Operations management (A Level)

Location and scale decisions, economies of scale, quality management (quality control, assurance, TQM, benchmarking), operations strategy and planning, lean production, technology, critical path analysis and supply chain management.

9.1 Location and scale

Location decisions

The location of **production** or **offices** depends on **cost and market**.

Factor	Influence
Proximity to market	cuts **transport** cost; essential for **services**
Costs	**land, labour, taxes, rent**
Labour	**skills, availability** and wage levels
Infrastructure	transport links, utilities, **broadband**
Raw materials	**bulk-reducing** industries locate near materials
Government	**grants, enterprise zones, regulations**
Safety, risk and reputation	stability, **natural disasters**

Quantitative methods compare **costs** and **revenue** at each location; **qualitative** factors include **quality of life** and **reputation**. **Offshoring** moves production **abroad** for **lower cost**; **reshoring** brings it back, sometimes for **quality**, **speed** and **control**.

Relocation (moving operations to another place) happens when **costs rise**, the business **grows** or the market **shifts**. It brings **disruption, redundancy and moving costs**, but may **cut costs** or reach **new markets**. **Globalisation** widens the choice: firms can locate **abroad** to use **cheaper labour, new markets, trade agreements and supply networks**, and better **transport and communications** make this easier. This leads to **offshoring**, but risks include **exchange-rate changes**, **political instability**, **supply-chain disruption** and **bad publicity** over working conditions.

> **Location is a long-term decision. Compare total costs (set-up, running, transport) and revenue, and weigh non-financial factors.**

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Scale of operation and economies of scale

Scale is the **size** of the business's operations. **Economies of scale** (see Chapter 1) lower **unit cost** as output rises (purchasing, technical, financial, managerial, marketing). **Diseconomies** raise it at very large size. **External economies** arise from the **location** or **industry cluster**.

> TRY IT
>
> A firm doubles output and total cost rises 60%. Has it achieved economies of scale?
>
> Unit cost has **fallen** (cost rose by less than output), so **yes**.

Capacity and the scale decision: expansion needs **finance** and **demand**; **downsizing** (rationalisation) cuts **excess capacity** at the cost of **jobs**.

Local, national and international location, and scale

Local location decisions weigh **site cost, labour and customers nearby**; **national** decisions compare **regions** (wages, grants, transport); **international** decisions add **exchange rates, tariffs, culture, language and political risk**. Factors affecting **scale** include the **size of the market**, **finance**, **technology**, **owners' objectives** and the **type of product**. **Examples: internal economies**: bulk purchasing and larger machines; **external economies**: a skilled labour pool or supporting suppliers nearby; **internal diseconomies**: poor communication and slow decisions; **external diseconomies**: congestion or higher local wages in a crowded area. These link to **unit cost**: economies **lower average cost as output rises**, diseconomies **raise it**.

9.2 Quality management

Quality means being **fit for purpose** and meeting **customer expectations**. **Poor quality** causes **returns**, **repair costs**, **lost customers** and **reputation damage**; **good quality** allows **higher prices** and **loyalty**.

Approach	Meaning
Quality control	**inspect** products at the end (or during) production to **find faults**
Quality assurance	**prevent** faults by **systems at every stage**, with **quality standards**
Total quality management (TQM)	**everyone** in the business is responsible for quality and **continuous improvement**

TQM features: quality circles, **zero defects**, **empowerment**, **supplier quality**, **right first time**. **Kaizen** is **continuous small improvements**.

Benchmarking compares **performance with the best rivals** to find gaps. **Quality standards** (ISO) give **recognition**.

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Costs: training, **inspection**, **equipment**; **benefits:** fewer **defects**, **less waste**, **higher sales**. A **balanced** approach is needed, since **perfect** quality is costly.

9.3 Operations strategy

Operations strategy is the **long-term plan for how operations support corporate objectives**: **cost leadership**, **quality**, **speed**, **flexibility** and **innovation**.

Lean production and efficiency

Lean production cuts **waste** and **inventory** while keeping quality: **JIT**, **kaizen**, **cell production**, **quality circles**, **waste management** and **simultaneous engineering** (design, production and marketing teams work **at the same time** instead of one after another, so a new product reaches the market **faster** with fewer changes). **Cell production** splits work into **small self-contained teams** responsible for a whole part of the process. Limits: lean needs **reliable suppliers, committed staff and stable demand**, and **disruption** can stop output. It reduces **costs** and **speeds** response but needs **reliable suppliers** and **skilled, flexible** staff.

IT and AI in operations

IT and AI are changing operations: **automated production and robotics**, **sensors and the Internet of Things** that monitor machines, **AI for forecasting demand, scheduling and quality inspection**, **digital twins** and **3D printing**. They raise **productivity and accuracy** and cut **waste and downtime**, but cost **a great deal to install**, need **new skills**, depend on **reliable data and security**, and can cause **job losses**.

Flexibility and process innovation

A business needs **flexibility in volume** (able to change output), **delivery time** and **specification** (customised products). **Process innovation** means **changing current processes or adopting new ways** of producing goods or delivering services (for example automation or a new layout) to cut cost, speed up output or raise quality. It needs **investment and training** and carries **risk**, but can give a **competitive edge**.

Enterprise resource planning (ERP)

ERP is a **software system that links all of a business's data and processes** (sales, purchasing, inventory, production, finance, HR) in **one shared database**. **Main features:** an **integrated database**, **real-time information**, **common processes** across departments and **reporting tools**. It improves efficiency by: **inventory control** (accurate stock levels and automatic re-ordering), **costing and pricing** (up-to-date costs), **capacity utilisation** (matching production to orders), **responses to change** (quick re-planning),

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workforce flexibility (scheduling) and **management information** (reports and dashboards). **Costs and risks: expensive** to buy and install, **disruption** and **training**, and a failure can **stop the whole business**.

Technology and automation

Automation, **robotics**, **computer-aided design and manufacture (CAD/CAM)**, **AI** and **data analytics** raise **productivity** and **quality**, reduce **error and labour costs**, and allow **mass customisation**. **Issues: high investment**, **job losses**, **training**, **system failure** and **cyber risk**.

Supply chain management

The **supply chain** is the **network from raw material to customer**. **Effective management** secures **reliable** and **ethical** suppliers, **controls cost** and **lead time** and manages **risk**. **Risks: single-source** dependence, **supplier failure**, **disruption** (events, transport) and **ethical failures** (child labour). Firms may build **long-term relationships**, **dual-source**, or hold **buffer stock**.

Critical path analysis (CPA)

CPA plans **projects** by showing **activities**, **their order** and **duration**. A **network diagram** has **nodes** with **earliest start time (EST)** and **latest finish time (LFT)**.

> **Earliest start time is the largest total of durations along the paths into the node. Latest finish time is found backwards: LFT of the previous node = LFT − duration, taking the smallest. Total float = LFT of the end node − EST of the start node − duration. Free float = EST of the next node − EST of the start node − duration: the delay possible without affecting the next activity. Activities with zero float make up the critical path.**

A **dummy activity** (a dotted arrow with **zero duration**) shows that one activity **depends on another** without using any time or resources.

The **critical path** is the **longest** path and sets the **minimum project time**. **Delays on it delay the project**; **non-critical** activities have **float** and can be delayed. **Benefits:** shows **resource** needs, **identifies priorities**, helps **time and cost** control. **Limits: estimates** may be wrong, and **complex** projects need software.

Overall evaluation

A good operations strategy balances **cost, quality, speed and flexibility** against the **business's** position. A low-cost producer may sacrifice **flexibility**; a **luxury** brand puts **quality** first.

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Operations decisions and lean production

Operations decisions are influenced by **human resources** (skills and availability of staff), **marketing** (the demand and quality customers expect) and **finance** (the **funds available** to invest in equipment and technology). **Lean production** aims to **cut waste, reduce cost and keep or raise quality**; it links to **inventory control** (JIT), **quality** (right first time), **employees' roles** (multi-skilled and empowered), **capacity management** (flexible) and overall **efficiency**.

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