



MANUFACTURING AUTOMATION

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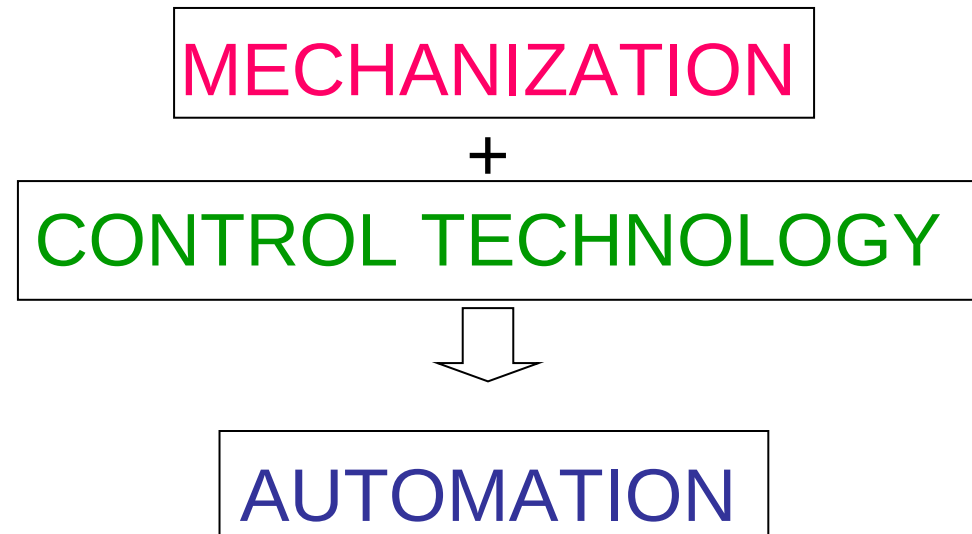
Indian Institute of Technology Kanpur

Kanpur, India



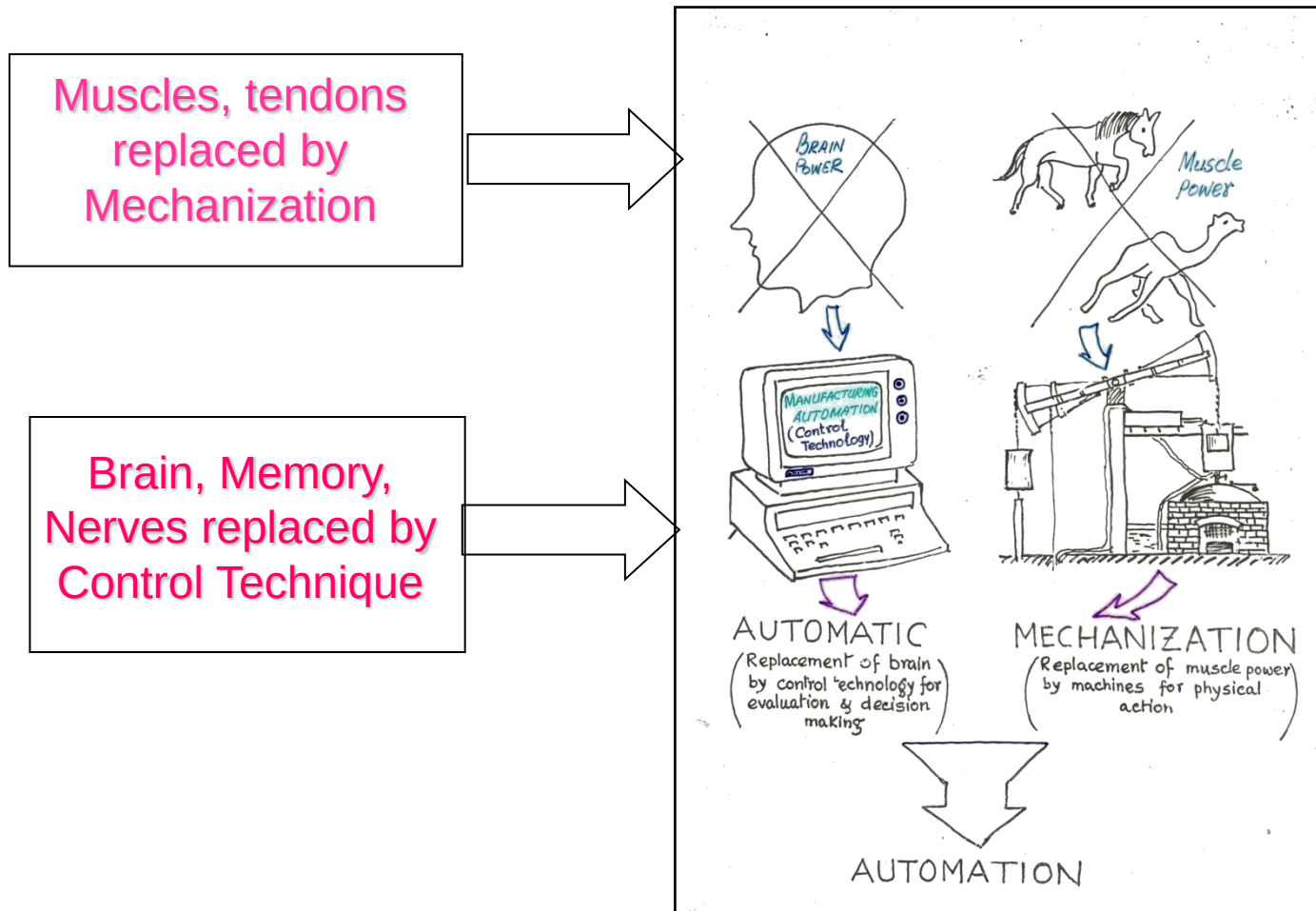
Automation in Manufacturing

Automation can be defined as a term applied to all measures taken which will cause a process to be carried out wholly or partly according to a previously set program without the intervention of human activity for its control.





AUTOMATION





Automation

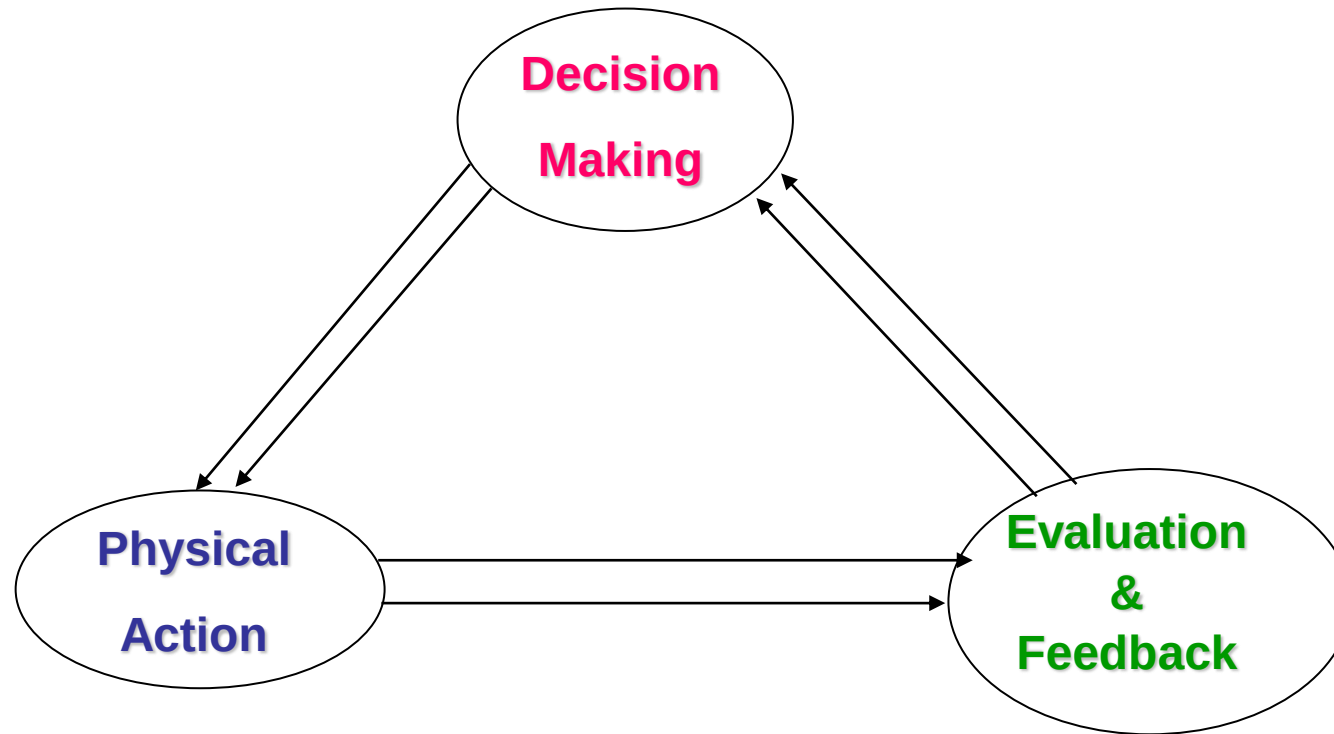
A trend of Science and Technology which causes a process to be carried out according to a previously set program without the intervention of human activity for its control

A truly automated system must have:

- ☐ the ability to make a decision
- ☐ the ability to carry out these decisions, and
- ☐ the ability to evaluate and correct performance

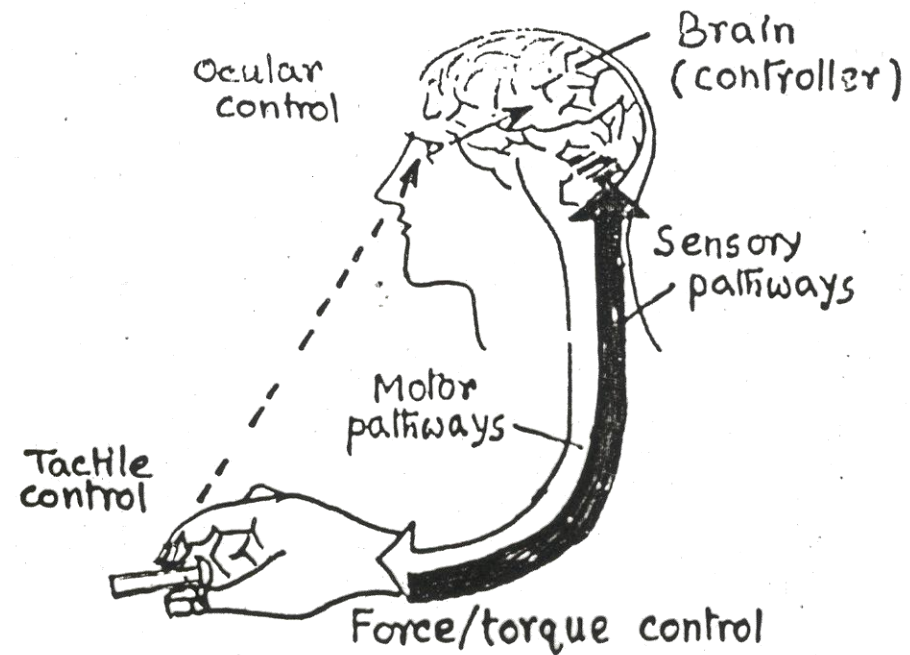


Truly Automated System





Truly Automated System





AUTOMATION

Automation is a technology concerned with the operation of Mechanical, Electronic and Computer-based systems to operate and control production

This technology includes:

- Automatic Machine Tools to process parts
- Automatic assembly machines
- Industrial robots
- Automatic material handling and storage systems
- Automatic inspection systems and quality control
- Feedback control and computer process control
- Computer system for planning, data collection and decision making to support mfg. activities



AUTOMATION

**AUTOMATION BEGINS WHERE MASS
PRODUCTION LEAVES OFF.**

OR

The Automation is Mass Production applied to the point where the substitution of human labour and human control by mechanical labour and mechanical control is made complete or nearly complete.



QUESTION

WILL NOT WIDESPREAD

UNEMPLOYMENT

BE THE RESULT?



ANSWER

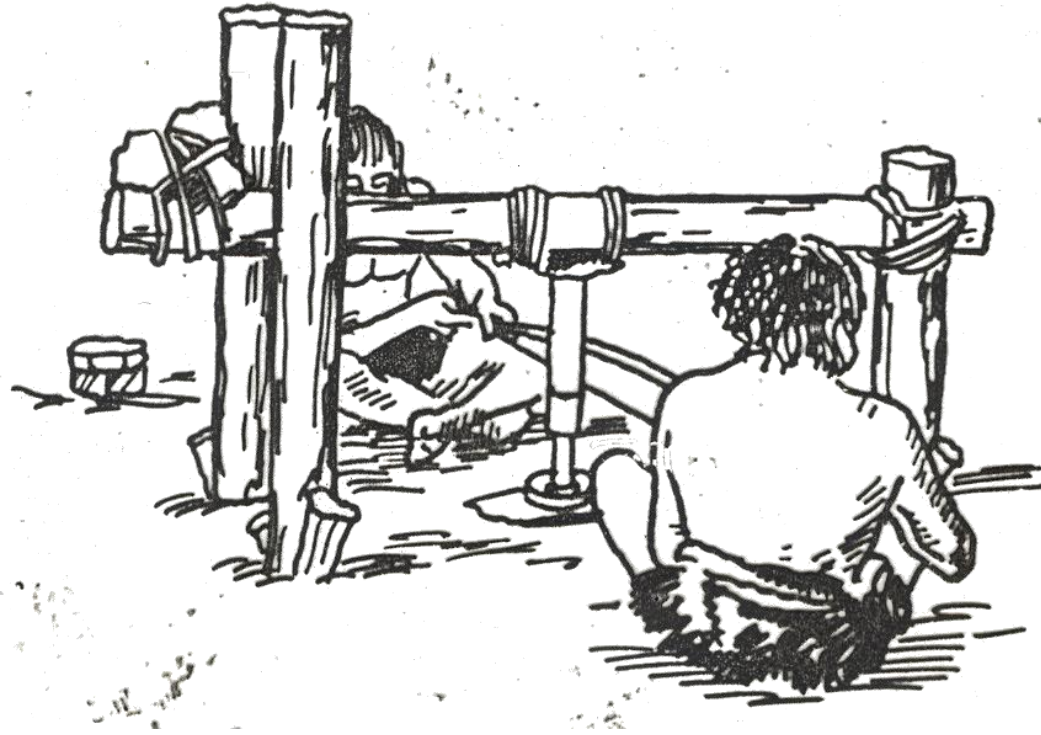
- Elimination of human labour has been going on for thousand of years
- The mechanization of labour has not only released more of man's time and energy for other pursuits, it has led to unmatched material prosperity and increasingly better use of natural resources.



- Greater productivity of mass production has opened and enlarged many fields of employment like designing, production, maintenance, packaging, distribution, selling, advertisement etc.
- It has also made possible the phenomenal expansion of the material processing industries like Metalworking, fuel, rubber and synthetic industries.

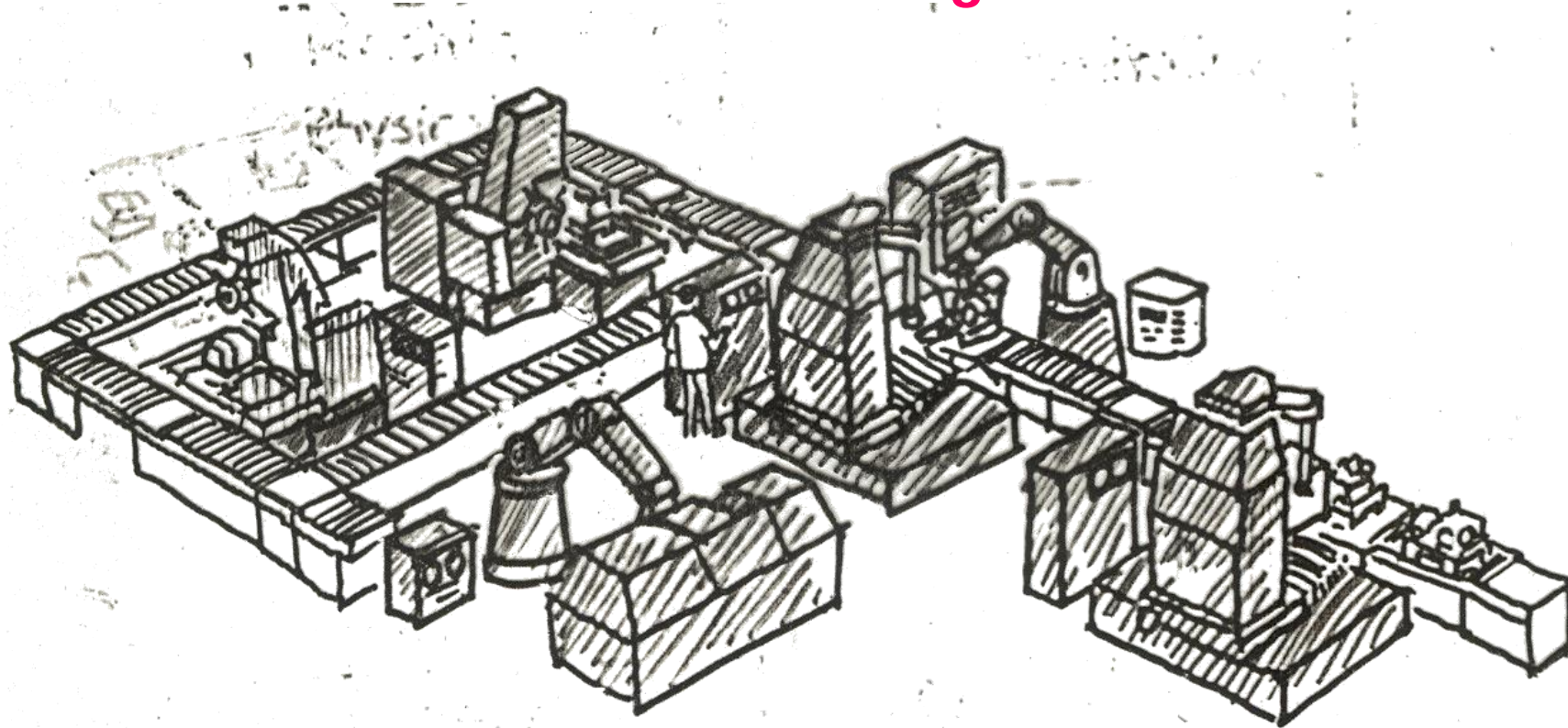


Manufacturing - THEN



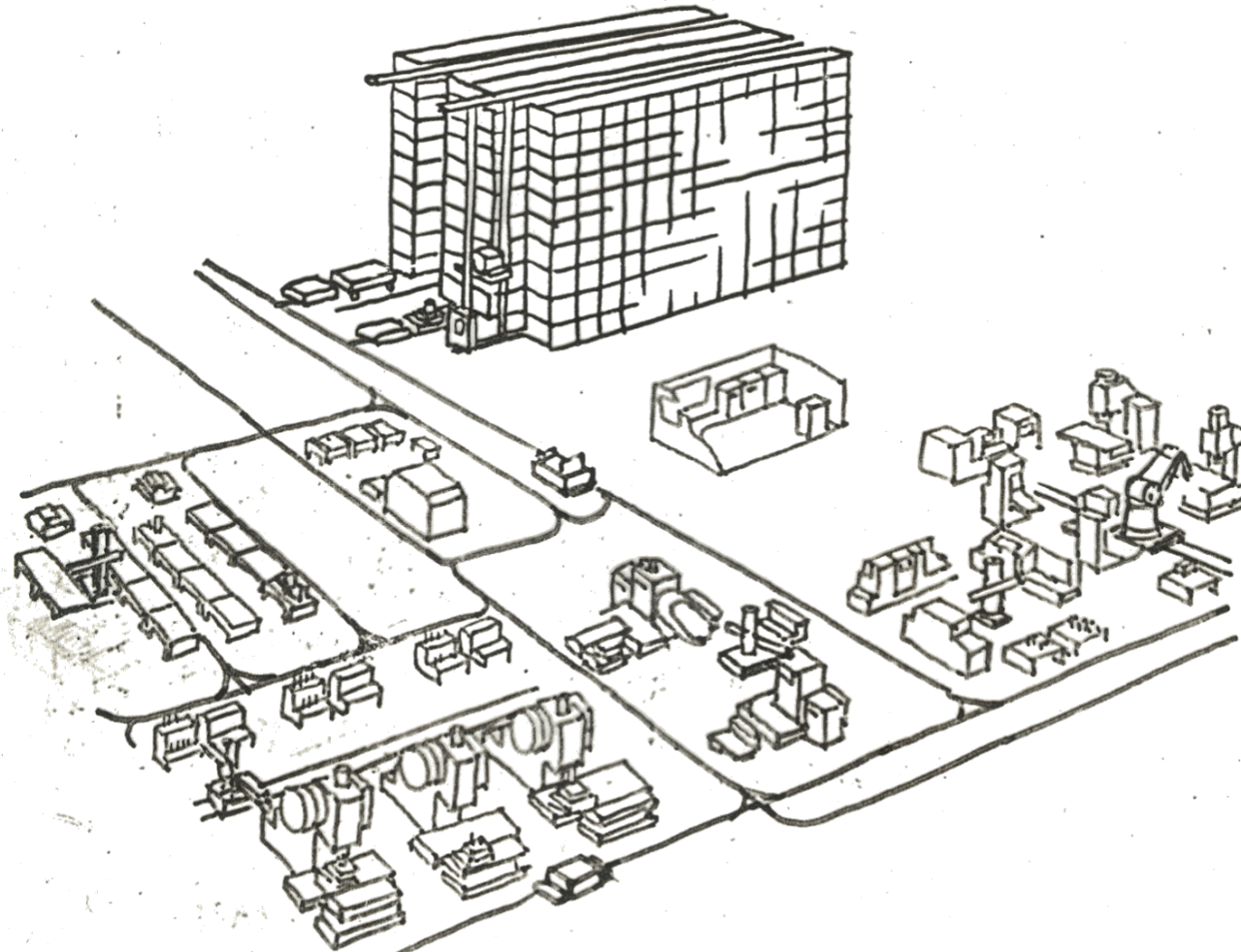


Manufacturing - NOW





Manufacturing - SOON





Benefits of Automation

- Reduction or total elimination of tedious and routine operations like loading, unloading, assembly, inspection etc.
- Creation of new and more interesting jobs
- Increase in the productive capacity of industry
- Greater flexibility through the use of standard production units
- Higher standard of living



Reasons for Automation

1. Increased productivity (greater output per hour of labour input)
2. High cost of labour
3. Labour shortages
4. Trend of labour towards the service sector (insurance, personal, legals, sales etc.)
5. Safety
6. High cost of raw material
7. Improved product quality
8. Reduced manufacturing lead time
9. Reduction of in-process inventory
10. High cost of non-automating



Automation Strategies

1. **Specialization of operations** – use of special purpose equipment
2. **Combined Operations** – reduce number of workstations
3. **Simultaneous Operations** – reduce total processing time
4. **Integration of Operations** – linking several work stations
5. **Increased Flexibility** – max. utilization of equipment
6. **Improved material handling and storage** – reduce non-productive time
7. **On-line inspection** – correction to the process
8. **Process control and optimization** – operate individual process and equipment more efficiently.
9. **Plant Operation Control** – control at the plant level
10. **Computer-Integrated Manufacturing** – integration of factory operations



TYPES OF AUTOMATION

Fixed Automation :

The sequence of Processing (or Assembly) operations is fixed by the equipment configuration.

- High initial investment for custom-engineered equipment
- High production rate
- Relatively inflexible in accommodating product changes

Example: Mechanised Assembly Lines (1913)

Machining Transfer Lines (1924)



Programmable Automation:

The production equipment is designed with the capability to change the sequence of operations to accommodate different product configurations.

- High investment in general-purpose equipment
- Low production rate w.r.t fixed automation
- Flexibility to deal with the change in the product configuration

Examples : NC Machine Tools (1952) and Industrial Robots (1961)



Flexible Automation:

Extension of Programmable Automation. It is a system capable of producing a variety of products with virtually no time loss for changeovers from one product to the next.

- ◆ High investment for a custom-engineered system
- ◆ Continuous production of variable mixtures of products
- ◆ Flexibility

Example: FMS (1960)