



Introduction to Industrial Engineering

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What is Engineering ?
What is Industry ?



Engineering

The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.



Industry

1. (Economics) organized economic activity concerned with manufacture, extraction and processing of raw materials, or construction.
2. (Business / Commerce) a branch of commercial enterprise concerned with the output of a specified product or service.

History of Industrial Engineering

Charles W. Babbage, a mathematics professor

- *Book : The Economy of Machinery and Manufacturers* in 1832.
- Developing **the learning curve, the division of task** and how learning is affected, and the effect of learning on the generation of waste.

Henry R. Towne and Fredrick A. Halsey

- Developing **wage incentive plans** to the ASME (American Society of Mechanical Engineers) increase the productivity of workers without negatively affecting the cost of production.

Fredrick Winslow Taylor

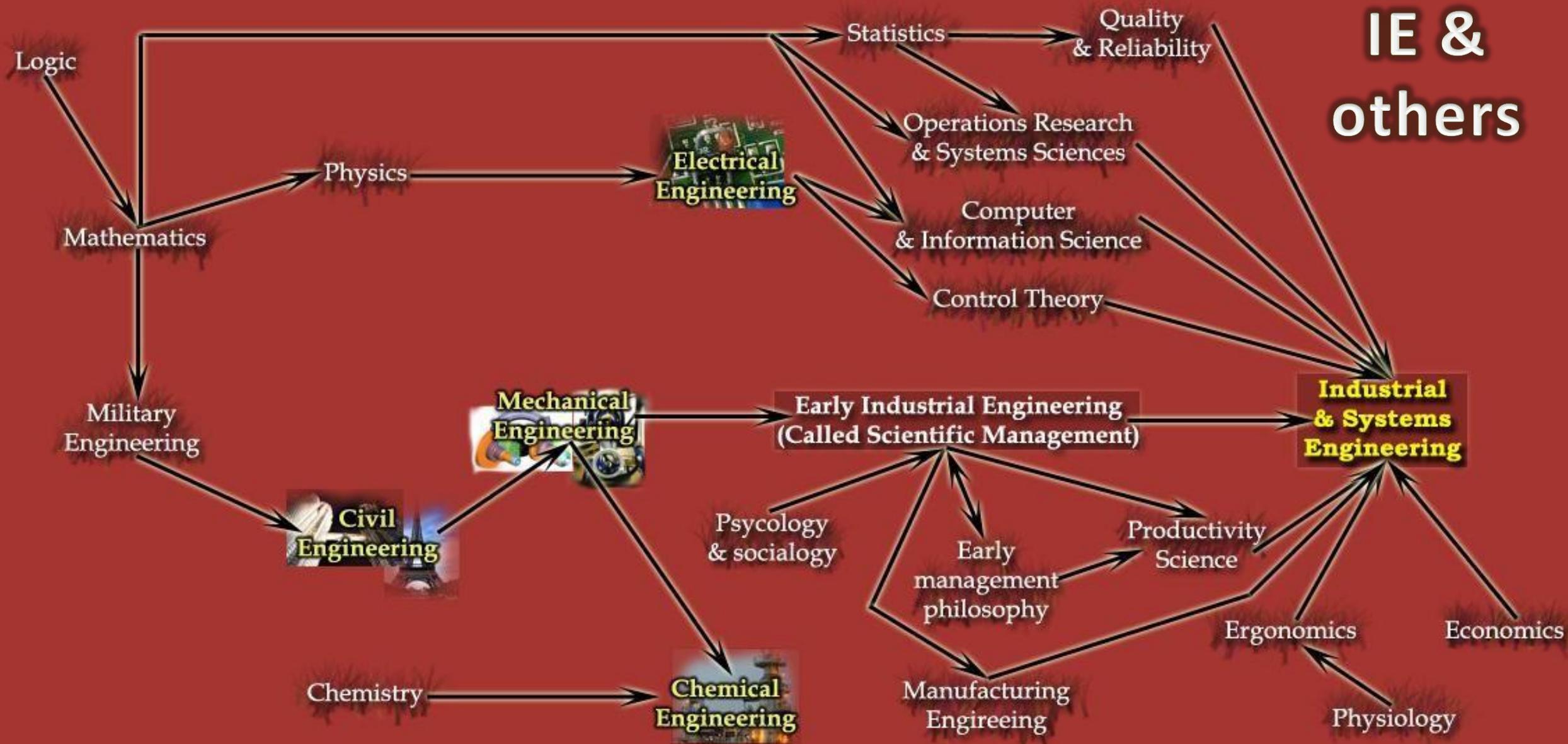
- The best known of **the pioneers in industrial engineering**. He was done potential improvements to be gained through analyzing the work content (minimum amount of work required to accomplish the task) of a job and designing the job for maximum efficiency.

Frank Bunker Gilbreth and his wife Dr. Lillian M. Gilbreth

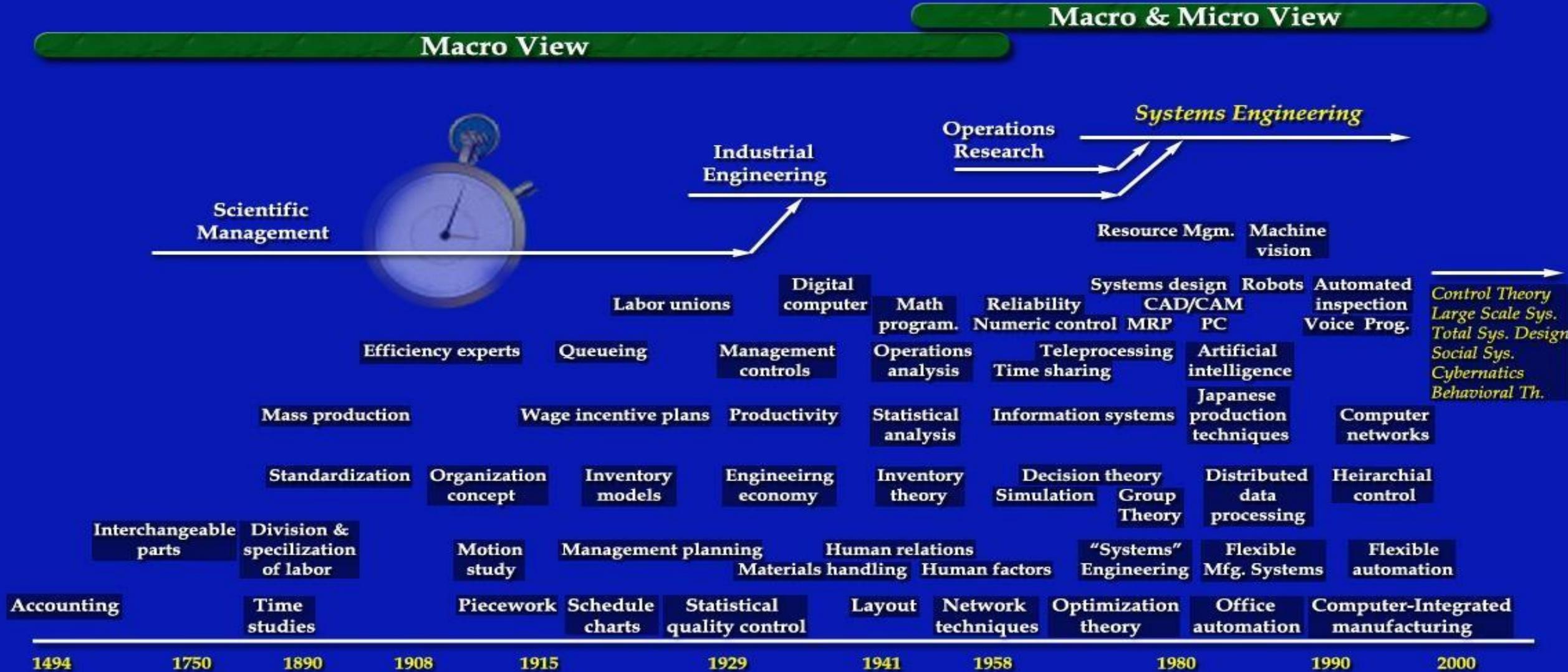
- Worked on understanding **fatigue, skill development, motion studies**, as well as time studies.

Henry L. Gantt

- Developing cost, selection of workers, training, good incentive plans, and scheduling of work. He is the originator of **the Gantt chart**.



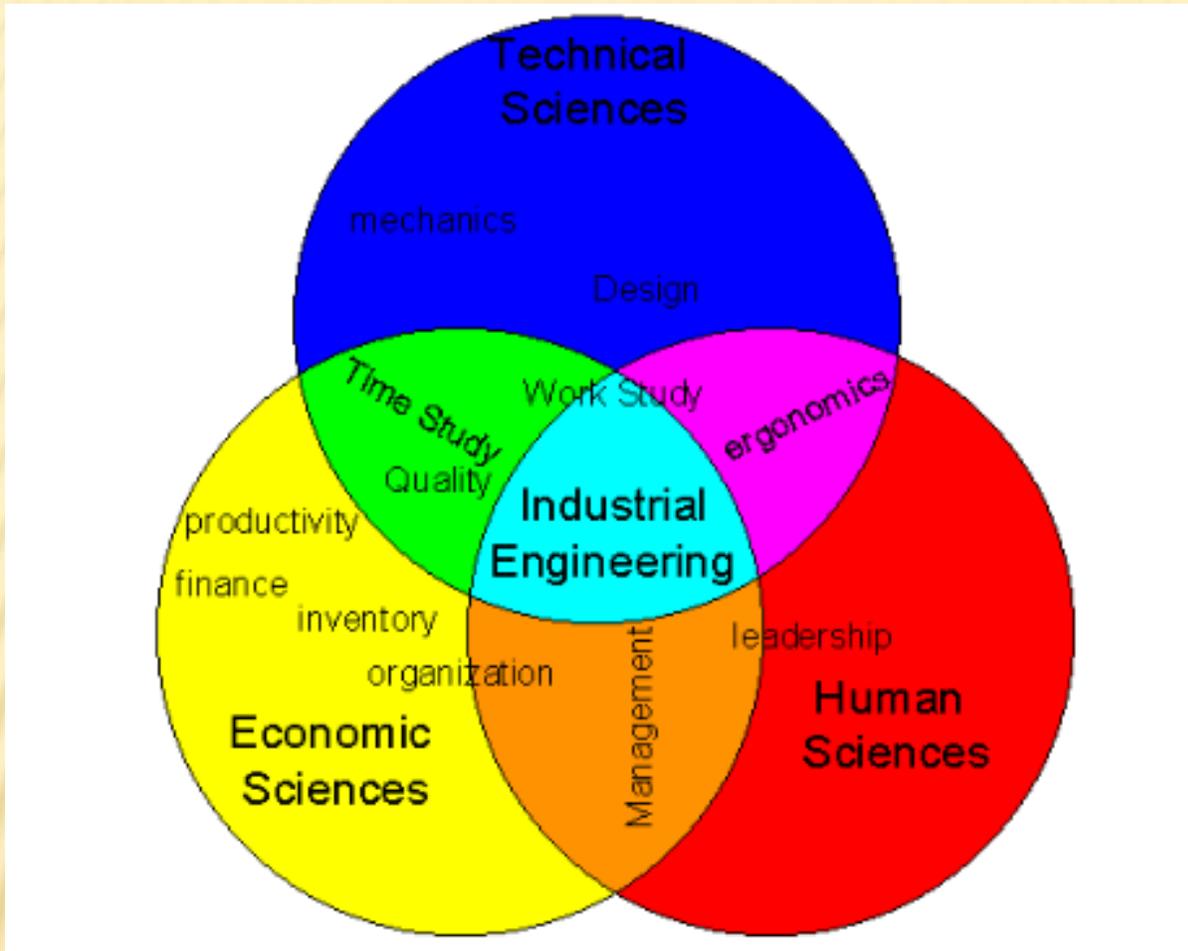
Chronology of significant events and developments in the evolution of "INDUSTRIAL & SYSTEMS ENGINEERING"



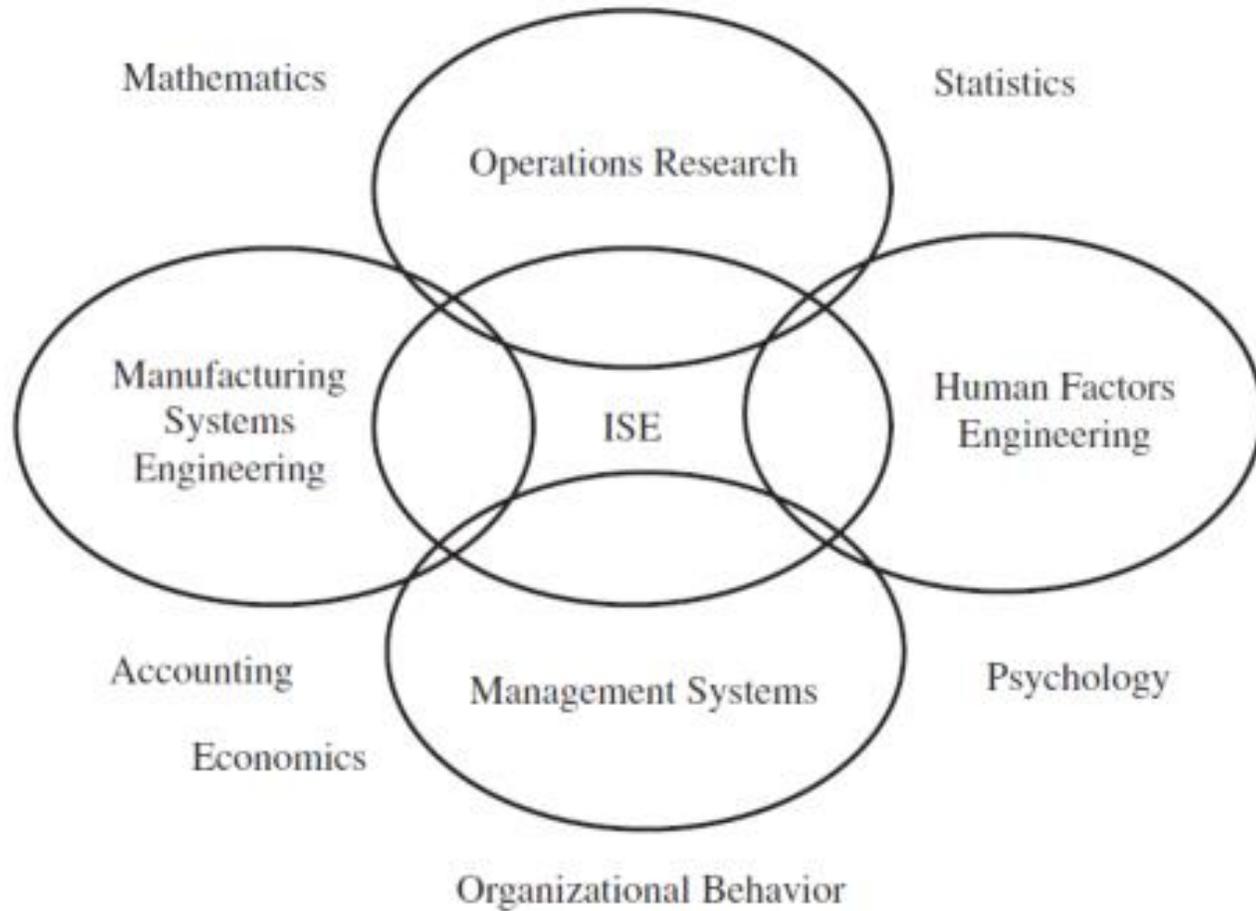
Industrial Engineering (IE) is concerned with the design, improvement and installation of integrated systems of people, materials, information, equipment and energy. It draws upon specialized knowledge and skill in the mathematical, physical and social sciences together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results to be obtained from such systems.

Definition of Industrial Engineering

(Based on Institute of
Industrial Engineering)



Academics Domain of IE



Academics Domain of IE

DIVERSITY

- IE is a **diverse (various) discipline** concerned with the **design, improvement, installation, and management of integrated systems** of people, materials, and equipment for all kinds of manufacturing and service operations.
- IE is concerned with **performance measures and standards, research of new products and product applications, ways to improve use of scarce (limited) resources and many other problem solving adventures.**
- An Industrial Engineer may be employed in **almost any type of industry, business or institution, from retail establishments to manufacturing plants to government offices to hospitals.**



Efficient and Effective

- Industrial engineers determine **the most effective ways** for an organization to use the basic factors of production - people, machines, materials, and energy. They are more concerned with people and methods of business organization than engineers in other specialties.
- To **solve** organizational, production, and related problems **most efficiently**, industrial engineers **design data processing systems and apply mathematical analysis** such as operations research.
- They also **develop management control systems** to help in financial planning and cost analysis,
design production planning and control systems to coordinate activities and control product quality, and design or improve systems for the physical distribution of goods and services.
- Industrial engineers **conduct surveys** to find plant locations with **the best combination** of
- raw materials, and transportation.

They also **develop wage and salary administration systems and job evaluation programs.**

Activities of IE

- ✓ Install data processing, management information, wage incentive systems.
- ✓ Develop performance standards, job evaluation, and wage and salary programs.
- ✓ Research new products and product applications.
- ✓ Improve productivity through application of technology and human factors.
- ✓ Select operating processes and methods to do a task with proper tools and equipment.
- ✓ Design facilities, management systems, operating procedures.
- ✓ Improve planning and allocation of limited resources.
- ✓ Enhance plant environment and quality of people's working life.
- ✓ Evaluate reliability and quality performance.
- ✓ Implement office systems, procedures, and policies.
- ✓ Analyze complex business problems by operations research.
- ✓ Conduct organization studies, plant location surveys, and system effectiveness studies.
- ✓ Study potential markets for goods and services, raw material sources, labor supply, energy resources, financing, and taxes.

Impact of Operations Research in Industry

- The development of IE has been greatly influenced by the impact of an analysis approach called operations research.
- This approach originated in England and the United States during 2nd World War and was aimed at solving difficult war-related problems through the use of science, mathematics, behavioral science, probability theory, and statistics.
- This approach is used to determine the optimal solution from some alternatives.
- Give your example about application of OR in your daily life !



Impact of Digital Computers in Industry

- Another development that had a significant impact on the IE profession is the digital computer. Digital computers permit the rapid and accurate handling of huge quantities of data, so permitting the IE to **design systems for effectively** managing and controlling large, complex operations.
- The digital computer also permits the IE to **construct computer simulation models of manufacturing facilities** in order to evaluate the effectiveness of alternative facility configurations.
- Computer simulation is emerging most widely used IE technique. The development and widespread utilization of personal computers is having an exciting impact on the practice of industrial engineering.





References

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Almost all quality improvement comes via simplification of design,
manufacturing... layout, processes, and procedures.

(Tom Peters)