BUSI4496

Supply Chain Planning & Management

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Division of Operations Management and Information Systems

Lecture 3

Aggregate Planning

Sales & Operations Planning (S&OP)

MRP-based Planning (MRP/MRPII)

ERP -Enterprise Resource Planning – SELF STUDY

13.10.2025

Nottingham University Business School

UNITED KINGDOM • CHINA • MALAYSIA

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Outline

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

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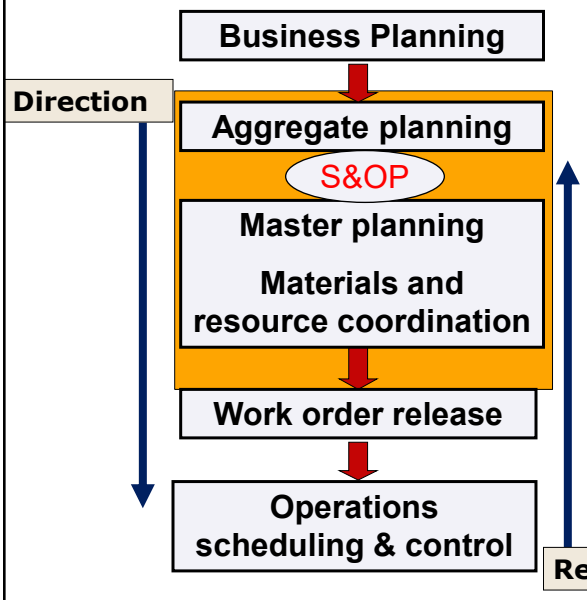
Hierarchical Planning (HPP)



- Check at each level ensure plans realistic, feasible - appropriate constraints set for next level down
- Brings stability
- Different aspects dealt with over different time frames
- Each planning level has a degree of autonomy within the constraints set

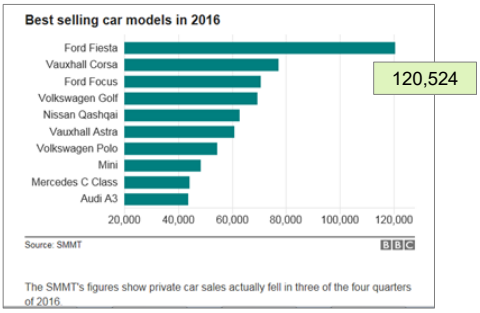
1. Aggregate Planning

Aggregate planning

Uk's best selling car up to the pandemic - Ford Fiesta – 120,524 sold in 2016 www.autoexpress.co.uk

https://tinyurl.com/y9oemlgd

Ford does not make any Fiesta's in the UK!



120,524

https://tinyurl.com/joqmnlx

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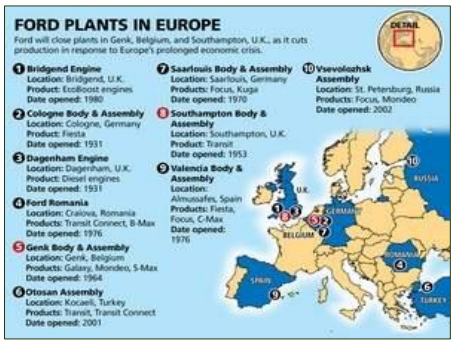
Aggregate planning across multiple sites



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Aggregate planning 1

- **Decide** the **products to produce** in terms of **volume** and **mix** for **given operational facilities** with **projected capacities** and **resources over a medium to long time horizon**
  - Done at an **aggregate level**
  - Product family/ group level (**aggregate units of production**)
  - Depends on product/sector characteristics
  - Based on **forecast demand** and **response policy**
  - Takes account of **known constraints** on major facilities/resources
  - Takes account of **strategic objectives**

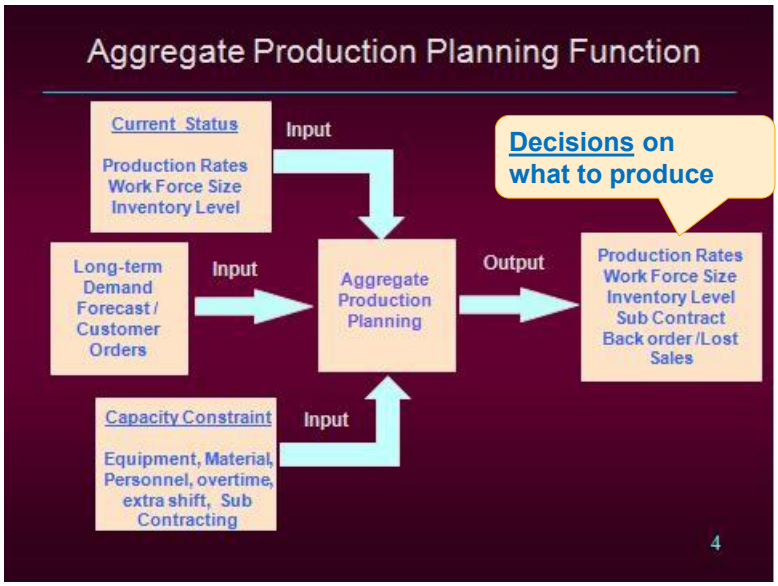
Figure 1

Period		1	2	3	4	5	6
Forecast		100	150	300	300	500	150
Output							
	Regular	250	250	250	250	250	250
	Overtime						
	Subcontract						
Output-forecast		150	100	-50	-50	-250	100
Inventory							
	Beginning	0	150	250	200	150	0
	Ending	150	250	200	150	0	100
	Average	75	200	225	175	75	50
Backlog	0	0	0	0	0	100	0

Cost of aggregate plan utilizing a level strategy:

Output:
Regular time = 5 × 1500 = $7500
Overtime = 5.0 × 0 = 0
Subcontracted = 010 × 0 = 0
Inventory carrying cost = 5 × 850 = 2650
Backorders = 010 × 100 = 1000
Total Cost $11050

Aggregate planning 2



Adapted from: Vaccaro P (2011) 'Applied Management Science for Decision Making' , Pearson Learning Solutions, 2011

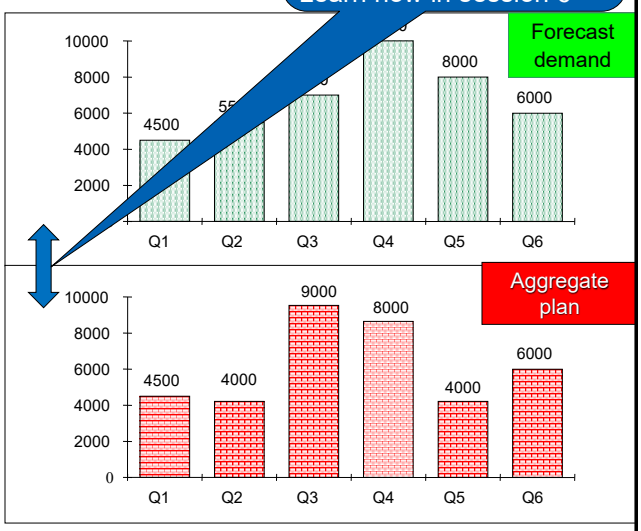
Aggregate planning 3

Balancing aggregate demand and aggregate production capacity

Do we 'chase demand'?
Do we run a 'level' plan?
What are the implications for capacity and inventory?
Learn how in session 6

Figure on top represents forecast demand in units Lower figure represents the aggregate capacity of the company to meet demand

Production rate, workforce levels, and inventory levels need to be balanced over the planning period



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Aggregate planning 4

- Requires information:
  - understanding of **major capacity constraints/ surpluses** including personnel
  - **timing and sizing** of **capacity** investments/ divestments, capacity building/lowering
  - **trade-offs** with implications for costs, margins, returns, market share....
- Demand forecasting **informs** the process but does **not dictate** the aggregate plan!
- Has **implications for supply chain partners** –how much information do you share?
- Links with **Sales &Operations Planning (S&OP)!**

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2. Sales & Operations Planning (S&OP)

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The need for Sales & Operations Planning(S&OP)

Demand Side

Requirements

Supply Side

Sales & Marketing

Operations & Supply chain

Metrics
- Revenue
- Sales
- Profit Targets
- Demand generated

Problems

Lack of understanding?
Lack of buy-in?

Metrics
- Cost
- Capacity
- Working Capital
- Maintenance
- Fixed Costs

https://tinyurl.com/tzg3oaa

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S&OP in practice 1

- S&OP - a 'process' that ensures **translation of business strategy into realistic operational plans**
- S&OP process needs to ensure that different **'interest groups' communicate**, **agree** and **balance** the inputs that MPS receives
- **Key functions** involved in S&OP decisions
  - **Sales & Marketing**
  - **Operations & Supply Chain Management**

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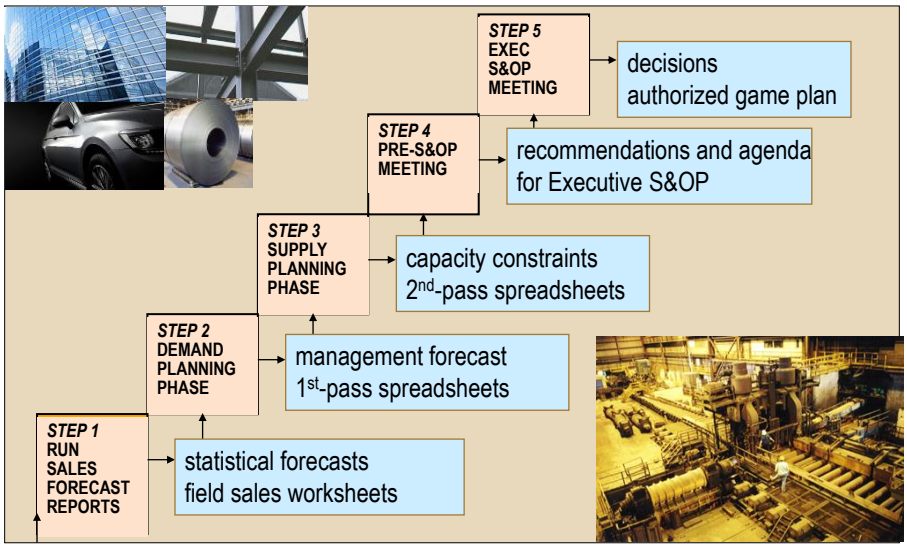
  (depends on the environment)
  - Purchasing/Materials management
  - Manufacturing engineering, Maintenance engineering
  - Human Resources,
  - Accounting …

Monthly Sales & Operations Planning process – steel industry



S&OP in practice 2

- **Focus** on communication and trade-offs'
- **Agreed workable plans**
- **Review** of execution and progress against the plan
- **Meetings-based** - regular, well-regulated, with significant preparation
- **Planning horizon** sufficiently long to resolve supply, resource, operational issues
- **May involve simulation** of revenue streams generated by different potential plans
- **P&G – S&OP**
- https://tinyurl.com/y9ssasog
- Integrated Business Planning
- https://tinyurl.com/y7exxkas

Integrated Business Planning

- **Integrated Business Planning** (IBP) - **latest incarnation** of medium term aggregate planning
  - Digital tools and **data driven**
  - Forecasting and **demand sensing**
  - Application of **advanced algorithms** and **optimization** generate high service level low cost plans
  - SAP's toolset is strongly pushing IBP

What is the Gartner Magic Quadrant for Supply Chain Planning Solutions?

https://www.youtube.com/watch?v=9DP_dnxPBgc

https://www.oracle.com/uk/scm/supply-chain-planning/integrated-business-planning-execution/

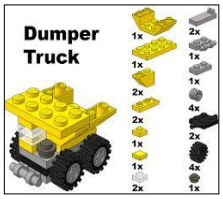
3. MRP-principles and overview

We have an order for 100 chairs due on 19th of December 2025.

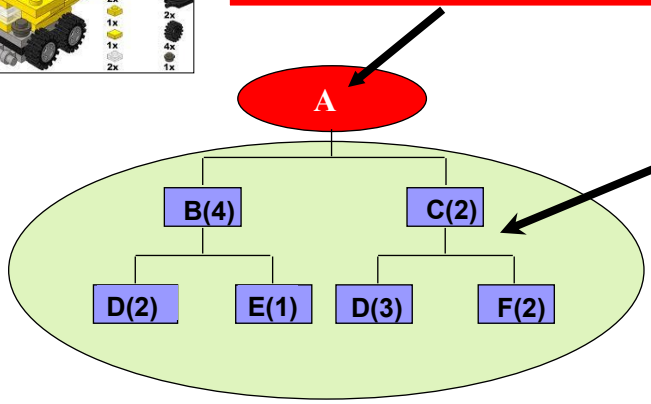
How do we plan production?
What do we need to know?

Independent and Dependent demand

Products and services require materials, modules, sub-assemblies, components etc



Independent Demand: Finished Goods and Spares
Forecasting and inventory management approaches



Dependent Demand:
Raw Materials, Component parts, Sub-assemblies, etc.
coordination approaches (MRP)

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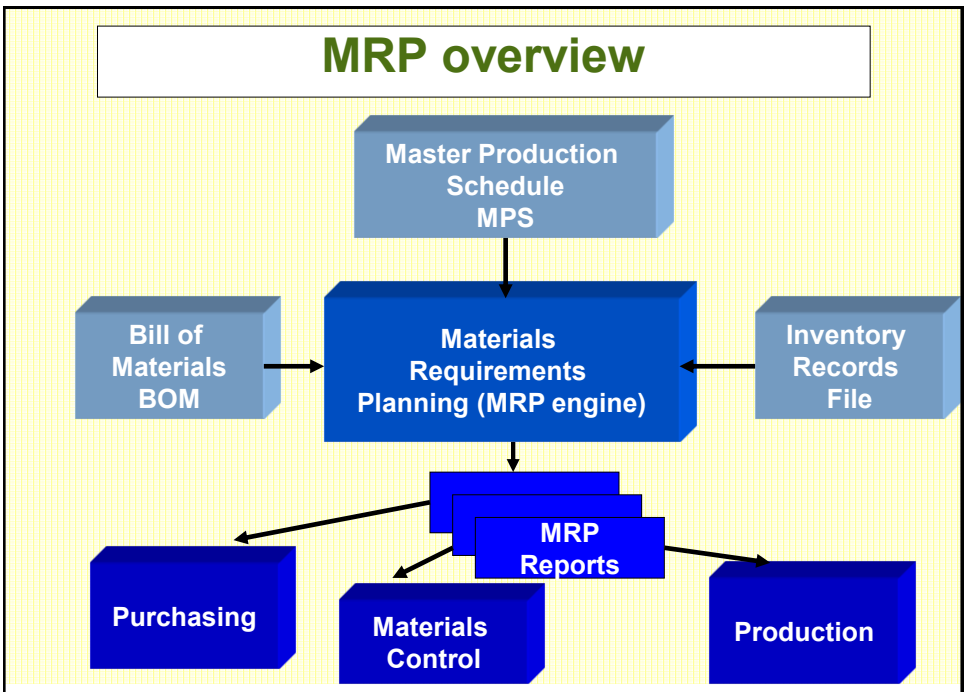
MRP overview



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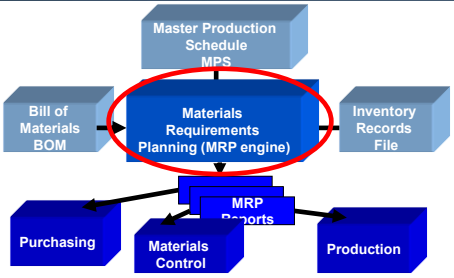
MRP computations: Gross/ Net/ Time Phasing

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



Product Requirement → **Parts Requirement** → **Gross Requirement**

Net Requirement = **Gross Requirement** − **Projected inventory**

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

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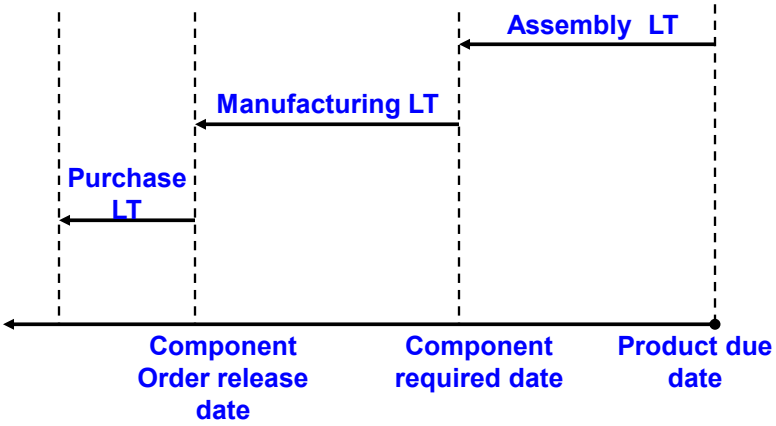
MRP computations $_2$ - Lead times

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

LEARN THE CALCULATIONS IN SESSION 7



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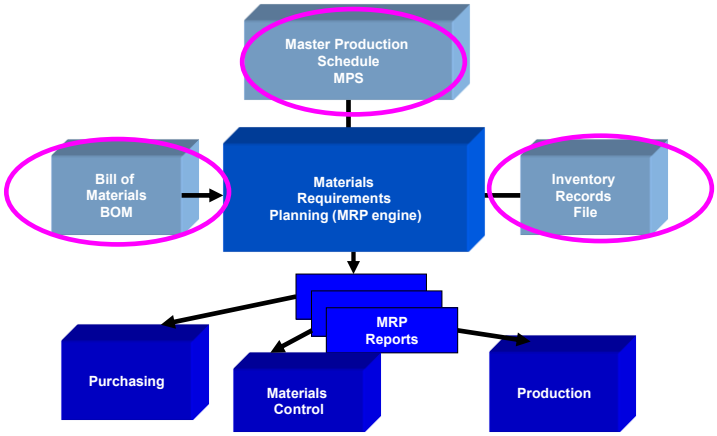
Self study – learn more about MPS, BOM, Inventory

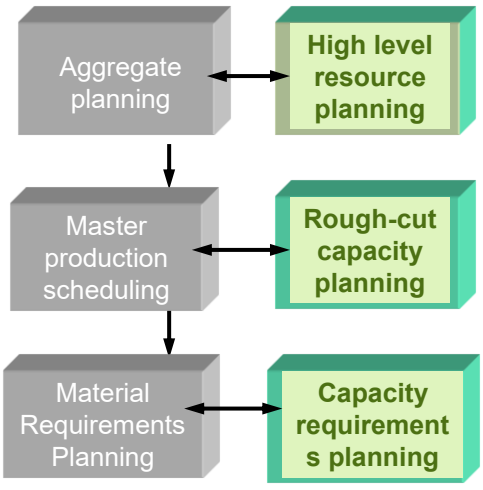


4. MRP II

The importance of capacity planning and management

MRP II = MRP + Capacity planning

Objective: match the demand for, and supply of capacity



E.g. resource implications of producing 2000 units per month for 6 months – 2 yrs. **Product families – whole production unit**

Test the feasibility of an MPS calculating workload on key resources for MPS items – an approximation

Resource requirements quantified for each MPS item

Check sufficient capacity exists to achieve an MRP plan.

Requirements considered at detailed level

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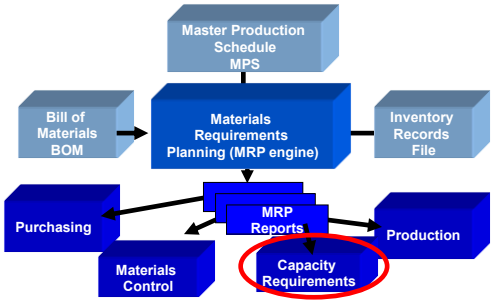
Capacity Requirements Planning (CRP)

- **A CRP** is an **additional report** from an MRPII system
- Planner may **respond** with:
  - adjustment to overtime worked
  - transfer of operators between work centres
  - alternative routings
  - subcontracting work out



Note: spare **capacity** in a particular period if **not used is lost**

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MRP evolution

- **MRP** – Materials Requirements Planning – basic, just material plans
- **MRPII** – Manufacturing Resources Planning – uses the information in the system to plan better and control costs
- **ERP** – Many implementations contain MRPII modules
- **Cloud-Based ERP services** (SaaS)
- But **legacy (old systems) MRP systems still in use**

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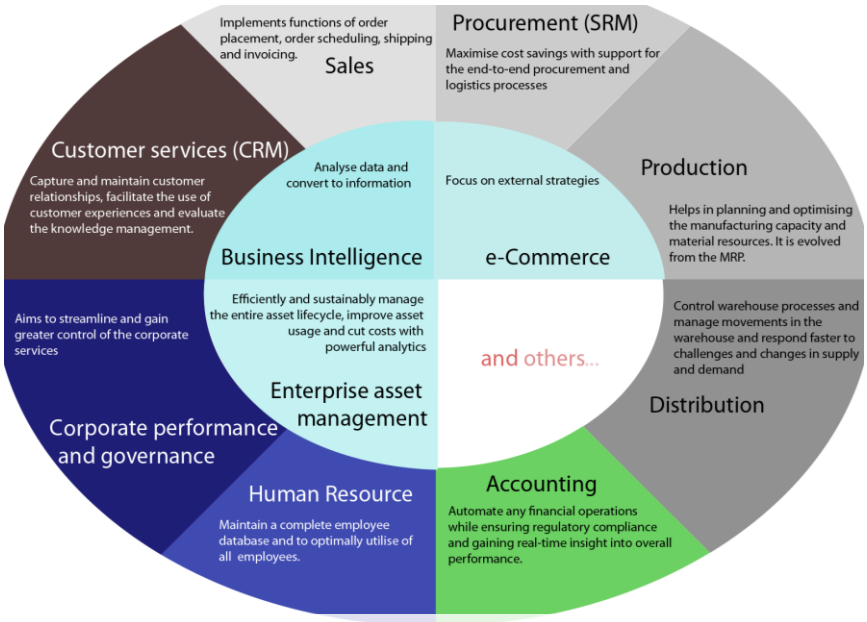
ERP scope – continually increasing



Adapted from "ERP Modules" by Shing Hin Yeung - Own work. Licensed under CC BY-SA 3.0 via Commons - https://commons.wikimedia.org/wiki/File:ERP_Modules.png#/media/File:ERP_Modules.png

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ERP in Managing Business Processes

- **Enterprise Resource Planning (ERP) as a management process:**

"…framework for organizing, defining, and standardizing the business processes necessary to effectively plan and control an organization so the organization can use its internal knowledge to seek external advantage." APICS

- **SAP**
- **ORACLE**
- **MICROSOFT DYNAMICS**

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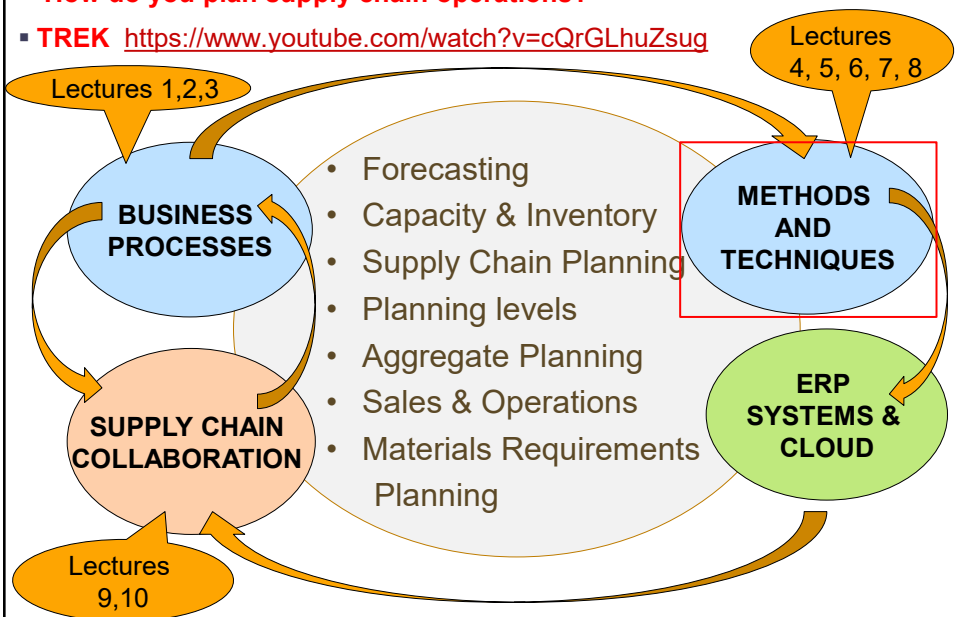
MODULE TOPICS

- **How do you plan supply chain operations?**
- **TREK** https://www.youtube.com/watch?v=cQrGLhuZsug



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Key learning points 1

1. **Aggregate planning**
   - **Essential** to ensure feasible plans that **balance the supply of capacity and inventory with forecasted demand** in the medium term
   - Has implications for workforce levels and inventory levels
   - Has implications supply chain partners
2. **Sales & Operations Planning**
   - many business **functions collaborate** to agree **workable plans**
3. **S&OP v. Aggregate Planning**
   - **More frequent and dynamic** than aggregate planning – seeks to be more responsive to market conditions

Key learning points 2

4. **MRP is the dominant approach** in industrial planning
   - You should understand **MRP principles** and its components
     - The **inputs** to an MRP system and **outputs** from an MRP system
     - See self-study session for more detail on running an MRP system
     - MRP **calculations – see session 7**
5. **MRPII adds** to basic MRP functionality particularly by **requiring capacity checks**
6. **ERP** systems are IT systems for **all operational and transactional aspects** of a business (including financials)
7. **ERP is covered** in the more detail in **self-study session for Lecture 3**