Name:

International SCHOOL OF LONDON Qatar

HL

DP DESIGN TECHNOLOGY

TOPIC 10

COMMERCIAL PRODUCTION

NOTES & GUIDANCE BOOKLET

2022-2023

This booklet contains the Notes, and teaching support material for Topic 10

DP DESIGN WITH

MR MONEEB

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Teaching & Learning Presentations

Topic 10: What is covered?

These are the topics covered in Topic 10:

10	**Commercial production**	10.1. Just in time (JIT) and just in case (JIC)	3	15			
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10.1 Just In Time (JIC) & Just In Case (JIC)

Essential Idea: Just in time and just in case are opposing production strategies utilized by the manufacturer.

Concepts and principles:
- Just in case (JIC)
- Just in time (JIT)

Guidance:
- Advantages and disadvantages of JIC and JIT

Aims:

An in-depth knowledge and understanding of the potential success of a product can lead manufacturers to decide in favour of JIC or JIT. This can vary from one product to the next and requires experience and intuition.

Nature of Design:

While inventory creates a safety net for companies, maintenance and potential waste of resources can have significant implications for companies and the environment. Manufacturers must evaluate and analyse each market and determine whether a JIT or JIC strategy is the best to follow.

Theory of knowledge:

Manufacturers decide whether to pursue JIT or JIC as a production strategy depending on their perception of where the market is going. To what extent do different areas of knowledge incorporate doubt as a part of their methods?

Just-in-Case (JIC)

Topic 10

Just in Case (JIC) manufacturing is the traditional model of production, in which products are created in advance and in excess of demand. According to the principles of lean production, the JIC model wastes resources because inventories must be maintained. The just-in-time JIT model of manufacturing was developed to eliminate the wastefulness of the traditional model. Companies will chose a strategy based on the nature of the market and the nature of the economy.

Advantages of JIC

- Every customer becomes a sale
- The manufacturer has a "buffer' of goods in stock in case of unforeseen circumstances; e.g. non delivery of supplies
- The manufacturer can respond quickly to a demand for a product
- The manufacturer can produce a steady flow of product and have a stable workforce
- Less capital costs than JIT e.g. information and communication technology systems, stock control systems
- Able to stock pile supplies or finished products

A situation where a company keeps a small stock of components (or complete items) or ones that take a long time to make, just in case of a rush order

Disadvantages

- Shop owners have to hold a lot of inventory
- A large investment at the start of business
- It occupies a lot of space, which can be expensive
- These products might spoil leading to waste
- If trends change you could be left with a lot of unsellable products

Companies have to hold a lot of inventory

Notes / Activities

Notes / Activities

Just in time (JIT)

A situation where a company does not allocate space to the storage of components or completed items, but instead orders or manufactures them when required. Large storage areas are not needed and items that are not ordered by customers are not made. Companies will chose a strategy based on the nature of the market and the nature of the economy.

Advantages

- Production to order with materials being supplied JIT cuts down on storage space
- Reduced capital investment as capital is not tied up in unused raw materials or unsold products
- Reduced work in progress
- Increased efficiency
- Improved stock control

Disadvantages

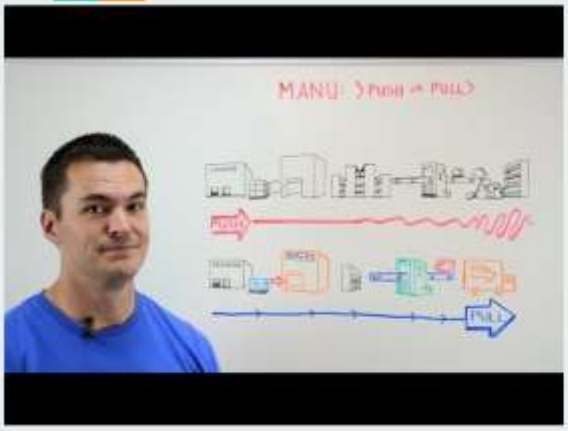
- If any of the stock is faulty then more has to be ordered from a supplier which could slow down the lead time and production process
- Companies may not benefit for economies of scale if they are purchasing smaller quantities.

JIT is used on production lines- components arrive when required

A situation where a firm does not allocate space to the storage of components or completed items, but instead orders them (or manufactures them) when required. Large storage areas are not needed and items that are not ordered are not made

Just in Time - Dell Computers

Just in Case (JIT) vs Just in Time (JIT)



Push or pull? It's a fundamental question for manufacturers. Pushing is a manufacturing method that emphasizes storing a lot of products in order to have them ready to push to customers at a moment's notice. This results in high carrying costs and potentially more unusable inventory as it passes its expiration date - it emphasises Just in Case (JIC)

Pulling is more efficient than pushing. It emphasizes JIT (Just In Time) shipping and only ordering parts and products when customer orders come in. This cuts down on carrying costs and leads to a more streamlined operation. It is slower than the push method, so there is a trade-off.

International Mindedness

Effective business processes and practices developed in some countries have been exported successfully.

Read page 278 in your textbook

Theory of knowledge

Manufacturers decide whether to pursue JIT or JIC as a production strategy depending on their perception of where the market is going. To what extent do different areas of knowledge incorporate doubt as part of their methods?

Read pages 278/279 in your textbook

Notes / Activities

Exam style questions

2019.

32. What is true of just-in-case (JIC) inventory management?

A. Guarantees that products will be available

B. Reduces inventory costs

C. Enables lean production

D. Efficient use of materials

2018

33. The ideal situation in a just in time (JIT) environment is piece per process, which equates to one piece ordered, one piece processed and one piece shipped. All inventory held over and above this quantity is regarded as waste.

However, this is not always possible or practical. Which of the following allows the inventory to be minimised as far as possible?

A. Carry parts that are expensive

B. Carry parts that are likely to become obsolete

C. Carry parts critical to manufacture

D. Carry parts that another local company can also sell

2017

33. Which of the following is a disadvantage of just in case (JIC) production?

A. The availability of a buffer of goods

B. The ability to respond to demand

C. Having to hold inventory

D. Greater supply chain flexibility

34. Which waste is reduced by moving from just in case (JIC) to just in time (JIT) production?

A. Waiting

B. Defects

C. Overproduction

D. Transporting

2016

34. Which waste would be eliminated by moving from just in case (JIC) to just in time (JIT) production?

A. Waiting

B. Defects

C. Overproduction

D. Transporting

Notes / Activities

10.2 Lean Production

Essential Idea: Lean production aims to eliminate waste and maximize the value of a product based on the perspective of the consumer.

Concepts and principles:

- Characteristics of lean production
- Principles of lean production
- Value stream mapping
- Workflow analysis
- Product family
- Role of the workforce
- Kaizen
- Lead time
- The 5 Ss: sorting, stabilizing, shining, standardizing, sustaining the practice
- The 7 wastes: overproduction, waiting, transporting, inappropriate processing, unnecessary inventory, unnecessary/excess motion, defects

Guidance:

- Characteristics of lean production include JIT supplies; highly trained multi-skilled workforce; quality control and continuous improvement; zero defects, zero inventory
- Principles of lean production include: eliminating waste; minimizing inventory; maximizing flow; pulling production from customer demand; meeting customer requirements; doing it right first time; empowering workers; designing for rapid changeover; partnering with suppliers; creating a culture of continuous improvement (kaizen)
- The role of the workforce includes training, devolution in power relating to process improvement and kaizen
- Consider the contribution of value stream mapping and workflow analysis to the design of an effective lean production method
- Advantages and disadvantages of lean production

Aims:

The role of the workforce in lean production is paramount, relying on their wisdom and experience to improve the process, reducing waste, cost and production time. Recognizing this results in motivated workforces whose interests are in the success of the product.

Nature of Design:

Lean production considers product and process design as an ongoing activity and not a one-off task, and should be viewed as a long-term strategy.

Theory of knowledge:

The importance of the individual is recognized in design processes. Is this the case in other areas of knowledge?

Characteristics of lean production

Lean production aims to eliminate waste and maximize the value of a product based on the perspective of the consumer. Characteristics of lean production includes:

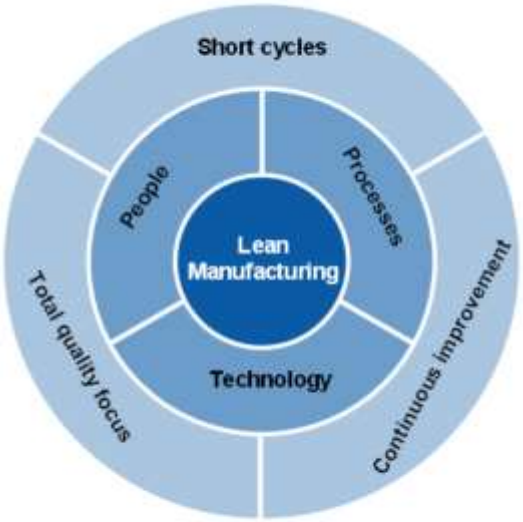
1 - JIT supplies
Getting the right amount of material to the production line Just In Time.

2 - Highly trained multi-skilled workforce
Having experts in place to ensure that no time is wasted.

3 - Quality control and continuous improvement
Checks are made at every stage of production to quickly identify and fix any problems that arise. Improvements to the system are actively sought.

4 - Zero defects
Ensure that time, material and energy are not wasting producing a sub-standard product.

5 - Zero inventory
Products are manufactured Just In Time to be sold.



A long-term production strategy that considers product and process design as an ongoing activity. It focusses on continual feedback and incremental improvement

Notes / Activities

Notes / Activities

Principles of Lean Production

There are many advantages and disadvantages to lean production for a company. Consider these in relation to the 10 principles of lean production.

1 - eliminating waste	6 - doing it right first time
2 - minimizing inventory	7 - empowering workers
3 - maximizing flow	8 - designing for rapid changeover
4 - pulling production from customer demand	9 - partnering with suppliers
5 - meeting customer requirements	10 - creating a culture of continuous improvement (kaizen)

Toyota was inspired by the model of Just-in-Time supermarkets in the United States. They figured that if they could get all materials used in the manufacture of their vehicles to arrive just in time for production, they could reduce waste and speed up production.

They also went about looking for other ways to reduce waste (time, energy or materials) in order to produce a truly efficient manufacturing system. What they created came to be the model for **'Lean Production'.**

Toyota production, 1959

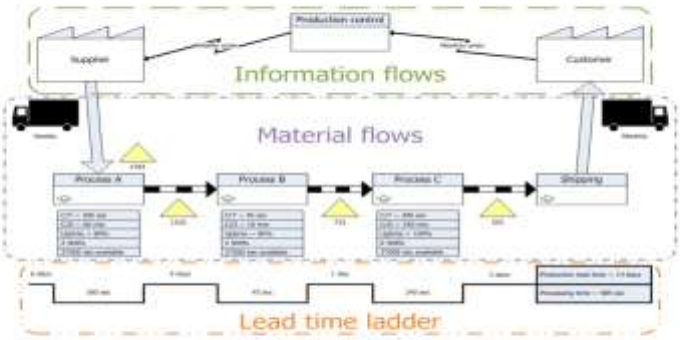
Taiichi Ohno

Toyota Production System

Toyota Kanban

Value Stream Mapping

Value stream mapping is a lean production management tool used to analyse current and future processes for the production of a product through to delivery to the consumer. Consider the contribution of value stream mapping to the design of an effective lean production method.



Value stream mapping allows production managers to plan the manufacture of a product from start (purchase of raw materials) to finish (sale to customer) and identify potential problems in the system.

This 'big picture' view provides production managers with the necessary overview to plan where they can make improvements to the process in order to speed it up.

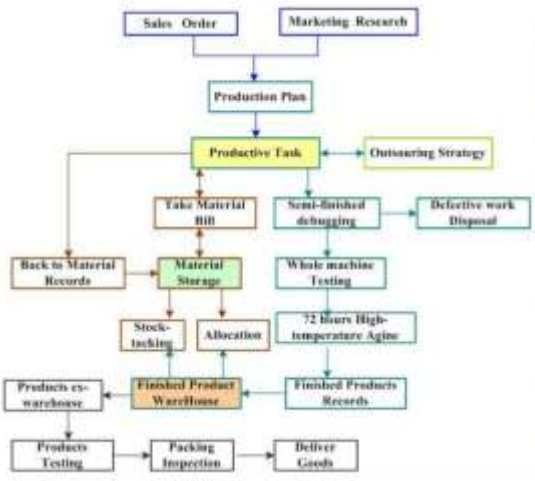
A lean production management tool used to analyse current and future processes for the production of a product through to delivery to the customer

Workflow Analysis

Workflow analysis is the review of workflow processes in order to identify potential improvements.

Where as **value stream mapping** provides a 'big picture' of the manufacturing process, **workflow analysis** is concerned with the details of the production line.

Workflow analysis considers the sequence, tools and even worker movement to ensure the highest possible efficiency in the system.



The review of processes in a workflow in order to identify potential improvements

Notes / Activities

Product Family

The concept of standardised specifications or components or assemblies within a product family or associated brands allows companies to create a competitive advantage. Often based around 'product platform' or 'standardised architecture' a product family gives the manufacturer the opportunity to produce customised or alternative designs through the addition, subtraction or substitution or parts.

Product family is a group of products using similar processing methods

Advantages of a product family include

- Increased modularity
- Reduced design effort
- Reduced time to market for products
- Less manufacturing processes
- Reduction of the number of suppliers needed
- Less diversity of stock material
- Waste from one product can be used to manufacture a different product
- Easily adapt production to meet demand for a particular family member

Waste from one product- Apple unibody

Role of the Workforce

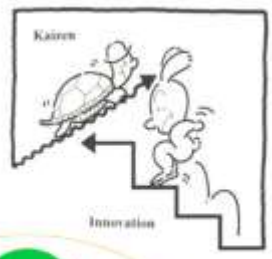
The development of a highly skilled workforce can build deep understanding of how the production process works and allow workers at all levels to identify areas of the workflow to be improved.

Companies striving for a lean production system ensure that all members of the workforce are able to contribute to the design of the system. This streamlines processes and reduces costs and also empowers the workforce and gives them a sense of ownership and loyalty to the company.

Role of the workforce in lean production focuses on training, devolution in power relating to process improvement and kaizen

Kaizen

Kaizen (改善) **Japanese for "improvement" or "change for the best".**
A culture of continuous improvement originating in Japan and considered an important aspect of an organization's long-term strategy. It is a philosophy and commitment to continuous process and product improvement of processes in manufacturing, engineering, business management or any process.



Toyota employees have the authority to halt the entire production line and are expected to suggest ways to improve the manufacturing system.

A culture of continuous improvement originating in Japan and considered an important aspect of an organization's long-term strategy

Notes / Activities

Kanban

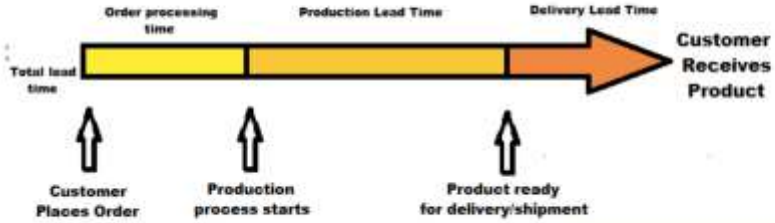
Kanban - translated from Japanese it means 'sign board'. Kanban is a way of managing knowledge (and or in this case stock, orders and quality).

Developed by Taiichi Ohno, at Toyota, to improve and maintain a high level of production. Kanban is one method through which JIT is achieved.

One way in which Kanban is used if for parts bins. When the parts bin reaches a low level (for example 20 left) the Kanban label is submitted to the accounts department to automatically order and deliver another batch of parts just in time

Lead Time

Lead time refers to the time quoted to customers (usually in days or weeks) between the date of purchase and the date of delivery.



The time between the initiation and the execution of a process

A lead time is the latency between the initiation and execution of a process. For example, the lead time between the placement of an order and delivery of a new car from a manufacturer may be anywhere from 2 weeks to 6 months. In industry, lead time reduction is an important part of lean manufacturing.

Topic 1

The 5 'S's

The Five S's is a formal approach to cleaning & organising the workplace involving these five steps

sorting, stabilizing (set in order), shining, standardizing, sustaining the practice

Notes / Activities

The 7 'Wastes'

Of all these wastes, overproduction is the worst as it inherently incorporates all the of the others.

When you manufacture a product that will never be sold

- The raw material used is wasted
- The energy of the manufacture is wasted.
- The time and movement of workers is wasted.
- The transportation of the raw material and the finished product is wasted.

Many of these same wastes are repeated when manufacturing a product that cannot be sold due to a defect.

The 7 wastes are:

1. Overproduction
2. Waiting
3. Transporting
4. Inappropriate processing
5. Unnecessary inventory
6. Unnecessary/excess motion
7. Defects

In what way is 'unnecessary motion' a waste?
In what way is 'waiting' a waste?

Advantages and Disadvantages of Lean Production

Lean production aims to eliminate waste and maximize the value of a product based on the perspective of the consumer.

Advantages of Lean Production	Disadvantages of Lean Production
• Minimises waste (and therefore reduces cost) • Less impact on the environment • Quickly adaptable to market pushes • Little capital is tied up in raw material or unsold stock • Increased autonomy for workers - leading to higher moral	• One problem in production stops the whole process • Manufacturers rely on suppliers, one mistake by them halts production • More suitable for large scale production • When a certain level of refinement is met, using lean methods to squeeze more economy from production can discourage workers, reversing positive motivation and undermining your leadership.

Notes / Activities

10.3 CIM (Computer Integrated Manufacture)

Essential idea: Computer-integrated manufacturing uses computers to automatically monitor and control the entire production of a product.

Concepts and principles:

- Elements of CIM: design, planning, purchasing, cost accounting, inventory control, distribution
- CIM and scales of production

Guidance:

- Advantages and disadvantages of CIM in relation to initial investment and maintenance
- Advantages and disadvantages of CIM in relation to different production systems

Aims:

The integration of computer control into manufacturing can streamline systems, negating the need for time-consuming activities, such as stock taking, but also reducing the size of the workforce.

Nature of Design:

When considering design for manufacture (DfM), designers should be able to integrate computers from the earliest stage of design. This requires knowledge and experience of the manufacturing processes available to ensure integration is efficient and effective. Through the integration of computers, the rate of production can be increased and errors in manufacturing can be reduced or eliminated, although the main advantage is the ability to create automated manufacturing processes.

Theory of knowledge:

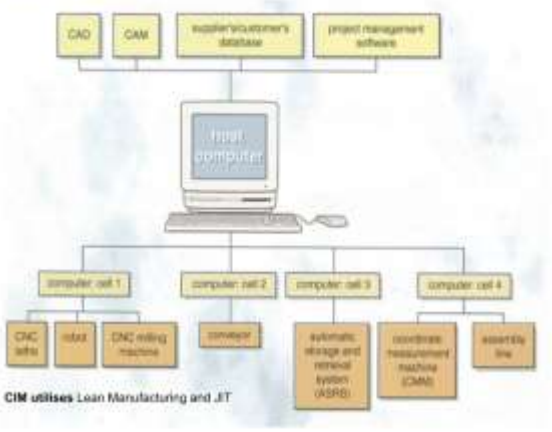
Technology has a profound influence in design. How have other areas of knowledge been influenced by technology?

Computer integrated Manufacture

Computer- integrated manufacture (CIM) takes the concept of integration of separate manufacturing technologies and combines these with all aspects of a company's operations, not just those that are directly involved in manufacture.

Under a CIM system, all teams can share the same information and easily communicate with one another.

A CIM system uses computer networks to integrate the processing of production and business information with manufacturing operations to create cooperative and smooth- running production lines.



Apple Mac- manufacturing

Boeing Aircraft- manufacturing

A system of manufacturing that uses computers to integrate the processing of production, business and manufacturing in order to create more efficient production lines

Notes / Activities

Elements of CIM: Design, Planning, Purchasing

Design

In a CIM system this is accomplished by a design department through computer aided design while considering the product requirements.

When the design is complete it is tested or its functions simulated on screen before even a prototype is made. If a circuit is involved it is designed by using software and tested on screen. Improvements / alterations are made to the design using the same CAD software.

Prototypes are then manufactured on machines such as 3D printers which produce an accurate 3D model. CNC routers and laser cutters may also be used to produce a realistic model. Sometimes working models are manufactured.

Complex designs are usually carried out by several design teams working simultaneously, located often in different parts of the world. The design process is constrained by the costs that will be incurred in actual production and by the capabilities of the available production equipment and processes. The design process creates the database required to manufacture the part.

Planning

The planning department take the design and on the computer system and database established by the design department and enriches it with production data and information to produce a plan for the most efficient method production of the product.

Planning involves several subsystems dealing with materials, facility, process, tools, manpower, capacity, scheduling, outsourcing, assembly, inspection, logistics etc.

In a CIM system, this planning process would be constrained by the production costs and by the production equipment and process capability, in order to generate an optimized plan.

Purchasing

The purchase department through the computer system orders the necessary materials to manufacture the product. Keeping costs to a minimum. The 'just in time' philosophy is applied. This means that materials / components are ordered as needed. Very little is stored at the factory. Usually only enough materials are stored to keep the factory going for a small number of days. Materials are automatically reordered when required, to keep the factory working smoothly and continuously.

The computer system is used to purchase orders and follow up, ensure quality in the production process of the vendor, log the received the items, arrange for inspection and supply the items to the stores or arrange timely delivery depending on the production schedule for eventual supply to manufacture and assembly.

Elements of CIM: Cost accounting, Inventory control, Distribution

Cost accounting

The finance department uses a computer system to deal with the financial resources of a company. Planning of investment, working capital, and cash flow control, realization of receipts, accounting and allocation of funds are the major tasks of the finance departments.

The components of cost accounting are:

- Inventory valuation
- Cost of goods sold valuation
- Constraint analysis
- Margin analysis
- Variance analysis
- Budgeting

Inventory control

Computerised inventory control systems make it possible to integrate the various functional subsystems that are a part of the inventory management into a single cohesive system.

An inventory control system encompasses all aspects of managing a company's inventories including:

- Purchasing
- Shipping
- Receiving
- Tracking
- Warehousing and storage
- Turnover
- Reordering

Distribution

Distribution (or warehousing) uses the computer system to aid in organizing the storage and retrieval of raw materials, components, finished goods as well as shipment of items.

All storage is automated using computer controlled vehicles move the finished product from the manufacturing area to storage. The computer systems keep track of every individual product. Products are bar coded which are constantly scanned and recorded by the computer system. The product is automatically moved from store to awaiting lorries / trucks for distribution to the customer.

In today's complex outsourcing scenario and the need for just-in-time supply of components and subsystems, logistics and supply chain management assume great importance.

CIM: case study

Identify the elements of CIM in the case study above:

Order from customer
Production Planning
Distribution
Accounting

Motorola has been using a computer-integrated process since 1988. A Motorola sales representative takes an order, for example, 150 black Bravo pagers to be delivered on a certain date, types the order into a laptop computer and requests delivery in two weeks.

The order passes to a mainframe computer in their new factory in Florida, USA. The computer automatically schedules the 150 pagers for production, (having calculated this is sufficient time for the pagers to be manufactured. It orders the proper components, and, on the day after assembly, informs the shipping docks to express-mail it to the company who order them. By connecting each aspect of the manufacturing process via computer links, costly time delays and lack of communication between sales representatives and production engineers (often a problem when sales persons are not aware of their company's production potential and product capabilities) can be brought to a minimum. This is possible because the machines and computers found in the factory use the same language as the computers used in sales and shipping.

The result for Motorola is that the Boynton Beach facility can produce the Bravo pocket pager at the same cost as the Singapore plant, which has cheaper labor and is not integrated, and can deliver, over-night, custom-built pagers that used to take nearly six weeks to supply. An additional benefit is that Motorola was able to use mostly the same machines that were in its older factory, meaning they did not incur great expense in developing and/or purchasing new equipment.

[http://horizon.unc.edu/projects/OTH/1-2_tech1.html]

Notes / Activities

CIM and scales of production

Given the high cost of implementing CIM systems, manufacturing scales of production have to sufficiently large enough enough to justify the cost. Most often CIM is implemented in factories with large production runs.
CIM is particularly advantageous for complex manufacturing operations and complex products - such as cars.
CIM can also be suited to Batch production where repetitive actions take place. It is suited because the system is flexible and because of the automated coordination of setup and changeovers.
CIM is not only for complex, capital-intensive manufacturing such as car making, but also for fast response manufacturing which requires flexibility such as textiles and fashion.

Create a resource - such as a visual revision card to explain the information about scales of production

CIM and scales of production

Scale of Production	Advantages	Disadvantages
One – off or small scale		• Costs are too to high to be used • Not suited for non-complex products
Batch, Volume or Mass	• Suited for batch due to the high flexibility and automation of CIM systems • Suited for volume and mass due to the fully automated nature of CIM • Monitoring of system at all times • Fewer errors and waste • Improvements in productivity and quality control • Greater consistency and cheaper products • Parts easily manufactured and changed • Less lead time and less labour • Higher quality of finish	• High initial investment and personnel, • Training cost • Job losses • Lack of individuality
Mass Customisation	• Can design in own requirements • Cheaper products • Parts easily manufactured and changed • Random introduction of parts • Less lead time • Higher quality of finish	• High initial investment and personnel, • Training cost • Job losses

Computer Integrated Manufacturing

Advantages	Disadvantages
Production time is reduced	Each company has to come up with its own system and integrate all the CIM components together
Reducing labour cost	Initial investment and maintenance costs can be high
Reducing inventory cost	No guarantee success in the market even though you have quality products
Minimising waste	Explain how each of the advantages align with the principles of Lean Manufacturing.
CIM components ensure higher quality in the end products	
CIM equipment allows production flexibility	

Notes / Activities

Exam style questions

2017 Multiple choice

35. Which of the following is an example of how design can be included in computer integrated manufacturing (CIM)?

A. Functions are simulated in the virtual environment before prototypes are made

B. Components are ordered and traced by the computer system

C. Production is tracked by computerised inventory control

D. Retrieval and storage of parts is organised by the system

1. The image shows a barcode being scanned using a handheld scanner as part of the stocktaking process

1a) Outline how the integration of computer control into manufacturing can streamline systems such as stock taking. [2 Marks]

2. The image shows an exploded view of the camera on a smartphone, highlighting the number of individual parts used in the manufacture of a relatively small product.

2a) Outline the advantages of using computers to integrate the planning stage of the manufacturing process [2 Marks]

3. Outline the importance of integrating computers into manufacturing in terms of inventory for a company using a Just in Time strategy. [2 Marks]

4. The image shows a number of different ways individual parts required for manufacture and the finished products might be distributed from supplier to manufacturer and from manufacturer to customer.

4a)Outline the advantage of integrating computers into the manufacturing process in terms of distribution. [2 Marks]

5. List 5 areas of manufacturing where computers might be integrated [5 Marks]

6. The image shows a craftsman making a one-off specialist table. This craftsman specialises in making made-to-order furniture designs

6a) Explain why CIM would not provide many, if any advantages for this context [3 Marks]

7. Outline how Computer Aided Design might be utilized in a computer integrated manufacturing company [2 Marks]

8. Outline why workers at a CIM facility need to be highly skilled [3 Marks]

Notes / Activities

10.4 Quality Management

Concepts and principles:

- Quality Control (QC)
- Statistical Process Control (SPC)
- Quality Assurance (QA)

Guidance:

- How QC at source eliminates waste from defects
- How continuous monitoring ensures that machines perform to the pre-determined standard/quality
- How QC, SPC and QA contribute to quality management
- The differences between QC, SPC and QA

Aims:

The implementation of quality management strategies requires a critical and complete understanding of the needs of a product. To ensure efficiency and efficacy, these measures need to be designed into the product and its production system.

Nature of Design:

Designers should ensure that the quality of products is consistent through development of detailed manufacturing requirements. They also need to focus on the means to achieve it. The importance of quality management through quality control (QC), statistical process control (SPC) and quality assurance (QA) reduces the potential waste of resources.

Theory of knowledge:

There are commonly accepted ways of assuring quality in design. How do other areas of knowledge ensure the quality of their outputs?

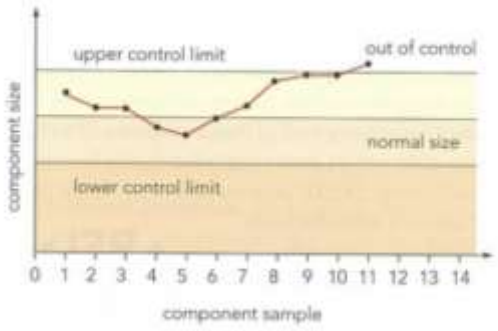
Quality Control (QC)

Quality control: *Tolerances* are defined at the design stage of the machinery. Parts not within tolerance need to be reworked or scrapped. Continuous monitoring ensures that the machines perform to the pre-determined standard/quality. Quality control at the source eliminates waste from defects as workers are responsible for the quality of the work they do.

Questions

How can QC at source eliminate waste from defects?

How could continuous monitoring ensures that machines perform to the pre-determined standard/quality?



Notes / Activities

Statistical process control (SPC)

Statistical process control: This is a quality control tool that uses statistical methods to ensure that a process operates at its most efficient. This is achieved through measuring aspects of a component to ensure that it meets the required standard throughout its production in order to eliminate waste.

Application of SPC

The application of SPC involves three main phases of activity;

Phase 1: Stabilisation of the process by the identification and elimination of special causes (this means that something was different and the component will need repairing)
http://www.endsoftheearth.com/SPC/Chap1.htm

Phase 2: Active improvement efforts on the process itself, i.e. tackling common causes (this is a controlled variation)

Phase 3: Monitoring the process to ensure the improvements are maintained, and incorporating additional improvements as the opportunity arises.

Quality measures

Attribute

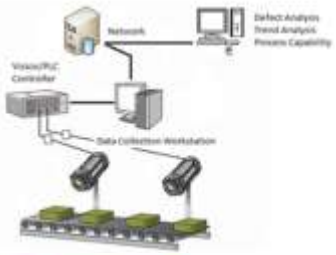
a product characteristic that can be evaluated with a discrete response

good – bad; yes - no

Variable

a product characteristic that is continuous and can be measured

weight - length



Statistical process control (SPC) continued

Hospitals

timeliness and quickness of care, staff responses to requests, accuracy of lab tests, cleanliness, courtesy, accuracy of paperwork, speed of admittance and checkouts

Grocery Stores

waiting time to check out, frequency of out-of-stock items, quality of food items, cleanliness, customer complaints, checkout register errors

Airlines

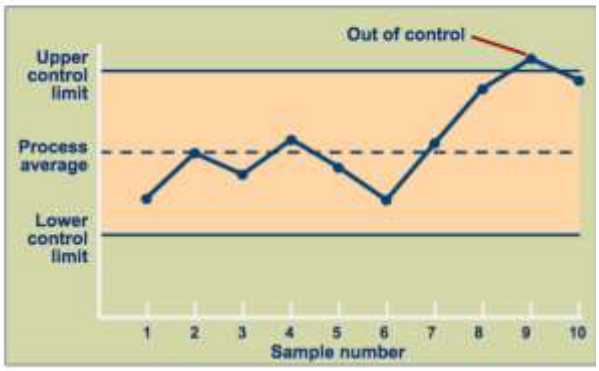
flight delays, lost luggage and luggage handling, waiting time at ticket counters and check-in, agent and flight attendant courtesy, accurate flight information, passenger cabin cleanliness and maintenance

Use of charts to track SPC

Process has a tendency to go out of control and is particularly harmful and costly if it goes out of control

Example;

At the beginning of a process it is a waste of time and money to begin production process with bad supplies before a costly or irreversible point, after which the product is difficult to rework or correct before and after assembly or painting operations that might cover defects before the outgoing final product or service is delivered



Quality assurance (QA)

Quality assurance. This covers all activities from design to documentation. It also includes the regulation of the quality of raw materials, assemblies, products and components, services related to production, and management and inspection processes.

What are the differences?

- Quality **Assurance** makes sure you are doing the right things, the right way.
- Quality **Control** makes sure the results of what you've done are what you expected.

THINK ABOUT THIS!

We have all probably bought a product and found that it was not of a good quality. What do you suppose was the problem with it – design, materials, manufacture, assembly or finish? Was there a guarantee with it? Using your product analysis skills developed in Unit 1 (see pages 3–9), outline the quality issues relating to a product that you are familiar with.

Notes / Activities

How do QA, QC & SPC contribute to quality management

By definition, quality assurance is the process of verifying or determining whether product or services meet or exceed customer satisfaction. It has four cycles - **PLAN, DO, STUDY** and **ACT.**

Plan involves using SPC tools to help you identify problems and possible causes.

Do involves executing the plan and making changes to correct or improve the situation.

Study involves examining the effect of the changes (with the help of control charts).

Act involves standardizing the changes and working on further improvements or, implementing other corrective actions.

Quality assurance teams **PLAN** on how to produce a product or service that will meet customer satisfaction. After planning, **EXECUTION** of the plan takes place and deliverables are **STUDIED** for conformity or variance. Any abnormality is then **ACTED UPON** by the team for correction.

Quality control on the other hand is a process employed to ensure a certain level of quality in a product or service. The goal of a quality control team is to identify products or services that do not meet a company's specified standards of quality. If a problem is identified, the job of a quality control team or professional may involve temporarily stopping production or implementation which can minimize waste from defects. Depending on the particular service or product, or the type of problem identified, production or implementation may not cease entirely.

Simply put, quality assurance ensures a product or service is manufactured, implemented, created, or produced in the right way; while quality control evaluates whether or not the end result is satisfactory.

How do QA, QC & SPC contribute to quality management continued

Quality Assurance is an overall development and management process whilst **Quality Control** is product oriented and comes as part of the overall Quality Assurance package on offer to the customer.

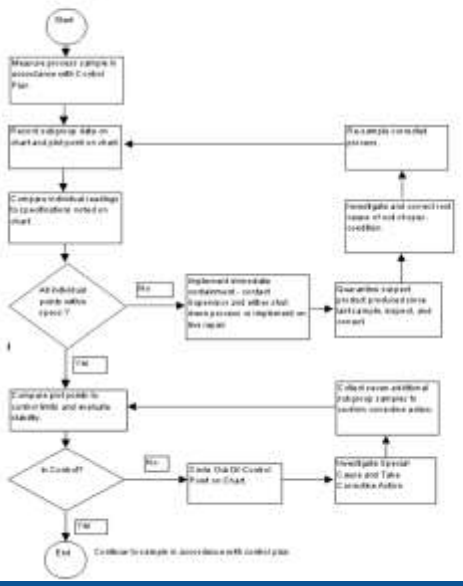
Quality Assurance includes a planned system of review procedures conducted by personnel not directly involved in the development process preferably by third parties should be performed upon the finalized inventory after the implementation of QC Process.

Quality Control is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed.

Quality Control includes general methods such as accuracy checks on data acquisition and calculation and the use of approved standardised procedure for emission calculations, measurements, estimating uncertainties, archiving informations and reporting.

Quality control process steps:
1. Choose control subject
2. Establish Measurement
3. Establish standards of performance
4. Measure Actual Performance
5. Compare to Standards (interpret the difference)
6. Take action on the difference

How do QA, QC & SPC contribute to quality management continued



The International Standards Organisation ISO 9000
The ISO 9000 family addresses various aspects of quality management and contains some of ISO's best known standards.

The standards provide guidance and tools for companies and organizations who want to ensure that their products and services consistently meet customer's requirements, and that quality is consistently improved.

Standards in the ISO 9000 family include:

- ISO 9001:2008 - sets out the requirements of a quality management system
- ISO 9000:2005 - covers the basic concepts and language
- ISO 9004:2009 - focuses on how to make a quality management system more efficient and effective
- ISO 19011:2011 - sets out guidance on internal and external audits of quality management systems.

http://www.iso.org/iso/iso_9000

Notes / Activities

The differences between QA, QC & SPC

QA is **process** oriented while QC is **product** oriented.
QA deals in developing processes and systems that align with **QMS**.
QC on the other hand deals with monitoring products.

For example, a QA engineer would develop a quality plan based on customer requirements and a QC engineer would monitor and ensure that all requirements of the quality plan are met during manufacturing.

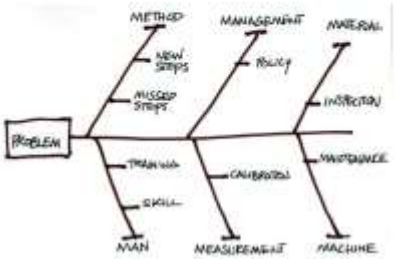
A QA engineer may be involved in developing packaging & shipping requirements or provide quality specifications to purchasing. The QC engineer would only focus on making sure product meets the requirements of quality plan as set by QA.

QA is the part of QM focussed on providing confidence that quality requirements will be fulfilled
QC is the part of QM focussed on fulfilling quality requirements

QC	QA	QC Examples	QA Examples
Product	Process	Walkthrough	Quality audit
Reactive	Pro-active	Testing	Defining process
Line function	Staff function	Inspection	Selection of tools
Find defects	Prevent defects	Checkpoint review	Training

The differences between QA, QC & SPC continued

SPC uses statistical tools to observe the performance of the production process to detect significant variations before they result in the production of a sub-standard article.
SPC is applied to reduce or eliminate process waste and can reduce time required to produce the product. SPC decreases the likelihood the finished product will need to be reworked and can also identify bottlenecks, waiting times, and other sources of delays within the process.
SPC emphasizes early detection and prevention of problems, rather than the correction of problems after they have occurred.



6M's, 7P's and 5S's
Cause and effect - The Ishikawa Diagram
Common uses of the Ishikawa diagram are product design and quality defect prevention, to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify these sources of variation.

Variables for cause and effect in the Marketing, Manufacturing and Service Industries

The 6Ms (used in manufacturing industry)

- Machine (Technology)
- Method (Process)
- Material (Includes Raw Material, Consumables and Information.)
- Manpower (Physical work/Mind Power: Kaizens, Suggestions
- Measurement (Inspection)
- Mother Nature (Environment)

The original 6Ms used by the Toyota Production System have been expanded by some to include the following and are referred to as the 8Ms.

- Management/Money Power
- Maintenance

The 7Ps (used in marketing industry)

- Product/Service
- Price
- Place
- Promotion
- People/personnel
- Positioning
- Packaging

The 5Ss (used in service industry)

- Surroundings
- Suppliers
- Systems
- Skills
- Safety

Notes / Activities

EXAM QUESTIONS

2016

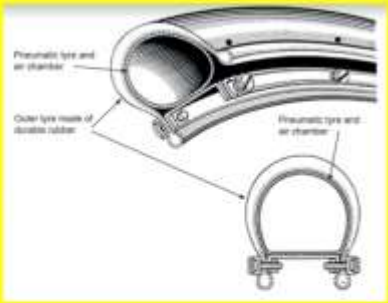
3. Read the case study. **Answer the following question.**

In 1889, Édouard Michelin took over a company that made farm machinery and rubber balls and renamed it Michelin et Cie. After a chance meeting with a cyclist, he developed the first pneumatic (air-filled) bicycle tyre (see Figure 3 below), which was used in a long distance race in 1891.

Following the success of this tyre, Michelin developed a pneumatic tyre for a car that was used in the Paris–Bordeaux–Paris race of 1895.

Although the newly patented tyres were perceived as a major development, the market for them was very small as there were few motorists on the road.

In 1900 the Michelin brothers decided to promote the excitement and romance of travel by car by producing travel guides and maps. The guides contained information on places to visit, obtain fuel, accommodation and good food. The guides were given away for free and quickly became popular.



EXAM QUESTIONS

Question 3 continued

A further development was the Michelin star (*) rating which grades restaurants with one, two or three stars based on the standard of food from very good to outstanding. A Michelin star is very difficult to achieve and is highly prized by restaurants around the world.

The Michelin Man (Figure 5) is one of the world's oldest trademarks, originating in 1898, and has evolved over time.

Today, Michelin produces 10 million maps and guides each year which are sold in 170 countries. Michelin also spends in excess of $700 million each year on research and development (R&D), employing 6000 people in this area alone.

Figure 4 shows an illustration of the Michelin brothers gaining inspiration for the Michelin Man trademark from a stack of tyres in 1898. Figure 5 shows the Michelin Man (Bibendum) trademark.

(e) Discuss how Michelin has used market penetration, product development and product diversification as growth strategies to develop its market over the past 125 years. [9]

Notes / Activities

10.5 Economic Viability

Essential idea and understanding

Essential Idea - Designers must consider the economic viability of their designs for them to gain a place in the market.

Essential understanding - Designers need to consider how the costs of materials, manufacturing processes, scale of production and labour contribute to the retail cost of a product. Strategies for minimising these costs at the design stage are most effective to ensure that a product is affordable and can gain a financial return.

Economic viability

How do companies set the price of a product? If they get it wrong their product could be a disaster:

- Too high and nobody will buy it
- Too low and you won't cover your costs

Identify a product which was not successful because the price was considered too high by the target market

Cost effective

Cost effectiveness is the most efficient way of designing and producing a product from the manufacturer's point of view.
Costs that the manufacturer my incur are

- Marketing
- distribution,
- Transportation
- government taxes,
- energy consumption,
- overhead expenditures,
- research and development,
- capital costs (plant and machinery),
- warehousing and inventory storage,
- profit margins value and price of raw materials
- time manufacturing (hourly rates for employees)

Cost effective

Designers can make their products more cost effective by:

- Reducing the number of components
- Standardizing components for use in a product family
- Reducing the number of processes
- Using automated or low-skilled processes

Identify a simple product and discuss which components could be removed and explain how this would affect the cost of manufacturing the product

Notes / Activities

Value for money

Value for money is the relationship between what a product is worth (or perceived to be worth) and what it costs.

A product can only be successful if customers believe they are getting good **value for money** when they purchase a product and if it is manufactured in a **cost-effective** way.

Costing versus pricing

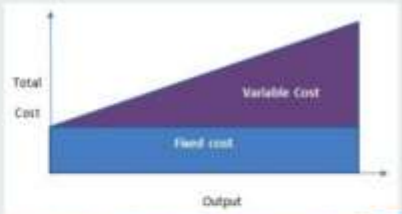
It is important to note the difference between cost and price. For a product to achieve profit, the price of a product has to be higher than its cost.
Price is the amount a customer pays for that product or service. The difference between the **price** that is paid and the **cost** that is incurred is the profit the business makes when the item sells. If a customer pays $10 for an item that **costs** the company $5 to produce and sell, the company makes a $5 profit.

Fixed costs and variable costs

In economics, fixed costs and variable costs are business expenses that are not dependant on the level of goods or services produced by the business. They tend to be time-related such as salaries or rents being paid per month, and are often referred as overhead costs.

Fixed costs do not vary with sales, usually are costs that must be paid out before production starts.

Variable costs change in proportion to the good or service the business produces. These include, materials (processed and raw), utilities (electricity, water etc), wages, storage, distribution.
Fixed costs and variable costs make up the two components of **total cost.**



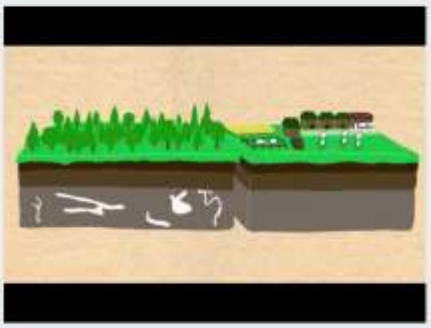
Fixed costs and variable costs

Assume your Design Prototype went into commercial production. Identify the fixed costs and the variable costs associated with its production.

Cost analysis

Cost analysis involves the evaluation of the separate elements of cost (fixed, variable, total and price).
Cost analysis is used to determine if a product fits within a fair and reasonable price range. It is used by manufacturers to determine the break-even point for a product. It allows the economic feasibility of a product to be established.

Identify reasons / factors which lead to a product being considered not economically feasible



Notes / Activities

Break even

When the sales revenue exceed the cost of production we get a profit. Until that point we will be operating at a loss.

Because of high set-up costs (fixed costs) most businesses do not make a profit until after their 5th year.

Break-even
Break-even is the point of balance between profit and loss. It represents the number of sales of a product required to cover the total costs (fixed and variable). This is the point in time when sales revenues overtake production costs and companies move from loss to profit.

Pricing strategies

Designers must consider economic feasibility of their designs.
When companies calculate the price of their products they use Pricing Strategies described below.
Often more than one strategy would be used.

Price minus	The market demand determines the product selling price before manufacturing begins. Then all commercial costs (manufacture, profits, etc) are determined and the company works within these constraints.
Retail pricing	It is the recommended retail price (RRP) suggested by the manufacturer (MSRP) that the retailer should sell the product for. It is to standardise prices Some retailers will sell below the RRP to lure customers.
Wholesale price	The cost of a product sold by the wholesaler. The product costs more than the manufacturer but less than the retailer.
Typical manufacturing price	It is the total costs (variable and fixed) to manufacture the product. Divide the total manufacturing/product costs by the total products/items produced to get the average cost/price per unit. Once total costs are determined then a profit margin is added. The goal is to maximise profit.

Pricing strategies

Target cost	It is desired final cost of a product is determined before manufacturing begins. This is based on the competing pricing. Profit is then removed to determine initial cost. The product is design or designed to meet it
Return on investment	Receiving a profit (return) on money invested into the product or service. Usually expressed as a percentage. The higher the ROI the better return
Unit cost	The costs a company incurs to produce store and sell one product (item). This is calculated as an average cost. These include fixed and variable costs
Sales volume	It is the amount of products sold in a specified time period during regular working operations of a company. They can be annual, quarterly, etc sales Can also be based on demographics, geographic regions, etc
Financial return	It is the profits generated from a sale or investment into a company.

Exam style questions

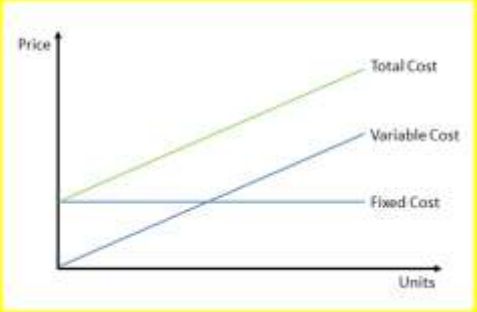
The image shows an exploded view of a Converse shoe. A designer is considering increasing the thickness of the canvas sides so the eyelets are no longer necessary.

Outline how the redesign of the shoe could make them more cost effective in terms of manufacture.
[2 Marks]

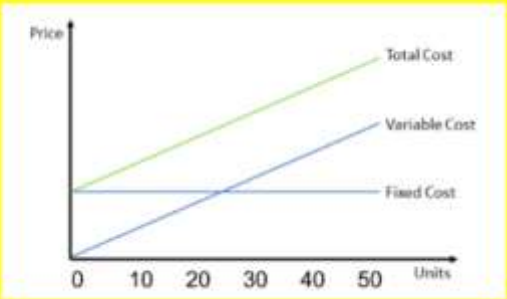
Notes / Activities

Exam style questions

The image shows a fixed and variable cost graph
State whether as volume of production increases, total fixed costs increase, stay the same or decrease. (1 mark)



The image shows a fixed and variable cost graph
As the number of units increase the fixed costs stay constant.
State what happens to the cost per unit when the number of units produced increases from 10 to 50
[1 Mark]



Explain why Standardizing components for use in a product family improves the cost effectiveness of manufacturing the products [3 Marks]

Exam style questions

The image shows the automated production line for a drinks manufacturer.
Outline how automation in a manufacturing system can help improve the cost effectiveness
[2 Marks]

Define Value for Money [1 Mark]

The following are costs that were incurred by Nike, Inc.
Determine which costs are fixed (F) and which are variable (V).

1. rubber for the sole of the shoe, $6 per shoe
2. rent on the manufacturing facility building, $188,000 annually
3. sales manager salary, $127,000 annually
4. worker who operates the machine that puts the shoe together, $2 per shoe
5. shoe laces, $1.80 per shoe
6. worker who puts the shoes in the shoe box, $0.20 per shoe
7. insurance on the manufacturing facility, $23,000 annually
8. water and utilities, $22,000 per month consistently
9. depreciation on manufacturing equipment, $18,000 each month
10. already contracted advertising on television, $1,800,000 annually
11. sales commission paid to salespeople based on 5% of sales
12. office supplies, usually approximately $3,000 per month
13. paper for the copier in the executive offices, usually about $1,200 per month
14. glue used in the shoe, approximately $0.18 per shoe
15. company jet lease, $14,000 per month
16. [15 Marks]

Notes / Activities

Many companies such as Apple Inc. subcontract the manufacture of their products to countries such as China and Vietnam
Outline why these companies choose to do this, in relation to Economic Viability
[2 Marks]

Exam style questions

The image shows where different parts of the Airbus A380 are manufactured before being assembled in Toulouse, France
Outline how Airbus could improve the cost effectiveness of the Airbus A380 [2 Marks]

In lean production there are 7 different wastes. Outline how a company can become more cost effective by reducing each of them [14 Marks]

Exam style questions

The image compares the price of an iPhone 7 and an Oppo F1s.
Outline why some consumers think the iPhone is still value for money even though the Oppo is more than half the price and has similar specs
[2 Marks]

Notes / Activities

Summary Notes

Topic 10. Summary Notes

Topic 10: Commercial production

Just in time (JIT) and just in case (JIC)

JIT and ***JIC*** are two production strategies used by manufacturers that have both advantages and disadvantages to them. A manufacturing company will choose one of these strategies to follow for many reasons that include the products they are producing, the nature of the market and the nature of the economy.

- **Just in time**: A situation where a company does not allocate space to the storage of components or completed items, but instead orders or manufactures them when required. Large storage areas are not needed and items that are not ordered by customers are not made.
- **Just in case**: A situation where a company keeps a small stock of components or products or ones that take a long time to make, just in case of a rush order.

Lean production - Lean production considers product and process design as an ongoing activity and not a one-off task. It should be viewed as a long-term strategy that focuses on continual feedback and incremental improvement. The characteristics of lean production include:

- JIT supplies
- a highly trained, multi-skilled workforce
- quality control and continuous improvement
- zero defects, zero inventory.

There are many advantages and disadvantages to lean production for a company. Students will need to consider these in relation to the ***10 principles of lean production.***

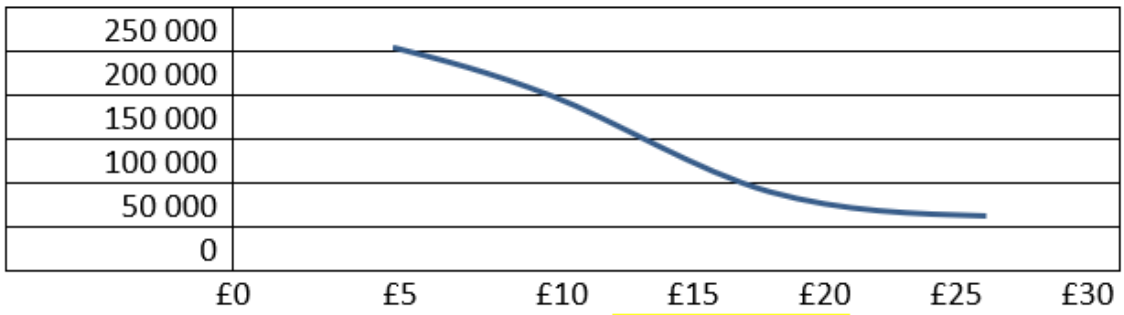
1. Eliminating waste
2. Minimizing inventory
3. Maximizing flow
4. Pulling production from customer demand
5. Meeting customer requirements
6. Doing it right first time
7. Empowering workers
8. Designing for rapid changeover
9. Partnering with suppliers
10. Creating a culture of continuous improvement (Kaizen)

Kaizen - The practice of continuous improvement. The concept was originally introduced to the West by Masaaki Imai in his book Kaizen: The Key to Japan's Competitive Success, in 1986. Today, Kaizen is recognized worldwide as an important pillar of an organization's long-term competitive strategy.

Kaizen helps to improve the efficiency of the production process by focusing on continuous improvement of the production process. It involves all employees and the supply chain and by improving efficiency it aims to reduce waste. This means that it is complementary to a philosophy of ***lean production.***

eg A company which manufacturers a range of computer accessories is considering future strategies in product development and the management of the production process. The company has used the graph in **Figure 1** to try and decide on its pricing policy for products and Kaizen has been discussed as a possible strategy to improve production.

Graph of predicted sales compared to price



The pricing strategy used here is known as 'demand pricing' – the volume of sales is based on the correlation (connection) between price and consumer demand.

The strategy is influenced by production costs by taking into account:

- the needs of the variation in costs of production at different levels of sales
- the break-even point for each level of sales needs to be calculated in order to choose the price which will provide the best profit

Cost Plus Pricing - estimates the average cost of producing and marketing a product and then adding a mark-up to make a profit;

Value stream mapping is a lean production management tool used to analyse current and future processes for the production of a product through to delivery to the consumer.

Using this tool, a cross functional team can produce:

- a visual map of the 'current state' (ie how things operate now),
- identifying all the steps in a construction pathway - from service user to supplies used.
- The team then focus on the 'future state' which often represents a significant change in the way the system currently operates.
- This means that the team need to develop an implementation strategy to make the future state a reality.

Using value stream mapping can result in streamlined work processes, reduced costs and increased quality.

Workflow analysis is the review of processes in a workflow, for example, a production line, in order to identify potential improvements.

- Streamlining manual business processes to make them more efficient.
- Automating business processes.

Consider how value stream mapping and workflow analysis contribute to an effective lean production method.

Method: describe:

- ***Value stream mapping***
- ***Work flow analysis***
- ***Explain How do they work together to meet lean production targets***

In terms of ***lean production***, a **product family** is a group of products using similar processing methods.

Eg – if you design a range of furniture it would be a product family if the same fixings and fittings were used for across the range of products. When considering the role of the workforce in lean production, students will need to focus on three particular areas.

- Training
- Devolution in power relating to process improvement
- **Kaizen**: a philosophy and commitment to continuous process and product improvement

The development of a highly skilled workforce can build deep understanding of how the production process works and allow workers at all levels to identify areas of the workflow to be improved. ***Understanding that the best people to identify improvements of a product or system are those who use it – ask your employees - companies striving for a lean production system ensure that all members of the workforce are able to contribute to the design of the system.***

This benefits the company, which is able to streamline processes and reduce costs and also empowers the workforce and gives them a sense of ownership and loyalty to the company.

Lead time refers to the time quoted to customers (usually in days or weeks) between the date of purchase and the date of delivery.

The 5Ss is a formal approach to cleaning and organizing the workplace involving five processes:

1. sorting
2. stabilizing
3. shining
4. standardizing
5. sustaining the practice.

The seven wastes are:

1. overproduction
2. waiting
3. transporting
4. inappropriate processing
5. unnecessary inventory
6. unnecessary/excess motion
7. defects.

Computer-integrated manufacture (CIM)

CIM is a system of manufacturing that uses computers to integrate the processing of production, business and manufacturing in order to create more efficient production lines. Integrating computers facilitates:

- ***sharing of data to create a more flexible and efficient manufacturing system.***

When considering the advantages and disadvantages of CIM, students need to do so in relation to ***initial investment – fixed costs - and maintenance – variable costs.***

CIM can be applied to different scales of production.

Student task: consider the advantages and disadvantages of CIM in relation to different production systems.

Craft:_____
_____
_____
_____

Batch:
_____
_____
_____
_____

Volume:
_____
_____
_____

Quality management

- **Quality control**: Tolerances are defined at the design stage of the machinery. Parts not within tolerance need to be reworked or scrapped. Continuous monitoring ensures that the machines perform to the pre-determined standard/quality. Quality control at the source eliminates waste from defects as workers are responsible for the quality of the work they do.
- **Statistical process control**: This is a quality control tool that uses statistical methods to ensure that a process operates at its most efficient. This is achieved through measuring aspects of a component to ensure that it meets the required standard throughout its production in order to eliminate waste.
- **Quality assurance**. This covers all activities from design to documentation. It also includes the regulation of the quality of raw materials, assemblies, products and components, services related to production, and management and inspection processes.
- **HACCP** – Hazard And Critical Control Points

Economic viability

Cost effectiveness is the most efficient way of designing and producing a product from the manufacturer's point of view – ***manufacturer evaluation criteria***

Value for money is the relationship between what a product is worth and what it costs. – ***customer evaluation criteria***

It is important to note the difference between cost and price. For a product to achieve profit, the price of a product has to be higher than its cost. Costs include fixed and variable costs involved in designing and manufacturing the product, and getting it to the point of sale.

- **Fixed costs** are the costs that must be paid out before production starts, for example, machinery. These costs do not change with the level of production.
- **Variable costs** are costs that vary with output, for example, fuel or raw material.
- **Cost analysis** is a tool used to determine the potential risks and gains of producing a product. It is used by manufacturers to determine the break-even point for a product and can be used to create multiple scenarios for a product. It allows the feasibility of a product to be established.
- **Break-even** is the point of balance between profit and loss. It represents the number of sales of a product required to cover the total costs (fixed and variable).

There are many strategies available for calculating prices of a product and often more than one strategy is used to determine a correct price. These strategies are used in conjunction with the price setting strategies listed in sub-topic 9.3: Marketing mix.

Price-setting strategies include:

- cost-plus pricing
- demand pricing
- competitor-based pricing
- product line pricing
- psychological pricing.

Pricing strategies include:

- price-minus strategy
- retail price
- wholesale price
- typical manufacturing price
- target costs
- return on investment
- unit cost
- sales volume
- financial return.

Topic Questions & Exam Practice

Exam Practice Questions

Figure 12 shows the first transparent toaster to go into commercial production. It is called Le Toaster Vision and is manufactured by Magimix. A user can see when the toast is brown enough. Four infra-red heating tubes provide the heat to toast the bread. The transparent walls comprise two panels of double insulated glass.

Figure 12: Le Toaster Vision by Magimix.

(ii) Discuss the criteria that a consumer might apply to evaluate Le Toaster Vision for value for money before purchase, during initial use and after long-term use. *[9]*

Figure 7 shows the award winning Ole chair designed by Ludovica and Roberto Palomba and manufactured by Crassevig company from plywood with a hardwood (oak) surface veneer.

Figure 7: The Ole chair

Explain three important quality control considerations for the manufacture of the Ole chair. *[9]*

9. **Figure 15** shows a double-winged lever design corkscrew patented by Dominick Rosati in 1930. The corkscrew is placed over the lip of the bottle and the worm screwed into the cork so that the wings lift up. When the worm is far enough into the corkscrew, the wings are pushed down and the cork is lifted out of the bottle. A force of 360 N is required to remove the cork from the bottle. **Figure 16** shows an Alessi Anna G novelty corkscrew designed by Alessandro Mendini. It works on the same principle as the corkscrew in **Figure 15**.

Figure 15: A double-winged lever design corkscrew

Figure 16: Alessi Anna G Corkscrew

(ii) Describe how the concept of break-even relates to the production of the Alessi Anna G corkscrew. *[2]*

(i) Outline **one** advantage to the consumer of cars produced by just-in-time (JIT). *[2]*

9. **Figure 6** shows a traditional design of a wooden pencil manufactured by the German company Faber-Castell. Faber-Castell have manufactured wooden pencils since 1761. The softwood casing is bonded to the graphite lead with epoxy resin glue. Although wooden pencils are very cheap nowadays, they were extremely expensive in 1761. Since 1761 the company has expanded its range of pencils to include ones with integrated sharpeners and erasers, cosmetic pencils and mechanical pencils. **Figure 7** shows a solid silver mechanical pencil from the Faber-Castell range. The silver casing has a space for a name to be engraved on it. It is an internationally-agreed legal requirement that all solid silver products are hallmarked. A hallmark identifies the manufacturer, the date and place of manufacture, and the silver content.

Figure 6: Faber-Castell wooden pencil

Figure 7: Faber-Castell solid silver mechanical pencil

(ii) Outline **one** quality assurance feature of the silver pen. *[2]*

(ii) Compare a wooden pencil produced in 1761 with the silver pencil produced in 2010 in relation to value for money for the consumer in each case. *[9]*

(a) Outline **one** advantage of a computer-integrated manufacturing (CIM) system for consumers. *[2]*

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(b) Outline **one** disadvantage of adopting a CIM system for a small manufacturing company. *[2]*

Glossary of Terms

Glossary of Terms

Topic 10: Commercial production

Term	Definition
Computer integrated manufacturing (CIM)	A system of manufacturing that uses computers to integrate the processing of production, business and manufacturing in order to create more efficient production lines.
Cost-effectiveness	The most efficient way of designing and producing a product from the manufacturer's point of view.
Environmental impact assessment matrix	A tool designed to identify and predict the impact of a product on the environment.
Just in case (JIC)	A situation where a company keeps a small stock of components (or complete items) or ones that take a long time to make, just in case of a rush order.
Just in time (JIT)	A situation where a firm does not allocate space to the storage of components or completed items, but instead orders them (or manufactures them) when required. Large storage areas are not needed and items that are not ordered are not made.
Kaizen	A culture of continuous improvement originating in Japan and considered an important aspect of an organization's long-term strategy.
Lead time	The time between the initiation and the execution of a process.
Lean production	A long-term production strategy that considers product and process design as an ongoing activity. It focusses on continual feedback and incremental improvement.
Quality assurance (QA)	This covers all activities from design to documentation. It also includes the regulation of quality of raw materials, assemblies, products and components, services related to production, and management and inspection processes.
Quality control (QC)	Involved in development systems to ensure that products or services are designed and produced to meet or exceed customer requirements and expectations.
Statistical process control (SPC)	A quality control tool that uses statistical methods to ensure a process is operating at its most efficient.
Value for money	The relationship between what something, for example, a product, is worth and the cash amount spent on it.
Value stream mapping	A lean production management tool used to analyse current and future processes for the production of a product through to delivery to the customer.
Workflow analysis	The review of processes in a workflow in order to identify potential improvements.

DP DESIGN TECHNOLOGY

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Mr Moneeb