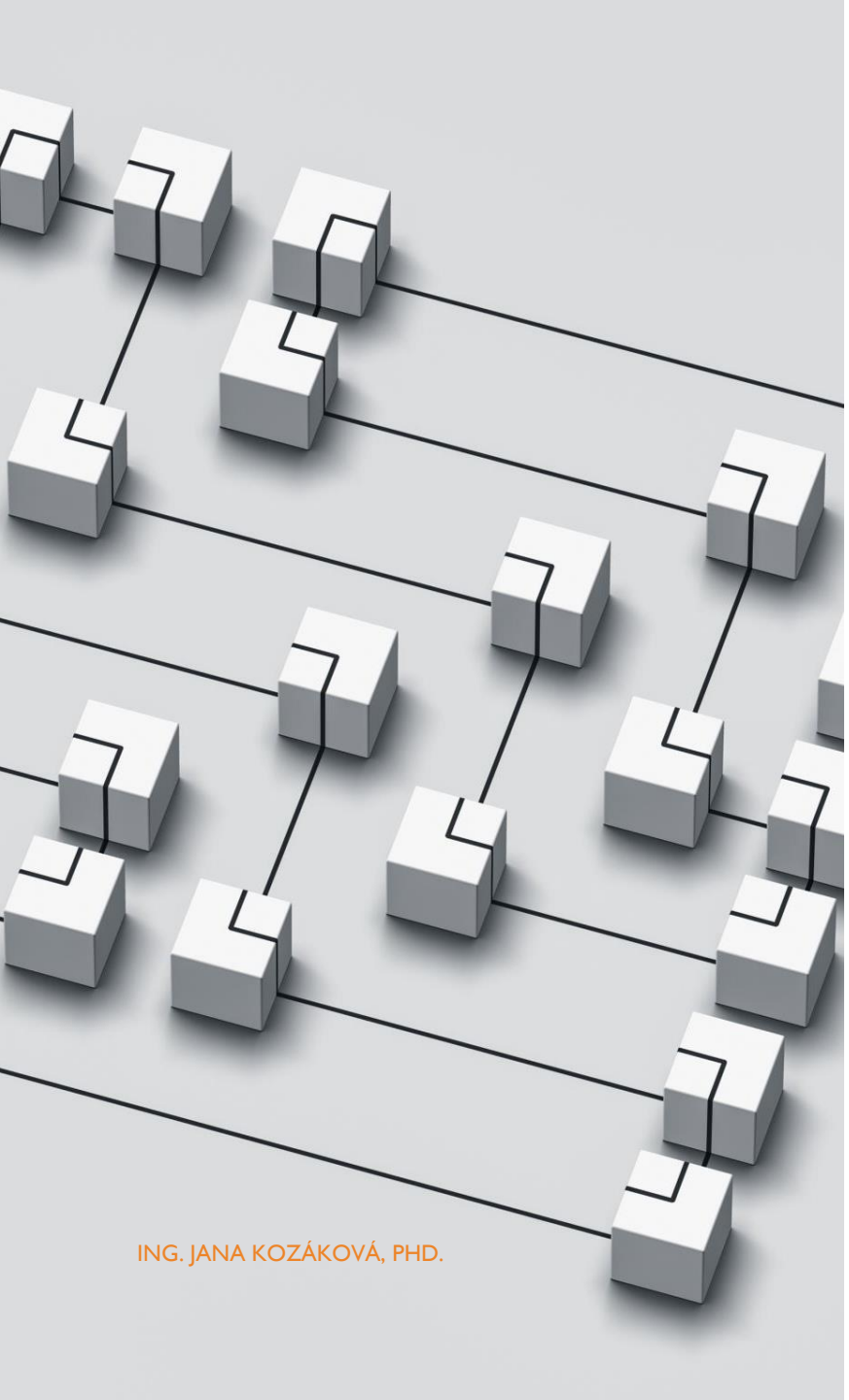
HISTORICAL DEVELOPMENT OF PRODUCTION MANAGEMENT



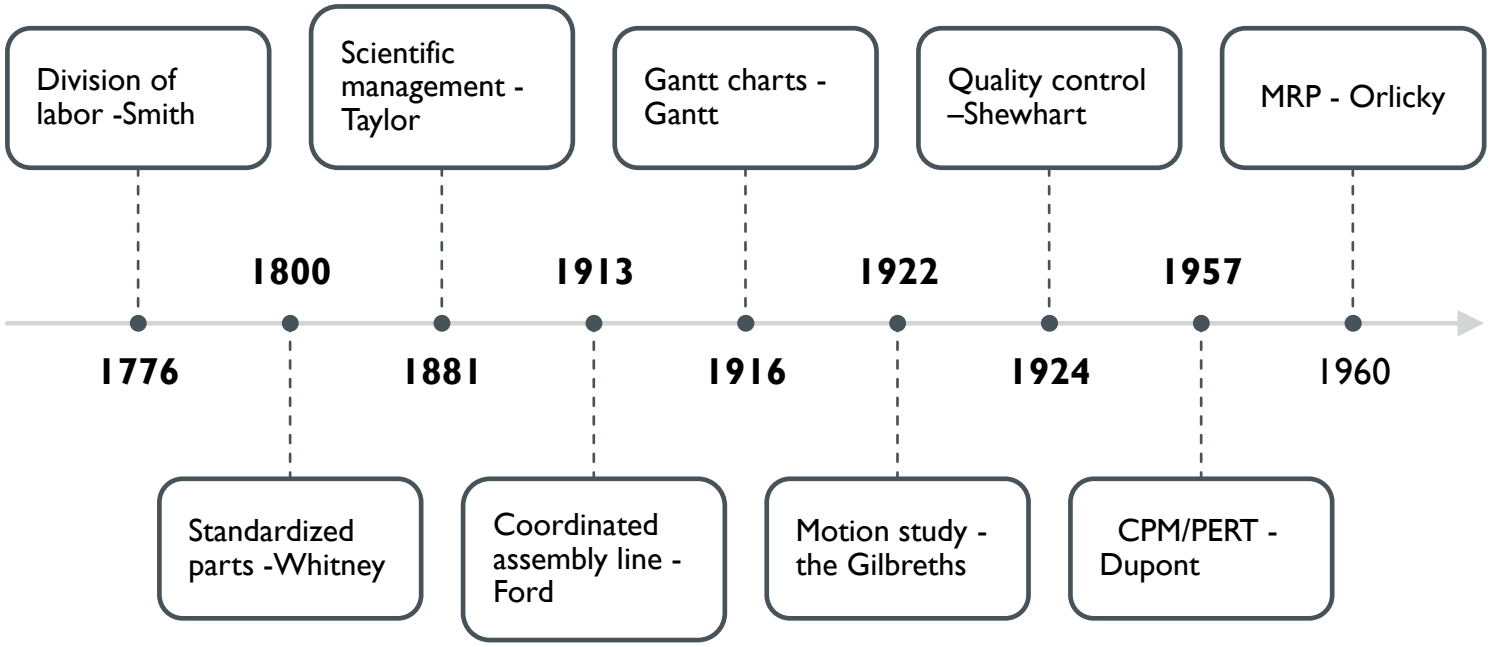
OPERATIONS MANAGEMENT

- Operations management is the management of an organization's productive resources or its production system.
- A production system takes inputs and converts them into outputs.
- The conversion process is the predominant activity of a production system.
- The primary concern of an operations manager is the activities of the conversion process.

HISTORICAL MILESTONES IN OM

- The Industrial Revolution
- Post-Civil War Period
- Scientific Management
- Human Relations and Behaviorism
- Operations Research
- The Service Revolution

HISTORICAL MILESTONES IN OM AND SIGNIFICANT EVENTS IN OM



- CPM/PERT (CPM- Critical Path Method)
- MRP (Materials Resource planning)
- CAD (Computer Aided Design)
- Flexible manufacturing systems (FMS)
- Manufacturing automation protocol (MAP)
- Computer-integrated manufacturing (CIM)

1. THE INDUSTRIAL REVOLUTION (1760-1820)

- The industrial revolution developed in England in the 1700s.
- The **steam engine**, invented by **James Watt** in 1764, largely replaced human and water power for factories.
- Adam Smith's The Wealth of Nations in 1776 touted the economic benefits of the specialization of labor.
- Thus, in the late-1700s factories had not only machine power but also ways of planning and controlling the tasks of workers.
- The industrial revolution spread from England to other European countries and to the United States.
- In 1790 an American, Eli Whitney, developed the concept of **interchangeable parts**.
- The first great industry in the US was the **textile industry**.
- In the 1800s the development of the **gasoline engine** and **electricity** further advanced the revolution.
- By the mid-1800s, the old **cottage system of production** had been replaced by the factory system.

ELI WHITNEY

- American inventor, businessman, engineer, tax collector and politician
- Born December 8, 1765 Westborough
- Death January 8, 1825 (age 59) New Haven - Cause of death- prostate cancer - Burial place Grove Street Cemetery
- Alma mater Yale College
- National Inventors Hall of Fame Award
- Husband of Henrietta Frances Edwards
- Child- Eli Whitney JR,
- In 1798, received a government contract to make 10,000 muskets
- Showed that machine tools could make standardized parts to exact specifications (musket parts could be used in any musket).

ELI WHITNEY

- He grew up on a farm in Massachusetts. During the American Revolution.
- When there was a shortage of nails in the emerging state as a result of the British embargo, he began **producing** these **nails**.
- That's when he first knew how the market worked. He soon expanded production to **needles and sticks**.
- After the revolution, he graduated from Yale University and moved to South Carolina.
- Here he returned to agriculture and came up with the invention for which he was most famous in the end: the **cotton ginning machine,** which was a major milestone in the industrial revolution.
- He managed to process cotton ten times faster than a slave and made the American South a cotton power.
- He built the machine in 1793, it was patented in 1794, but there were many patent disputes, as other ginning machines soon appeared, which Whitney called copies of his machine.
- Tired of patent struggles, he began making **weapons** at the end of the 18th century, which he supplied to the US government.
- His weapons were successful, among other things, because he bet on the interchangeability of individual parts of combat machines. This idea later strongly influenced Henry Ford.

II. POST CIVIL WAR (RECONSTRUCTION) PERIOD (1865-1877)

- The Reconstruction era was a period in American history following the American Civil War (1861–1865);
- it lasted from 1865 to 1877 and marked a significant chapter in the history of civil rights in the United States.
- Reconstruction, as directed by Congress, abolished slavery and ended the remnants of Confederate secession in the Southern states.
- It proclaimed the newly freed slaves (freedmen; black people) citizens with (ostensibly) the same civil rights as those of whites;
- these rights were nominally guaranteed by three new constitutional amendments: the 13th, 14th, and 15th, collectively known as the Reconstruction Amendments.
- Reconstruction also refers to the general attempt by Congress to transform the 11 former Confederate states and refers to the role of the united states in that transformation.

POST-CIVIL WAR PERIOD AND OPERATIONS MANAGEMENT

During the post-Civil War period great expansion of **production capacity occurred**.

By post-Civil War the following developments set the stage for the great production explosion of the 20th century:

- increased capital and production capacity
- the expanded urban workforce
- new Western US markets
- an effective national transportation system

III. SCIENTIFIC MANAGEMENT (PEAK 1910)

- **Scientific management** is a theory of management that analyzes and synthesizes workflows.
- Its main objective is improving economic efficiency, especially labor productivity.
- It was one of the earliest attempts to apply science to the engineering of processes to management.
- Scientific management is sometimes known as **Taylorism** after its pioneer, Frederick Winslow Taylor.
- Although scientific management as a distinct theory or school of thought was obsolete by the 1930s, most of its themes are still important parts of industrial engineering and management today.

FREDERICK W. TAYLOR

- Born 1856; died 1915
- Known as 'father of scientific management'
- in 1881, as chief engineer for Midvale Steel, studied how tasks were done
- Began first motion & time studies
- **Created efficiency principles**
- Taylor: Management Should Take More Responsibility for Matching employees to the right job
- Providing the proper training
- Providing proper work methods and tools
- Establishing legitimate incentives for work to be accomplished

FREDERICK W. TAYLOR

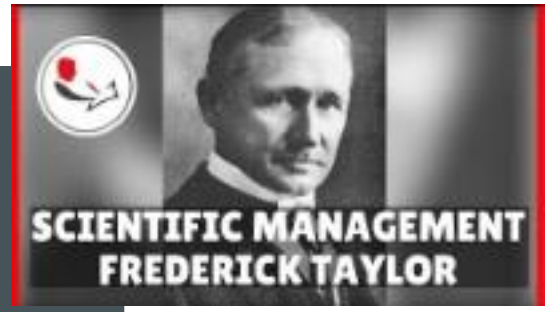
Born	March 20, 1856 Philadelphia, Pennsylvania, U.S.
Died	March 21, 1915 (aged 59) Philadelphia, Pennsylvania, U.S.
Cause of death	Influenza
Resting place	West Laurel Hill Cemetery Bala Cynwyd, Pennsylvania, U.S.
Nationality	American
Occupation	Efficiency expert Management consultant
Known for	"Father" of the Scientific management & Efficiency Movement
Home town	Germantown, Philadelphia, Pennsylvania
Religion	Quaker
Spouse(s)	Louise M. Spooner
Children	Kempton, Robert and Elizabeth *(all adopted orphans)*
Parents	Franklin Taylor Emily Annette Winslow
Awards	Elliott Cresson Medal (1902)

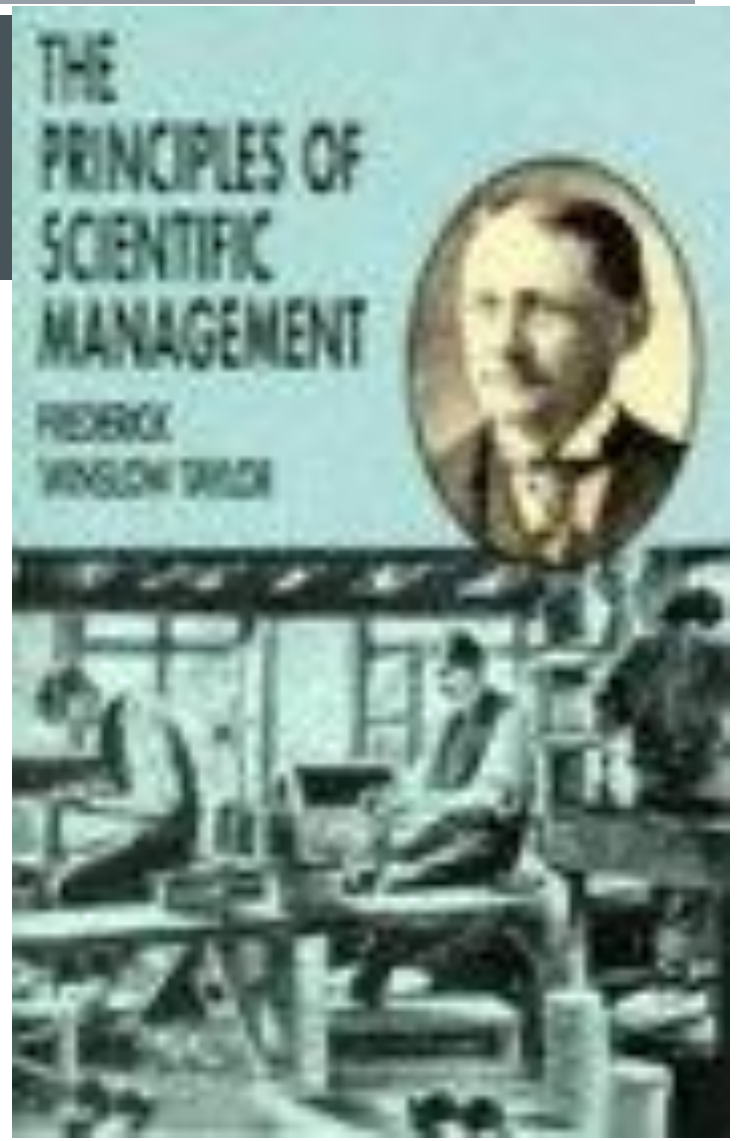
- In 1911 he published the book ***Principles of Scientific Management*** and thus laid the foundations of scientific management
- he verified that (at that time) the reserves in technology are smaller than the human reserves
- According to him, the basis of management should be to ensure maximum prosperity for the employer, combined with the maximum prosperity of each employee
- Taylor's work has focused on
  - increasing labor productivity introduced daily performance standards to be met earnings high,
  - in case of non-performance he applied sanctions - remuneration according to performance
- He identified the following nine characteristics (assumptions) for managers:

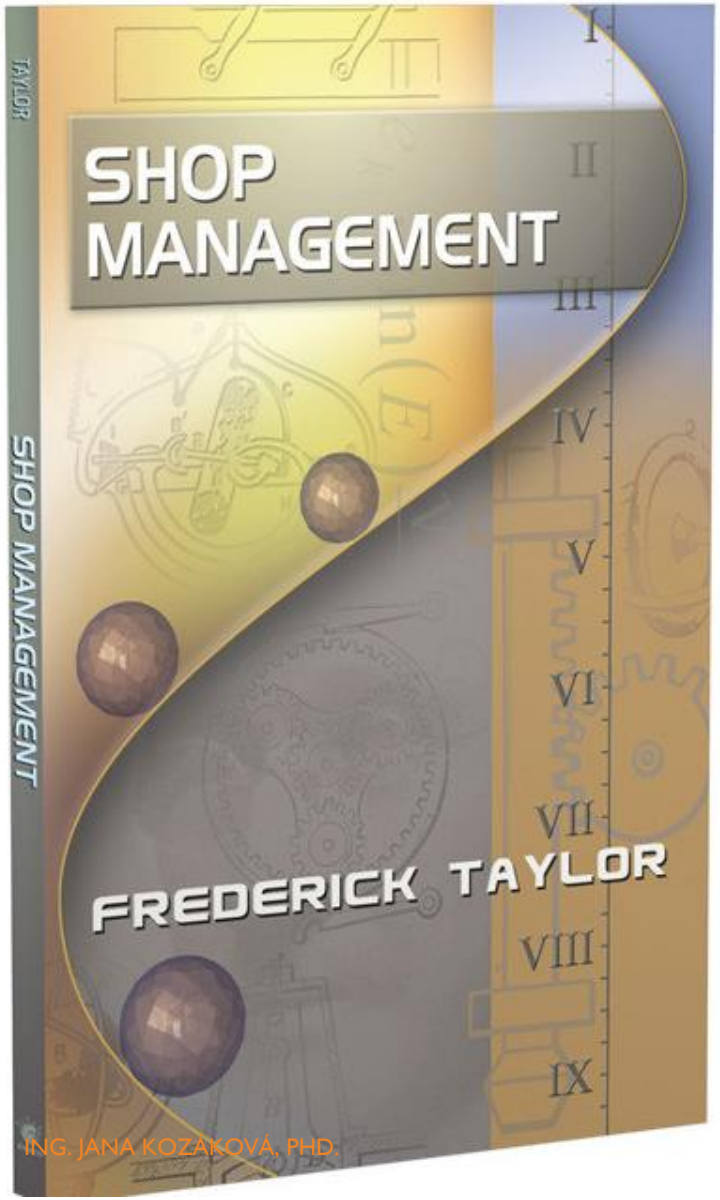
intelligence, education, expertise, skill, tact, vigor, principledness, honesty, common sense, good health

The essence of Taylor's scientific management is expressed by four principles:

- creating a real management science
- scientific selection and progressive development of the worker
- the most friendly cooperation of managers with workers
- division of labor and responsibilities between management and labor



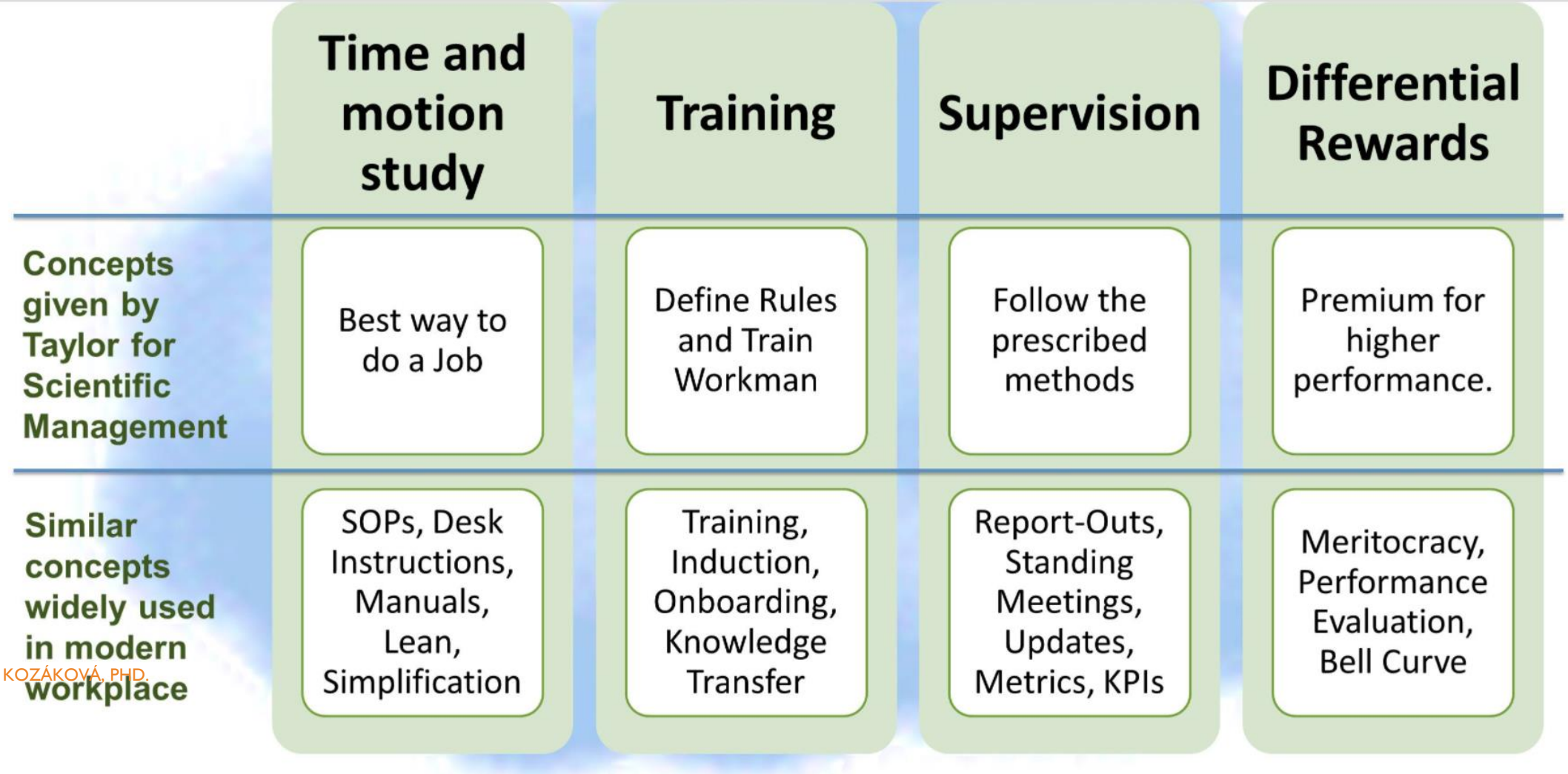




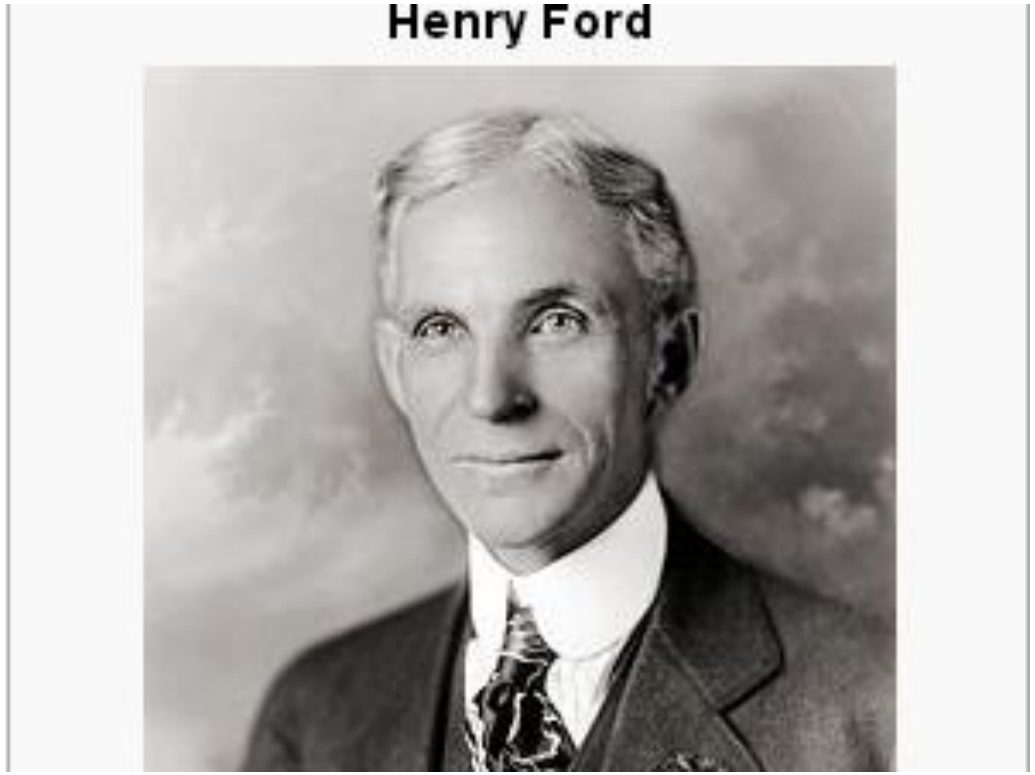
SCIENTIFIC MANAGEMENT TODAY

- Frederick Taylor is known as the father of scientific management.
- His shop system employed these steps:
  - Each worker's skill, strength, and learning ability were determined.
  - Stopwatch studies were conducted to precisely set standard output per worker on each task.
  - Material specifications, work methods, and routing sequences were used to organize the shop.
  - Supervisors were carefully selected and trained.
  - Incentive pay systems were initiated.

TAYLORS SCIENTIFIC MANAGEMENT



HENRY FORD (MAKE THEM ALL ALIKE!)

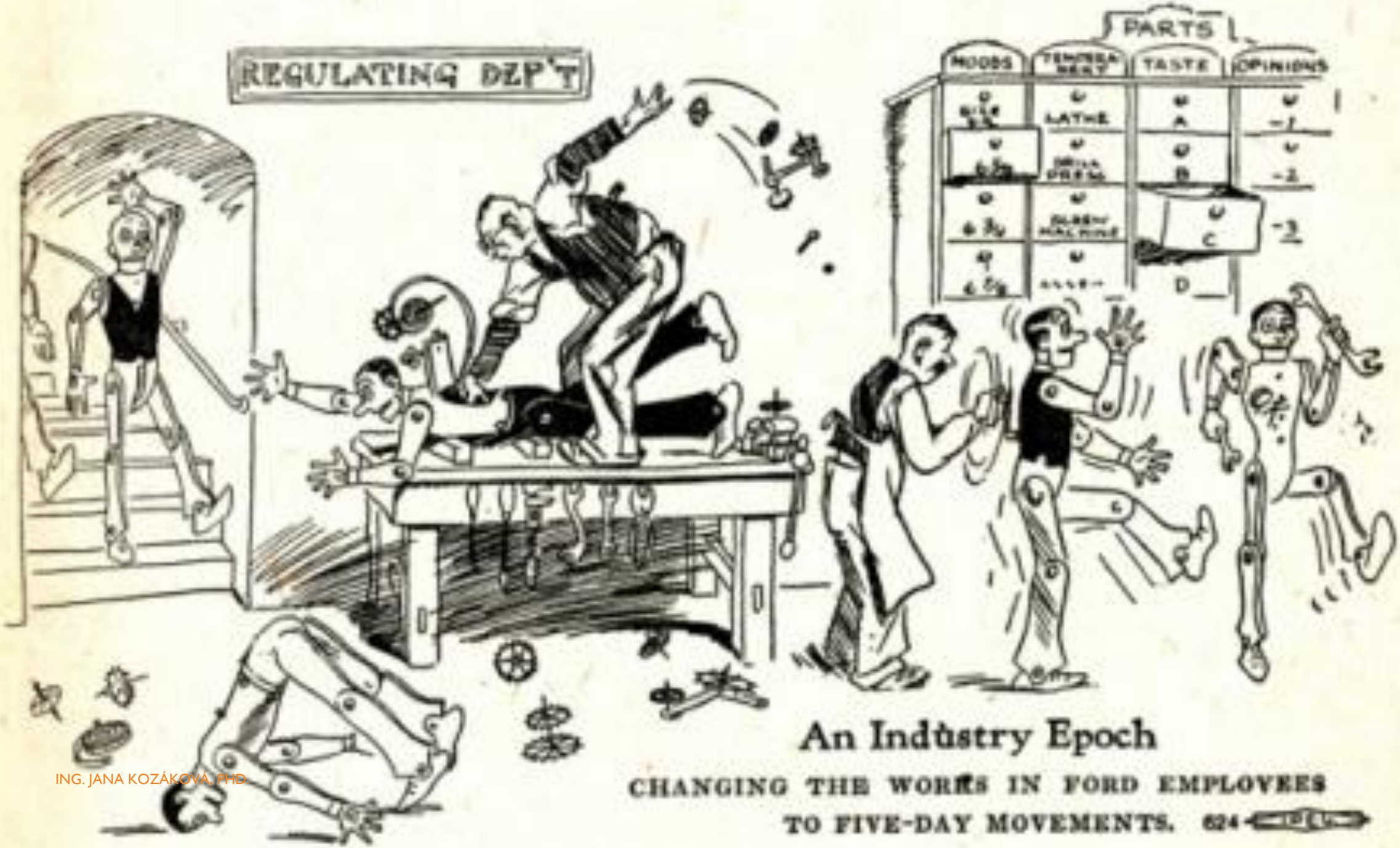


- Born 1863; died 1947
- in 1903, created Ford Motor Company
- in 1913, first used moving assembly line to make Model T
- Unfinished product moved by conveyor past work station
- Paid workers very well for 1911 ($5/day!)

HENRY FORD

Born	July 30, 1863 Greenfield Township, Michigan, United States
Died	April 7, 1947 (aged 83) Fair Lane, Dearborn, Michigan, U.S.
Nationality	American
Occupation	Founder of Ford Motor, business magnate, engineering
Net worth	▲**$188.1 billion** (based on February 2008 data from *Forbes*)
Religion	Anglican
Spouse(s)	Clara Jane Bryant
Children	Edsel Ford
Parents	William Ford and Mary Ford
Signature	

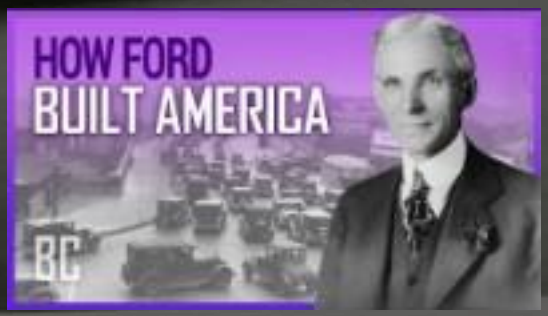
- Founder of the Ford Motor Company and father of the assembly line used in mass production.
- The introduction of its Model T marked a major step in transportation and American industry.
- He was an inventor with many awards and obtained many patents.
- As the owner of the Ford Motor Company, he has become one of the richest and most famous people in the world.
- Thanks to **belt production**, he was able to offer a large number of cars at a low price to a wide mass, while his workers had a high wage.



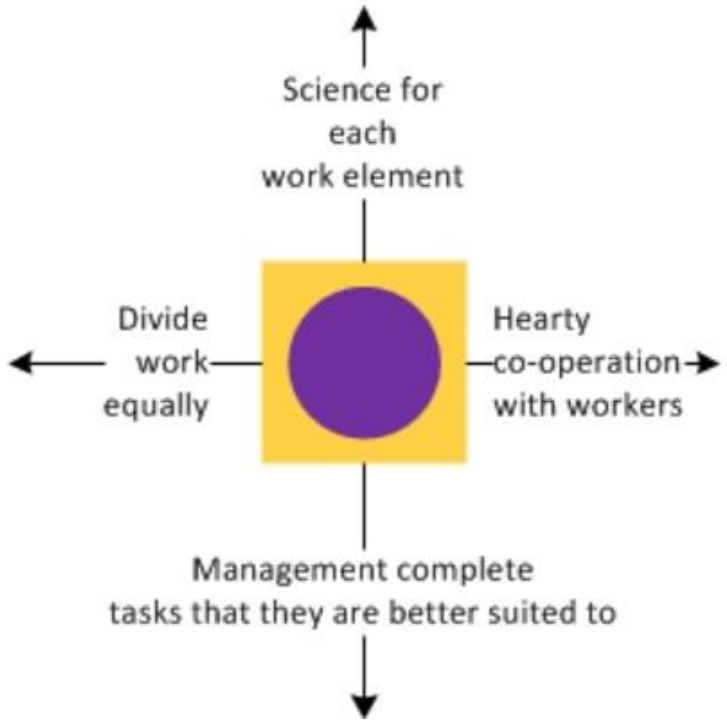
An Industry Epoch

CHANGING THE WORKS IN FORD EMPLOYEES TO FIVE-DAY MOVEMENTS. 624

- He introduced three innovations - **mass, technical standardization and belt production in the automotive industry**
- he divided the work operations into the s**implest tasks** that even an unskilled worker could perform
- workers in order according to the technological process at the closest **distances from each other**
- the smoothness of production was achieved by moving the unfinished parts through **conveyor belts**
- the result was a large number of products at a low price



SCIENTIFIC MANAGEMENT



- In the 1920s, Ford Motor Company's operation embodied the key elements of scientific management:
  - standardized product designs
  - mass production
  - low manufacturing costs
  - mechanized assembly lines
  - specialization of labor
  - interchangeable parts

IV. HUMAN RELATIONS AND BEHAVIORISM IN MANAGEMENT

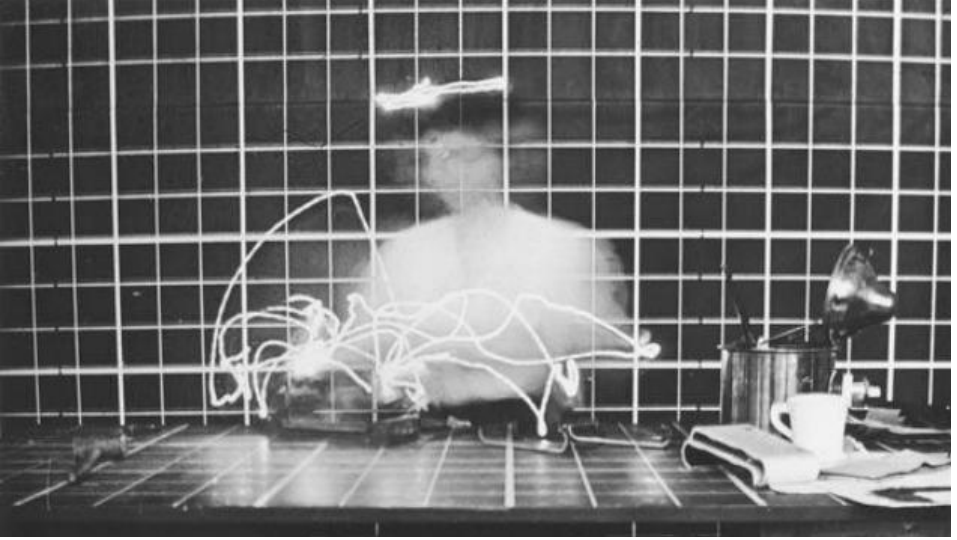
- The behavioral management theory is often called the human relations movement because it addresses the **human dimension of work**.
- Behavioral theorists believed that a better understanding of human behavior at work, such as motivation, conflict, expectations, and group dynamics, improved productivity.

BEHAVIORALISM IN PRODUCTION MANAGEMENT

- In the 1927-1932 period, researchers in the Hawthorne Studies realized that human factors were affecting production.
- Researchers and managers alike were recognizing that psychological and sociological factors affected production.
- From the work of behavioralists came a gradual change in the way managers thought about and treated workers.

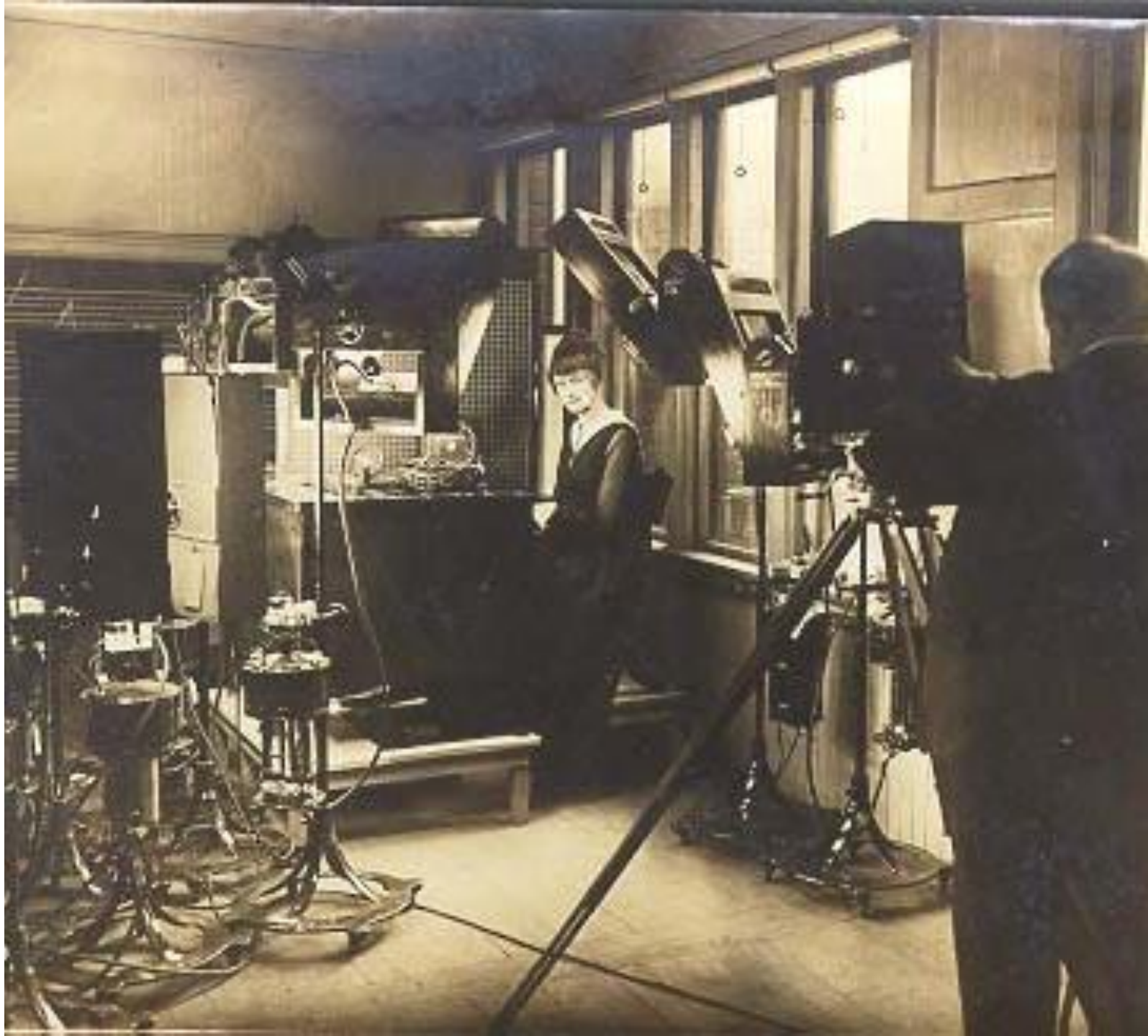
FRANK & LILLIAN GILBRETH

- Frank (1868-1924); Lillian (1878-1972)
- Husband-and-wife engineering team
- Further developed work measurement methods
- Applied efficiency methods to their home & 12 children



Frank B. Gilbreth - dealt with the rationalization of unnecessary movements at work. Its contribution is the development of the process of movement studies, harmonization of people's working methods and available resources in the elimination of unnecessary attitudes.

Lilian Gilbreth - her contribution is the application of psychology in the selection and placement of workers, in creating a suitable working climate.



V. OPERATIONS RESEARCH

- **Operations research** (British English: **operational research**), often shortened to the **OR**, is a discipline that deals with the development and application of advanced analytical methods to improve decision-making.
- It is sometimes considered to be a subfield of mathematical sciences.
- The term management science is occasionally used as a synonym.
- Employing techniques from other mathematical sciences, such as modeling, statistics, and optimization, operations research arrives at optimal or near-optimal solutions to complex decision-making problems.
- Because of its emphasis on practical applications, operations research has overlaps with many other disciplines, notably industrial engineering.
- Operations research is often concerned with determining the extreme values of some real-world objective: the maximum (of profit, performance, or yield) or minimum (of loss, risk, or cost).
- Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries.

PRINCIPLES OF OPERATIONAL RESEARCCH (OR)

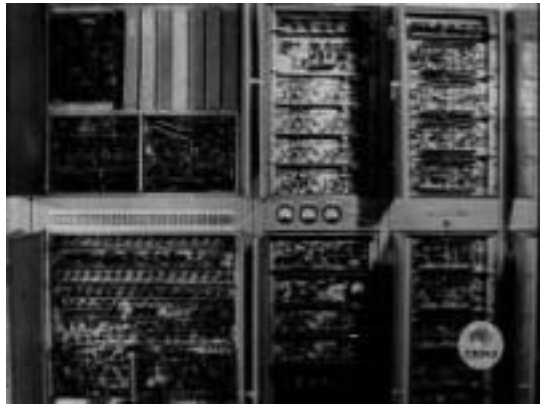
- OR encompasses the development and the use of a wide range of problem-solving techniques and methods applied in the pursuit of improved decision-making and efficiency, such as simulation, mathematical optimization, queueing theory and other stochastic-process models, Markov decision processes, econometric methods, data envelopment analysis, neural networks, expert systems, decision analysis, and the analytic hierarchy process.
- Nearly all of these techniques involve the construction of mathematical models that attempt to describe the system.
- Because of the computational and statistical nature of most of these fields, OR also has strong ties to computer science and analytics.
- Operational researchers faced with a new problem must determine which of these techniques are most appropriate given the nature of the system, the goals for improvement, and constraints on time and computing power, or develop a new technique specific to the problem at hand (and, afterward, to that type of problem).

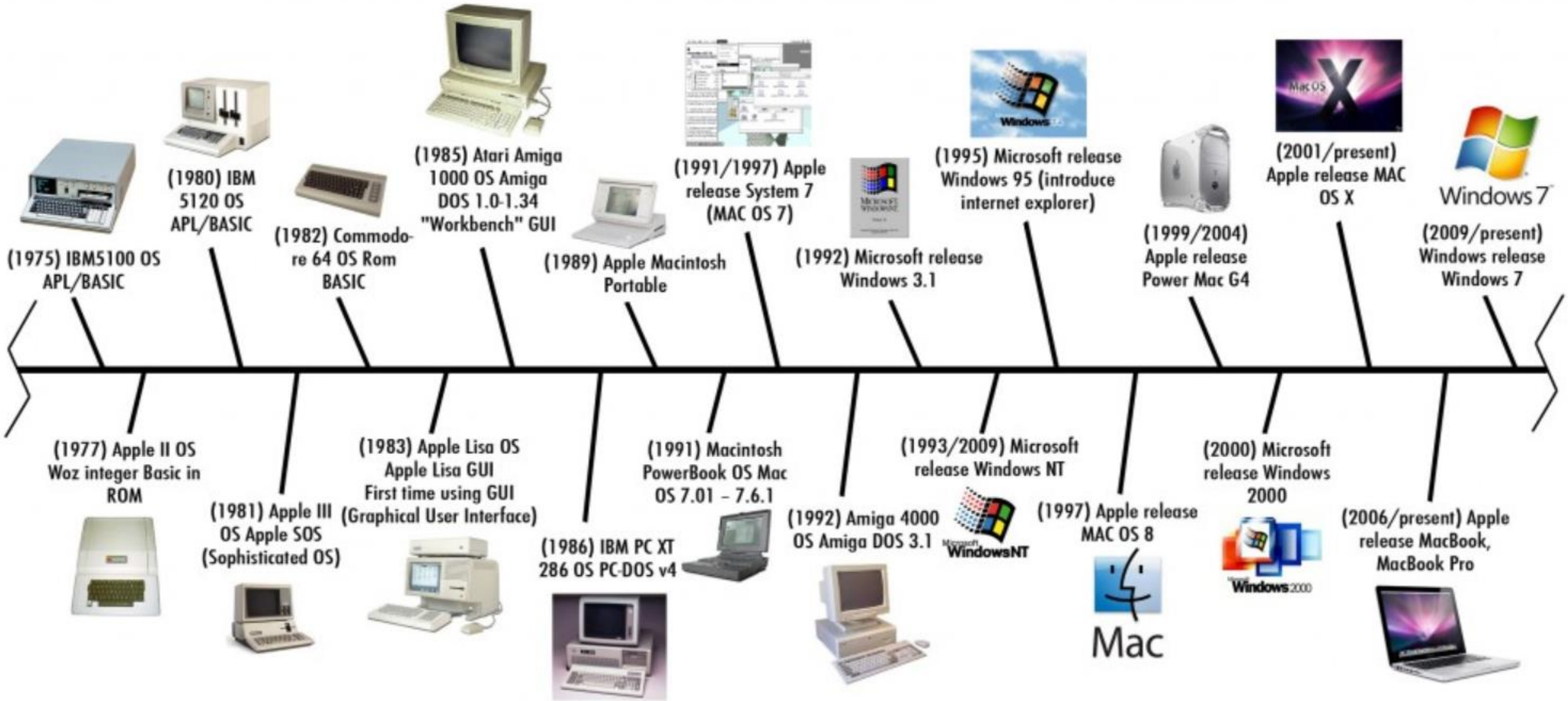
The major sub-disciplines in modern operational research, as identified by the journal OR are:

- Computing and information technologies
- Financial engineering
- Manufacturing, service sciences, and supply chain management
- Policy modeling and public sector work
- Revenue management
- Simulation
- Stochastic models
- Transportation

THE COMPUTER REVOLUTION

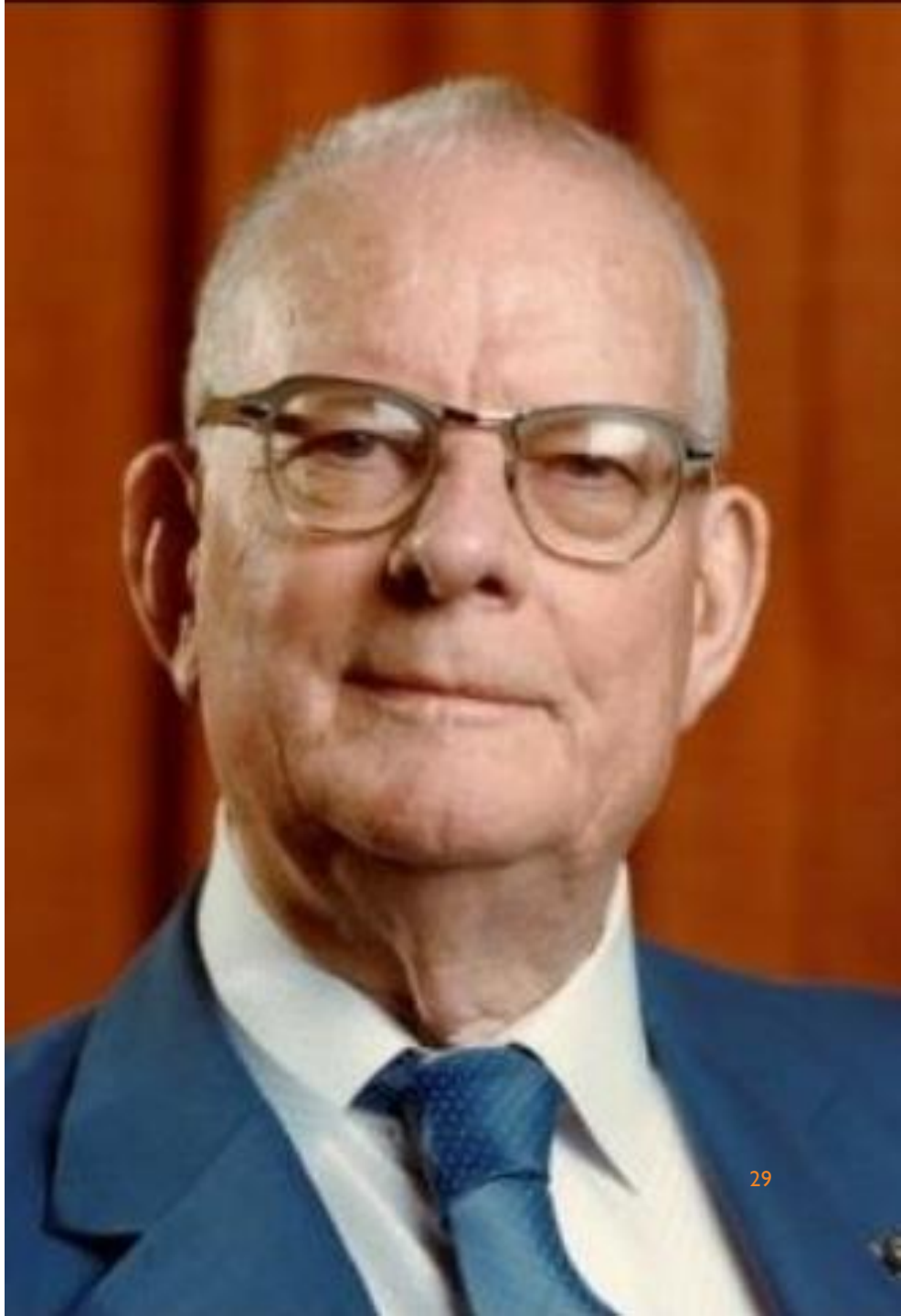
- Explosive growth of computer and communication technologies
- Easy access to information and the availability of more information
- Advances in software applications such as Enterprise Resource Planning (ERP) software
- Widespread use of email
- More and more firms becoming involved in E-Business using the Internet
- Result: faster, better decisions over greater distances




(1975) IBM5100 OS APL/BASIC
(1977) Apple II OS Woz integer Basic in ROM
(1980) IBM 5120 OS APL/BASIC
(1981) Apple III OS Apple SOS (Sophisticated OS)
(1982) Commodore 64 OS Rom BASIC
(1983) Apple Lisa OS Apple Lisa GUI First time using GUI (Graphical User Interface)
(1985) Atari Amiga 1000 OS Amiga DOS 1.0-1.34 "Workbench" GUI
(1986) IBM PC XT 286 OS PC-DOS v4
(1989) Apple Macintosh Portable
(1991) Macintosh PowerBook OS Mac OS 7.01 – 7.6.1
(1991/1997) Apple release System 7 (MAC OS 7)
(1992) Amiga 4000 OS Amiga DOS 3.1
(1992) Microsoft release Windows 3.1
(1993/2009) Microsoft release Windows NT
(1995) Microsoft release Windows 95 (introduce internet explorer)
(1997) Apple release MAC OS 8
(1999/2004) Apple release Power Mac G4
(2000) Microsoft release Windows 2000
(2001/present) Apple release MAC OS X
(2006/present) Apple release MacBook, MacBook Pro
(2009/present) Windows release Windows 7
Windows 7
Mac

W. EDWARDS DEMING

- Born 1900; died 1993
- Engineer & physicist
- Credited with **teaching Japan quality control** methods in post-WW2
- Used statistics to analyze the process
- His methods involve workers in decisions



W. EDWARDS DEMING

- Deming's work and writing constitute not so much a technique, but a philosophy of management, Total Quality Management, that focuses on quality and continuous improvement but which has had - justifiably - a much wider influence.
- Deming's interest in variation and his approach to systematic problem solving led to his development of the 14 points which have gained widespread recognition and which are central to the quality movement and his philosophy of transformational management.
- Deming's seven deadly diseases of management and his use and promotion of the PDCA cycle, known to many as the Deming Wheel.

SEVEN DEADLY DISEASES OF MANAGEMENT

- 1. Lack of constancy of purpose to plan product and service that will have a market and keep the company in business, and provide jobs.
- 2. Emphasis on short-term profits: short-term thinking (just the opposite from constancy of purpose to stay in business), fed by fear of unfriendly takeover, and by the push from bankers and owners for dividends.
- 3. Evaluation of performance, merit rating, or annual review.
- 4. Mobility of management; job hopping.
- 5. Management by use only of visible figures, with little or no consideration of figures that are unknown or unknowable.
- 6. Excessive medical costs. (As reported by Dr. Deming in *Out of the Crisis* (pages 97-98), executives shared with him that the cost of medical care for their employees was amongst their largest overall expenses, not to mention the cost of medical care embedded in the purchase price of what they purchased from their suppliers.)
- 7. Excessive costs of liability, swelled by lawyers that work on contingency fees.

VI. THE SERVICE REVOLUTION

- The creation of services organizations accelerated sharply after World War II.
- Today, more than two-thirds of the US workforce is employed in services.
- About two-thirds of the US GDP is from services.
- There is a huge trade surplus in services.
- Investment per office worker now exceeds the investment per factory worker.
- Thus, there is a growing need for service operations management.

HISTORICAL MILESTONES IN OM AND SIGNIFICANT EVENTS IN OM (REID AND SANDERS, 2019)

- Division of labor (Smith, 1776)
- Standardized parts (Whitney, 1800)
- Scientific management (Taylor, 1881)
- Coordinated assembly line (Ford 1913)
- Gantt charts (Gantt, 1916)
- Motion study (the Gilbreths, 1922)
- Quality control (Shewhart, 1924)
- CPM/PERT (Dupont, 1957)
- MRP (Orlicky, 1960)
- CAD
- Flexible manufacturing systems (FMS)
- Manufacturing automation protocol (MAP)
- Computer integrated manufacturing (CIM)

- Thank you for your attention.