

Learning Objectives

- To learn about the impact of computer aided design and production techniques on the design and manufacturing industry.
- To further advance CAD skills in 2D Design and SketchUp.
- To further develop CAD drawing techniques

WHAT WILL YOU BE DOING THIS PROJECT?

You will start with a recap on Automation, CAD and CAM, then further your knowledge by learning about more advanced production techniques. After that you will take part in a range of CAD projects, further developing your knowledge and skills of CAD drawing techniques such as isometric and orthographic, also learning new techniques such as sectional and exploded views.

Key words

Computer aided design (CAD): using computer software to draw, design and model on screen.

Computer aided manufacturing (CAM): manufacturing products designed by CAD.

Flexible manufacturing system (FMS): a system in which production is organised into cells of machines performing different tasks.

Computer numerically controlled (CNC): machine tools that are controlled by a computer.

Just in Time (JIT): a production method that means materials and components are ordered to arrive and the product assembly point just in time for production.

Lean manufacturing: focusing on reduction of waste when manufacturing.

Production techniques

Flexible manufacturing system (FMS)

Production is organised into **cells of machines performing different tasks**. Each cell has a range of **computer numerically controlled (CNC) machines**.

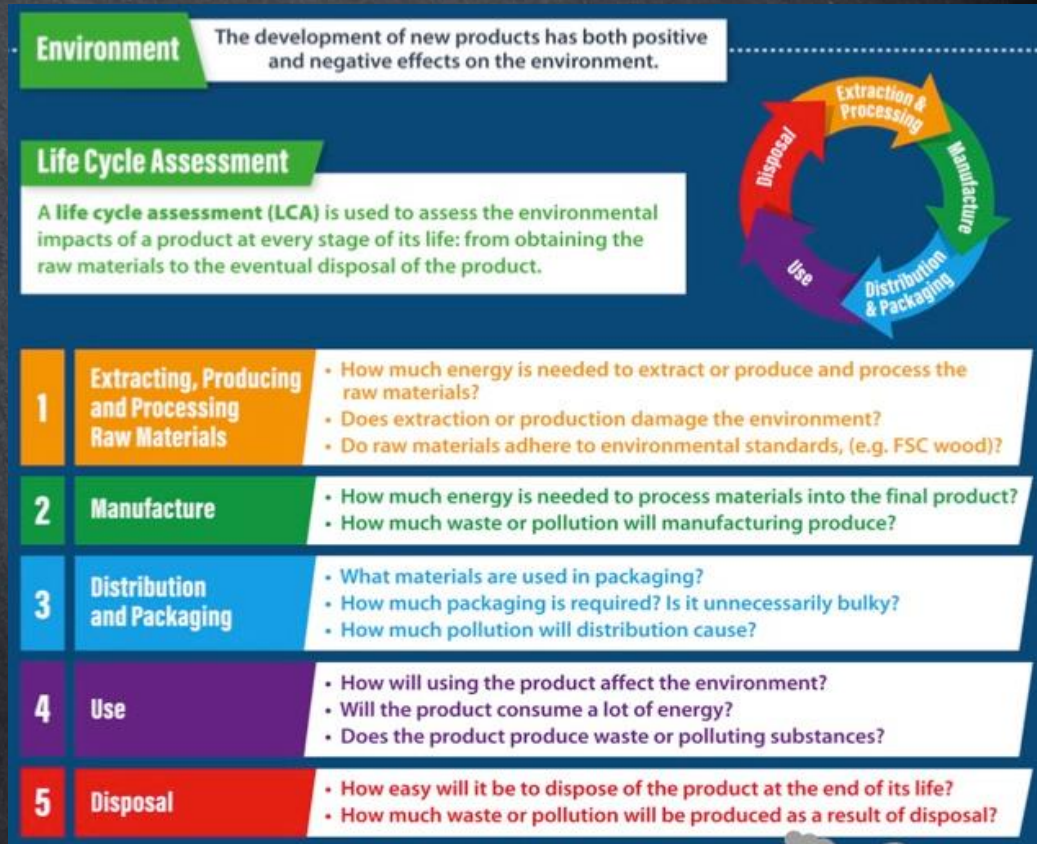
FMS are highly flexible because:

- they can produce different products at the same time
- they can be set up to produce new products quickly and easily, saving time and effort.



Just in Time (JIT) and lean manufacturing

Just in Time (JIT) production is a method of organising a factory so that materials and components are ordered to **arrive at the product assembly plant just in time for production**. It helps to create **lean manufacturing**, which means it focuses on **giving customers value for money by reducing waste**.



Finite Resources

Finite resources are non-renewable. They cannot be replenished as fast as they are consumed and are therefore unsustainable.

Examples: Fossil fuels (oil, gas, coal)

Non-Finite Resources

Non-finite resources are renewable. They can be replenished faster than they are consumed and are therefore sustainable.

Examples: Timber and wind power



Waste Disposal

Once a product comes to the end of its life, it must be disposed of. Historically, most waste was buried at **landfill sites**, but decaying waste can cause pollution by contaminating the local land and water supply and generating greenhouse gases.

To try and reduce the amount of waste going to landfill, people are being encouraged to recycle their waste. However, only certain materials (e.g. paper, plastic, metal) can be recycled. Food waste can be recycled for fertiliser and to generate biofuels.

Waste can also be incinerated (burned) to reduce the volume of waste going to landfill. However, this generates significant greenhouse gas emissions causing more pollution.



The 6 Rs

The 6 Rs help designers to analyse the potential environmental impact and sustainability of new products. The 6 Rs also help consumers evaluate their impact on the environment.

Rethink: Consider how the product can be made in a more sustainable way using sustainable resources and be more sustainable itself.

Reduce: We can limit the amount of resources and energy used when creating, using and disposing of products.

Refuse: We can refuse to use unsustainable and unethical resources, processes and products.

Recycle: Consider how the product can be made from recyclable materials and whether all or part of it can be recycled at the end of its life.

Repair: We can create products that are easy to repair so that their life cycle can be extended.

Reuse: Consider how the product can be used again or in other ways once it has served its function.



Planned Obsolescence

Most products are designed to have a set lifespan. Some are designed to last a long time, whereas others are designed to last for only one use. This is known as planned obsolescence.



Car
10–15 years



Mobile phone
2–3 years



Coffee pod
1 use

Single-use products do not necessarily need to be durable, but it is preferable that they are biodegradable or can be recycled. Many technology and fashion products will have intentionally short lifespans because customer demand quickly changes in response to new technologies and trends.

Some businesses use planned obsolescence to ensure a steady stream of sales. If their products last a long time, they will suffer from fewer sales. However, this is bad for the environment as it produces more waste. As such, designers must balance ethics and the environment with profit when developing new products.

Design for Maintenance

Some products are designed for maintenance. This means that when part of the product is broken or worn out, that component can be repaired or replaced without having to throw the whole product away. This is far better for the environment.

Design for disassembly is a design strategy that considers the future need to disassemble a product for repair, recycling or to prolong its life cycle.



Ethics

To keep prices low for customers, some manufacturers look for ways to cut costs during production. Sometimes this may involve behaviour that is considered unethical, such as:

Using cheaper overseas labour

Using cheaper materials

Illegally disposing of waste

Some customers are willing to pay a higher price for ethically sourced, fair trade products in the knowledge that the workers can work safely and have been paid fairly.

The Environment

Designers must consider how new products will affect the environment, from their manufacture through to their disposal. Products made from renewable materials and manufactured with minimal energy consumption can help minimise damage to the environment. Using timber branded with the FSC label ensures that it has come from a sustainable source.

Ensuring new products have long lifespans, or can be recycled or reused, will also reduce the environmental impact.

