5.3 Lean production and quality management (HL)

Lean production

Efficiency and waste

The terms efficiency and waste are interconnected; if waste can be reduced, then efficiency should improve. Efficiency refers to how well a business can transform physical, human and financial inputs into outputs. A business is more efficient if it can produce more products (output) using the same or even fewer resources (inputs). Improved efficiency reduces costs of production (see **Figure 1**). If more output is produced with the same inputs, or if the same output is achieved with fewer inputs, then the average cost per unit will fall.

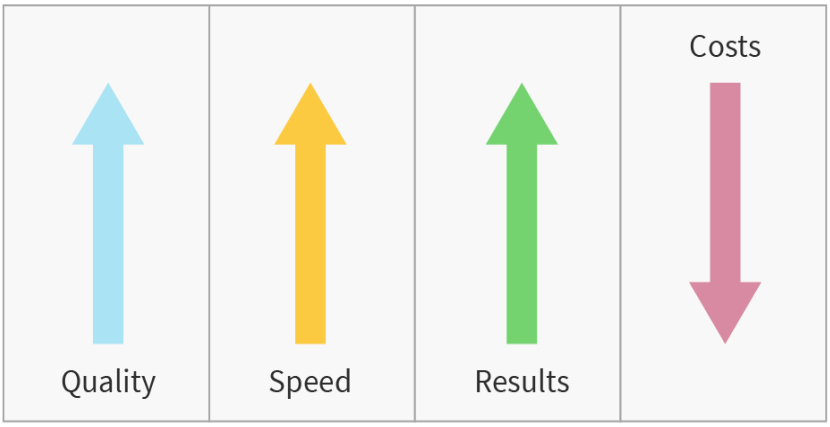

Figure 1. The benefits of efficiency.

For many companies, labour costs are the most expensive resource input. Labour efficiency can therefore have a significant effect on unit costs. If fewer employees are needed, or if the same number of employees can produce more, unit labour costs will be reduced.

Imagine, for example, that you run a large hotel chain. One of the biggest variable costs of selling a room for the night is the cost of cleaning the room after the guests have left. If you pay your cleaning staff $12 per hour and it takes one person 30 minutes to clean a room, then the average variable cost will be $6 per room. However, if you train your staff and give them the necessary tools to do their job, cleaning time could be reduced to 20 minutes per room. This increased efficiency will see the average variable cost fall to just $4 per room.

Waste is any part of the production process that does not add value to the final consumer. Waste means resources are lost and often results in damage to people and the planet. If waste can be reduced, costs of production are also often reduced, leading to higher profits. Toyota has identified seven main categories of waste:

- **transportation** – moving components between workstations or from suppliers
- **inventory (stock)** – building up excessive stocks, resulting in storage costs
- **motion** – staff risking injury while making the product
- **waiting** – delays in the production process
- **over-processing** – adding features to a product that are not required by the customer and therefore do not add value
- **over-production** – producing an inventory of finished goods before they are needed
- **defects** – finished goods that do not meet quality control standards

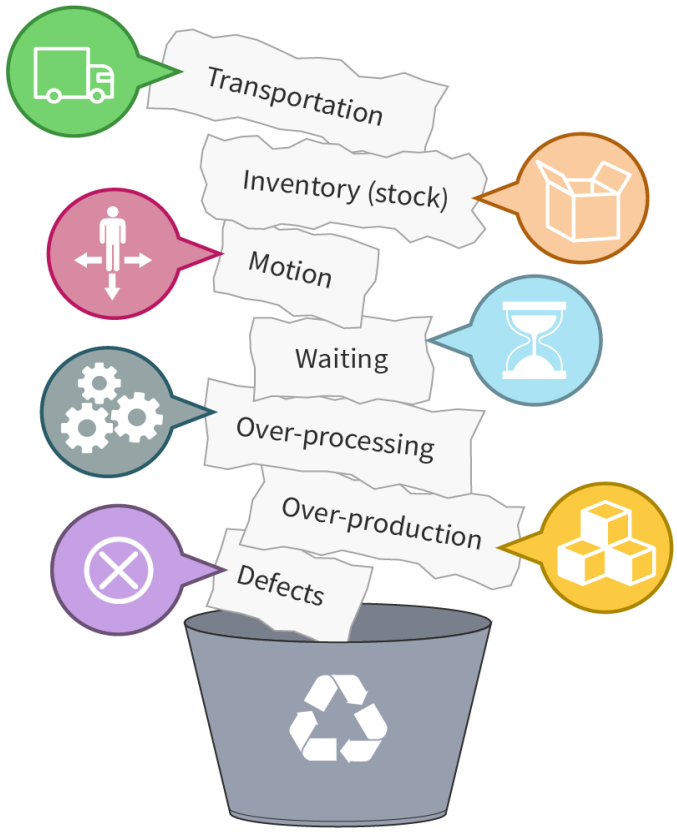

Figure 2. Types of waste.

These types of waste can be remembered by using the mnemonic (memory aid) 'TIM WOOD' – the initial letter of each type of waste. **Table 1** provides an example of how each type of waste might occur in a hairdressing salon.

Table 1. Types of waste in a hairdressing salon.

Type of waste	Hairdressing salon example
Transportation	Clients moving between different stations for washing, cutting and colouring.
Inventory (stock)	Having excessive stock of hair colouring products that is unlikely to be needed.
Motion	Staff using faulty electrical equipment, such as hair dryers.
Waiting	Customers having to wait to see their stylist due to overbooking.
Over-processing	Offering additional hair treatments that the customer does not need or want.
Over-production	Making large amounts of coffee or snacks that customers do not ask for and that are eventually thrown away.
Defects	Poor quality hair services that lead to dissatisfied customers.

Activity

Learner profile: Thinkers
Approaches to learning: Thinking skills (transfer)

Copy and complete the following table. Think about the types of waste outlined above in the context of your school. Consider examples of what waste would look like and what could be done to reduce that waste.

Type of waste	School example	Ideas for improvement
Transportation		
Inventory (stock)		
Motion		
Waiting		
Over-processing		
Over-production		
Defects		

In a hairdressing salon that provides a service with a visible result, or in a factory producing a physical product, it may be easy to see the negative impact of waste on the business. Fewer customers can be served, fewer items produced. The waste may be very visible in terms of material resources.

- Why might the impact of waste in a school be more difficult to see and measure? Discuss with a partner, or in the class.

Case study

Food waste

According to the UNEP Food Waste Report (https://www.unep.org/resources/report/unep-food-waste-index-report-2021), almost a billion tonnes of usable food is wasted each year globally. This is about 17% of all food produced each year. **Figure 3** shows where that waste occurs after it leaves the farm.

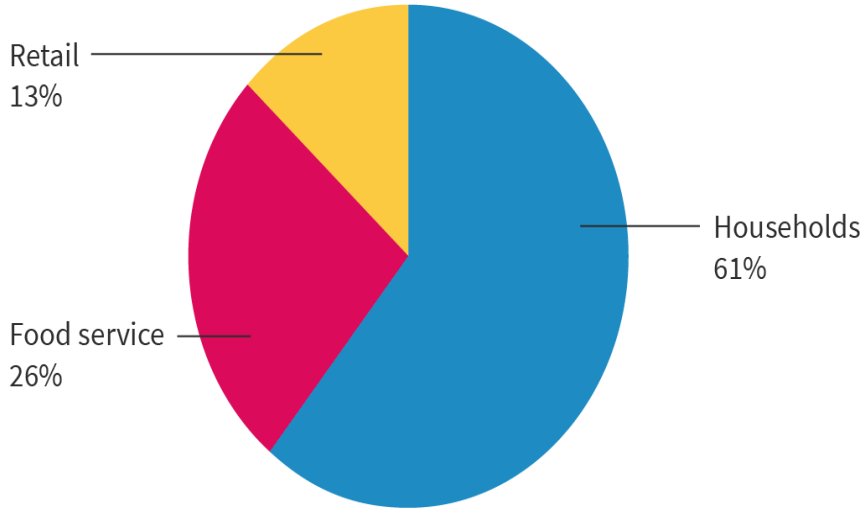

Figure 3. Proportion of total global food waste occurring in households, food service and retail.

Source: United Nations Environmental Programme (UNEP) Food Waste Index Report, 2021. Nairobi.

This food waste is a problem for both people and the planet. While food is wasted all along the food chain, the Food and Agriculture Organisation (FAO) reported in 2021 that more than 800 million people globally – more than 10% of the world's population – are malnourished. Hunger has worsened globally during the COVID-19 pandemic. Enough food is produced globally, often by those experiencing malnutrition themselves, to meet the needs of all. But the distribution of food needs to be improved, and waste needs to be reduced.

Food waste contributes significantly to climate change because, according to the UN, 8 to 10% of global carbon emissions are linked to food waste. Climate change increases food insecurity and increases the likelihood of waste due to increases in unpredictable and severe weather affecting agriculture. Food waste also causes increased pollution, loss of biodiversity, excessive land conversion and freshwater extraction, all of which threaten planetary boundaries and further worsen poverty and hunger.

Supermarkets can reduce waste by maintaining the quality and safety of produce on their shelves while using as little energy as possible. They can provide discounts earlier, when the sell-by dates of food approach, or they can donate surplus food to charities and community organisations to avoid throwing it away. Technology can also help. 'The internet of things' technology (HL Subtopic 5.9 (/study/app/y12-

business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-39043)) can help to monitor storage conditions and stocks (inventory) to ensure that only what is needed is ordered.

Restaurants can reduce food waste by cutting back the diversity and complexity of their menus. This would require fewer inputs to produce food for customers. They can also provide smaller-sized food portions. Any food waste that still occurs should be processed for energy and compost. Many businesses around the world offer such services to the food industry.

Households can reduce waste by more careful shopping. People should buy only what they need and plan meals to use what they already have. Like restaurants, left-over food and food scraps should become resources for food and energy systems.

Questions

- Explain why a pie chart, as opposed to another graphic form, is used for the data in **Figure 3**. [2 marks]
- Explain **one** reason why a restaurant would want to reduce its food waste. [2 marks]
- Using the Doughnut Economics model or the SDGs, explain how food waste is a problem for both the social foundation (human needs) **and** planetary boundaries. [4 marks]

Making connections

Young activists around the world are exposing food waste in supermarkets by investigating what gets disposed of in supermarket dumpsters. Matt Homewood (https://www.matthomewood.com/) is one such activist, exposing high levels of food waste in Copenhagen, which is considered one of the more sustainable cities in the world.

Investigating and taking action to reduce food waste in your home, school, and/or local restaurants and supermarkets can be an interesting CAS project. You can use the Youth Mayors Field Guide (https://sites.google.com/uwcmaastricht.nl/youth-mayors-curriculum/home) to help you organise the investigating, planning and designing, taking action, sharing and scaling of such a project.

Lean production

Lean production refers to a set of strategies to reduce waste in the production process. The objective of lean production is to produce a high-quality product using minimal resources. There is always room for new, creative ideas for reducing waste in

production. This creative mindset has led businesses that practise lean production to cut costs and reduce defects year after year. The principal methods of lean production covered in this section are:

- continuous improvement (kaizen)
- just-in-time (JIT) production

Continuous improvement (kaizen)

Meaning ‘change for the better’ in Japanese, kaizen is both a process and a philosophy. It involves businesses holding regular, scheduled meetings where staff are invited to give their opinions and suggest improvements.

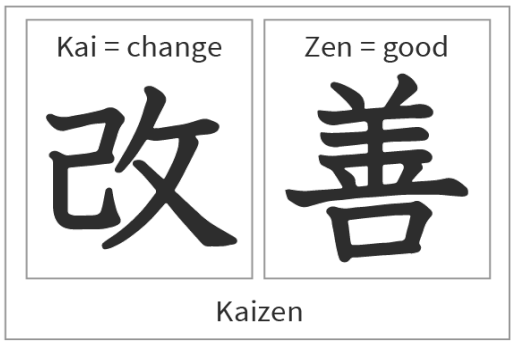

Figure 4. Continuous improvement or kaizen.

Thousands of ideas are suggested each year in the kaizen process. Clearly, not all these ideas are used, but at least some will be of value to the business. These meetings can reduce costs and drive up product quality. They also have another benefit, which is that staff feel respected because their ideas are taken seriously. This can lead to a boost in motivation and further gains in productivity. **Table 2** outlines the main benefits and limitations of continuous improvement (kaizen).

Table 2. Benefits and limitations of continuous improvement (kaizen) for a business.

Benefits of continuous improvement (kaizen)	Limitations of continuous improvement (kaizen)

Benefits of continuous improvement (kaizen)	Limitations of continuous improvement (kaizen)
Diversity of ideas. A range of ideas is suggested so the business is more likely to make the 'best' decision.	**Lower productivity.** Meetings and evaluation of ideas takes time, possibly reducing productivity.
Better ideas. Employees may have a greater knowledge of the problem than the managers/directors that may traditionally make decisions.	**Higher labour costs.** Involving staff in improvements may result in them demanding higher wages for increased responsibility.
Employee motivation. Involving staff helps them to feel valued, improving motivation.	

Theory of Knowledge

Toyota provides an excellent example of success in the reduction of production waste resulting from the implementation of lean production and quality control. Some of the most innovative approaches to reducing waste in production and quality control have come from Japanese companies and have quickly been adopted by other businesses.

This poses the question of whether the consideration of production waste and product quality is related to the culture of the producers and consumers.

- What is the role of both organisational culture and national culture in the innovations related to waste reduction and product quality?

Just-in-time (JIT) production

Traditionally, companies liked to hold large quantities of stock (inventory) 'just in case' it was required for an unexpected order or there was a problem with the supply chain (such as a delayed delivery). However, this system of inventory control proved expensive. It led to high storage costs and potential waste if the product went out of date or was damaged in storage. It also involved committing large amounts of cash to stock purchases; this cash could be put to better use elsewhere in the business.

Figure 5. Just-in-time production means that resources are delivered just before they are needed, reducing the need to store inventory (stock).

Credit: Kmatta, Getty Images

Just-in-time (JIT) production aims to minimise costs by reducing or even eliminating the stock (inventory) being held by a company. JIT works on the principle of placing smaller, regular orders that are delivered just in time for them to be used. Major global supermarket chains have fully implemented JIT delivery systems. Sophisticated IT systems allow new products to be ordered from suppliers the instant they are scanned at the sales checkout. As a result, stores receive deliveries from suppliers 24 hours a day, meaning that shelves are rarely empty or under-stocked. This has also allowed the stores to convert now empty stock rooms into additional retail space.

To be successful, just-in-time production requires excellent relationships and regular communication between a company and its suppliers. The suppliers must deliver their goods more regularly and in smaller batches, increasing their distribution costs. In addition, a company may ask its suppliers to react quickly to changing demand for products. To help overcome these problems, companies using just-in-time production usually seek to develop long-term partnerships with a limited number of suppliers. Giving these suppliers guaranteed sales over a period of time makes them more willing to meet the increased demands placed upon them. **Table 3** outlines some of the benefits and limitations of just-in-time production for a business.

Table 3. Benefits and limitations of just-in-time production for a business.

Benefits of just-in-time production	Limitations of just-in-time production
Improved cash flow and reduces costs. Businesses can reduce costs by reducing the stock (inventory) they hold. They can then use the money saved for other operations (Subtopic 3.7 (/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-39317)).	**Reduced economies of scale.** Businesses will make smaller orders, possibly reducing purchasing economies of scale (Section 1.5.2 (/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/internal-and-ext-economies-id-36534)).
Improved operations. Employees know they need to be careful in operations, because there is no spare stock (inventory) to rely on.	**High risk.** Production may halt if a small part of the supply chain breaks down. Any delay in delivery becomes critical for production.
Increased capacity. With less storage space needed for stock (inventory), more space can be allocated to production.	**Reduced resilience.** Businesses may be unable to adapt to changes in the internal or external environment (related to risk). JIT may not be suitable for businesses with seasonal demand.

Making connections

HL students will learn more about just-in-time production and contrast it with just-in-case production in Subtopic 5.6 (/study/app/y12-business-management-a-hl-may-2024/sid-351-cid-174702/book/the-big-picture-id-39337).

Activity

Learner profile: Thinkers
Approaches to learning: Thinking skills (transfer)

Find out whether your school uses lean production strategies in its operations.

- Does the school hold regular meetings where employees are invited to provide feedback for improvement of the school and its processes?
- Does the school have any strategies to order supplies only when needed to avoid inventory costs?

International Mindedness

For many years, businesses seeking lower costs of production have sourced component parts and products from other countries, where just-in-time production is also used to reduce stock (inventory) costs. When global supply chains work well, these complex chains and just-in-time production are beneficial. When there is a disruption to the external environment however, as was the case with the pandemic, these supply chains can break down, leading to production disruption and higher costs.

The COVID-19 pandemic forced many businesses to rethink their long and complex supply chains. As a result of the pandemic, many businesses are considering moving to higher cost (but lower risk) localised suppliers. Businesses must always weigh up the trade-off between cost and risk/resilience.