

## TYPES OF FLEXIBILITY

In a **Flexible Manufacturing System (FMS)**, *flexibility* refers to the system's ability to adapt to changes. There are several **types of flexibility** that are commonly recognized in FMS:

### 1. Machine Flexibility

- **Definition:** The ability of machines to perform a variety of operations without requiring major retooling.
- **Example:** A CNC machine that can be reprogrammed to manufacture different parts.

### 2. Routing Flexibility

- **Definition:** The ability of a system to use multiple machines or routes to produce the same part.
- **Example:** If one machine is down, the part can be rerouted to another machine.

### 3. Product Flexibility

- **Definition:** The ability to produce a wide range of products with minimal delay or changes in equipment.
- **Example:** Switching from making gear shafts to making brake discs without major setup changes.

### 4. Volume Flexibility

- **Definition:** The capability to operate profitably at different production volumes.
- **Example:** Scaling up or down production based on demand.

### 5. Expansion Flexibility

- **Definition:** The ability to increase system capacity by adding new machines or equipment.
- **Example:** Adding a new robotic arm to the system to speed up production.

### 6. Operation Flexibility

- **Definition:** The system's ability to execute different operations in various sequences.
- **Example:** Changing the order of machining operations based on availability or urgency.

### 7. Process Flexibility

- **Definition:** The ability to produce a variety of part types using the same equipment and processes.
- **Example:** An FMS capable of handling both aluminum and steel parts with different geometries.

## **8. Market Flexibility**

- **Definition:** The ability to adapt quickly to market changes such as design modifications or custom orders.
- **Example:** Incorporating last-minute customer design changes in the production line.