

BUSI4496

Supply Chain Planning & Management

Prof Bart MacCarthy
Division of Operations
Management and
Information Systems

Lecture 3 Self-Study Session 1

5. MRP-based Planning - Self study



SOURCE: **ERP** enterprise application migration support integrated management methodology common time cost include industry standard multiple enterprise information



UNITED KINGDOM • CHINA • MALAYSIA

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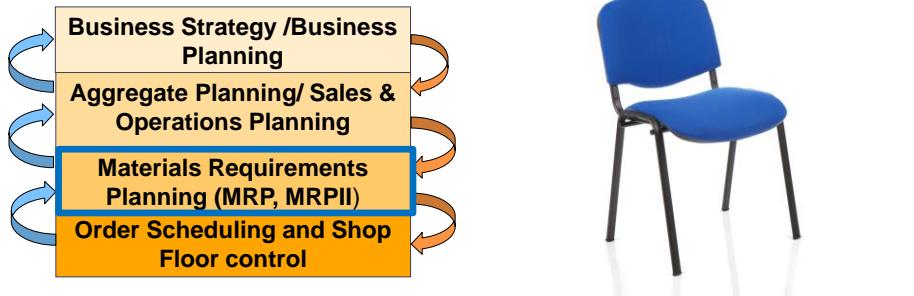
Outline

1. Aggregate Planning
2. Sales & Operations Planning (S&OP)
3. MRP principles and overview
 - o Independent and Dependent demand
 - o Overview, main components and computations
4. MRPII and Capacity Requirements Planning
 - o Requirements for effective MRP-based control

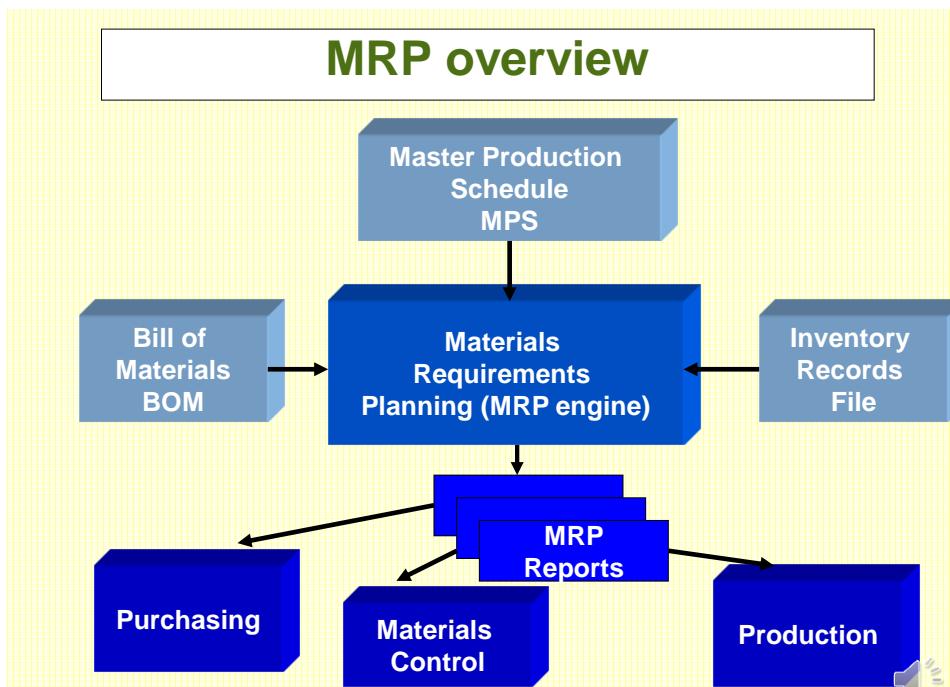
Pre-Recorded Self Study Session on Moodle

5. Running an MRP- based planning and control
6. Enterprise Resource Planning (ERP) systems and IS/IT support for Supply Chain Planning
7. Review questions





How do we plan and make an office chair?

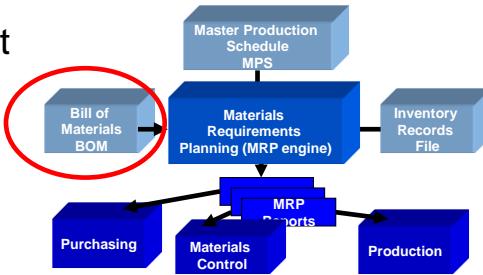


What does the product comprise of?

BOMs and Parts Master File

- **BOMs** relate dependent items to independent items:

- quantities per build
- level in build

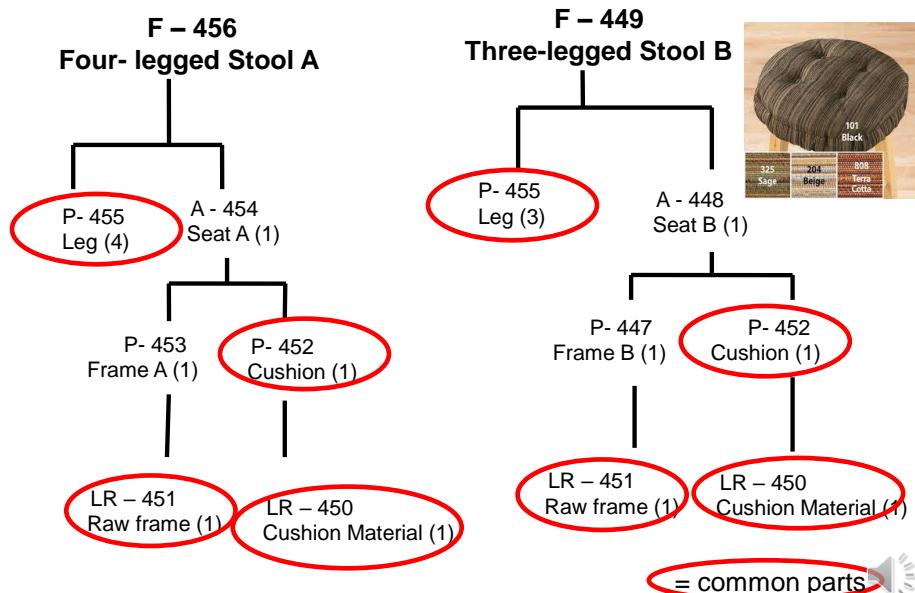


- **Parts Master Files** provide information on each part:

- Description
- Unit of measure
- **Lead time**
- **Lot size policy**
- **Safety stock policy**
- Make or buy
- Cost information
- Storage information
- Level code

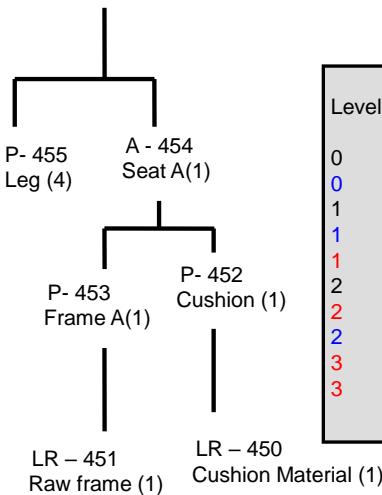


The Bills of Materials (BOMs)



Bills of materials & Parts master file

Four-legged Stool A



Parts Master File

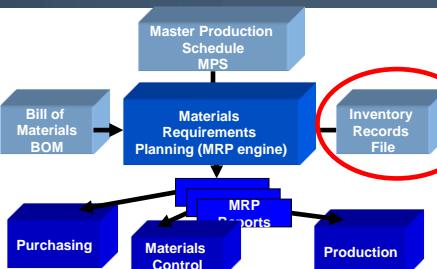
| Level Number | Part Number | Lot size | Lead time | Description | Make/buy |
|--------------|-------------|----------|-----------|-------------|----------|
| 0 | F-449 | L | 2 | Stool B | M |
| 0 | F-456 | L | 2 | Stool A | M |
| 1 | A-448 | L | 1 | Seat B | M |
| 1 | A-454 | L | 1 | Seat A | M |
| 1 | P-455 | L | 2 | Leg | B |
| 2 | P-447 | L | 1 | Frame B | M |
| 2 | P-452 | L | 1 | Cushion | M |
| 2 | P-453 | L | 1 | Frame A | M |
| 3 | LR-450 | L | 3 | Cushion Mat | B |
| 3 | LR-451 | L | 2 | Raw Frame | B |



What have we got? - Inventory records

MRP systems require:

Accurate databases needed on current inventory holdings (on hand) and inventory that is ordered (scheduled receipts), when it will arrive (including inventory produced in-house)



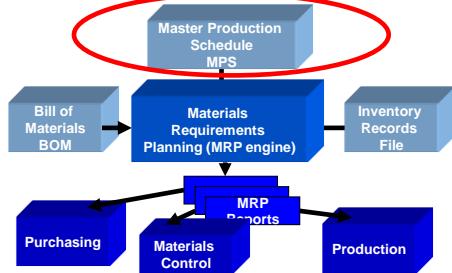
| Level Number | Part Number | M/B | On Hand | Scheduled receipts |
|--------------|-------------|-----|---------|--------------------|
| 0 | F-449 | M | 14 | 6 |
| 0 | F-456 | M | 0 | 0 |
| 1 | A-448 | M | 10 | 0 |
| 1 | A-454 | M | 4 | 24 |
| 1 | P-455 | B | 54 | 10 |
| 2 | P-447 | M | 0 | 0 |
| 2 | P-452 | M | 6 | 0 |
| 2 | P-453 | M | 0 | 14 |
| 3 | LR-450 | B | 18 | 16 |
| 3 | LR-451 | B | 0 | 0 |

Inventory databases need to be kept accurate and up to date!



The Master Production Schedule (MPS)

- What is it?
- **The MPS drives the MRP system**
- The MPS states **what the company intends to produce at independent demand level** by defining the required quantities of each end item in each time period **over a rolling horizon**

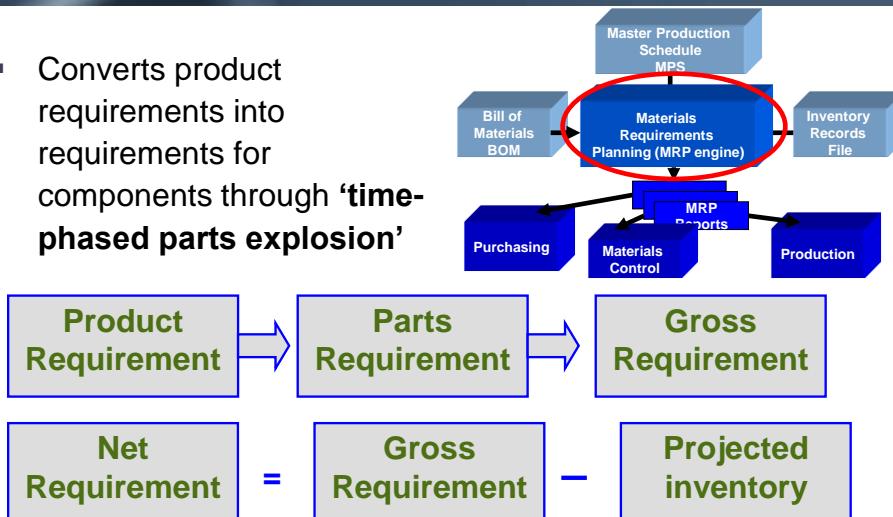


- Combines **firm orders, forecast orders and best guesses** (invariably **some speculative production**)
- **Informed by the aggregate plan**
- Once the **MPS is fixed**, MRP ‘engine’ does the computations to meet finished product delivery requirements



MRP computations: Gross/ Net/ Time Phasing

- Converts product requirements into requirements for components through ‘**time-phased parts explosion**’



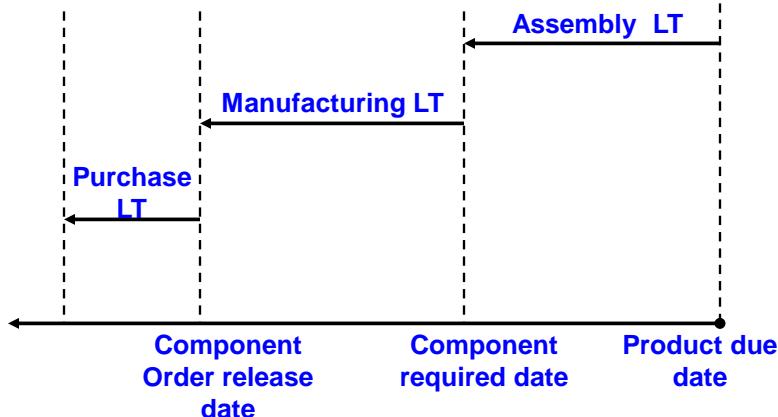
- **Projected inventory** is material allocated from current inventory & orders scheduled for receipt



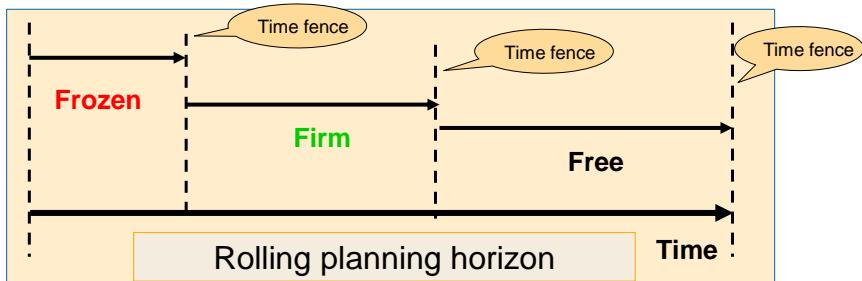
MRP computations - Lead times

- Requirements are **time-phased**
 - Known as **backward scheduling**
 - Normally within established time periods (as the most manageable approach)

LEARN THE
CALCULATIONS IN
LECTURE 7



Running an MRP system - the rolling planning horizon



- As time rolls forward, **forecasts orders become firm orders (hopefully)** – demand consumes the forecast
- ‘**Time fences**’ are set relative to lead time - **important and difficult**
 - Determines **the balance between stability and responsiveness** - schedule adherence may conflict with ability to be responsive
- Impact & authority to amend firm & frozen zones – may need policy decisions



Running and MRP system – two approaches

Regenerative approach

- **Re-exploses** the MPS **totally** at preset intervals (weekly, monthly, quarterly)
- **Works through all levels of the BOMs** - complete regeneration of net requirements and planned orders
 - Overall plan may change significantly

Net change approach

- Current MPS and MRP stored. May be modified at any time
- **Partial explosions** carried out when plans affected by:
 - new orders, material supply or capacity problems, engineering changes
 - More reactive but may propagate **errors & exception** reports



Dealing with uncertainty in MRP systems

| | Sources | |
|----------|---|---|
| Types | Demand | Supply |
| Timing | Requirements shift from one period to another | Orders not received when due |
| Quantity | Requirements for more or less than planned | Orders received for more or less than planned |

Categories of uncertainty in MRP systems, adapted from Vollman et al. (2005), Ch 11.

Safety stock helps to buffer against supply and demand uncertainties



MRP Complicating factors - Lot sizing and Safety stock

1. Lot sizing

- **Net requirements generated** by the MRP system for a specific part over a future planning period will be (i) **discrete** and (ii) **lumpy**
- **Lot sizing techniques** attempt to achieve a **minimum cost ordering plan** by balancing the costs of placing an order with cost of carrying inventory over future periods

2. Safety stock

- specifies a minimum holding level of a part
- easily handled within MRP by calculating net requirements **on top of the minimum level**
- estimating the appropriate safety level is difficult
- scrap rates may influence the level



Buffering and safety stock

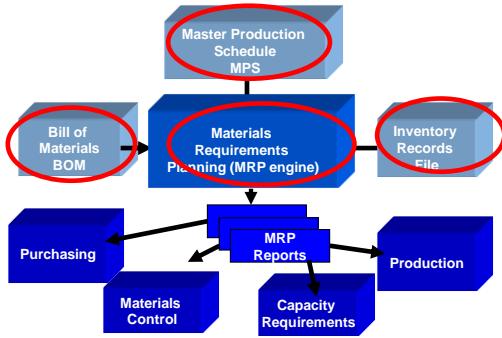
- **Buffering can mask underlying problems**
 - poor demand forecasting, poor quality manufacturing, poor quality supply, poor delivery performance of suppliers....
 - results in ‘behavioural issues’ and ‘informal systems’ to tell people **what is really needed**
 - when combined with lot sizing can result in **MRP system nervousness** – small changes in the plan at one level result in large changes lower down
- Every effort should be made to reduce uncertainties and hence the reliance on extensive buffering
- **Safety lead time** - an alternative approach to buffering
- **Essentially MRP-based control with buffering is a ‘PUSH’ system with potentially high inventory levels**



MRPII system requirements

Accurate database information needed

- Many different types of data needed
 - Inventory information
 - Master parts and bills of materials
 - Supplier information
 - Routing information
 - Work centre information
 - Tooling information
 - Safety policies/lot sizes (**system parameters**)



MRPII systems require current inventory holdings (on hand) and inventory that is ordered (scheduled receipts), when it will arrive (including inventory produced in-house).
The real system and the MRP system must be closely aligned!



Key learning points

- **MRP is the dominant approach** in industrial planning
 - Typically batch manufacturing, combination of MTS/MTO
 - Makes assumptions e.g. constant static lead time!
 - Originally developed for engineered products with complexity at component & assembly levels
 - Now used very widely e.g. even JIT systems will have some level of MRP control
- **You should understand**
 - The components of an MRP/MRPII system
 - The **inputs** to an MRP system
 - The **outputs** from an MRP system
 - How it does its **calculations**
 - **MRPII adds** to basic MRP functionality particularly by requiring capacity checks
 - Some of the **challenges** in running and MRP system

