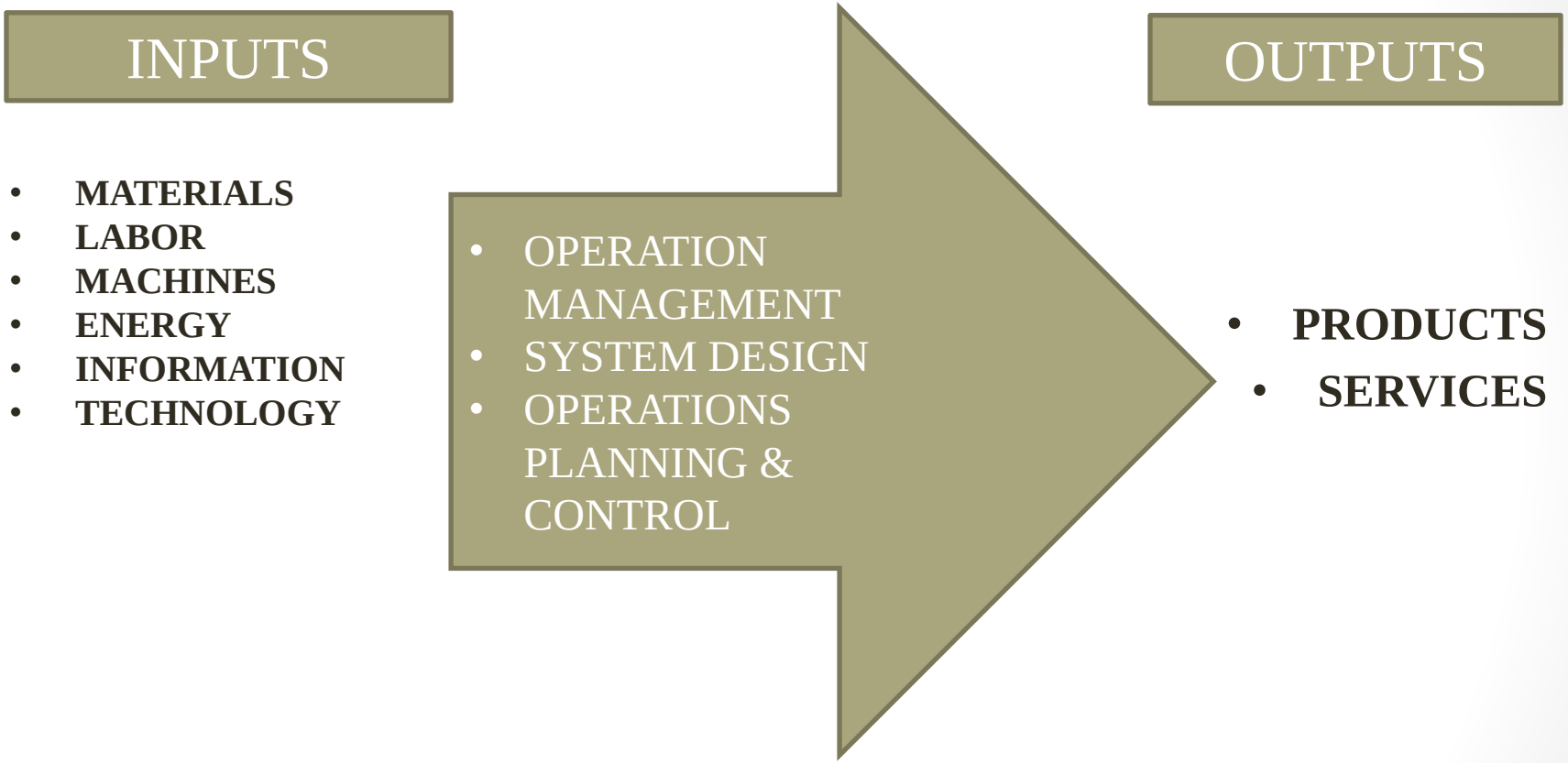


FIGURE: SYSTEM CONCEPT OF PRODUCTION MANAGEMENT

2. System concept

Productive system is defined as *the means by which we transform resource inputs to create useful goods and services as outputs. An operation is some step in the overall process of producing a product or service that leads to the final product.*

Production management may be defined as *a task of planning, coordinating, motivating and controlling the efforts of others towards a production of goods or services in an efficient, effective manner.*

2. System concept

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.*

2. System concept

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.

2. System concept

Role of Industrial Engineer

1. *Advisor*
2. *Advocator*
3. *Analyst*
4. *Motivator*
5. *Decision maker*
6. *Designer/Planner*
7. *Coordinator*
8. *Trainer/Educator*

2. System concept

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.*

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.

THANK YOU