CHAPTER 3
PRODUCTION PLANNING AND SCHEDULING

BASIC COMPETENCIES

Students are able to understand the concepts of production planning and scheduling, analyze production data, and communicate production plans in English with the right terminology.

LEARNING OBJECTIVES

After studying this chapter, students are expected to:

1. Understand and use production planning and scheduling terminology
2. Read and understand procedural texts in the context of production planning
3. Write production reports dan scheduling proposals
4. Presenting production plans and performance analysis
5. Using conditional sentences in the context of production planning

PHASE 1: PRE-ACTIVITY

Warm-up Discussion

1. Why is production planning important for manufacturing efficiency?
2. What are the factors that must be considered in making a production schedule?
3. Have you ever experienced or heard of production delays? What causes it?

Mind Mapping Activity

Create a mind map with "Production Planning" in the middle. Add branches for:

- Inputs (resources, data, requirements)
- Processes (planning, scheduling, controlling)
- Outputs (schedules, reports, performance metrics)

PHASE 2: INPUT & EXPLORATION

PROCEDURE TEXT: HOW TO CREATE A MASTER PRODUCTION SCHEDULE

About Procedure Text: A procedure text provides step-by-step instructions on how to accomplish a specific task or process. In manufacturing contexts, procedure texts are essential for standardizing operations and ensuring consistent outcomes (Chapman et al., 2017).

Task 1. Read the following procedure text carefully and answer the questions that follow.

STANDARD OPERATING PROCEDURE FOR CREATING A MASTER PRODUCTION SCHEDULE (MPS)

Goal:

To develop an effective Master Production Schedule that balances customer demand with production capacity, ensuring timely delivery of products while optimizing resource utilization.

Materials and Tools:

- Demand forecast data and customer orders
- Current inventory records
- Bill of Materials (BOM) for each product
- Production capacity data
- Lead time information for materials and production
- MPS spreadsheet template or ERP software
- Safety stock requirements

Procedure:

Step 1: Gather Demand Information – First, collect all relevant demand data including customer orders, sales forecasts, and historical sales patterns. Analyze market trends and seasonal variations that may affect demand. Consolidate this information to create a comprehensive demand plan for the planning horizon, typically covering 3 to 18 months.

Step 2: Assess Current Inventory Levels – Next, review current inventory levels of finished goods, work-in-process (WIP), and raw materials. Determine the beginning inventory for each product. Calculate the safety stock required to protect against demand variability and supply uncertainties.

Step 3: Define Product Categories and Groups – Then, organize products into specific categories and product families. Create clear definitions for each product variant or SKU (Stock Keeping Unit). This categorization helps in precise scheduling and resource allocation.

Step 4: Determine Production Capacity – After that, evaluate the available production capacity including equipment, labor, and facility constraints. Consider machine availability, shift patterns, and maintenance schedules. Identify potential bottleneck operations that may limit overall throughput.

Step 5: Calculate Lead Times – Subsequently, determine the lead times for each product, including time for material procurement, manufacturing processes, quality control, and delivery. Set realistic lead times that account for potential delays and variability in the production process.

Step 6: Develop the MPS Draft – Using the gathered information, create the initial MPS draft. Specify the quantity of each product to be produced in each time period (weekly or monthly). Balance production quantities with demand requirements while considering inventory targets.

Step 7: Validate with Rough-Cut Capacity Planning – Following the draft creation, perform rough-cut capacity planning (RCCP) to verify that the proposed schedule is feasible. Compare required capacity against available capacity. Identify any periods where demand exceeds capacity and adjust the schedule accordingly.

Step 8: Finalize and Communicate the MPS – Finally, after making necessary adjustments, finalize the Master Production Schedule. Communicate the approved MPS to all relevant departments including production, procurement, sales, and logistics. Establish a regular review cycle to monitor performance and make adjustments as needed.

Source: Adapted from Chapman, S. N., Arnold, J. R. T., Gatewood, A. K., & Clive, L. M. (2017). Introduction to materials management (8th ed.). Pearson.

questions.

1. What is the main goal of creating a Master Production Schedule?
   Answer: _____
2. List five materials or tools needed for creating an MPS.
   Answer: _____
3. According to the text, what information should be gathered in Step 1?
   Answer: _____
4. What is the purpose of rough-cut capacity planning (RCCP)?

Answer: _____

5. What factors should be considered when determining production capacity?
   Answer: _____
6. Why is it important to maintain safety stock in production planning?
   Answer: _____
7. What would happen if a company creates an MPS without considering lead times?
   Answer: _____
8. How does categorizing products into families help in production planning?
   Answer: _____
9. Why should the MPS be communicated to all relevant departments?
   Answer: _____
10. What actions should be taken if RCCP reveals that demand exceeds capacity?
    Answer: _____

VOCABULARY BUILDING

A. Planning & Scheduling Terms

Task 2. Study the following production planning terminology and complete the table with Indonesian meanings and example contexts.

No	Term	Indonesian Meaning	Usage Example
1	Master Production Schedule (MPS)		The MPS shows what products to manufacture each week.
2	Material Requirements Planning (MRP)		MRP calculates material needs based on the MPS.
3	Capacity planning		Capacity planning ensures resources match production needs.
4	Lead time		The lead time for this component is two weeks.
5	Bottleneck		The assembly station is a bottleneck in our process.

No	Term	Indonesian Meaning	Usage Example
6	Throughput		We increased throughput by 20% this quarter.
7	Work-in-process (WIP)		WIP inventory should be minimized to reduce costs.
8	Dispatch		The dispatcher releases work orders to the shop floor.
9	Setup time		Reducing setup time improves machine utilization.
10	Cycle time		The cycle time per unit is 5 minutes.
11	Takt time		Takt time determines the pace of production.
12	Safety stock		We maintain safety stock to handle demand spikes.
13	Demand forecast		The demand forecast predicts sales for next quarter.
14	Resource allocation		Proper resource allocation maximizes efficiency.
15	Production order		A new production order was released today.

B. Scheduling Methods & Rules

Task 3. Complete the table with descriptions and appropriate usage scenarios for each scheduling method.

Method/Rule	Description	When to Use
FCFS (First Come First Served)		
SPT (Shortest Processing Time)		
EDD (Earliest Due Date)		
Critical Ratio		
Johnson's Rule		
LPT (Longest Processing Time)		

C. Vocabulary Application Exercise

Task 4. Complete these production planning scenarios with appropriate vocabulary from the list above.

1. The assembly line's _____ is 60 seconds, meaning each unit must be completed within this time to meet demand.
2. The painting station is a _____ because it cannot process units as fast as other stations.
3. The _____ for ordering raw materials from overseas suppliers is approximately 6 weeks.
4. We need to reduce _____ inventory to free up working capital.
5. The _____ indicates that we need to produce 500 units per day.
6. Machine changeover requires 30 minutes of _____ before starting a new product.

GRAMMAR FOCUS

CONDITIONAL SENTENCES IN PRODUCTION PLANNING

Conditional sentences are essential in production planning for expressing cause-effect relationships, hypothetical scenarios, and contingency plans. Understanding different conditional types helps planners communicate possibilities, predictions, and past analyses effectively (Jacobs & Chase, 2018).

A. Types of Conditional Sentences

Type	Structure	Usage	Example
Zero	If + present, present	Facts/general truths	If production stops, the line shuts down automatically.
First	If + present, will + verb	Real/possible situations	If we increase capacity, we will meet the deadline.
Second	If + past, would + verb	Hypothetical situations	If we had more machines, we would reduce lead time.
Third	If + past perfect, would have + past participle	Past unreal situations	If we had ordered earlier, we would have avoided delays.

B. Conditional Sentences in Production Context

1. Zero Conditional (Production rules):

- *"If the machine overheats, the system alerts the operator."*

- *"If inventory falls below safety stock, the system generates a purchase order."*

2. First Conditional (Planning scenarios):

- *"If we add a second shift, we will increase output by 40%."*
- *"If the supplier delivers late, we will need to adjust the schedule."*

3. Second Conditional (Hypothetical planning):

- *"If we invested in automation, we would reduce labor costs."*
- *"If we had unlimited capacity, we would accept all orders."*

4. Third Conditional (Analyzing past decisions):

- *"If we had scheduled maintenance earlier, we would have prevented the breakdown."*
- *"If the forecast had been accurate, we would have met customer demand."*

GRAMMAR EXERCISES

Exercise 1: Complete the conditional sentences with the correct verb forms

1. If the bottleneck machine _____ (break down), production _____ (stop).
2. If we _____ (order) materials now, they _____ (arrive) next week.
3. If the company _____ (invest) in MRP software, planning _____ (become) more efficient.
4. If we _____ (receive) the order yesterday, we _____ (start) production already.
5. If demand _____ (increase), we _____ (need) to hire temporary workers.

Exercise 2: Match the situations with the appropriate conditional type

Situations: A = Planning for future orders | B = Describing production rules | C = Discussing unrealistic scenarios | D = Analyzing past mistakes

1. "If we had implemented lean practices, we would have reduced waste." → _____
2. "If the cycle time exceeds takt time, production falls behind." → _____
3. "If we receive the order by Friday, we will ship by next Wednesday." → _____
4. "If we could clone our best workers, we would double productivity." → _____

PHASE 3: PRACTICE & APPLICATION

TASK 5: SCHEDULING EXERCISE

Simple Scheduling Problem:

You have 4 jobs to schedule on one machine:

Job	Processing Time (hours)	Due Date (hours from now)
A	3	10
B	5	12
C	2	8
D	4	15

Questions:

1. Create schedules using three different rules: FCFS (arrival order: A, B, C, D), SPT, and EDD
2. For each schedule, calculate: Completion time, Lateness, Average lateness
3. Which scheduling rule performed best? Explain why.

FCFS Schedule:

Job	Start	Finish	Due Date	Lateness

Average Lateness: _____

PHASE 4: PRODUCTION

TASK 6: CREATING A WEEKLY PRODUCTION SCHEDULE

Scenario:

You are the production planner for a furniture manufacturer. Create a weekly production schedule using the information provided below.

Given Information:

- Products: Tables (T), Chairs (C), Cabinets (B)
- Weekly orders: 50 Tables, 200 Chairs, 30 Cabinets
- Processing times: Tables = 2 hours each, Chairs = 0.5 hours each, Cabinets = 4 hours each
- Available resources: 2 production lines, 40 hours per line per week
- Setup time: 1 hour when switching products

WEEKLY PRODUCTION SCHEDULE

Week of: _____ Prepared by: _____

Production Line 1:

Day	Product	Quantity	Start Time	End Time	Notes
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					

CAPACITY ANALYSIS:

Total available hours: _____ | Total required hours: _____ | Setup hours: _____

Productive hours: _____ | Utilization rate: _____% | Bottlenecks identified: _____

PHASE 5: AUTOMATIZATION, FLUENCY & ENRICHMENT

TASK 7: CASE STUDY - TOYOTA PRODUCTION SYSTEM

Toyota's JIT Philosophy

Toyota's production system revolutionized manufacturing through its JIT (Just-In-Time) philosophy and pull-based scheduling. The system emphasizes producing only what is needed, when it is needed, and in the amount needed, thereby minimizing waste and improving efficiency (Liker, 2004).

Kanban System:	**TaKtTime:**
• Visual scheduling system • Cards signal need for materials • Pull-based production control • Limits work-in-process inventory	• Rate of customer demand • Paces production to match demand • Formula: Available time ÷ Customer demand • Creates rhythm for entire factory

Analysis Tasks:

1. Comparison Analysis (250 words): Compare Toyota's approach with traditional MRP-based planning. Discuss key differences, advantages/disadvantages, and situations where each works best.
2. Calculation Exercise: A production line operates 8 hours/day and must produce 480 units/day. Calculate takt time, and if current cycle time is 1.5 minutes, determine the production rate and whether capacity is sufficient.

Calculation Space:

TaKT time = _____ (show your calculation)

Production rate = _____ units/day

Is capacity sufficient? _____ Explain: _____

PHASE 6: REFLECTION & TRANSFER

Knowledge Check

Rate your understanding (1-5):

- Production planning concepts: _____
- Scheduling methods: _____
- Capacity planning: _____

- Performance metrics: _____
- Writing production reports: _____

Self-Assessment Checklist

Can you now:

- ☐ Define key production planning terms?
- ☐ Understand and follow procedure texts for MPS creation?
- ☐ Apply different scheduling rules (FCFS, SPT, EDD)?
- ☐ Create a weekly production schedule?
- ☐ Use conditional sentences correctly in planning contexts?
- ☐ Calculate and interpret takt time?

Personal Application: Apply to Your Daily Life

Task 8. Apply production planning concepts to manage your academic activities:

1. Your "Products" (outputs):

_____

2. Your Constraints (capacity limits):

_____

3. Your Personal MPS for next week:

_____

4. Your Personal Bottleneck: _____