FLEXIBLE MANUFACTURING SYSTEM

19MEB301 CADCAM & AUTOMATION

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FMS (**Flexible Manufacturing Systems**)

- A flexible manufacturing system (FMS) is a highly automated GT(Group technology) machine cell. Consisting of a group of processing workstations (usually CNC machine tools), interconnected by an automated material handling and storage system, and controlled by a distributed computer system.
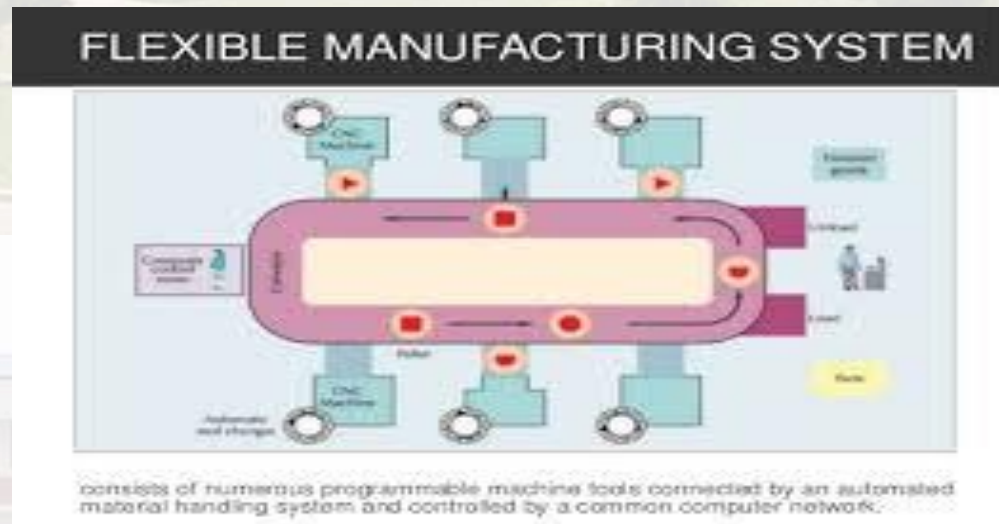

FLEXIBLE MANUFACTURING SYSTEM

consists of numerous programmable machine tools connected by an automated material handling system and controlled by a common computer network.

TABLE 16.1 Types of Flexibility in Manufacturing. These Concepts of Flexibility Are Not Limited to Flexible Manufacturing Systems. They Apply to Both Manned and Automated Systems. Sources: [3], [7], [23], [26]

Flexibility Type	Definition	Depends on Factors Such As:
Machine flexibility	Capability to adapt a given machine (workstation) in the system to a wide range of production operations and part styles. The greater the range of operations and part styles, the greater the machine flexibility.	Setup or changeover time. Ease of machine reprogramming (ease with which part programs can be downloaded to machines). Tool storage capacity of machines. Skill and versatility of workers in the system.
Production flexibility	The range or universe of part styles that can be produced on the system.	Machine flexibility of individual stations. Range of machine flexibilities of all stations in the system.
Mix flexibility	Ability to change the product mix while maintaining the same total production quantity; that is, producing the same parts only in different proportions.	Similarity of parts in the mix. Relative work content times of parts produced. Machine flexibility.
Product flexibility	Ease with which design changes can be accommodated. Ease with which new products can be introduced.	How closely the new part design matches the existing part family. Off-line part program preparation. Machine flexibility.

Routing flexibility	Capacity to produce parts through alternative workstation sequences in response to equipment breakdowns, tool failures, and other interruptions at individual stations.	Similarity of parts in the mix. Similarity of workstations. Duplication of workstations. Cross-training of manual workers. Common tooling.
Volume flexibility	Ability to economically produce parts in high and low total quantities of production, given the fixed investment in the system.	Level of manual labor performing production. Amount invested in capital equipment.
Expansion flexibility	Ease with which the system can be expanded to increase total production quantities.	Expense of adding workstations. Ease with which layout can be expanded. Type of part handling system used. Ease with which properly trained workers can be added.

Flexible manufacturing systems can be distinguished according to the kinds of operations they perform: 1.Processing operations
　　　　2.Assembly operations

Types of FMS

1. DEPENDING UPON KINDS OF OPERATION-

- I. **Processing operation.** Such operation transforms a work material from one state to another moving towards the final desired part or product. It adds value by changing the geometry, properties or appearance of the starting materials.

- II. **Assembly operation.** It involves joining of two or more component to create a new entity which is called an assembly/subassembly. Permanent joining processes include welding, brazing, soldering , adhesive bonding, rivets, press fitting, and expansion fits.

2. DEPENDING UPON NUMBER OF MACHINES

- **I. single machine cell (SMC).** It consist of a fully automated machine capable of unattended operations for a time period longer than one machine cycle. It is capable of processing different part styles, responding to changes in production schedule, and accepting new part introductions.

- **II. Flexible manufacturing cell (FMC).** It consists of two or three processing workstation and a part handling system. The part handling system is connected to a load/unload station. It is capable of simultaneous production of different parts.

- **III. A Flexible Manufacturing System (FMS).** It has four or more processing work stations (typically CNC machining centers or turning centers) connected mechanically by a common part handling system and automatically by a distributed computer system. It also includes non-processing work stations that support production but do not directly participate in it. e.g. part / pallet washing stations, co-ordinate measuring machines.
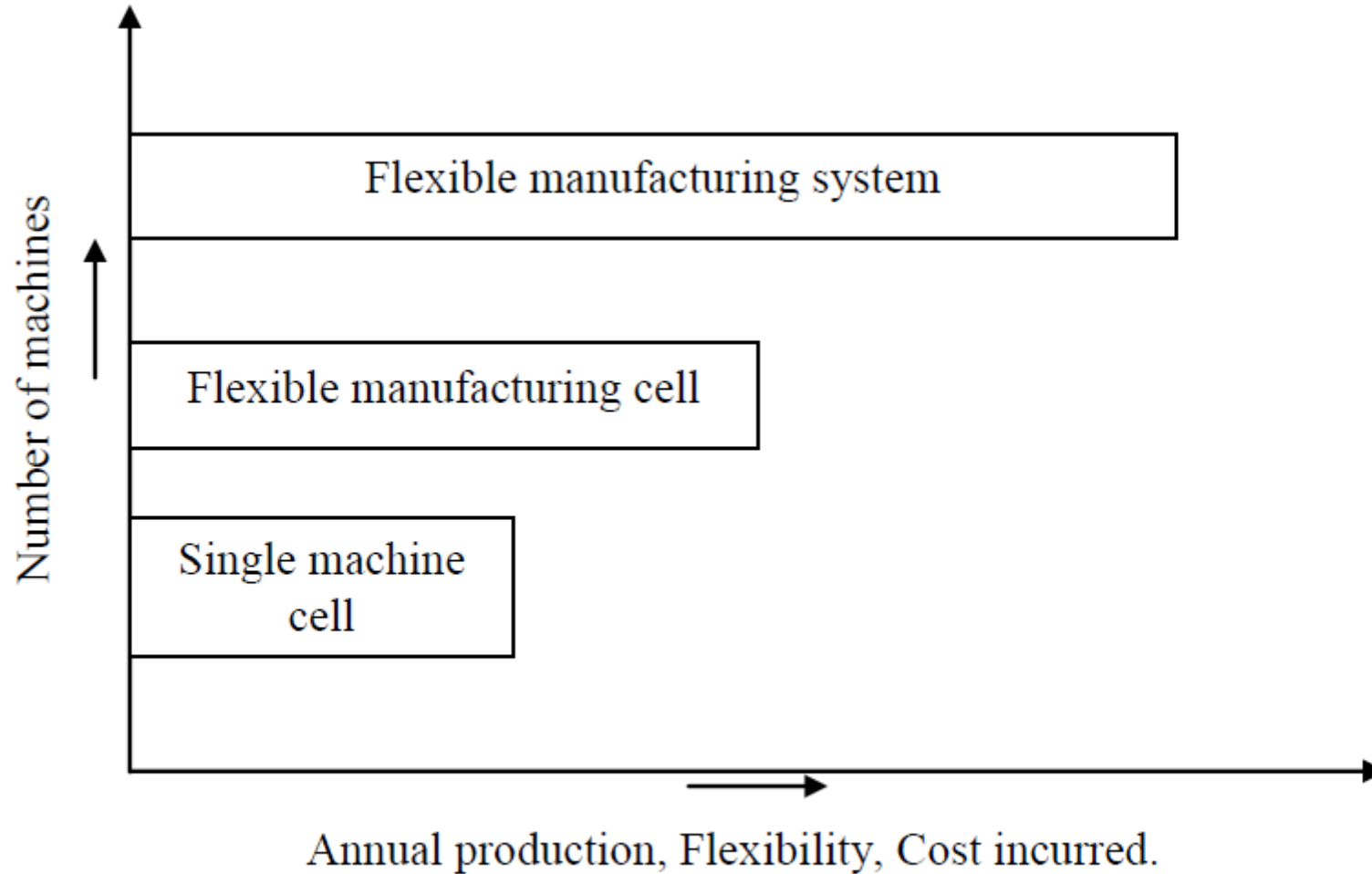
Categories of FMS

Figure 6.2 Comparison for three categories of FMS

- I. **Dedicated FMS.** It is designed to produce a particular variety of part styles. The product design is considered fixed. So, the system can be designed with a certain amount of process specialization to make the operation more efficient.

- **II. Random order FMS.** It is able to handle the substantial variations in part configurations. To accommodate these variations, a random order FMS must be more flexible than the dedicated FMS. A random order FMS is capable of processing parts that have a higher degree of complexity.
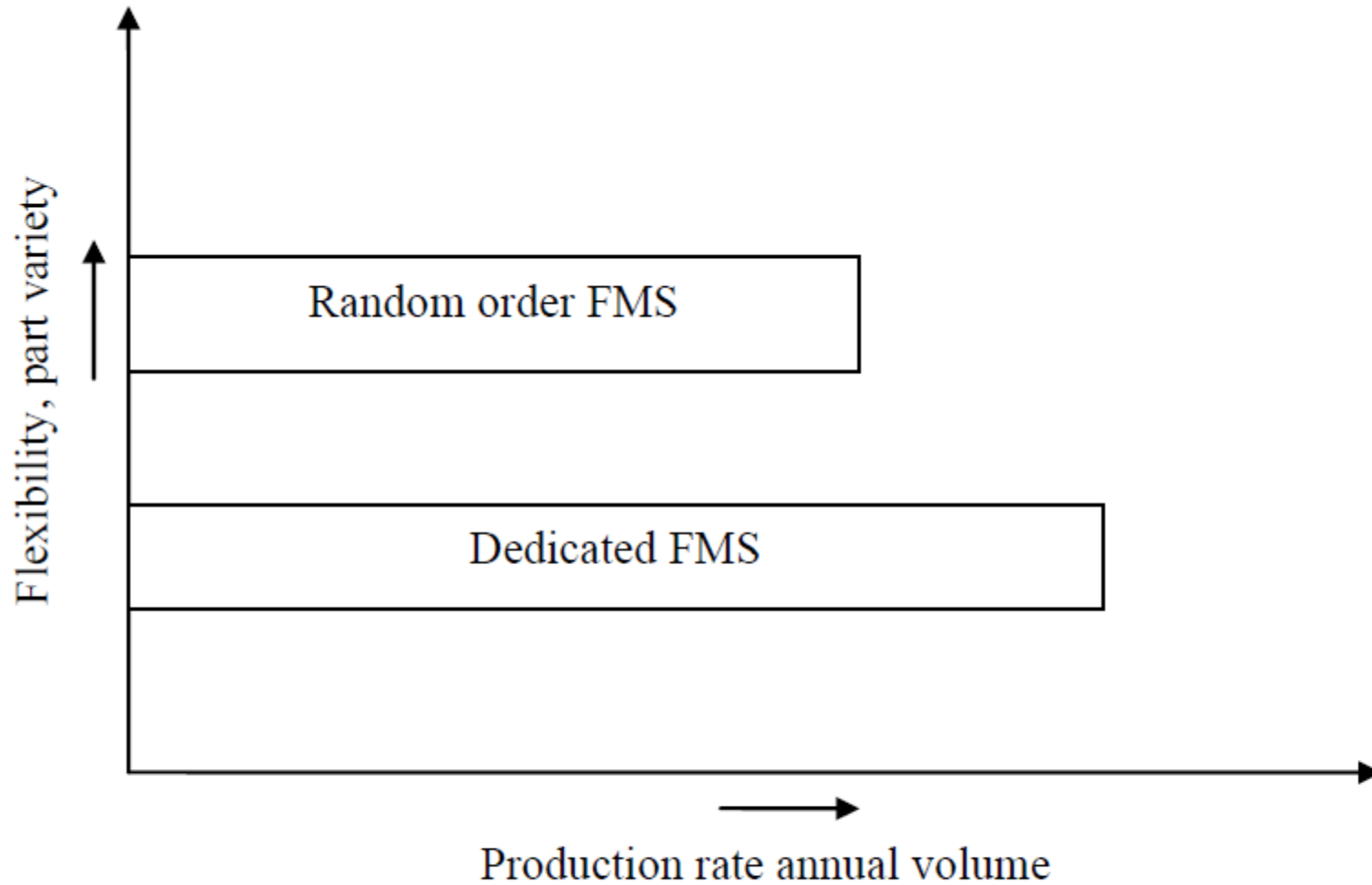
Figure 6.3 differences between dedicated and random-order FMS types

FMS-Sub systems

- A flexible manufacturing system consists of two subsystems:
- Physical subsystem
- Control subsystem

Physical subsystem

➢ **Workstations**.

➢ **Storage-retrieval systems.**

➢ **Material handling systems.**

Control subsystem

➢**Control hardware**

➢**Control software**

THANK YOU

Assessment

https://create.kahoot.it/share/quiz-on-csg/5929c3cf-6a07-427d-ad01-23cc06ac1b38