

# Production Techniques and Systems

## What you need to know:

- Understand contemporary and potential future use of automation, Computer Aided Design (CAD), and Computer Aided Manufacture (CAM).
- Be able to recognise and characterise the use of Flexible Manufacturing Systems (FMS)
- Understand how Just In Time (JIT) and lean manufacturing contribute to manufacturing efficiencies

## Automation

The use of computers in production lines make them flow more easily and lead to less human interaction needed. In the past manual production lines were slower and more expensive to operate than the automated production lines used today. Despite this, some traditional manufacturers still rely on skilled manual labour. Products made in this way tend to be bespoke, low volume and high cost items, including sports cars or high-end furniture.

Most manufacturing is still becoming increasingly automated. Automation involves computers using complex software systems that have an overview of many aspects of the production. Production data management is the term used to describe these software systems. All of the data is stored centrally, is updated live and is accessible by all employees who need the most up to date information. This reduces mistakes, ensures that all teams in the company can work together, leads to accurate costing and forecasting production progress.

## Computer-Aided design and manufacturing

Computer aided design (CAD) and computer aided manufacture (CAM) are essential to ensure smooth transition between the designing and manufacturing stages of creating products. CAD is the design of new products using specialist computer based software. CAM is uses the CAD files to turn these designs into prototypes or finished products. Many designers still prefer to start sketching an idea using pen and paper in order to express ideas more freely. Once the design has been created CAD can be used to re-sketch accurately and can be used to manipulate and test the design until it is finalised.

Both CAD and CAM work through the use of computer numerical control (CNC). This is when the CAD software generates a series of machine codes which are interpreted by the CNC machine into movements of the machine bed or other actions such as motor speeds to control needles or cutters.

In schools common CAM equipment includes laser cutters, vinyl cutters, computerised sewing and embroidery machines, CNC routers and lathes.

## Flexible manufacturing systems (FMS)

This refers to a collection of automated machines that are adaptable and used in production lines where the products being made may change on a regular basis. Manufacturers can respond quickly to changes in the market and consumer demands, it also allows for a reaction to trends and fashion. FMS machines are flexible and adaptable, they are best equipped for batch production. The need for flexibility could add further set up costs to the production. CNC machines are frequently used in FMS as they can be reprogrammed easily so changes are quick, simple and cost effective. Robot arms are also used because they can be programmed to do many tasks. They can also perform multiple tasks while on one production line, making the FMS capable of real time changes and greater flexibility during manufacture.

## Key Questions:

- Which types of products would be best produced using the JIT production method? Why?
- Find out about the term KAIZEN.
- How could Kaizen be used to support the lean manufacturing philosophy?
- How would FMS allow a company to respond to trends and market changes?
- Explain the term Product data management.
- Why is it a good idea for companies to invest in product data management software?
- Why do some people still prefer to purchase hand-built items instead of mass produced products? What kind of products may sell better if made by traditional methods?
- What is meant by a machine being 'computer numerically controlled'?
- How can CAD/CAM save on shipping costs for a business?
- Find out about CAM equipment available in school—what are the advantages and disadvantages of these?
- Find out about design software—download a free access one and trial use of it!

Advantages of JIT	Disadvantages of JIT
Reduced storage costs as stock is not stored	Relies on high quality , fast and reliable supply chains for materials and components
Money is not tied up in unsold stock	All production could stop or be delayed if the supply chain breaks down
Orders are secured on a deposit or full payment—money is paid before outlay of materials and production costs	Stock is not ready to be purchased 'off the shelf'. Some customers may not want to wait, so sales could be lost.
Materials are supplied as needed, saves financial outlay on unused materials or additional storage	A deposit or full balance usually needs to be paid upfront which may be off-putting for some customers
Stock does not become old, obsolete or out of date	Discounts from suppliers for purchasing materials in bulk may not be available
Almost all waste is reused or recycled so little landfill waste is produced	

Advantages of CAD	Disadvantages of CAD
Designs can be altered easily	Software can be difficult to learn
Faster to draw complex designs, so saves labour costs and development time	Software can be expensive
Design can be saved and historic versions kept and archived. Designs can also be easily copied or repeated.	There can be compatibility issues with the software
Work can be sent be email for approval and for manufacture	Security issues—data could be corrupted or hacked
Teams of designers can work on the same project simultaneously	Software may need regular updates
Designs can be rendered to look photo realistic to gather public or target market opinion	Demand on computer memory
Software can process stress testing and associated calculations to predict issues with a product prior to manufacture	Data could be lot in power cuts

Advantages of CADM	Disadvantages of CAM
Faster than traditional tools	Expensive to set up/buy equipment
More accurate than traditional methods	Training costs and time
High accuracy and repetition	CAM machines need specialist engineers for maintenance and repair
Machines can operate 24/7	CAM machines can lead to unemployment due to replacing traditional skills/jobs
Work can be produced directly from CAD files	

## Lean Manufacturing

Lean manufacturing is based on an ethos of eliminating waste in manufacture. An increasing number of responsible manufacturers now adopt this principle to save money and resources. This first began in Japan during the 1990's but has grown in popularity across the world. Manufacturers are cutting down on the waste they produce by changing the way they operate. An example of this is to use Just In Time production methods (JIT)

## Just In Time Manufacturing (JIT)

Using Just In Time production methods manufacturers are able to respond to customer demands more effectively. JIT manufacturing ensures that customers get the right product at the right time and at the right price. A customer's order will trigger the production proves and the manufacturer makes the product specifically to meet the order. Stock is not ordered until the product will be made, reducing waste and making production more economical as stock is not ordered of not needed.

Key words: (Find out what these mean!)

Automation	Flexible-Manufacturing Systems
Computer-Aided Manufacture	Production data management
Computer-Aided Design	Computer numerical control
Just-In Time Production	Kaizen