

BK10A3800 Principles of Industrial Manufacturing Processes

# Overview to manufacturing


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# What is manufacturing?

- The word manufacture is derived from two Latin words, manus (hand) and factus (make); the combination means “made by hand”
- *“manufacturing is the application of physical and chemical processes to alter the geometry, properties, and/or appearance of a given starting material to make parts or products”*
- Material things(goods) are made to satisfy human needs
- *”Manufacturing represents the organized activity that convert raw materials into salable goods”*

# Role in modern society

- Think of the world without manufactured products
- 40 % of product retail price is typically from manufacturing costs
- Modern society and welfare is based on cheap manufacturing



**290**  
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1 [LISÄÄ](#)

Tuotetta löytyy tavaratalosta [5 tavaratalo](#)

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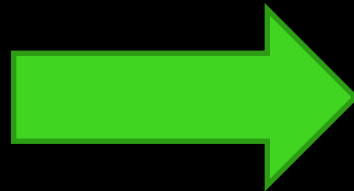
*Sales page for a stapler. Biltema*

# A double-edged sword

- Cheap manufacturing leads to excess usage of natural resources
- Manufacturing generates **20%** of world CO<sub>2</sub> annually.



*Souvenir shop*



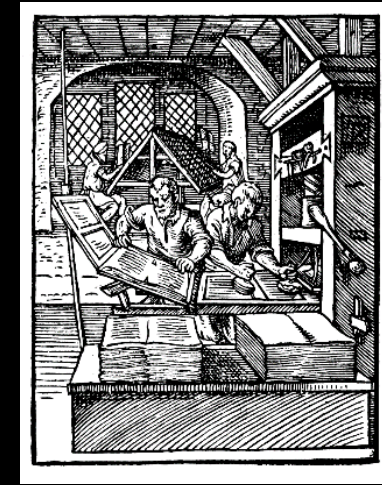
*Landfill*

# Brief history

- First stone axes a million years ago
- Changing material properties 120 000 years ago
- Book press in 1450
- American system of manufacturing 1850
- Mechanized assembly line 1910s
- Lean manufacturing 1930s



Stone axe



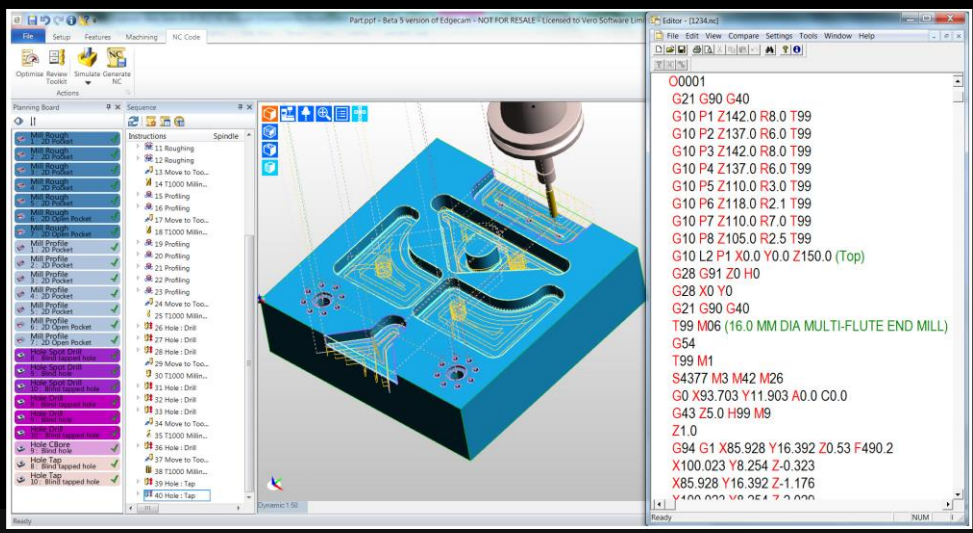
Book press(1450)



Ford assembly line(1910)

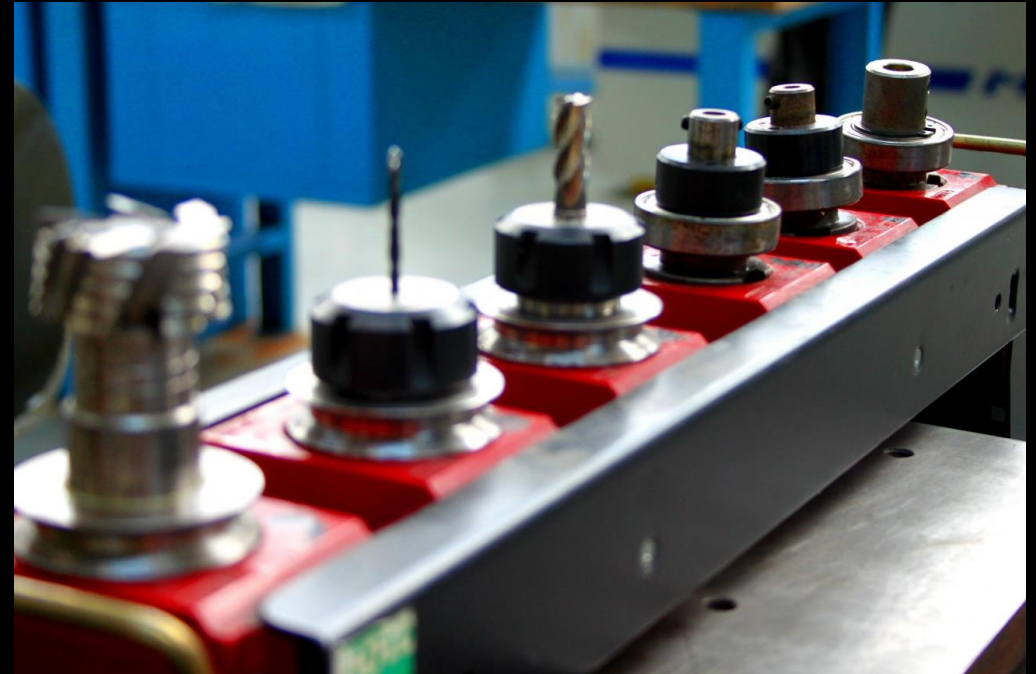
# Modern developments

- Flexible Manufacturing System(FMS)
- CAD/CAM software integration
- Industry 4.0
- 3D printing and local hubs



# How to manufacture certain products?

- Decision based on:
  - Costs
  - Quantity
  - Flexibility
  - Quality
  - Time
  - Capability



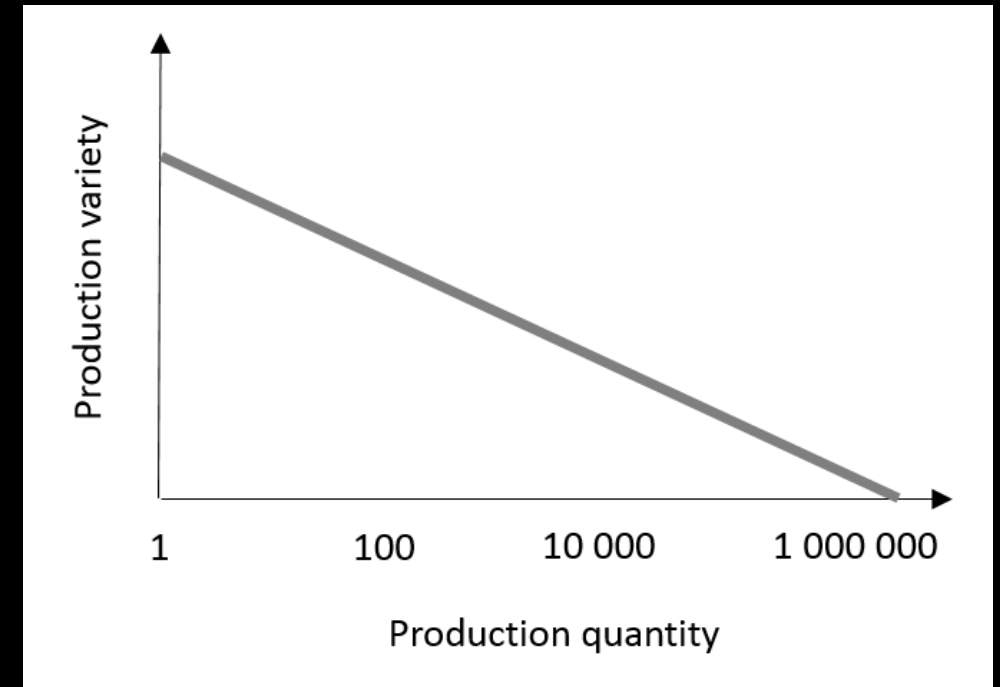
# Economical aspects

- Costs are typically the defining factor for the selected manufacturing method and material.
- Manufacturing costs include labor, material, machine overhead, utilities and inventory costs.
- Economy of the scale.



# Quantity vs variety

- Production quantity refers to the number of units produced annually of a particular product type.
- Product variety refers to different product designs that are produced
- Variety decreases when quantity increases

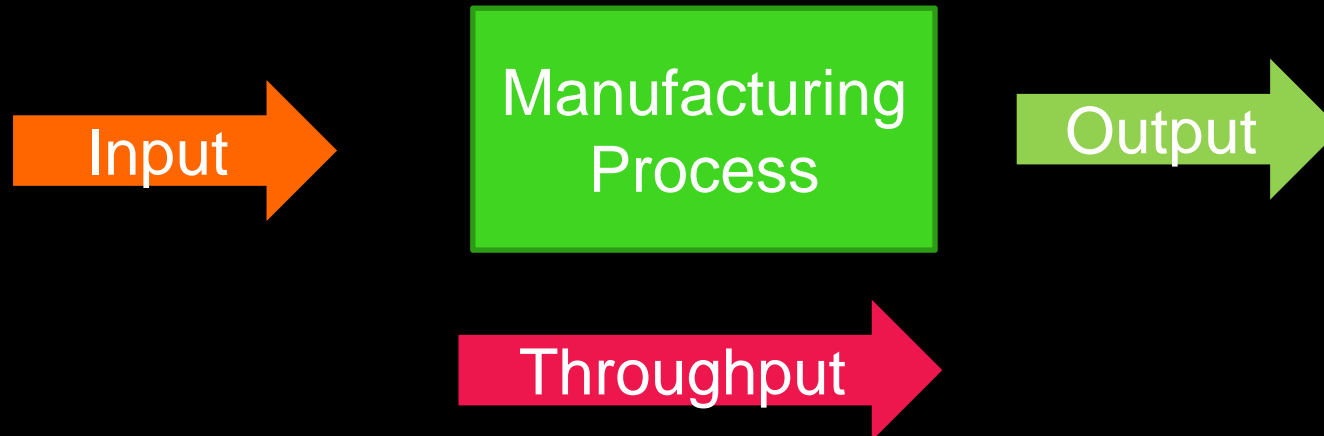


# Manufacturing capability

- **Technological capability** Refers to available manufacturing methods of the plant. For example foundry is capable of doing casting.
- **Physical product limitations** A plant with a given set of processes is limited in terms of the size and weight of the products that can be accommodated. Large, heavy products are difficult to move.
- **Production capacity** The production quantity that can be produced in a a time period. This quantity limitation is commonly called production capacity.

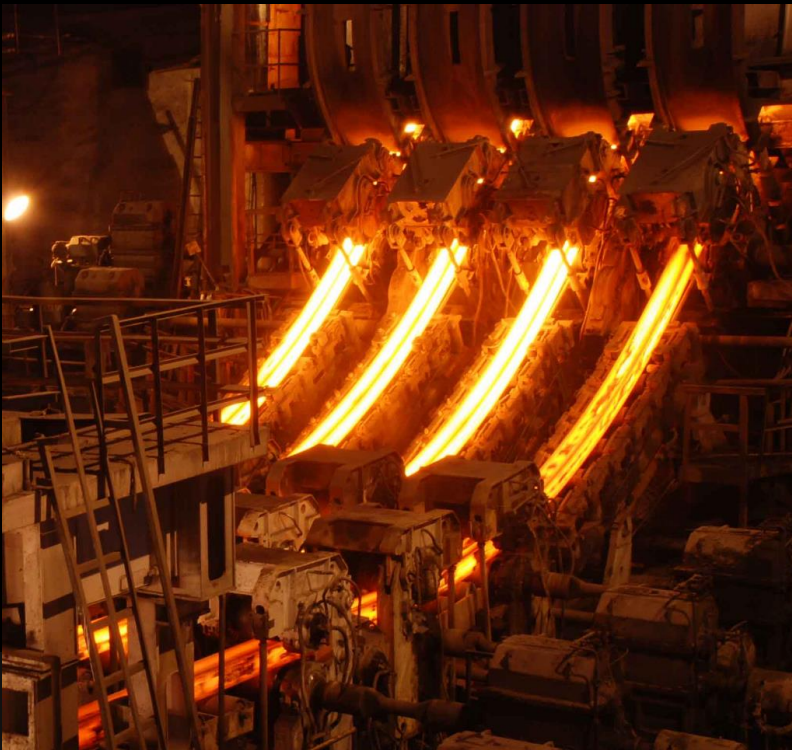
# Manufacturing process

- Process is a single step towards ready product.



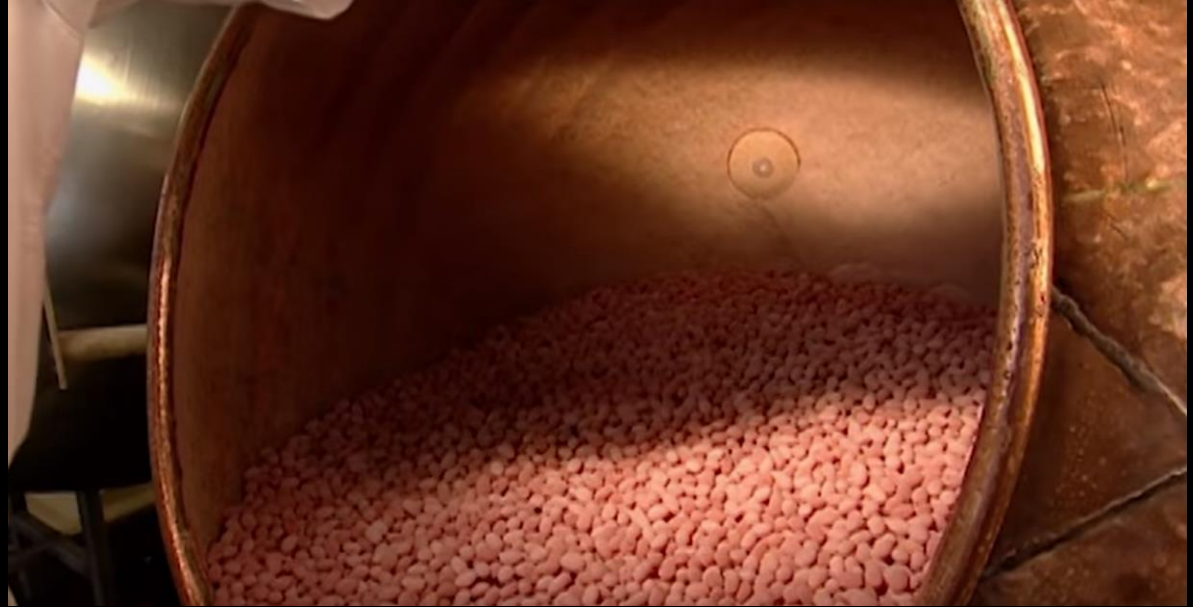
# Continuous process vs discrete process

- Continuous process is sustained production without interruptions. Typical products are metal coils, plates and chemical products.
- Discrete production creates separatable products.



# Batch process(something between)

- A batch process is a process in which the product comes out in groups and not continuously.



A batch of candy in mixer.

# Manufacturing system(MS)

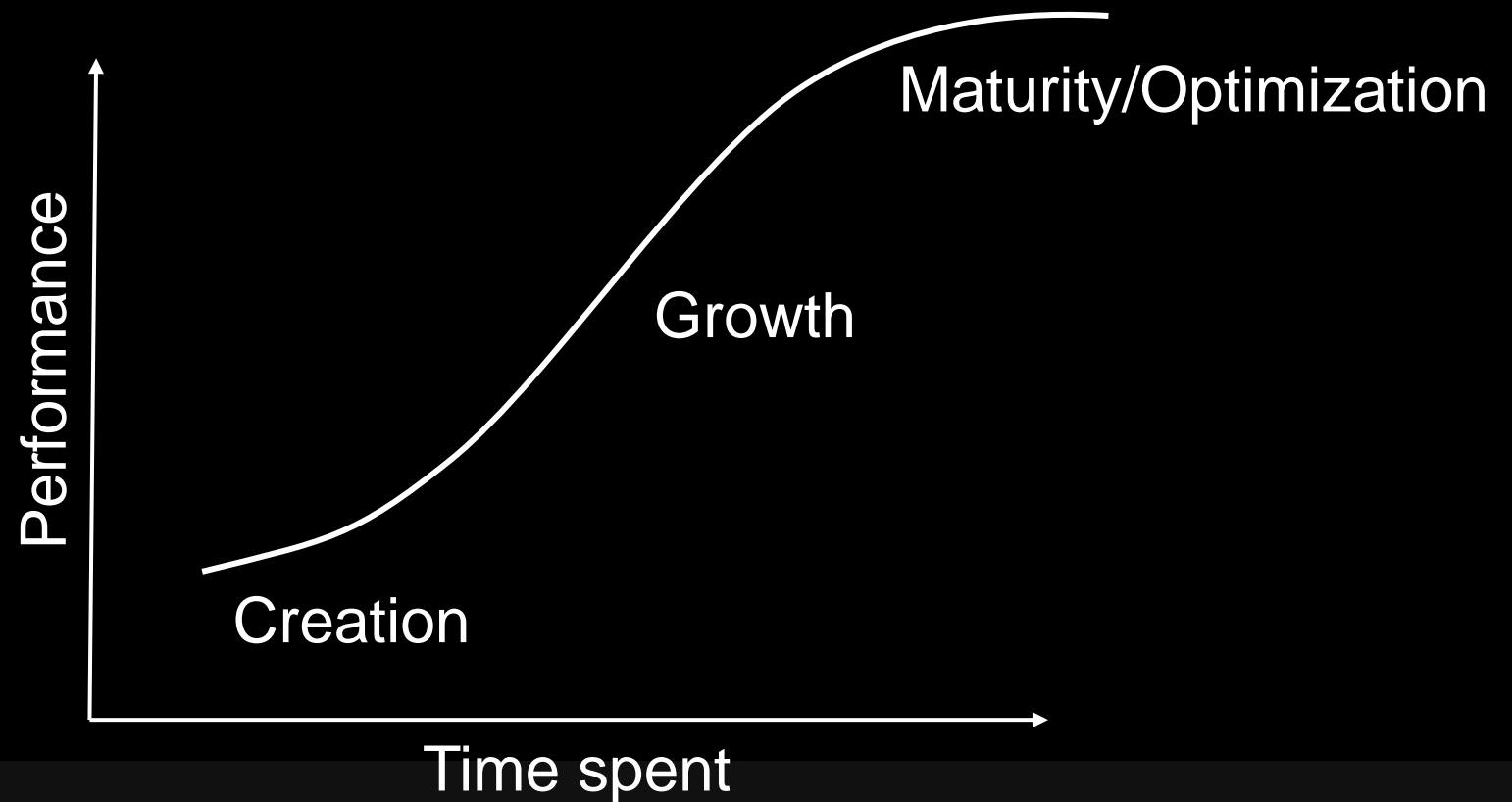
- Collection of manufacturing processes to produce products
- For example manufacturing line of A-class Mercedes in Uusikaupunki



*Car factory. Uusikaupunki. ©Valmet Automotive*

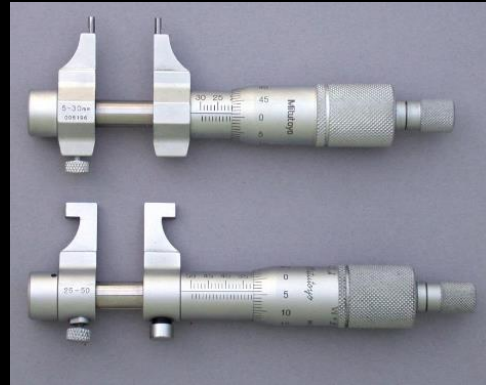
# Continuous improvement

- Manufacturing process of certain products can be presented with S-shaped life-cycle curve



# Role of quality measurement

- Verification of measurements and quality inspection is a vital part of manufacturing since no manufacturing method can be perfect
- Verification of the product to conform standard sizes
- Inspection(metrology) is usually done with gauges



*Inside micrometer*

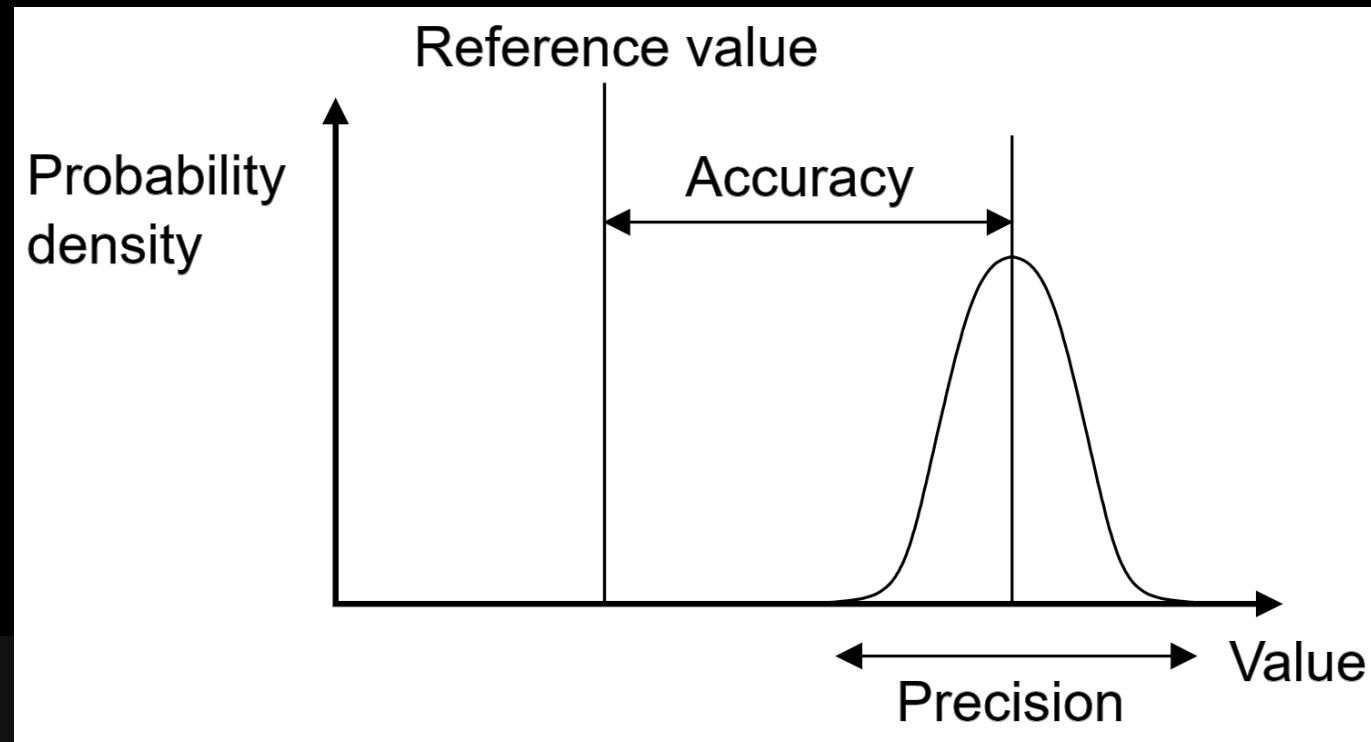
Glenn McKechnie, CC BY-SA 2.0



*Vernier caliper* (Wikipedia)

# Precision and accuracy

- **Precision** tells how repetitive the process is (how wide the value range is)
- **Accuracy** tells how close the dimensions are on target (absolute position of the average value)



# Summary

- Manufacturing has a vital role in modern society
- Efficient manufacturing can lead to excess usage of materials and generation of waste
- Basic classification of manufacturing methods(discrete, batch and continuous)
- Manufacturing is often based on economical decisions and capabilities
- Quality management and verification plays important role in manufacturing