BUSI4496

Supply Chain Planning & Management

Prof Bart MacCarthy

Division of Operations Management and Information Systems

Lecture 2

Planning and Forecasting Processes – why/how? Inventory and Capacity basics

06.10.2025

Nottingham University Business School

UNITED KINGDOM • CHINA • MALAYSIA

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Outline

1. Why do we need operations and supply chain planning processes?
   - Defining planning, scheduling and control
   - The Hierarchical Planning Model
2. Forecasting for operations planning and control
   - What is forecasting? Why forecast?
   - Overview of forecasting methods and techniques
   - Subjective (qualitative) methods
   - Forecasting as a management process
3. Inventory basics
   - Inventory forms
   - Inventory functions

……

Pre-Recorded Self Study Session on Moodle

4. Capacity basics
   - Capacity definitions
   - Capacity utilisation and capacity losses
5. Review questions
   - The Group Assignment

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1. Why do we need operations and supply chain planning processes?

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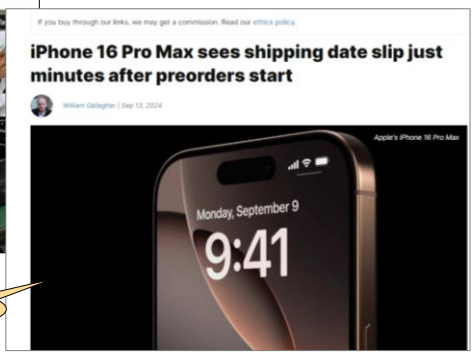
How soon should you start producing using MTS?



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Matching supply with demand

We need operations and supply chain planning to
balance supply with **demand**
but

Efficient operations

Happy customers

Supply - difficult to change

Demand - difficult to predict

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Supply Chain Planning, Scheduling and Control

DEMAND

Operations and Supply Chain Planning and Control Process

SATISFIED CUSTOMERS

EFFICIENT AND EFFECTIVE USE OF RESOURCES

Planning:

managerial activities aimed at **allocating**, deploying or consuming **resources** to meet projected or actual demand over a **'long time period'**

Scheduling:

allocating **specific resources** to specific activities for specific **time periods** over a **'short time period'**

Control:

managerial activities aimed at **ensuring plans/ schedules are met/** adhered to, **taking action** if problems arise

What should effective Planning and Control Systems do?

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Operations and Supply Chain Planning and Control

1. Meet demand in a manner that **satisfies customers and generates repeat orders**
   - Offer competitive **lead times,** delivery **accuracy, reliability** and **flexibility**
2. Be **responsive** – react to changes in the 'environment'

Customers

3. Be ready to meet future demand
- Plan in **appropriate detail** for future demand
- Use supply chain resources **efficiently**

4. Maintain some **stability** in production operations

Resources

5. Provide **information** needed for **production planning**
6. Provide **information** needed for **supplier planning**
7. Provide **information** needed for **performance monitoring**
8. Highlight **future** resource, capacity, inventory **problems**

Information

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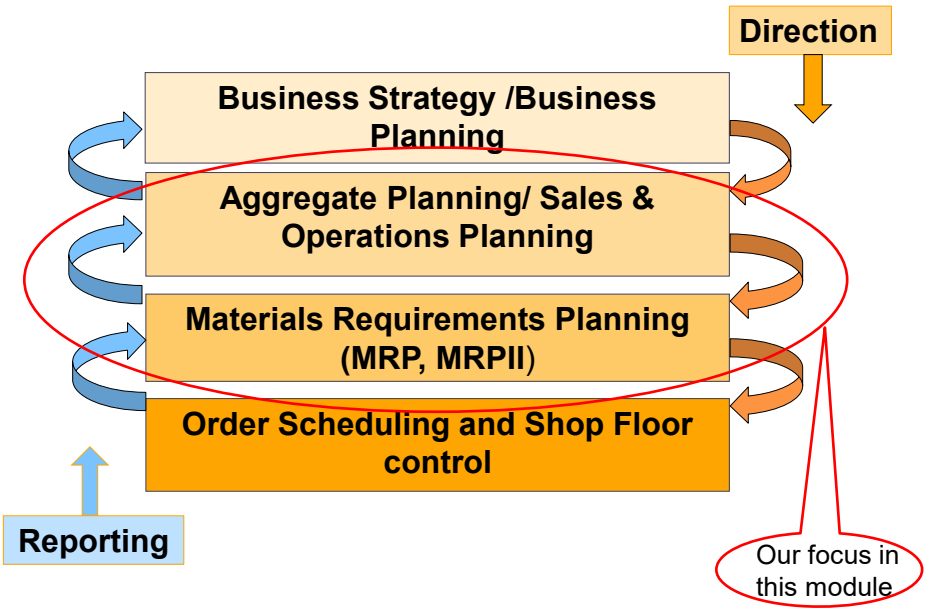
Hierarchical Operations Planning



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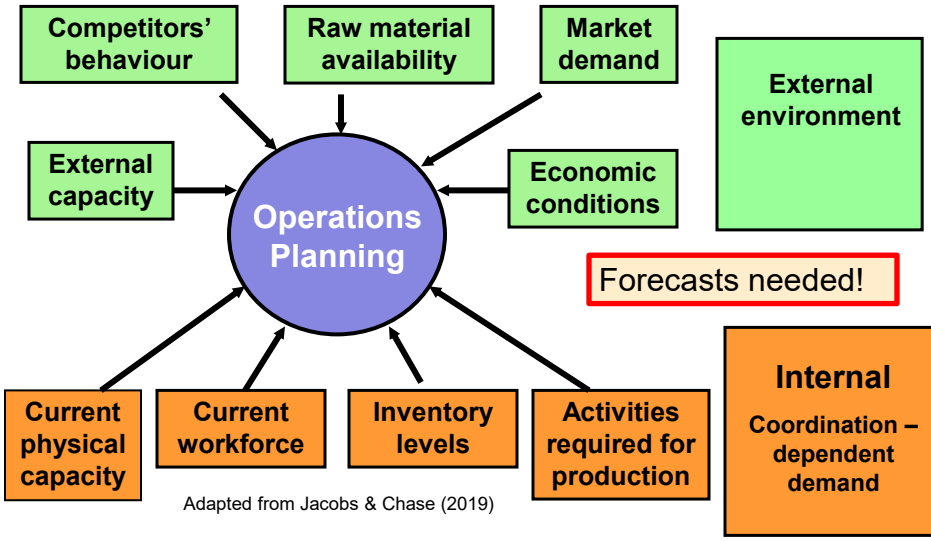
Inputs for Operations and Supply Chain Planning



Adapted from Jacobs & Chase (2019)

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2. Forecasting for operations and supply chain planning

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Why forecast?

1. **Is demand sufficient** to justify entering or staying in a market?
   - long term with a **strategic dimension**
   - maintaining excess capacity may be costly!

2. **Determine long term capacity needs**
   - facilities/ infrastructure
   - developing a supply base




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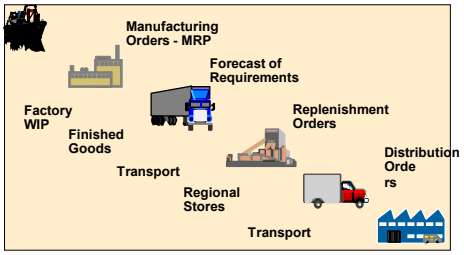
Why forecast?

3. **'Flex' resources,** medium term
   - recruit or shed labour, balancing operations across multiple sites
   - ensuring supply chains can 'ramp' up or down

4. **Enable efficient, responsive operations**
   - short term, 'real time' operations
   - personnel scheduling, materials, inventory, maintenance planning etc.



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About forecasts

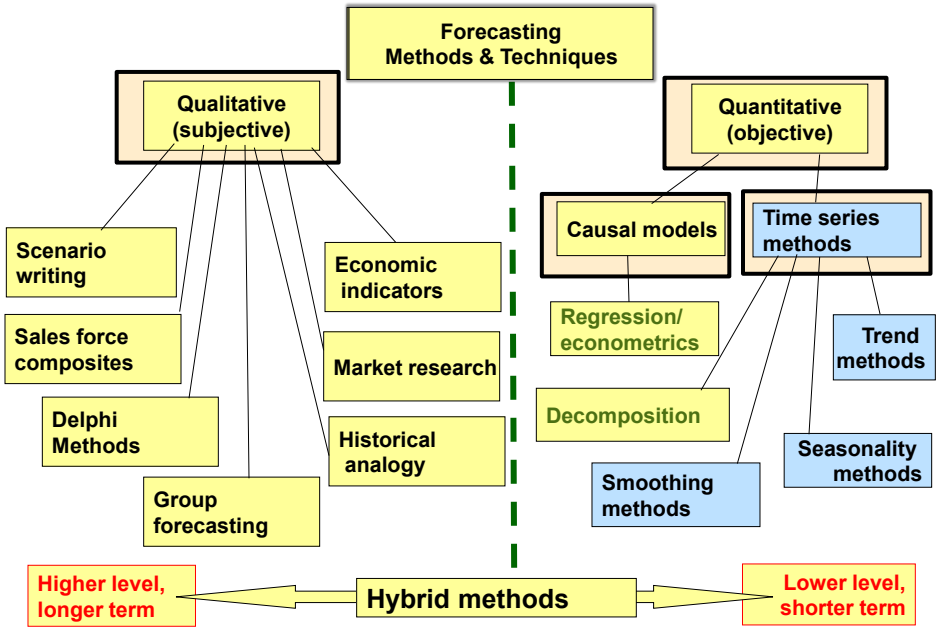
Forecasting

- Predicting future events or future conditions - **predicting change**
- Considers what **may** happen

Forecasts

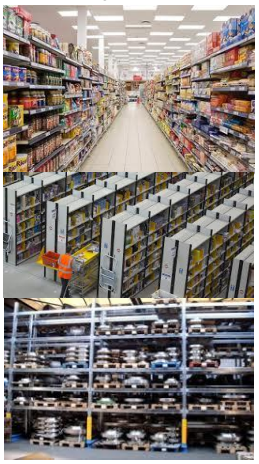
- Usually **wrong**
- **More than a single number**
- **Aggregate** may be **more accurate** than detailed
- **Long term** may be **less accurate than short term**
- Failure to forecast
  - acceptance of previous outdated forecasts
  - lack of preparation for change

Classification of forecasting methods



Time series methods

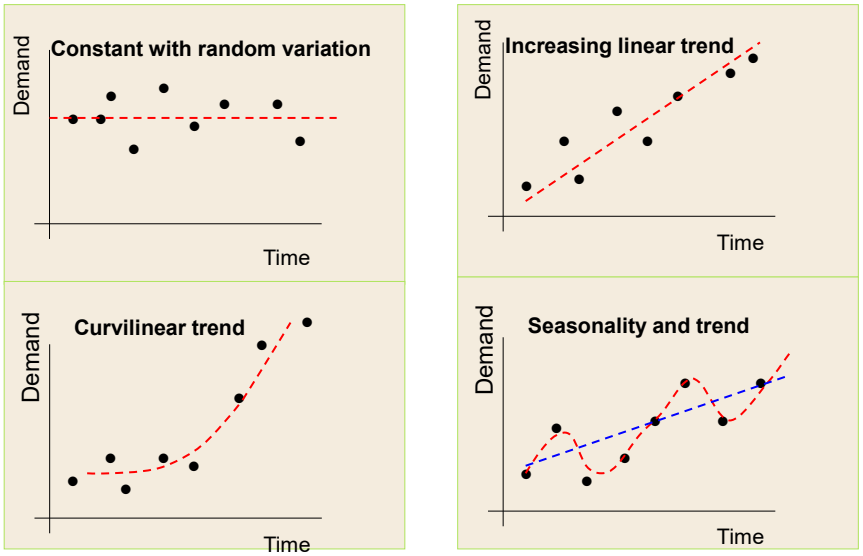
- Try to **extrapolate** to the future **from the previous history/patterns** in the data
- Very important for **short-term demand forecasting**



- Fast moving consumer goods **(FMCG)** markets
- **Retail sector** to ensure on-shelf availability
- **Web-based retailers** with many hundreds of product lines
- **Commodity products**
- Many other applications in **inventory** replenishment systems in industrial contexts for **independent demand items** – finished products, **aftermarket spares…**

Time series demand patterns

Learn time series techniques in session 4!

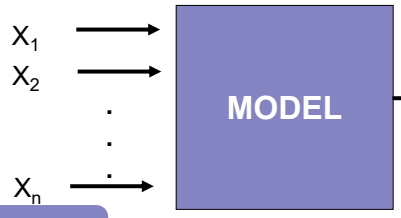


Causal modelling

Example in auto-industry:
Syed Shahabuddin, (2009), "Forecasting automobile sales", Management Research News, Vol. 32, No 7, pp.670 - 682

Predicting annual sales

Can we 'build' a model?



The explanatory variables

Output – (dependent variable)

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Causal modelling

- Tries to relate **demand to explanatory variables** to predict **aggregate volume** of demand
- Used by
  - **Corporate planning departments** in large companies often maintain this kind of model
  - **Forecasting groups in companies** trying to understand and plan for demand
- Some models developed by **independent companies** for a sector or type of product
  - Market research, consultancies, advertising agencies etc
  - Used by a variety of companies in the sector

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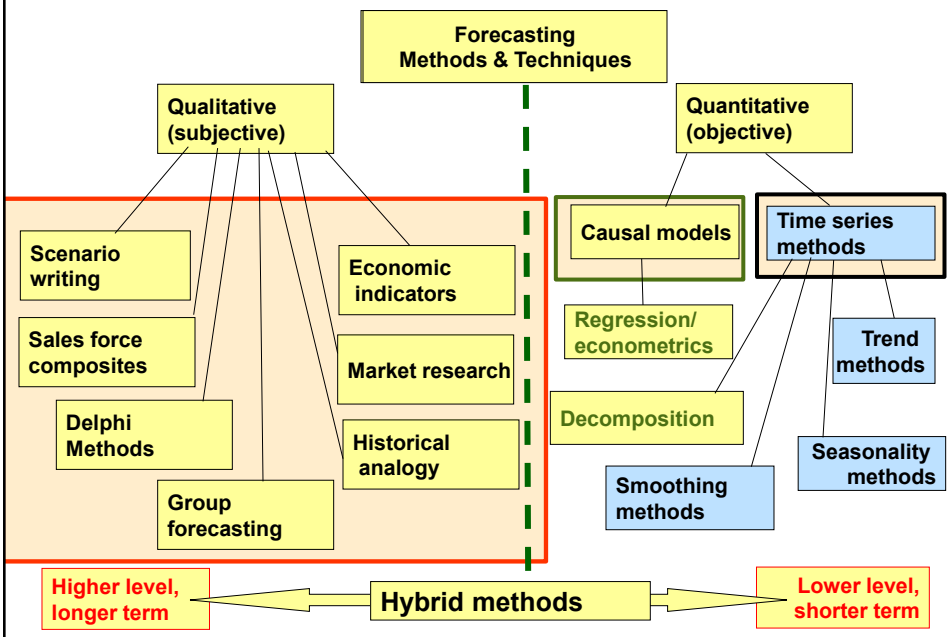
Classification of forecasting methods



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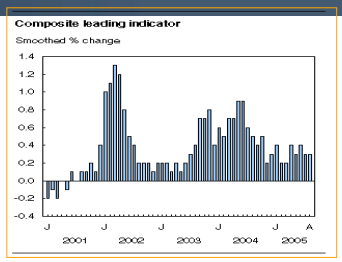
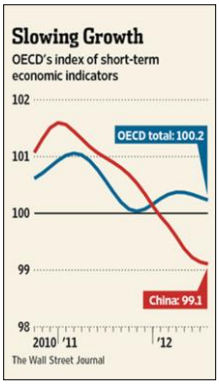
Qualitative forecasting – See notes

- Economic indicators
- Market research
- Historical analogy
- Group based forecasting methods
- Sales force composites
- Delphi methods
- Scenario planning





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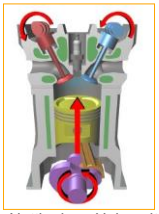
Is the future electric? Delphi Studies

https://tinyurl.com/y7zb2rbf

Tesla's CEO, Elon Musk, Allowing open access to its technology to promote hybrid and electric vehicles
www.inautonews.com

- BEV
- FEV
- HYBRIDS

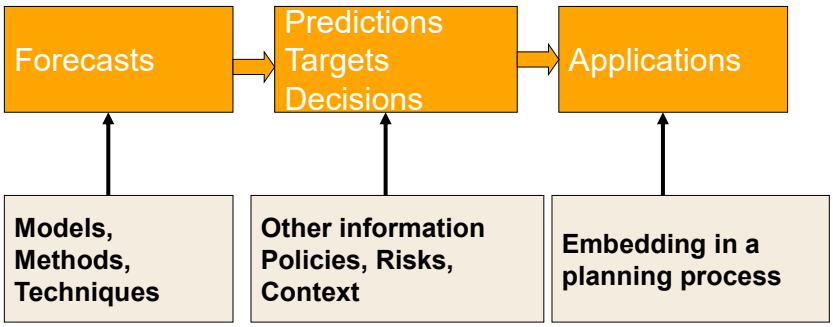
V



- ICEV

Which will win?

Using forecasts in planning

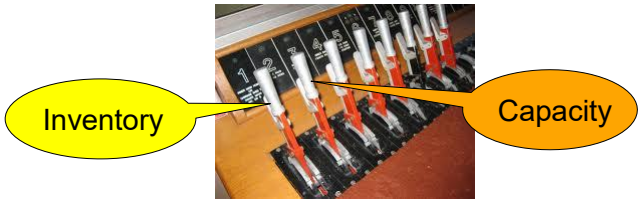


- Measurement and **tracking of forecasting errors** is important, particularly for time series methods
- Errors made consistently in one direction imply **bias**, important to **track errors and bias over time**
- **Explicit formal** methods best. Most importantly:

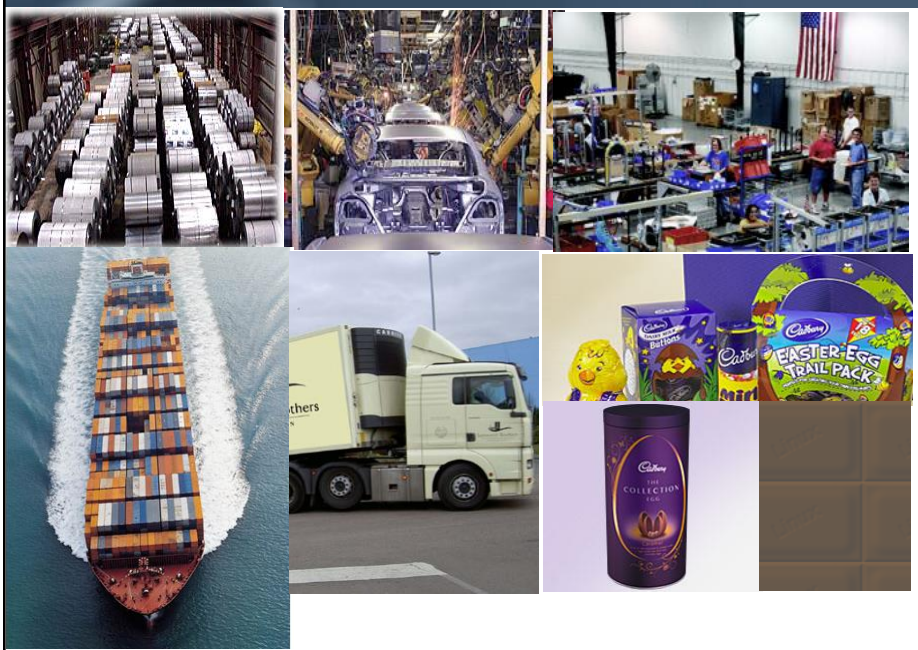
1. Do it 2. Use it 3. Review it.

Inventory and Capacity are key 'tools' in operations and supply chain planning

3. Inventory basics



Inventory everywhere!

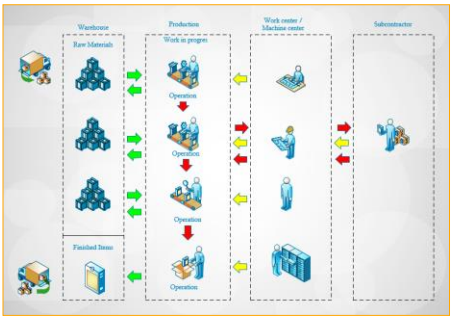


Inventory – where?

Physical forms

Where?

- Raw materials
- Work in process (WIP)
- Finished goods
- Intermediaries (spares and supplies)



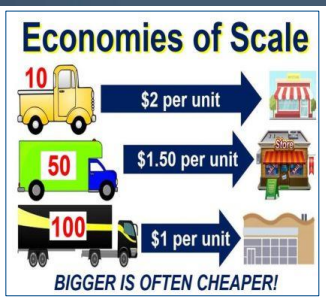
High levels of inventory may enable quick response but can incur significant costs and significant risks

Inventory – why hold?

Inventory functions

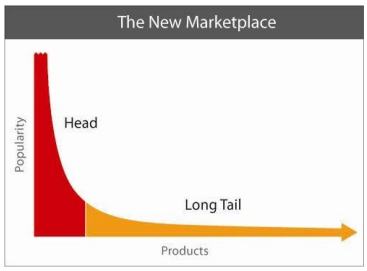
Why hold?

- **Economies of scale** – lower unit cost/price with high volume
  - purchasing
  - production
  - transportation
- **Buffer inventories** – protect against uncertainty in supply, demand, or price
  - **Transit** inventories
  - **Decoupling** inventories
  - **Anticipation** inventories
  - **Risk hedging** (supply problems, currency fluctuations)
- **Cycle inventories** – arise from the ordering cycle

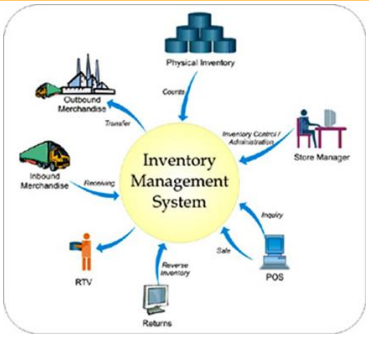


Inventory costs

- **Costs**
  - **Total cost minimisation** desirable – needs models
  - **Major problem is scale** – may be many hundreds or thousands of items



- Key questions
  - **when** to replenish inventory?
  - **how much** to order?
  - We need methods and techniques to decide when and how much.



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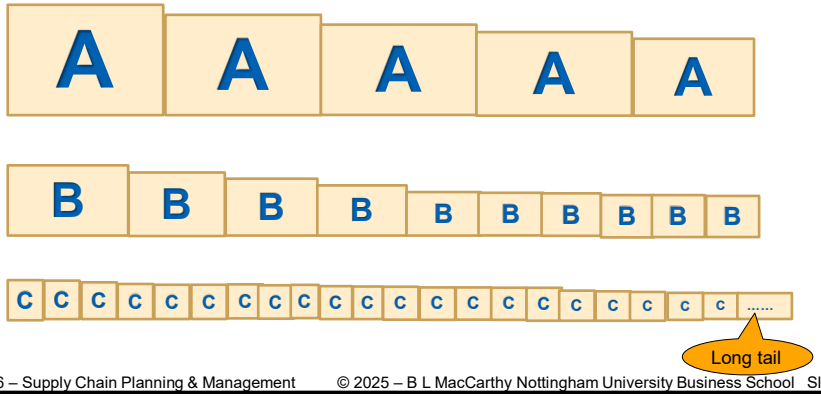
Managing large scale inventory – ABC classification

- The major problem is **scale** – may be many hundreds or thousands of items
- ABC classification groups inventory items based on **value**
  - **A items – most valuable**
  - **B items** – intermediate value
  - **C items** – least valuable
- Production/supply chain – cost of the item
- Retail – the volume sold



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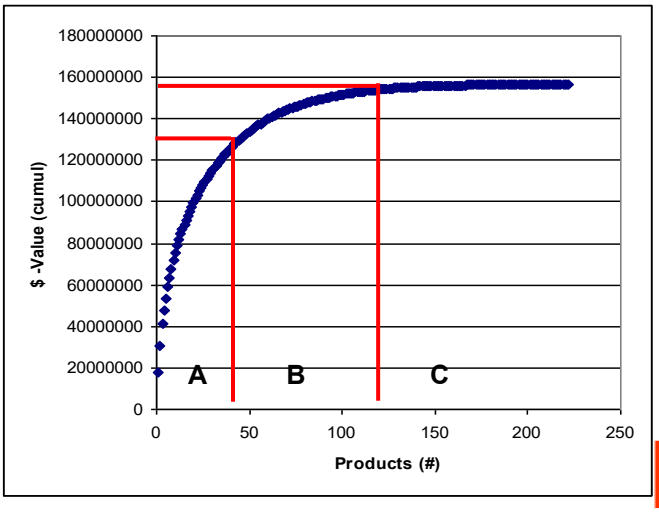
ABC inventory classification



A items:

20% of items – 80% of revenue

B items:

Next 30% of items – next 15% of revenue

C items:

Remaining 50%:

5% of revenue

80/20 does not always hold!

Adapt control: e.g. A: continuous review; B: periodically; C: simple rules

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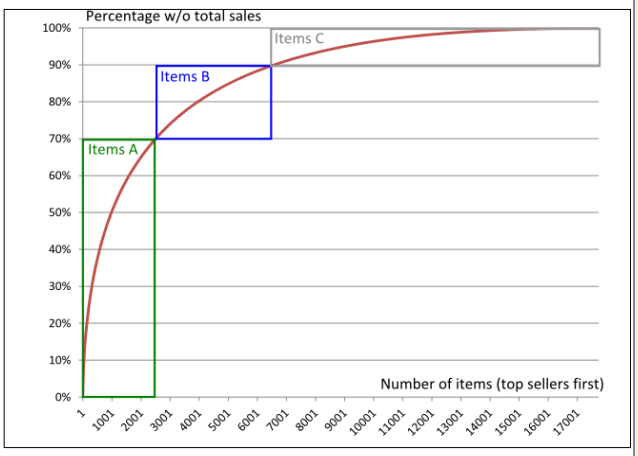
E-commerce example



From: http://www.lokad.com/abc-analysis-(inventory)-definition

- ERP software allows ABC type analyses to be done easily
- **Criticisms of ABC?**

US eComm. Co. 2011 sales for all products that sold at least one. Products ranked starting with the highest sales volumes.

Out of **17,000**:
Top 2,500 products **(Top 15%)** represent **70% of the sales.**

Next 4,000 products **(Next 25%)** represent **20% of the sales**.

Bottom 10,500 products **(Bottom 60%)** represent **10% of the sales.**

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Inventory management systems

- **Inventory management systems** require policies and controls that
  - monitor levels of inventory
  - determine what levels should be maintained
  - determine when stock should be replenished
  - determine how large orders should be
  - requires **information management**, **decision systems** and **control of physical operations**
- **Pareto analysis** and **ABC classifications important**
- Good information can reduce inventory holding!
- **Forecasting and inventory decisions** often done together

Learn the methods in sessions 5 and 6!

Summary – key learning points$_1$

1. **Effective Supply Chain Planning and Control Systems** should meet demand in a manner that **satisfies customers** and generates repeat orders and use **supply chain resources efficiently**
   - The **Hierarchical planning and control model(HPP)** is the dominant approach for industrial operations
   - Time horizon decreases and level of detail increases as you move down the hierarchy
2. **Forecasting** is crucial for **operations planning** and control - wide range of methods and techniques
   - **Qualitative (subjective) methods** – longer term/higher level
   - **Quantitative (objective) methods** – let the model do the work – shorter term/lower level – more later
   - Forecasting should be seen as a **management process** that can inform and drive supply chain planning

Key learning points 2

3. **Inventory** and **Capacity** are major planning levers
4. **Inventory** management
   - **Inventory** appears in **different forms**
   - Has different **functions**
     - **Economies of scale** inventories
     - **Buffer** inventories – protect against 'uncertainty'
     - **Cycle** inventories - arise from how we purchase
   - **Inventory management** is a major challenge because of scale
     - **ABC analysis** helps
     - Concentrates on most important/critical items
5. **Important - capacity** is just as important and is discussed in **the self-study material**

Assignment handout

- Please read the assignment document on Moodle before the **first seminar session on 17th of October**
- If possible, meet up and introduce yourself to your other group members
- We will allocate each group a specific supply chain to research at th seminar session.