# INDE2211.1 Industrial Production Systems

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**MY PRODUCT AND NECESSARY PROCESSES**

1. **What is your product?**

**Plastic water cups.**

2. **How many models does your product have?**

- 2 models: single-use cups and reusable cups.

3. **What are the raw materials you need to produce your product?**

- Plastic, Polythene, Plastic seal (aluminum foil composited with plastic film) and water.

4. **What are the main processes**

- Injection molding (for both types of cups).
- Cooling and solidification.
- Trimming and finishing.
- Quality control.
- Packaging**.**

5. **Define the types of manufacturing operations that need to be performed.**

   - Processing operations: -- Injection molding (shaping process).
   - Assembly operations: --Trimming, finishing, quality control, and packaging (joining processes).

6. **Determine the sequence of unit operations.**

   - Injection molding: Shaping the plastic material into cup forms.
   - Cooling and solidification: Allowing the molded cups to cool and solidify.
   - Trimming and finishing: Removing any excess material and finishing the cups.
   - Quality control: Checking the cups for defects, consistency, and safety.
   - Packaging: Packaging the finished cups for distribution

7. **Define the product parameters (production quantity, product variety, product complexity, part complexity)**
   **Production quantity:**

   - Medium to high production

   **Product variety:**

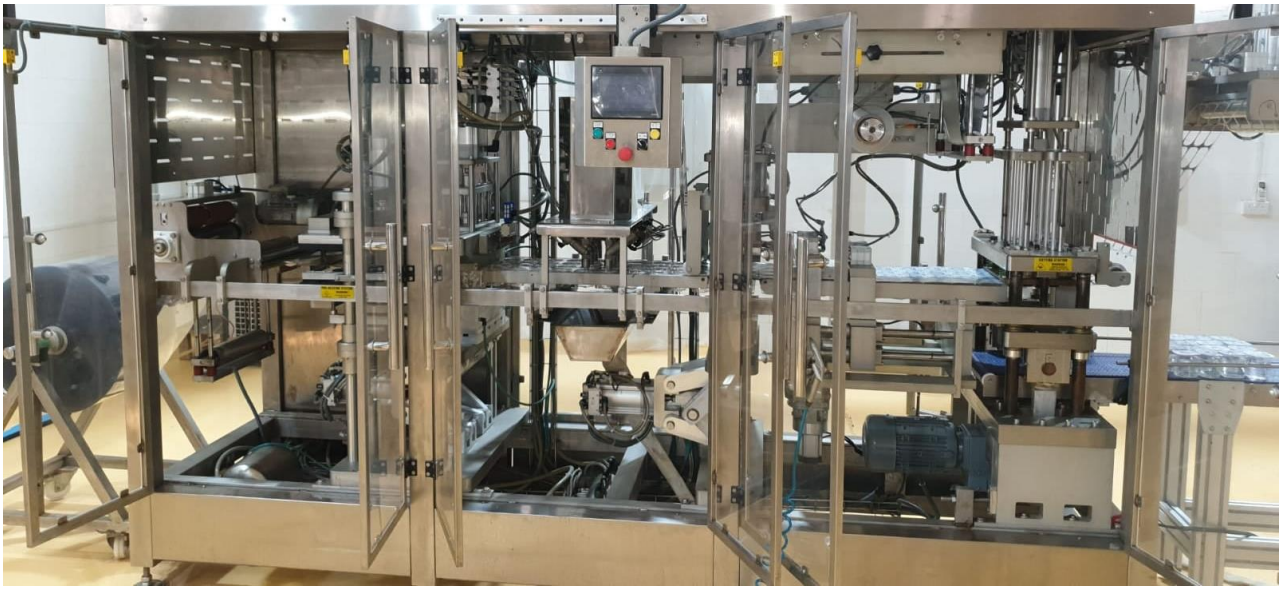
   - P1=1 (only one product), P2=2 (two models: single-use and reusable cups).

   **Product complexity (np):**

   - 3 components assembled (molded plastic, finishing, packaging).

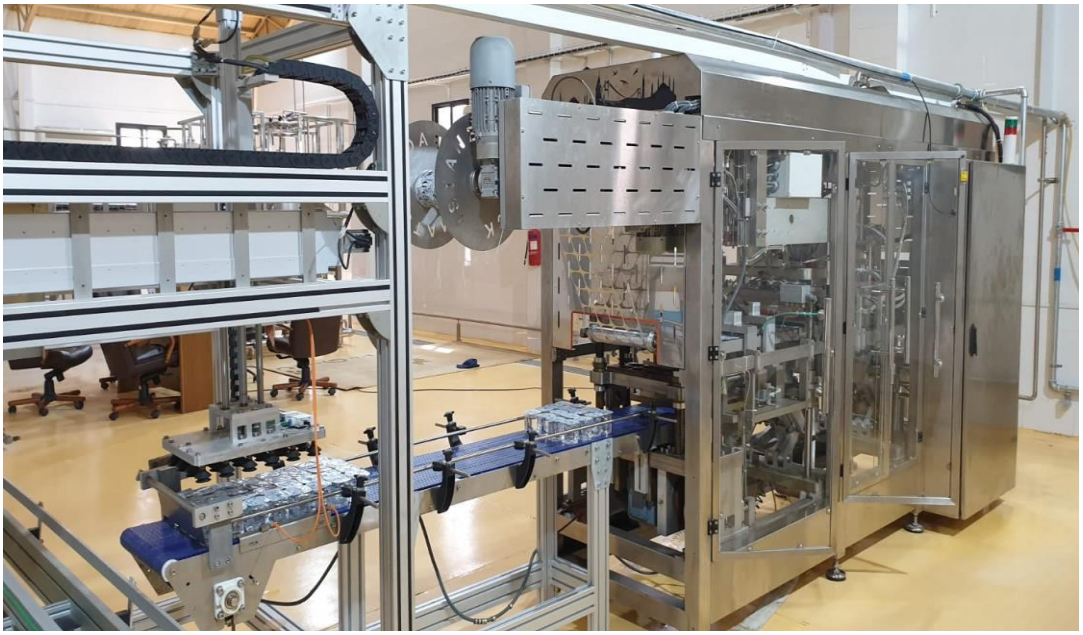
   **Part complexity (no):**

   - The molded plastic part complexity involves processing operations. If manufacturing the plastic resin in-house, part complexity increases.



1) **Injection molding for the 1st part.**

2) **Then Cooling and solidification and trimming and finishing. For the 2nd part.**



3) **Then finally Quality control and Packaging for the last part.**

**MY INITIAL PRODUCTION SYSTEM DESIGN**

1. **Define the initial design by stating manufacturing system and type of production.**

    - Manufacturing System: 20-piece every operation flow production with a process layout.
    - Type of Production: Assembly plant producing plastic water cups for end customers using suppliers for raw materials

      These processes are among the advanced processes that do not require workers, but they require one worker to arrange the cartons of the water cups after they are fully prepared automatically

      Equipments: machine to forming the cup and checking and filling the cup.

      And a robotic to fill ready-made water cups into cartons

2. **Plant scope:**
    - Assembly plant for plastic water cup production.
3. **Manufacturing capability of the plant:**

    **What is your technological processing capability - the available set of manufacturing processes?**

    - Cutting and assembly processes available. Can potentially expand to new product types such as containers.

    **Define the physical size and weight of your product.**

    - Standard size and weight for plastic water cups.

    **Define production capacity (plant capacity) - production quantity that can be made in a given time**

    **Annual production capacity:** more than 1,000,000 cups

    **The operating conditions:**

    Number of weeks in a year: 50

    Number of days in the week that the plant operates: 5

    Number of shifts per day: 2

    Number of hours per shift: 8

4. **Performance Metrics and Costs**

**What performance and cost metrics do you need to monitor to manage your operations? Define each metric based on your product and your facility.**

The machines Production rate per hour is two sets, each set consisting of 100 boxes, and in each box, there are 40 cups of water, and the cost of producing each box of water which has 40 cups is 0.65 JD per box and 0.65/40 to find it per cup 0.01625 per cup inclusive

That is mean (2*100*40) = 8000 cups of water per hour

And the cost to produce 8000 cups of water is (8000 * 0.01625) = 130JD per hour

And the cost to produce 200 box per hour is (200*0.65) =130JD per hour

which is same as 8000 cup~130JD = 200 boxes ~130JD / per hour

Quality: Monitor the percentage of defect-free cups produced.

5. **Manufacturing System**

**Define your current manufacturing system by stating the number of workstations, workstation types, number of machines to assign a worker if you have machine clusters. Make sure it is based on your product demand and production rate. Explain your future plans according to Automation Migration Strategy.**

Current Manufacturing System:

- 20-piece every operation flow production with a process layout.
- Equipment includes machines for injection molding, checking, and filling cups, along with a robotic system for packaging.
- One worker is required to arrange cartons after cups are prepared automatically.

Future Plans and Automation Migration Strategy:

- Implementing automation for tasks such as injection molding, trimming, and packaging to increase efficiency and reduce labor costs.
- Upgrading to advanced machinery with integrated quality control systems to minimize defects and ensure consistency.
- Incorporating automated material handling systems such as conveyors or robotic arms for transporting cups within the facility.

**What type of material handling equipment does your facility use to handle your product?**

Currently, a robotic system is used for filling ready-made water cups into cartons. Future plans may include additional automation for material handling, such as conveyor belts or AGVs.

6. **Work Study**

**How does your facility tracks manual work performance?**

Manual work can be tracked through time and motion studies, where the time taken to complete each task is recorded and analyzed.

**What are your future plans to improve manual work performance?**

- Predictive Maintenance: Implement predictive maintenance techniques to anticipate equipment failures and schedule maintenance proactively, minimizing downtime and maximizing overall equipment effectiveness (OEE).

- Integration of AI and Machine Learning: Integrate AI and machine learning technologies to enable the automation systems to learn from operational data and improve performance over time.

- Remote Monitoring and Control: Enable remote monitoring and control capabilities to allow operators to oversee production processes from a centralized location and respond to any issues or alarms promptly.

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