

Operations management

IGCSE Business Studies

Methods of production

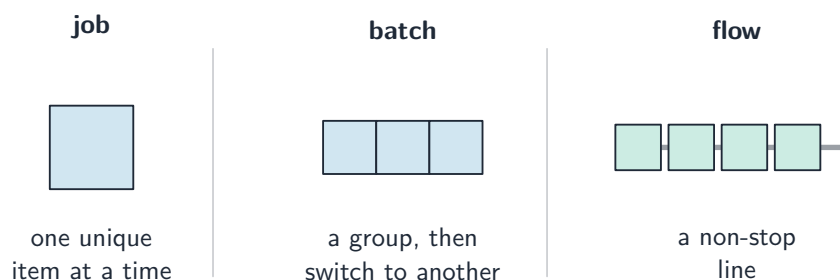
Production 生产 means turning materials and **labour** 劳动力 into finished goods and **services** 服务. There are three main methods.



A car assembly line: making many identical products on a moving line

Image: Marek Ślusarczyk (Tupungato) Photo portfolio, CC BY 3.0 (commons.wikimedia.org)

Method	What it is	Good for	Drawback
job production 单件生产	making one item at a time, to order	special, one-off items: a wedding cake, a ship	slow and costly per item
batch production 批量生产	making a group of the same item, then switching to another group	bakeries, clothes in different sizes	machines stand idle while switching
flow production 流水线生产	making goods non-stop on a moving line	mass-made goods: cars, drinks	costly to set up; work can be boring

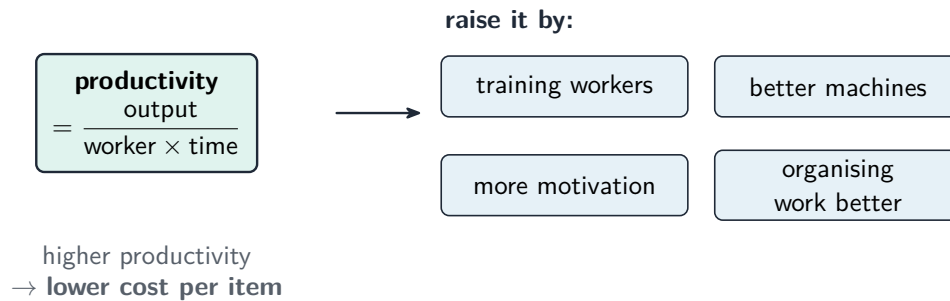


The three methods of production

Productivity

Productivity 生产率 measures how much each worker or machine produces in a set time. Higher productivity lowers the cost per item. A business can raise productivity by:

- training workers,
- using better machines and **technology** 技术,
- improving **motivation** 激励,
- organising the work better.

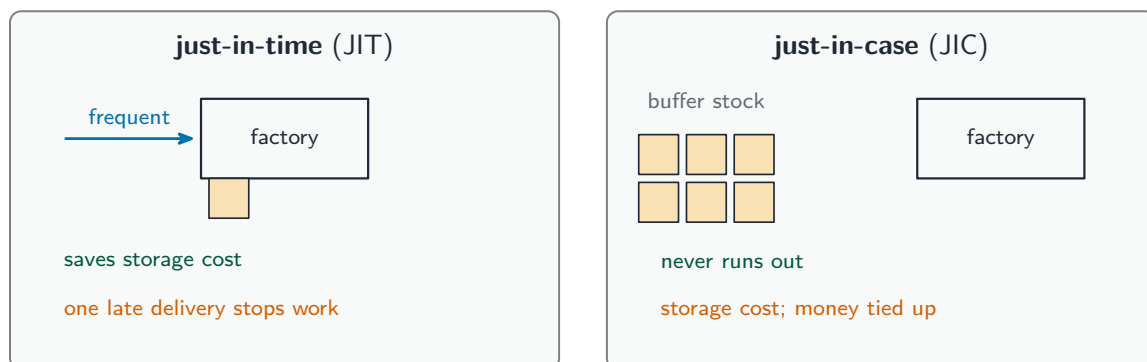


Productivity is output per worker in a set time; raising it lowers the cost per item

Lean production and just-in-time

Lean production 精益生产 means cutting all waste —wasted time, materials, space and effort —while keeping quality.

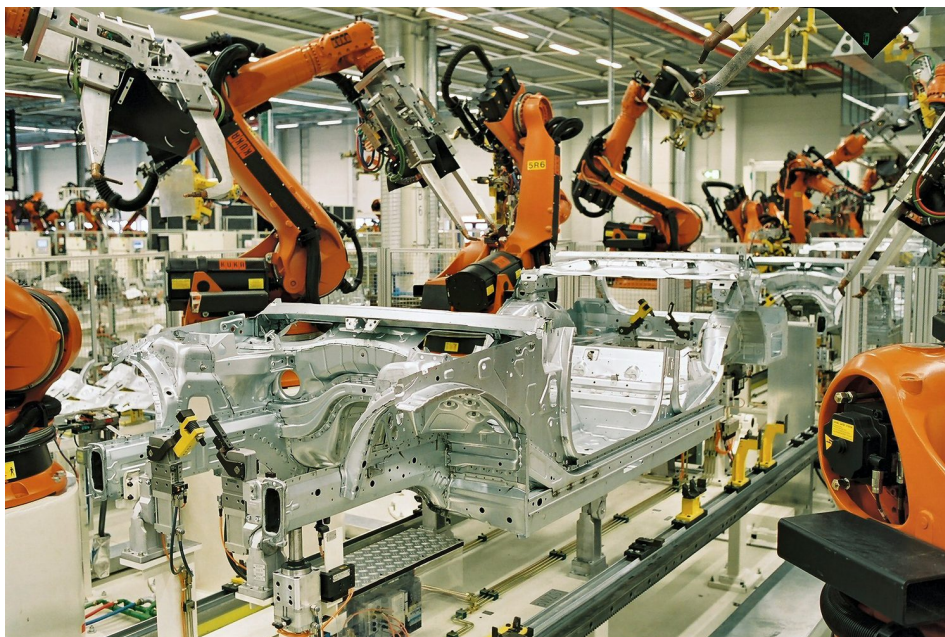
One key method is **just-in-time** 准时制 (JIT). With JIT, materials arrive just as they are needed, and finished goods are sold quickly, so the business holds very little **inventory** 库存 (its stock of materials and goods). This saves storage cost, but one late delivery can stop production. Good management of inventory keeps enough stock to meet demand, but not so much that money is tied up or goods go out of date.



Just-in-time holds little stock with frequent deliveries; just-in-case holds a buffer of stock

Technology in production

Technology has changed production. **Automation** 自动化 (machines and robots doing tasks), computer design and online ordering all make production faster, cheaper and more exact. But machines cost a lot to buy and can replace workers' jobs.



Automation: industrial robots weld and assemble car bodies —faster and more exact than by hand, but they cost a lot and replace some workers

Image: BMW Werk Leipzig, CC BY-SA 2.0 de (commons.wikimedia.org)

Costs, scale and break-even

Types of cost

A business has different kinds of **cost** 成本.

- **fixed costs** 固定成本 do not change with output —rent, salaries, insurance. You pay them even if you make nothing.
- **variable costs** 可变成本 change with **output** 产量—materials, and pay for each item made. More output means more variable cost.
- **total cost** 总成本 is fixed costs plus variable costs.
- **average cost** 平均成本 is the total cost divided by the number of items made.

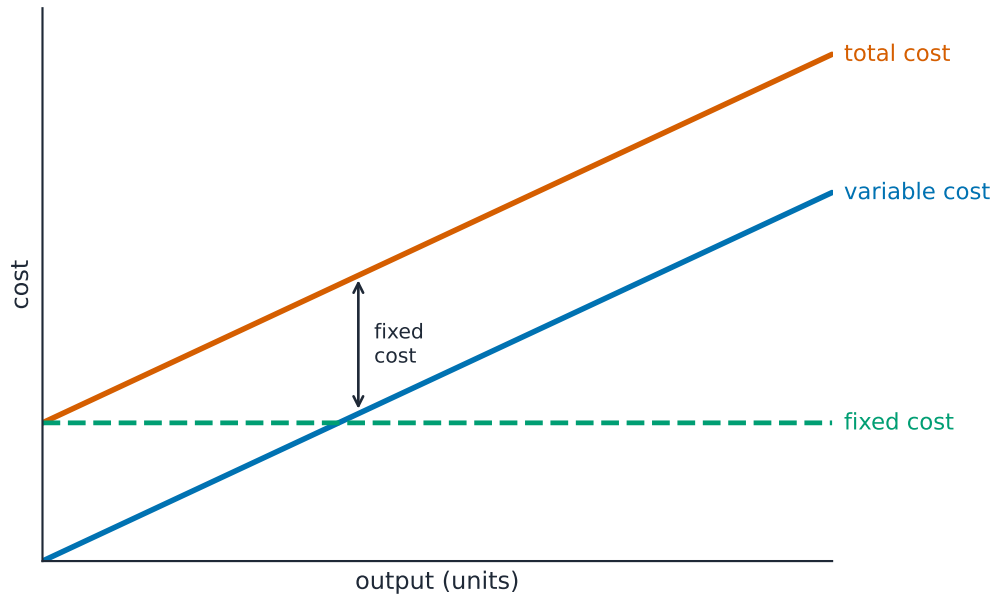
$$\text{total cost} = \text{fixed costs} + \text{variable costs}$$

$$\text{average cost} = \frac{\text{total cost}}{\text{output}}$$

Worked example. A factory has fixed costs of £8,000 and variable costs of £2 per unit, and makes 1,000 units. Find the total cost and the average cost per unit.

$$\text{total cost} = £8\,000 + (1\,000 \times £2) = £10\,000$$

$$\text{average cost} = \frac{£10\,000}{1\,000} = £10 \text{ per unit}$$



Total cost = fixed cost + variable cost; only variable cost rises with output

Revenue and profit

Revenue 收入 is the money a business gets from selling its products.

$$\text{total revenue} = \text{price} \times \text{quantity sold}$$

Profit 利润 is what is left after all costs are paid.

$$\text{profit} = \text{total revenue} - \text{total cost}$$

Worked example. The same factory sells all 1,000 units at £15 each. Find its total revenue and its profit.

$$\text{total revenue} = £15 \times 1\,000 = £15\,000$$

$$\text{profit} = £15\,000 - £10\,000 = £5\,000$$

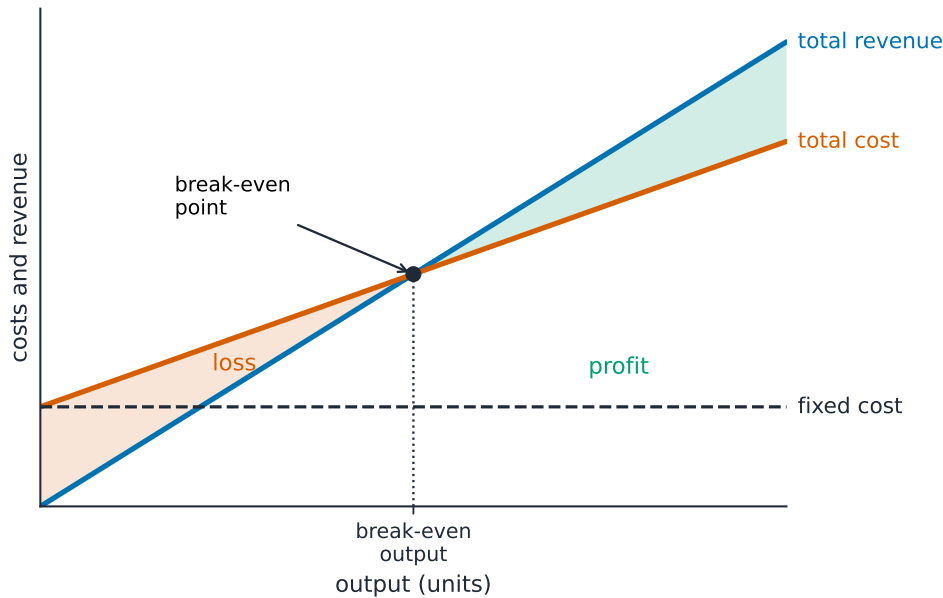
Break-even

The **break-even** 盈亏平衡 point is the level of output where total revenue exactly equals total cost: the business makes no profit and no loss. Below it the business makes a loss; above it, a profit.

Each item sold gives an amount towards covering the fixed costs. This amount is the selling price minus the variable cost of one item (sometimes called the **contribution** 贡献 per unit).

$$\text{break-even output} = \frac{\text{fixed costs}}{\text{selling price per unit} - \text{variable cost per unit}}$$

A **break-even chart** 盈亏平衡图 plots total cost and total revenue against output. The two lines cross at the **break-even point** 盈亏平衡点.



The break-even point is where total revenue equals total cost —left of it is loss, right of it is profit

The **margin of safety** 安全边际 is how far the actual output is above the break-even output.

$$\text{margin of safety} = \text{actual output} - \text{break-even output}$$

Worked example. A product sells for £15 with a variable cost of £5 per unit, and the firm's fixed costs are £8,000. Find the break-even output, and the margin of safety if the firm actually makes 1,200 units.

The contribution per unit is £15 – £5 = £10, so

$$\text{break-even output} = \frac{\text{£8 000}}{\text{£10}} = 800 \text{ units}$$

$$\text{margin of safety} = 1\,200 - 800 = 400 \text{ units}$$

A large margin of safety is safer, because sales can fall a long way before the business makes a loss.

Limits of break-even analysis. It assumes that all output is sold, and that the selling price and the costs stay the same at every level of output. In real life these often change, so break-even is only a guide.

Achieving quality

Why quality matters

Quality 质量 means a product is good enough for what **customers** 顾客 need. Good quality:

- builds a strong **brand** 品牌 and **customer loyalty** 顾客忠诚度,
- means fewer returns, complaints and wasted materials,
- lets a business charge a higher price.

Poor quality loses customers and damages the brand.

Quality control and quality assurance

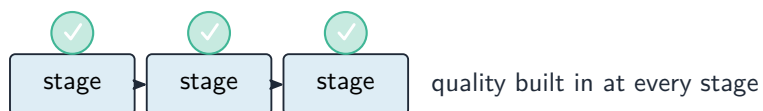
There are two main ways to manage quality: **quality control** 质量控制 and **quality assurance** 质量保证.

	Quality control	Quality assurance
When	check at the end	build in quality at every stage
Who	inspectors check finished goods	every worker is responsible
Idea	find and remove faulty goods	stop faults from happening at all

quality control



quality assurance



Quality control checks at the end; quality assurance builds quality into every stage

Location decisions



Where a business locates —like this distribution centre —affects its costs and service.

Image: Peka, CC BY-SA 4.0 (commons.wikimedia.org)

Locating a business

Where a business sits affects its costs and its sales. A **manufacturing** 制造业 business (one that makes goods) looks at:

- nearness to **raw materials** 原材料, because heavy or bulky materials cost a lot to move,
- nearness to customers and the **market** 市场,
- the cost and size of the land,
- a supply of suitable labour,
- good transport links,
- government grants offered in some areas.

A **service** business (one that sells services, such as a shop or a hair salon) looks more at being close to customers, passing foot traffic, nearby shops, and the rent.

Locating in another country

A business may produce or sell abroad in order to reach new customers and bigger markets, pay lower wages or rent, get nearer to raw materials, or avoid **tariffs** 关税 (taxes on imports) by making goods inside the country. But it must then deal with different laws, languages and customs, and follow the **legal controls** 法律管制 of both countries.

Exam tips

- Match the production methods: **job** (one-off items to order), **batch** (a group, then switch to another), **flow** (non-stop mass production on a line).
- Learn the formulas: total cost = fixed + variable; average cost = total cost $\div$ output; total revenue = price $\times$ quantity; profit = total revenue $-$ total cost.
- **Break-even output** = fixed costs $\div$ (selling price $-$ variable cost per unit). How far actual output is above break-even is the **margin of safety**.
- Break-even analysis assumes everything made is sold at one fixed price and cost, so it is only a guide.
- **Quality control** checks finished goods at the end; **quality assurance** builds quality in at every stage.