PRODUCT DEVELOPMENT AND MANAGEMENT

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What we need to know

Here are all the points this PowerPoint aims to cover from the BME Y12 Syllabus.

This is a very long PowerPoint, please remember to take breaks and consolidate your understanding.

- purpose of production management systems
- features of product development
- features of quality management
  - control
  - assurance
  - improvement

Understanding Operations Management

The topic of production management and systems is a core component of a firm's **operations management** which is defined as:

- The administration of business practises to create the **highest levels of efficiency** possible within a firm by transforming goods and services as efficiently as possible to **maximise profitability**.

There are **three key concepts** involved in production systems (which are elaborated on later):

1. Inputs – land, labour, capital and enterprise
2. Processes – transforming and converting inputs
3. Outputs – final goods and how they are delivered and transported

Production Management System and the Transformation Process

- In the earlier slide, we discussed what **Inputs, Processes, and Outputs** are.
- **Inputs** combined with **Production** and **Distribution** are what makes up the **transformation process**, which is a continual strategy used by firms to produce **goods** and **services**.

Transformation Process

1. **Inputs** – these are the factors of production which are put into a system to obtain a desired output
   - **Factors of Production** – people, raw materials, energy, finance
   - **Systems include** – economy, manufacturing plants, computer systems

   <u>Factors to Consider</u>
   - **Sources** – location, cost
   - **Costing** – fixed costs (i.e. rent, insurance, loan repayments), mixed costs (utilities like water, electricity etc), variable costs (raw materials, labour, commissions), budget and monitoring costs
   - **Transport** – the medium (rail, road, sea, air), and time to delivery
   - **Inventory control** – Security systems, just in time v just in case (to be explained in future slides)

Production Management System and the Transformation Process (Continued)

2. **Production** - the processes and methods used in converting tangible (physical) and non tangible (non physical) goods into goods and services outputs

<u>Factors to Consider</u>

- **Facilities** – the layout, efficiency and communication channels between factories, warehouses, offices etc
- **Machinery** – the type, supplier, warranties/guarantees and servicing (maintenance) options
- **Maintenance** – whether machinery, buildings etc are serviced internally or outsourced, and the costs of facility management firms (if applicable)
- **Monitoring** – the procedures and protocols, code of conduct, KPIs etc of a firm
- **Adoption of technology** – costs of adopting technology and the training and development opportunities to ensure employees are competent in using new systems
- **Quality Assurance** – control, assurance, improvement (explained later)

Production Management System and the Transformation Process (Continued)

3. Distribution – the movement of goods and services through distribution channels from production to the consumer

Factors to Consider

- **Type** – whether it is through air (planes), road (trucks), rail (trains), sea (freights/ships)
- **Speed and Cost** – the firm must consider the trade off between cost and delivery time, whether transport pricing should be included in the price of the product or separately
- **Channel** – You can have either a short channel (direct sale to consumer) or long channel (external warehouses, distribution centres etc). With a short channel you can maintain control and preserve profits, while with a long channel you lose control in favour of expanded streams of distribution
- **Payment** – electronic funds transfer, letter of credit, Stripe, PayPal, AfterPay etc. Payment methods offered depends on the firm's tolerance for credit (borrowing) and the risks associated with bad debt (consumers inability to pay off debt)

Production Management System and Research and Development

A popular production management strategy is **Research and Development (R&D)**. While referred to in this course, we have not explicitly defined it until now!

"The systematic research aimed at **discovering solutions** to problems or creating **new goods** and **knowledge**".

May result in a firm developing new intellectual property, typically trademarks and patents.

During **Research**, a firm typically investigates the unknown such as a **new product or process**. While in Development, research findings are used to create products typically for **commercialisation** (sale). This strategy **can** be used to **improve or develop existing products** and processes to be better.

Contains: **Inputs** -> **Production** -> **Distribution** -> **Point of Sale**

Point of Sale refers to the point at which a sale is made, and the ownership/possession of a good and service **is transferred to the buyer from the seller**. This is typically either an e-commerce store or retail outlet.

Purpose of Production Management Systems

There are four core reasons for production management systems to exist:

- **Cost** – with efficient processes, these systems are able to turn inputs into outputs in a way that reduces costs from wastage and labour. This enables value to be added to the production stage of the transformation process (outputs > inputs = profitability)
- **Ensures quality** – systems can create a sense of consistency which can minimise **human** defects, especially when automated
- **Time** – streamlined processes that arise from these systems enable firms to turnover stock (sell inventory) quickly and respond quickly to fluctuations in demand
- **Increases competitiveness** by spreading overhead and fixed costs over an increased output
- **Helps promote customer satisfaction** through a consistent and reliable experience that is created through a level of quality that is enforced in production systems

Forms of Production

- In this course, it is important to understand the three main ways in which firms produce products. See below table.

Form	Definition	Advantages	Disadvantages	When appropriate
Job Production	A process that creates single and customisable products for specific clients.	- Increased flexibility - High quality required to produce niche outputs - Increased customer satisfaction through high customer involvement - Motivates workers who are passionate about specialised processes	- Labour intensive, which increases costs - Can require unique equipment, adding more costs - Production can take long periods of time as the processes are not standardised	- For products with a niche or unique focus - When a firm has a highly skilled and unique workforce
Batch Production	A process where a group of identical products are manufactured at the same time with multiple stages.	- Extremely efficient with minimal changes in processes, more goods produced and possibility for automation - Some flexibility in allowing minor variations using the same equipment	- Small batches can increase cost per good - Delays can be incurred with changes in batches produced - Less customer involvement, which can result in reduced satisfaction - Minimal resources flexibility	- When slight variations are required to mass produced products - When goods with different sizes or slightly tailored requirements are required
Mass Production	The manufacturing of large quantities of standardised products, which uses assembly lines to achieve high levels of efficiency and organisation of material flow.	- Highly efficient as minimal process changes can occur - Automation can be used in a cost-effective way - Costs associated with holding stock minimised - Consistent quality through standardisation	- Start up costs are typically high - Production is not flexible - Work can be repetitive and demotivating - Individual system failures can halt all production	- Alike products have standardised production processes - Highly competitive industries with an emphasis on price competition - Low skilled workforces

Features of Product Development

As consumer tastes, preferences, technology and competition is continually evolving, firms **cannot rely on existing products** to **maintain** their **profitability**.

In recognition of this, firms develop and successfully launch new products and services to **remain competitive** in increasingly globalised markets.

There are **four** primary features of product development: **incremental innovation**, **disruptive innovation** and **value addition** which work alongside **the product development process**.

1. **Incremental Innovation** – when a significant upgrade or new feature is added to an existing product or service to extend its product life cycle or maintain a competitive advantage. i.e. updates, expanded batteries, bigger screens, faster processors
2. **Disruptive Innovation** – when a new and innovative product is launched that is unique to a market i.e. self driving cars, 3D printing, e-commerce
3. **Value Adding** – the process of combining and transforming inputs of a product or service to add value or quality over an existing version of the offering.
    1. Firms can add value by improving features beyond industry norms/expectations, removing non-value adding features and eliminating waste.
    2. Sources of value adding comes from research and development, copying others within legal boundaries, product extensions and general market research
    3. Provides the opportunity to increase customer base, unique selling point, market share, and also helps in aligning with changing consumer preferences. It can also revitalise existing products or make a firm a viable competitor in an existing market

PRODUCT DEVELOPMENT PROCESS

This is a four-step process with the goal of commercialising ideas

Stage	Description
Idea Generation	• The continuous and systematic search for new product opportunities, including updating or changing an existing product which is done through **Market Research**. • Market Research involves gathering information about consumer needs, demands, wants and preferences. • The information is used to identify opportunities for niche markets, unmet consumer needs or as a way to use value and quality to capture market share. It can help establish ideas to then be used as unique selling points. Several processes include: - Prototyping, which is modelling the product to test its properties and improve prior to launch. - Testing the product in various situations to determine usability, quality and safety against various standards.
Feasibility Study OR Business Analysis	Once the concept has been tested and finalised, a business case is proposed to assess whether the new product or service is viable. Considerations include: - **Legal and financial viability** – exploiting intellectual property laws can solidify unique selling points. - **Research** – cost and availability of resources, scope of market.
Test Marketing	• The product or service here and its marketing plan are shared to a specific sample of the population to determine if it should be rejected before final launch. • The performance of the product, customer satisfaction, required resources for full launch and distribution requirements are all evaluated. • Beta testing is conducted, where the good or service is given to consumers for testing under normal circumstances to identify areas of improvement or flaws.
Launch	The good or service is finally released into the market. - Pricing and marketing plans are finalised before this stage, with sales and distribution teams briefed. - New products require a comprehensive marketing plan with emphasis on promotion. - Distribution is carefully considered, as it can be a competitive advantage. Shortening cash on delivery (required cash to purchase the good) through borrowing services and interest free payment plans can help.

Features of Quality Management

- Quality Management is the act of overseeing all activities and tasks required to maintain a desired level of excellence.
- Quality products attract customers and help build a positive public image, maintaining competitive advantage and customer loyalty.
- In order to remain competitive, firms need to be proactive rather than reactive with regards to quality management.
- The two types of quality management studied in this course are **control** and **assurance.**
- Quality Control is a strategy of **detection**, sampling products at the **end** of the production process. Quality Assurance however is a strategy of **prevention**, preventing poor quality at the **start** of the production process.
- **Firms use both strategies, in recognition of each one's limitations.**

Quality Management and Control

Control is when firms monitor a product **during and** after the **manufacturing process**.

It involves testing, checks, mechanisms and policies being in place to examine whether the product meets required specifications and standards set by the firm, before it reaches customers.

Businesses typically aim to meet International Organisation for Standardisation, specifically ISO 9000 clause 3.2.10 “A part of quality management focused on fulfilling quality requirements”

Processes that occur under Control include:

- Random samples in production inspected for faults and defects – with employees typically given the authority to pause production should they find variations or defects
- Statistical process control – this is the continual monitoring and charting of a process while it is in operations. Data collected is used to warn when certain processes are exceeding limits imposed by the firm
- Quality checklist – before distribution, automated or human testing is performed by firms against a final quality checklist. It serves as the final measure to prevent defective products from reaching customers
- KANBAN inventory tagging – which involves using coloured cards to track production and order new parts or materials as they run out
- ANDON problem identification systems are implemented – this system is based on the colours Green Yellow Red. Green means production is normal, continue. Yellow means a problem occurred that cannot be identified and needs investigation. Read means production has stopped and an operator needs to have a supervisor check the facility.

Quality Management and Assurance

Assurance guarantees the quality of a consumer's product by ensuring that everything is done 'right the first time' with no defects. It is achieved primarily through benchmarking the product against external standards, requirements and expectations.

ISO 9000 clause 3.2.11 states "A part of quality management focused on providing confidence that quality requirements will be fulfilled"

Firms typically inform customers that their products have been made to require certain specifications and quality standards to be met

This is a proactive quality management method, concerned with preventing poor quality outputs rather than fixing them

Methods of Assurance include:

- External consultation – where Quality Assurance is implemented and examined by external appraisers from consultancy firms that specialise in quality management
- Six Sigma – the firm benchmark of not producing more than 3.4 defects per million opportunities
- Benchmarking against standards set by other firms or industry
- Auditing – continually reviewing procedure, systems and policies within a firm to ensure compliance and that they are efficient and effective. Purpose is to detect and correct errors, identify deficiencies

Considerations for Control and Assurance

Control

Advantages	Disadvantages
- Improves quality by preventing faulty products from reaching the customer - Helps safeguard firm reputation - Cheaper to have trained quality control inspectors instead of every employee being individually trained for quality assurance	- Does not prevent mistakes from occurring - Individual accountable for the quality of work is not a focus, which can promote laziness - Root cause of defects are not necessarily dealt with under Control

Assurance

Advantages	Disadvantages
- Generally, improves quality - Enables employees to make decisions regarding production, can be a motivator - Competitive advantage attainable in reduced costs, wastage etc - Employee participation encourages new ideas for improving quality	- Implementation costs are typically steep, as market research of customer satisfaction is a costly but essential process - Production disruptions can occur which can reduce productivity in the workforce

Quality Improvement

This refers to the continuous commitment by firms to reduce waste and losses in production through incorporation of **both** quality **control** and quality **assurance** systems.

This approach means responsibility lies with **every stakeholder**/employee of the firm to **continually improve quality**.

Improvements are made based on **performance of the firm** compared against **industry standards** or production from past **periods**

Methods of Improvement

- **Quality Circles** – this is where small groups of employees meet regularly to examine quality problems, brainstorm solutions and take corrective action. It encourages a shared approach to problem solving
- **Benchmarking** – as mentioned earlier
- **Kaizen** or **'Continuous Improvement'** – a strategy where employees of all levels of a firm work together to achieve regular, incremental improvements to manufacturing processes

Refer to Quality Assurance for the same Advantages and Disadvantages!