

MANUFACTURING SYSTEMS & LEAN MANUFACTURING

By

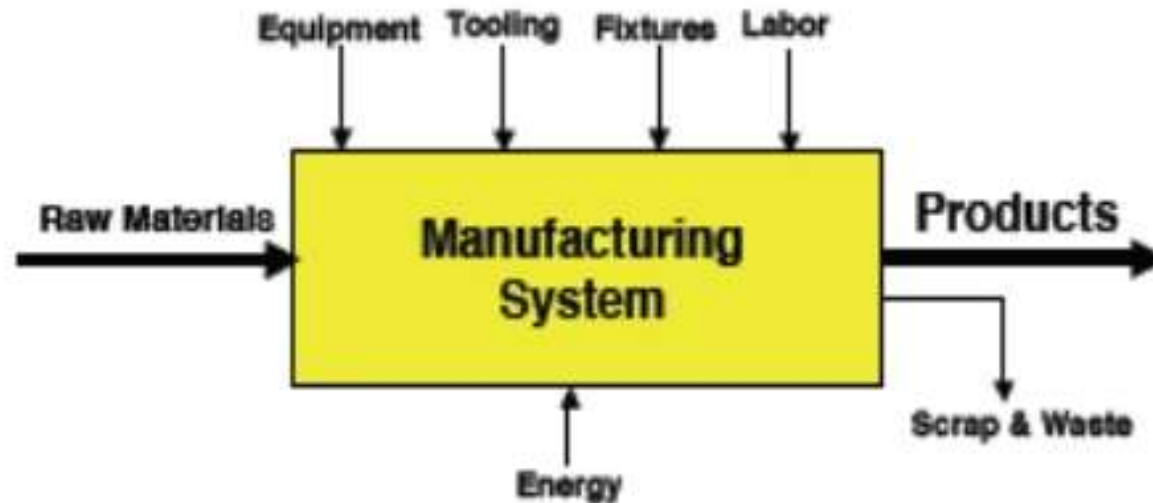
SUMIT BHATTACHARYA 710

SHARVIL DALVI 713

Department Of Mechanical Engineering

Manufacturing System

- “ Manufacturing system is a collection of integrated equipments and human resources whose function is to perform one or more processing and/or assembly operations on a raw material , part or set of parts”
- A set of operations performed on material which brings them closer to the desired final form



All operation here are concerned with **input-transformation-output** process.

- **Input:** Men, material, machines, drawings etc.
- **Transformation:** Operations, material handling , procurement etc.
- **Output:** The final goods and services.

Thus the combination of operations and activities mentioned before, employed to create goods or services is termed as manufacturing systems.

Selection of Manufacturing System:

It must be able to meet the specifications set for the final product and be cost effective.

The factors affecting the selection :

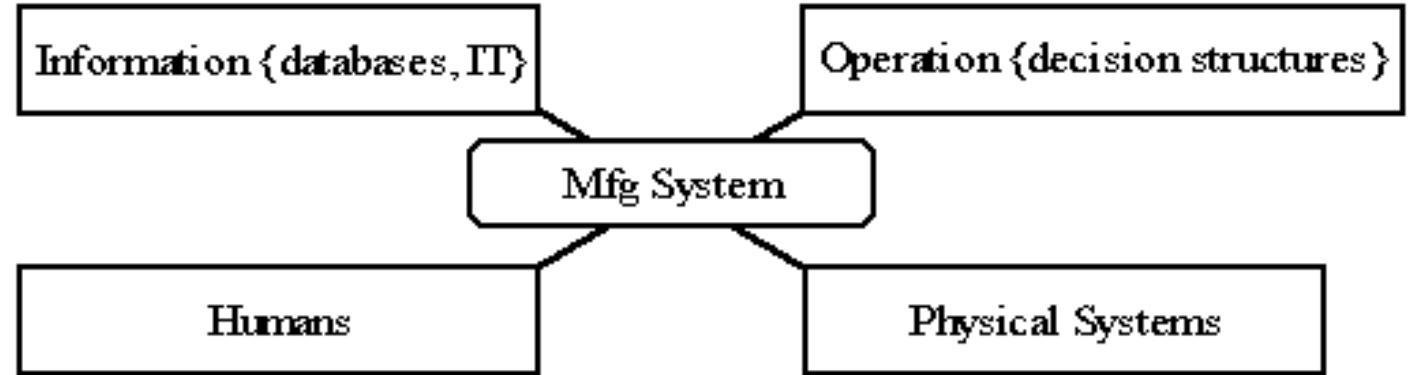
- Effect of volume
- Capacity of plant
- Flexibility
- Lead time
- Efficiency
- Environment

Examples Of Manufacturing Systems

- Single station cells
- Machine clusters
- Manual assembly lines
- Automated transfer lines
- Automated assembly systems
- Flexible manufacturing system

Components Of Manufacturing System

- Production Machines
- Material handling system
- Computer systems
- Human Resources



Production Machines:

- In all manufacturing systems, most of the actual assembly work is accomplished by machines or with aid of tools
- Classification of manufacturing systems:
 1. Manually operated machines which are controlled or supervised by a human worker.
 2. Semi-automated machines perform a portion of work cycle under some form of program control, and worker tends the machine the rest.
 3. Fully automated machines.

Material Handling Systems:

The material handling functions in most manufacturing systems:

1. Loading work units at each station
2. Positioning work units at each station
3. Unloading work units at each station
4. Transporting work units at each station in multi-station systems
5. Temporary storage of work units

Work transport between stations:

- Fixed Routing
- Variable Routing

Computer Control Systems:

Typical computer functions in manufacturing systems:

- Communicate instruction to workers(receive processing or assembly instructions fro specific work unit)
- Download part programs
- Control material handling system
- Schedule production
- Failure diagnosis
- Safety monitoring
- Quality control
- Operations management

Human Resources:

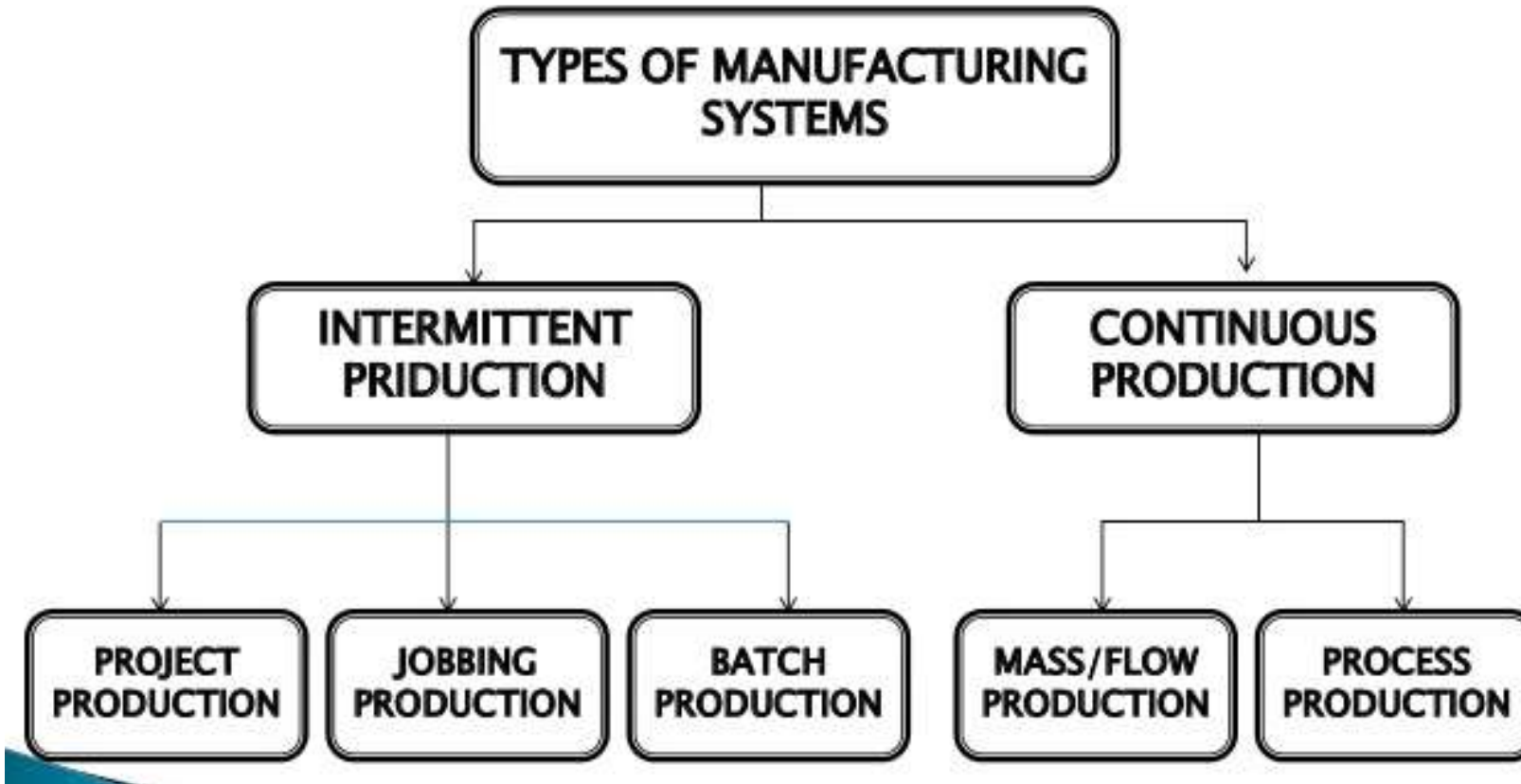
- To operate and manage the system/process
- Required either fulltime or periodically to keep the system running
- Humans refers to all personnel , operators, vendors
- In context of manufacturing system , human perform some or all of the value added work that is accomplished on the parts/products.
- Performing either manual (direct)work on it or by controlling the machines.
- In fully automated machine, direct labour is still needed.
- For example : loading or unloading parts, changing tools, resharpening tools etc.

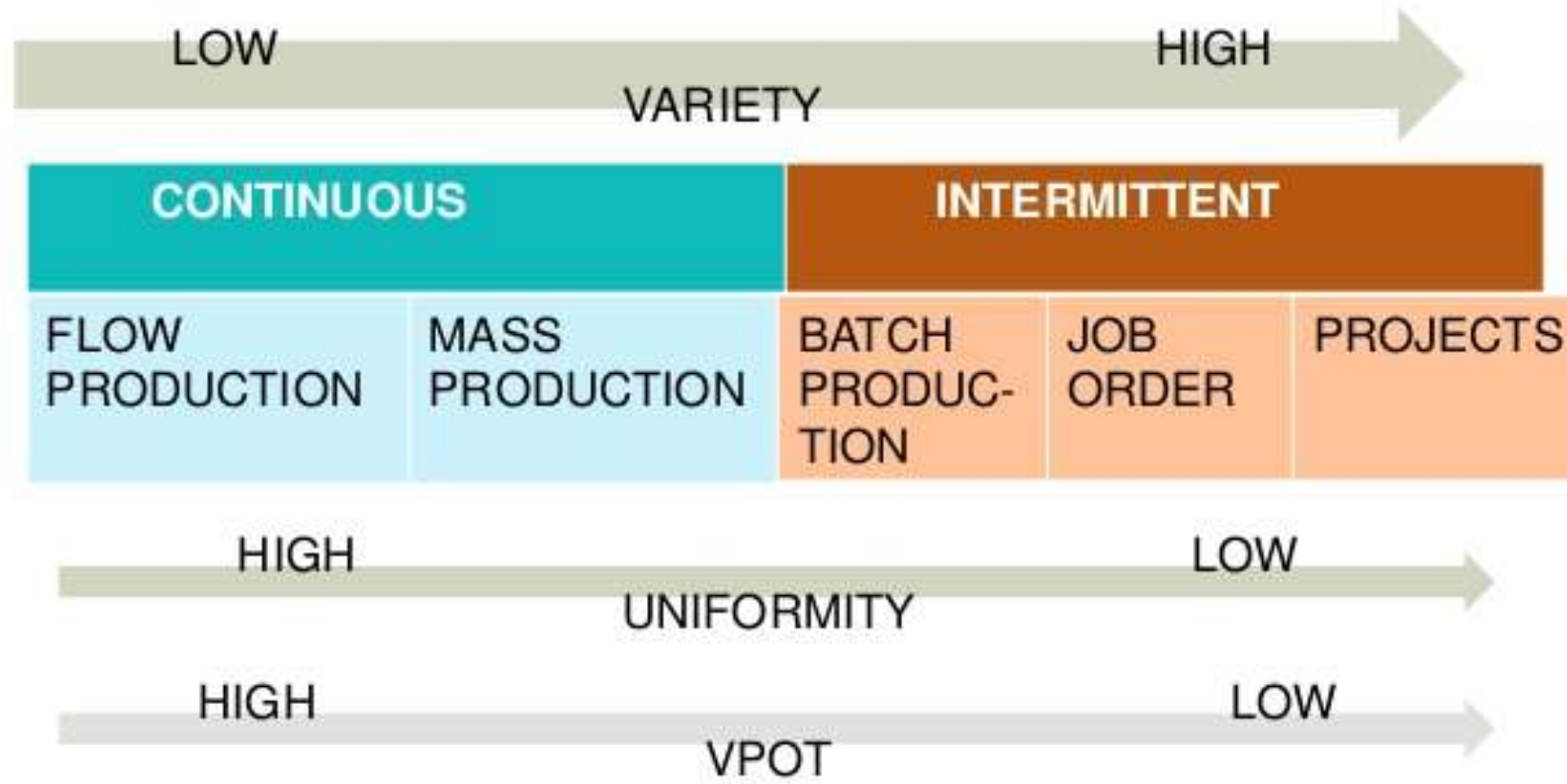
Classification Of Manufacturing Systems:

Factors that define and distinguish manufacturing systems:

- Types of operations performed
- Number of workstations
- System Layout
- Automation and manning level
- Part or product variety

Types Of Manufacturing Systems:





On Basis of Material Handling and labor:

<u>CONTINUOUS</u>	<u>INTERMITTENT</u>
1.UNSKILLED AS WELL AS SMALL TEAM OF SPECIALISED LABOUR FORCE	1.HIGHLY SKILLED LABOUR FORCE
2.MECHANIZED MATERIAL HANDLING	2.NOT FEASIBLE TO EMPLOY MECHANIZED HANDLING
3.MATERIAL HANDLING COST IS LESS	3.MATERIAL HANDLING COST IS HIGHER
4.INVESTMENT IN INVENTORY IS HIGHER	4.NEED FOR INVENTORY IS MINIMISED

On Basis of Machinery:

<u>CONTINUOUS</u>	<u>INTERMITTENT</u>
1.SPECIFIC MACHINERY	1.GENERALISED MACHINERY
2.PERMANENT MACHINE SETUP	2.FREQUENT CHANGES IN MACHINE SETUP
3.DUPLICATION OF MACHINES	3.LESS MACHINES REQUIRED

On Basis of Output Produced:

<u>CONTINUOUS</u>	<u>INTERMITTENT</u>
1.FEW STANDARD PRODUCTS IN LARGE QUANTITIES	1.WIDE RANGE OF PRODUCTS IN SMALL QUANTITIES
2.OUTPUT ON THE BASIS OF ANTICIPATION OF DEMAND	2.OUTPUT ACCORDING TO ORDER RECEIVED

Continuous Production System:

1. Flow Type:

- Output cannot be segregated into different units
- High degree of output
- Output cannot be measured directly
- Eg: Power Plant

2. Mass Production:

- Straight line flow of material
- Output visible as identical units.
- Standardized output produced in large quantities.

Problems: Balancing production lines, Machine maintenance, raw material

Eg: Sugar production

Intermittent Production System:

1. Batch Production System:

- Variety of products made in small quantities
- Various products compete for share of machine
- Outputs are aggregated in form of batches, where batches can have similar or dissimilar outputs

Problems: Machine-Job allocation problem

Eg: Electrical goods

2. Job Order Production System:

- Does not have its own standard product but accepts whatever customer orders
- Output identifiable in terms of specific job order
- Material flow complex

E.g: Tailor shop

3. Project Production System:

- It uses resources on different projects
- Product remains remains fixed and manpower and facilitates put work on it
- PERT/CPM can be used for planning and control

LEAN MANUFACTURING

- "lean", is a systematic method for the elimination of waste within a manufacturing system.
- The waste includes:-
 1. **Overproduction** – producing more than the consumers demand.
 2. **Waiting** –waiting for the next production step, interruptions of production during shift change.
 3. **Inventory** – supply levels and work in progress inventories too high.
 4. **Transportation** – moving products that are not actually required to perform the processing and the efficiency with which the product is transported.
 5. **Over-processing** - working on the same product again and again thereby reducing its efficiency.
- It aims at increasing the efficiency and minimizing the cost of the product.

BRIEF HISTORY OF LEAN MANUFACTURING

(Case Study)

- Lean principles are derived from the Japanese manufacturing industry introduced by John Krafcik in 1988 who worked as a quality engineer in the Toyota industry.
- Toyota industry past improvements:-
 1. Redesigning of the casting assembly thereby reducing repairs in the future.
 2. Reducing overproduction (build to order)
 3. Adopting the TPM approach.
- It lead to flexibility in operation, reduction in waste, smooth production flow, proper sequencing and timing of processes, better customer supplier connection, etc.
- Henry Ford was one of the people to develop the idea behind Lean Manufacturing. He used the idea of "continuous flow" on the assembly line for his automobile models, where he kept production standards extremely tight, so each stage of the process fitted together with each other stage, perfectly.

References:

- <http://www.slideshare.net/pakkiaarzoo/types-of-production-system>
- <http://www.slideshare.net/akashbakshi/4types-of-manufacturing-system-and-layouts?related=1>
- <https://www.scribd.com/doc/17341282/components-of-manufacturing-system>