

Module 4 – MPS and MRP

MPS and MRP

MPS and MRP are two key concepts in production and inventory management, commonly used in manufacturing environments to streamline operations, optimize resources, and ensure timely delivery of products. A Master Production Schedule is a Schedule of the completions of the end items and these completions are very much planned in nature. Master production schedule acts as a very distinct and important linkage between the planning processes. With the help of this schedule, one can know the requirements for the individual end items by date and quantity. In companies, MPS are generally produced in order to know the number of each product that is to be made over some planning horizon. This schedule forms a very unique part of the company's sales program which deals with the planned response to the demands of the market.

A master production schedule is also in management language referred to as the master of all the schedules as this schedule provides the production, planning, purchasing & top management, the most needed information required for planning and control of the whole manufacturing process or the operation. The master production schedule definition is a term used to describe a centralized document telling you what you need to produce, how much you need to produce, and when you need to produce it. In short, everything related to production in your business, including time frames, such as your manufacturing lead time.

The Master Production Schedule (MPS) enables you to keep your commitments to your customers.

Here is a quick overview of the master production schedule process steps you'll need to follow when putting this together:

1. Map your demand and make a Demand Plan;

2. Work out the raw materials you need and get your supply-chain up and running with production planning processes;
3. Now you're ready to develop a master production schedule proposal. This is like a rough draft to see if your MPS is workable;
4. Use a rough-cut capacity planning technique to calculate if you can meet your proposed MPS. Continue using this technique to continuously assess if your capacity can meet demand when your master production schedule is in action; and
5. If your master production schedule proposal is workable, you then evaluate it with regards to customer service, effective use of resources, and inventory investment.

The Importance of the Master Production Schedule

The master production schedule plays a vital role in the following areas:

1. Demand Fulfillment

The primary purpose of the master production schedule is to fulfill customer demand effectively. It aligns production activities with sales forecasts, customer orders, and inventory levels, ensuring that products are available when needed. By meeting customer demand promptly, it enhances customer satisfaction and strengthens business relationships.

2. Production Planning and Scheduling

The master production schedule provides a detailed plan for production activities, including what products to produce, the quantities required, and the timing of production. It enables efficient production planning and scheduling by considering factors such as available resources, production capacity, and lead times.

3. Resource Optimization

An effective master production schedule optimizes the utilization of resources, including labor, materials, and equipment. By providing visibility into production requirements, it

helps balance resource availability with demand, minimizing idle time and reducing costs associated with underutilized resources.

4. Inventory Management

The master production schedule plays a crucial role in inventory management. By aligning production schedules with sales forecasts, it ensures that inventory levels are optimized. This prevents excessive inventory buildup or stockouts, leading to cost savings and improved inventory control.

Strategies for Creating an Effective Master Production Schedule

Consider the following strategies to create an effective master production schedule:

1. Collaborative Planning

Involve key stakeholders, such as sales, operations, and supply chain teams, in the development of the master production schedule. Collaborative planning ensures that inputs from different departments are considered, enhancing the accuracy and feasibility of the schedule.

2. Accurate Demand Forecasting

Accurate demand forecasting is crucial for an effective master production schedule. Leverage historical data, market trends, and customer insights to develop accurate sales forecasts. This information serves as a foundation for the production quantities and timing outlined in the schedule.

3. Flexibility and Contingency Planning

Build flexibility into the master production schedule to accommodate unexpected changes in customer demand or unforeseen disruptions. Develop contingency plans and alternative production scenarios to respond effectively to changing conditions without compromising customer satisfaction.

4. Continuous Monitoring and Review

Regularly monitor and review the master production schedule to ensure its accuracy and effectiveness. Assess actual production outputs, customer demand, and inventory levels

to identify any deviations or opportunities for improvement. Make adjustments to the schedule as needed to optimize production processes.

MRP (Material Requirement Planning)

Material Requirements Planning (MRP) is a systematic approach to managing materials, inventory, and production processes in manufacturing and supply chain management. It plays a critical role in ensuring that the right materials are available at the right time to meet production demand while minimizing excess inventory. Material Requirements Planning is a comprehensive system that helps organizations plan, schedule, and control the flow of materials required for production. It involves analyzing demand, determining what materials are needed, and when they are needed, in order to maintain efficient production operations.

Objectives of MRP

The primary objectives of implementing MRP are as follows:

1. **Ensure Material Availability:** The primary objective of MRP is to ensure that the right materials and components are available in the required quantities and at the right time for production. By accurately assessing material requirements, organizations can avoid shortages and prevent production disruptions.
2. **Minimize Inventory Costs:** MRP aims to strike a balance between ensuring material availability and minimizing inventory holding costs. By planning material requirements based on production schedules, lead times, and demand forecasts, organizations can optimize inventory levels, reduce excess inventory, and avoid stockouts.
3. **Optimize Production Planning:** MRP helps organizations optimize their production planning processes by synchronizing material requirements with production schedules. It enables effective scheduling of manufacturing activities, reducing idle time, and improving overall operational efficiency.
4. **Enhance Customer Service:** With accurate material planning, organizations can meet customer demands more reliably and consistently. MRP ensures that products are

delivered on time, improving customer satisfaction and fostering stronger customer relationships.

The MRP process:

- **Estimates demand and required materials.** After determining customer demand and utilizing the bill of materials, MRP breaks down demand into specific raw materials and components.
- **Allocates Inventory of materials.** MRP allocates inventory into the exact areas as needed.
- **Schedules Production.** Time and labor requirements are calculated to complete manufacturing and a timeline is created.
- **Monitors the process.** MRP automatically alerts managers of any delays and even suggests contingency plans to meet build deadlines.

Benefits of Material Requirements Planning (MRP)

Implementing Material Requirements Planning offers several advantages:

- Improved inventory management by reducing excess stock and preventing shortages.
- Enhanced production scheduling, leading to better on-time delivery performance.
- Cost savings through optimized procurement and reduced carrying costs.
- Increased visibility into the entire supply chain, enabling better decision-making.
- Efficient allocation of resources, including labor and machinery.

Challenges in Material Requirements Planning (MRP)

Despite its benefits, MRP also presents some challenges:

- **Dependence on accurate data:** MRP relies heavily on accurate data for demand forecasts, lead times, and inventory levels.
- **Complexity:** Managing MRP can be complex, especially in large organizations with numerous products and suppliers.

- Integration: Integrating MRP with other enterprise systems like Enterprise Resource Planning (ERP) can be challenging.
- Dynamic demand: Rapid changes in customer demand can lead to constant adjustments in material requirements.

Difference between MRP and MPS:

S.No. MRP MPS

01. MRP refers to Material Requirements Planning in manufacturing planning systems and inventory planning system.

 MPS refers to Master Production Scheduling in manufacturing planning systems and inventory planning system.

02. It plans items that have dependent demand.It plans items that have independent demand.

03. Demand is passed down as the product needs to be produced. Demand is directly from the customer or forecasts or service orders.

04. It runs daily to gather idea about required materials and plan accordingly.

It runs on weekly based on sales order/service order and forecasts for that period.

05. Material Requirements Planning is the planning of critical product.

 Master Production Scheduling is the planning of any kind of material.

06. It runs after MPS. It runs before MRP.

07. Material Requirements Planning is used for multi-level planning.Master Production Scheduling is used for single level planning.

08. Example of MRP items cap, barrel, spring and refill. Example of MPS item is the pen.

Bill of Material (BOM)

Bill of materials is a compiled list of raw input goods, sub-assemblies or any intermediary product needed to manufacture the final goods. Bill of materials basically helps in the communication during the production process so as to plan the quantity of goods that would be required to meet the demand. This is an important concept in material management during manufacturing.

A BOM is of vital importance in Materials Requirement Planning (MRP) and Enterprise Resource Management (ERP) systems. It provides the Manufacturer's part number (MPN) which is a series of numbers assigned to the parts by its manufacturer. Since each manufacturer provides its unique MPN to its parts, it becomes easier to track the source of a component by referring to the BOM.

It is a structured list of all the components, parts, assemblies, and sub-assemblies required to manufacture a finished product. It serves as a comprehensive inventory of everything needed to build a particular item. The BOM is an essential document in manufacturing and production management, used in various stages of the production process, including planning, procurement, assembly, and quality control.

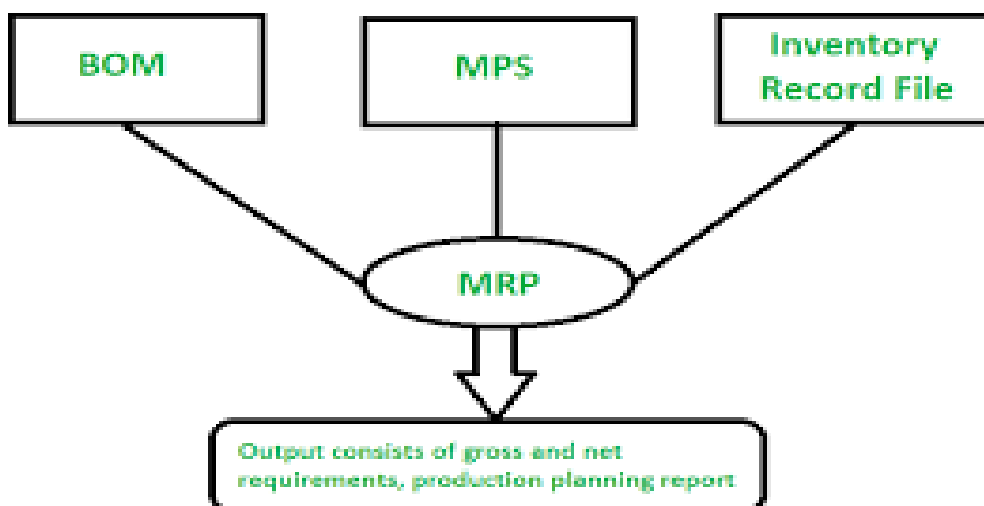
Key features of a Bill of Materials include:

- **Component Identification:** Each item in the BOM is identified with a unique part number or code to distinguish it from other components. This ensures accurate tracking and facilitates inventory management.
- **Description:** The BOM includes a description of each component, providing details such as material type, dimensions, specifications, and any other relevant information necessary for procurement and assembly.
- **Quantity:** The BOM specifies the quantity of each component required to manufacture the finished product. This quantity may vary based on factors such as product design, production volume, and assembly process.
- **Hierarchy:** Components in the BOM are organized in a hierarchical structure, typically with multiple levels of assembly. This structure reflects the relationship

between different parts and how they are assembled to create the final product.

- **Reference Designators:** Reference designators are alphanumeric codes assigned to each component in the BOM, indicating its location or position within the product. These designators are used during assembly to identify where each component should be installed.
- **Lead Times:** In some cases, the BOM may include lead times for each component, indicating the time required to procure or manufacture the part. This information helps in planning production schedules and managing inventory levels.
- **Revision Control:** As product designs evolve or components change, the BOM may undergo revisions. A revision control system is used to manage these changes, ensuring that the latest version of the BOM is always used in production.

The Bill of Materials is a critical document that provides detailed information about the components needed to manufacture a product, enabling efficient procurement, accurate assembly, and effective inventory management throughout the production process. It serves as a foundation for other production planning and control activities, such as Material Requirements Planning (MRP) and Master Production Scheduling (MPS)



Capacity requirement planning

Capacity planning refers to determining what kind of labour and equipment capacities are required and when they are required. Capacity is usually planned on the basis of labour or machine hours available within the plant. Thus, capacity planning is planning for quantity or scale of output.

Capacity planning is the process of determining the production capacity needed by an organization to meet changing demands for its products

Capacity Requirements Planning (CRP) is a process used in manufacturing and production management to determine if a company's facilities have the capacity to meet its production plans. It involves analyzing the production schedule, available resources, and capacity constraints to ensure that production requirements can be met in a timely and efficient manner.

Key aspects of Capacity Requirements Planning include:

- **Production Schedule Analysis:** CRP begins with an analysis of the production schedule generated by the Master Production Schedule (MPS). This schedule outlines the quantity and timing of finished products to be produced over a specific period.
- **Resource Availability:** CRP evaluates the availability of various resources needed for production, including labor, equipment, machinery, facilities, and materials. It considers factors such as workforce availability, machine capacity, and material availability.
- **Capacity Constraints:** CRP identifies any constraints or limitations that may affect the company's ability to meet production requirements. These constraints could include limited machine capacity, labor shortages, material shortages, or other factors that may impact production capacity.
- **Capacity Planning:** Based on the production schedule and resource availability, CRP determines if the company's facilities have the capacity to meet production

requirements. It involves comparing the required production capacity with the available capacity to identify any shortfalls or excess capacity.

- **Adjustments and Optimization:** If capacity constraints are identified, CRP may involve making adjustments to the production schedule, reallocating resources, outsourcing certain tasks, or implementing other measures to optimize production capacity and ensure that production requirements can be met.
- **Scenario Analysis:** CRP may also involve conducting scenario analysis to evaluate different production scenarios and their impact on capacity requirements. This helps in identifying potential bottlenecks, capacity shortages, or excess capacity under different scenarios.
- **Continuous Monitoring:** Capacity Requirements Planning is an ongoing process that requires continuous monitoring and adjustment as production requirements, resource availability, and other factors change over time. It involves regularly updating production schedules, evaluating resource availability, and making adjustments to ensure that production capacity remains aligned with production requirements.

Overall, Capacity Requirements Planning plays a crucial role in ensuring that a company's facilities have the capacity to meet its production plans efficiently and effectively. It helps in identifying potential capacity constraints, optimizing resource utilization, and making informed decisions to maximize production capacity and meet customer demand.

Procedure for Capacity Planning

1. Assessment of Existing Capacity

Capacity of a unit can be measured in terms of output or inputs. Output measure is appropriate in case of manufacturing concerns, e.g., automobile plant (number of cars), iron and steel plant (tons of steel), brewery (barrels of beer), cannery (tons of food), power company, (megawatts of electricity), etc. Service concerns like hospitals (number of beds), airlines (number of seats), theatres (number of seats), restaurants (number of tables), university (number of students), warehouse (cubic feet of space), etc., can measure capacity in terms of inputs.

2. Forecasting Future Capacity Needs

Short term capacity requirements can be estimated by forecasting product demand at different stages of the product life cycle. It is more difficult to anticipate long-term capacity requirements due to uncertainties of market and technology. Capacity forecast helps to determine the gap between the existing capacity and estimated capacity so that necessary adjustments may be made. For example, a company engaged in manufacturing two products may find that one product has a low demand in summer (e.g. coffee or tea) while another product has low demand in winter (e.g. cold drink).

3. Identifying Alternative ways of Modifying Capacity

In case where the existing capacity is inadequate to meet the forecast demand capacity, the expansion is required to meet the shortage. Additional shifts may be employed to expand the capacity. Expansion will provide economies of scale and help in meeting the forecast demand. But it involves additional investment and danger of fall in forecast demand in future.

When the existing capacity exceeds forecast capacity, there is a need for reduction

of excess capacity. Developing new products, selling of existing facilities, layout of workers or getting work from other firms are the methods of overcoming it.

4. Evaluation of Alternatives

Various alternatives for capacity expansion or reduction are evaluated from economic, technical and other viewpoints. Reactions of employees and local community should also be considered. Cost Benefit analysis, Decision theory and Queuing theory are the main techniques of evaluating alternatives.

5. Choice of Suitable Course of Action

After performing the cost-benefit analysis of various alternatives to expand or reduce the capacity, the most appropriate alternative is selected.

Relation between MPS, CRP and MRP

- The Master Production Schedule (MPS), Capacity Requirements Planning (CRP), and Material Requirements Planning (MRP) are three interconnected components of production planning and control systems in manufacturing. Each plays a crucial role in ensuring efficient operations and meeting production goals. Here's how they relate to each other:

Master Production Schedule (MPS): The MPS is the starting point in the production planning process. It outlines the quantity and timing of finished products to be produced over a specific period, typically covering several weeks to several months.

The MPS serves as the foundation for both MRP and CRP. It provides the production schedule that MRP uses to calculate material requirements, and it also serves as the input for CRP to assess production capacity.

Material Requirements Planning (MRP):

MRP is a system for planning and managing material requirements throughout the production process. It uses the MPS as a primary input to calculate the materials needed to fulfill production requirements.

- Based on the MPS, MRP analyzes the bill of materials (BOM), current inventory levels, lead times, and other factors to determine the quantity and timing of materials required for production.
- MRP generates purchase orders or production orders to procure materials or initiate production activities based on the calculated material requirements.

Capacity Requirements Planning (CRP):

CRP is a process used to assess whether a company's facilities have the capacity to meet the production requirements outlined in the MPS.

- CRP uses the MPS to determine the production schedule and production volumes. It then assesses the availability of resources such as labor, equipment, and facilities to ensure that production capacity aligns with production requirements.
- If capacity constraints are identified during CRP, adjustments may be made to the production schedule or resource allocation to optimize production capacity and meet production goals.
- In summary, MPS serves as the input for both MRP and CRP. MRP uses the MPS to calculate material requirements and generate purchase or production

orders, while CRP uses the MPS to assess production capacity and ensure that resources are adequate to meet production requirements. Together, MPS, MRP, and CRP help manufacturing companies optimize production planning, manage material and capacity requirements, and ensure efficient operations.

