Operations management

Production and productivity, lean production, job, batch and flow production, technology in production, classifying costs, economies and diseconomies of scale, break-even analysis, quality control and assurance, and location decisions.

Operations management is about **producing goods and services efficiently**: using resources well, keeping costs down and quality up.

4.1 Production of goods and services

Production and productivity

Production is the process of turning **inputs** (raw materials, labour, machines) into **outputs** (goods or services) by managing resources effectively.

Productivity measures **how efficiently** inputs are used: output per worker (or per machine) in a given time.

> **Labour productivity = output ÷ number of workers. A factory making 2,400 units with 30 workers has a productivity of 80 units per worker.**

Production is the **total output**; **productivity** is **output per input**. A firm can raise production simply by hiring more workers, but productivity rises only if each worker produces more.

Benefits of increasing efficiency: lower **unit costs**, higher **profit**, lower prices or better quality, an advantage over competitors.

How to increase it: **automation and technology**, **improved labour skills** (training), better **motivation**, better **layout** and organisation, more reliable **machinery**.

Inventories

Inventories (stocks) are the raw materials, work in progress and finished goods a business holds. Businesses hold them to **avoid running out**, to meet **sudden demand**, to keep production going if a delivery is late and to buy materials in bulk more cheaply. Holding too much **costs money** (storage, insurance, risk of damage, tied-up cash).

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Lean production

Lean production means **producing with as little waste as possible**: of materials, time, effort and money, while keeping quality.

- **Just-in-time (JIT)**: materials arrive **only when needed**, so almost **no inventory** is held. **Benefits**: lower storage costs, less waste, more cash. **Risks**: delivery delays stop production; needs reliable suppliers.
- **Kaizen**: **continuous improvement**: small, regular improvements suggested by **all employees**. **Benefits**: lower costs, higher quality, motivated staff.

Benefits of lean production: lower costs, less waste, higher efficiency, better quality, quicker response to customers.

Methods of production

Method	Description	Benefits	Limitations
Job	**one-off, made to order** (a wedding dress, a bridge)	high quality, **flexible**, customer's exact needs, can charge a **high price**	**slow and costly**, needs skilled workers
Batch	a **group of identical products** made together, then the next batch (bread, clothes in sizes)	flexible, **economies of scale** on each batch, variety	time lost **switching** between batches, stock of unfinished goods
Flow	**continuous** production on a production line (cars, soft drinks)	**high output, low unit cost**, **economies of scale**, uses machines	**high set-up cost**, **inflexible** and boring work, breakdown stops the whole line, needs a **mass market**

Recommend and justify: link the **product and demand** to the method: **unique or custom** goods need **job**; **standard goods in varied sizes or flavours** suit **batch**; **very high demand for an identical product** suits **flow**.

Technology in production

Computers now help in **design** (CAD: computer-aided design) and **manufacturing** (CAM: computer-aided manufacturing), and **robots** and automated lines do repetitive work. **Benefits**: faster, more accurate and consistent, lower unit costs, work 24 hours a day, safer. **Limitations**: **high cost** to buy and maintain, **job losses**, training needs, and breakdown or cyber risk.

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4.2 Costs, scale of production and break-even analysis

Classifying costs

Cost	Meaning	Example
Fixed	do **not change** with output in the short run	rent, salaries, insurance, loan interest
Variable	**change with output**	raw materials, packaging, piece-rate wages
Total	**fixed + variable** costs	
Average (unit)	**total cost ÷ output**	

> **Total cost = fixed cost + variable cost. Average cost = total cost ÷ units produced.**

Cost-based decisions: a business can use cost data to decide **whether to stop or continue** production. If the **price is below average variable cost**, it loses money on every unit and should stop; if the price covers **variable costs** but not all fixed costs, it may **continue in the short run** because it still contributes towards the fixed costs.

Economies of scale

Economies of scale are **falling average costs as output grows**.

Type	How
Purchasing	**bulk-buying** discounts
Marketing	advertising costs spread over more units
Financial	large firms borrow at **lower interest**
Managerial	can afford **specialist** managers
Technical	can use **larger, more efficient machines** and flow production

Diseconomies of scale are **rising average costs when a business becomes too big**: **poor communication** (long chains), **lack of commitment** from employees who feel unimportant, **weak coordination** between departments, and slower decisions.

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Break-even analysis

The **break-even point** is the output at which **total revenue = total cost**: no profit and no loss. Below it, the business makes a **loss**; above it, a **profit**.

> **Contribution per unit = selling price – variable cost per unit. Break-even output = fixed costs ÷ contribution per unit. Margin of safety = actual (or budgeted) output – break-even output.**

> TRY IT
>
> A business has fixed costs of $6,000, sells at $20 and has variable costs of $8 a unit. **Contribution = $20 – $8 = $12. Break-even = 6,000 ÷ 12 = 500 units.** If it plans to sell 650 units, the **margin of safety** is 650 – 500 = **150 units**. If the price rises to $24, the contribution is $16 and break-even falls to 6,000 ÷ 16 = **375 units**.

The break-even chart has **output** on the horizontal axis and **costs and revenue** ($) on the vertical axis. To **construct** one:

1. Draw the **fixed cost line** (horizontal).
2. Draw the **total cost line**, starting at the fixed-cost level on the vertical axis and **sloping upward** (fixed cost plus variable).
3. Draw the **revenue line** from the origin, **sloping upward**.
4. The point where **total cost and revenue cross** is the **break-even point**. The **gap** between the lines to the right of it is **profit**, to the left is **loss**. The **margin of safety** is the distance between the planned output and break-even output.

Use a chart to **read off** break-even, profit or loss at a given output, and see the effect of **changes** (a higher price makes the revenue line steeper, so break-even falls; higher fixed costs raise break-even).

Uses: decide whether a **new product** is viable, set **prices**, plan **output**, show lenders. **Limitations**: assumes **all output is sold**, assumes a **constant price and constant variable costs per unit** (in practice discounts for bulk buying occur), **fixed costs may change**, only as accurate as the **forecast data**, ignores competitors.

4.3 Achieving quality production

Quality means that a product or service is **fit for purpose** and meets **customer expectations**. It matters to **all businesses** because poor quality leads to **returns and complaints**, **lost customers**, a **bad reputation** and extra costs, while good quality builds **brand loyalty** and allows **higher prices**.

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	Quality control	Quality assurance
What	**checking** products **at the end** (or at set points) to find faults	**preventing** faults by making quality **everyone's responsibility at every stage**
How	**inspection** and **testing**, sampling, rejecting faulty items	**quality standards** at each stage, supplier checks, **training**, **quality circles** (staff groups discussing problems), clear procedures
Limitations	finds faults **after** they happen (waste), needs **inspectors**	costs of **training** and setting up, needs staff commitment

4.4 Location decisions

Factors in choosing a location

Business type	Factors
Manufacturing	**cost of land and rent**, **proximity to raw materials** (if heavy or bulky), **transport links** (to customers and suppliers), **availability and cost of labour**, **government help** (grants, tax breaks), **space for expansion**, **power and water**
Services (such as shops)	**closeness to customers**, **footfall** (passing trade), **competition**, **rent and rates**, **parking**, **visibility**
Online	cost, **broadband**, **skilled labour**, less dependence on customers' location

Choosing a country

Cost and availability of labour, **wage rates and skills**, **infrastructure** (roads, ports, power), **political stability**, **taxes and government incentives**, **exchange rate** risk, **closeness to markets**, **language and culture**, **trade restrictions** (tariffs).

Legal controls on location

Governments control where firms can locate: **planning permission**, **zoning** (industrial against residential areas), **environmental laws**, and **grants and tax incentives** that attract firms to **development areas**.

> **Recommend and justify a location: choose the most important factors for that business (a bakery wants customers nearby; a heavy-industry plant wants transport and raw materials), compare cost against benefit and give a reason why other locations are less suitable.**

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