CHAPTER 3

Operations processes

OVERVIEW

3.1 Introduction
3.2 Inputs
3.3 Transformation processes
3.4 Outputs

3.1 Introduction

Imagine visiting a chocolate factory. Apart from a desire to sample some of the products, what you will see is an operations system in action. As was briefly explained in chapter 1, an operations system is used to transform inputs into outputs. It does this by using the 'input-transformation-output' process commonly referred to as the operations process. In a chocolate factory, this means using labour, energy, machinery and materials such as cocoa beans, milk and plenty of sugar to make chocolate. The Cadbury chocolate factory in Tasmania, for example, produces around 50 000 tonnes of chocolate a year! Most of the entire process of chocolate making is automated (done by machines) — just picture the huge vats of melting chocolate and caramel, conveyor belts transporting rows upon rows of chocolates with lots of workers in white coats (see figure 3.1).



FIGURE 3.1 Operations processes are at the heart of the success of all businesses. Production involves the skilful bringing together of a number of inputs, such as finance, equipment, management, technology, materials and people, to create the finished goods or services through a series of operations processes.

Operations processes are those processes involved directly with transformation. The processes may be broadly classified according to their role in transformation:

- inputs into transformation processes
- the actual processes of transformation
- outputs of the transformation process.

Figure 3.2 shows an overview of operations processes.

Inputs, transformation processes and outputs are all important and each of these features of operations has its own features and presents challenges for operations managers.

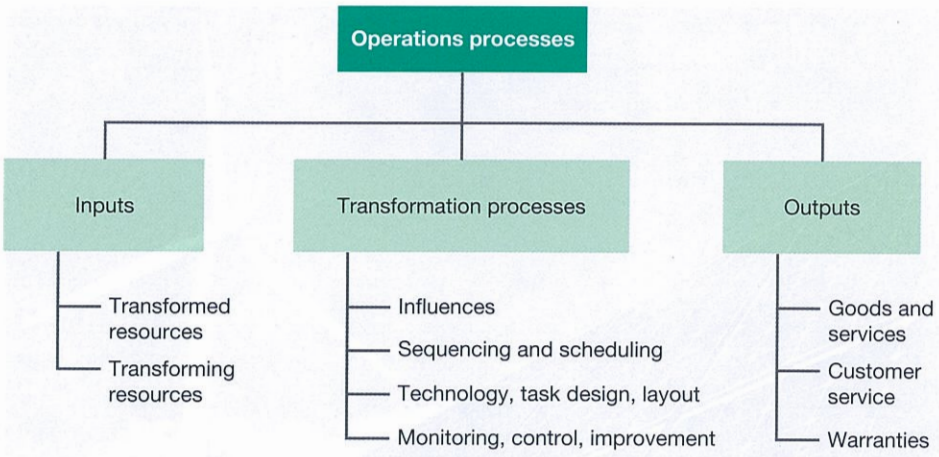


FIGURE 3.2 An overview of operations processes

3.2 Inputs

As was outlined in chapter 1, **inputs** are the resources used in the transformation (production) process. Some inputs are already owned by the business, while others come from suppliers.

BizWORD

Inputs *are the resources used in the transformation (production) process.*

3.2.1 Common direct inputs

Although many different types of inputs are used in the transformation process, generally there are four common direct inputs used by most businesses, including:

- labour
- energy
- raw materials
- machinery and technology (capital equipment).

BizFACT

In Business Studies, capital refers to the money provided by the owners to finance a business's activities. In Economics, capital refers to machinery and technology used to produce goods and services.

Labour

Human effort, both mental and physical, is a necessary input into operations processes. Jobs in the field of business operations include those in the areas of sourcing and supply chain, technical support and maintenance for machinery, inventory management and control, quality processes, production, logistics and distribution. Clearly labour is crucial to all aspects of business operations.

Energy

Energy, in the form of electricity or fuels, which can be converted into heat, movement, light, sound or other forms of energy, is an essential input into transformation. Energy is required to bring inputs to the business, to transform them and to distribute them to consumer markets. Indeed, value adding is directly proportional to the amount of energy expended. For example, the manufacture of a high value added product such as a motor vehicle requires large amounts of energy.

Raw materials

Raw materials are essential inputs into operations processes. The basic components of manufactured goods are wood, unprocessed agricultural products, natural resources in the form of minerals and fossil fuels, water, and so on. Raw materials are sourced through the supply chain and businesses will determine the volume of raw materials required against the level of demand for their finished goods.

BizFACT

Raw materials are also sometimes called 'direct materials'. However, raw materials are not always 'raw'. This is because some businesses use already processed materials as their inputs. Consider, for example, a clothing designer. The cloth used is already processed — the raw materials such as cotton have already been transformed into cloth. In this case, the 'raw' materials are partially processed (or 'intermediate') materials.



FIGURE 3.3 Most manufacturing plants consume large quantities of energy and rely on a reliable source of power. In recent years, businesses have begun to implement energy-saving measures to reduce their energy bills and greenhouse gases. As well, businesses are starting to access alternative energy supplies.

Machinery and technology

Machinery and technology are necessary to enable transformation processes, which are characteristic of operations. Machinery is used to process raw materials, as well as to design and make products. Machinery integrated with technologies can perform very complex tasks very quickly. Indeed, over time, there has been a concern about what is called **capital-labour substitution**. Capital-labour substitution means that the machinery and technology displace people by doing the work they do. This makes labour redundant. In reality, when machinery and technology are used in business, some labour may be lost but there is then a period of retraining that takes place as people acquire new skills relevant to use with new technologies.

BizWORD

Capital-labour substitution *means that the machinery and technology displace people by doing the work they do.*

3.2.2 Input classification

Now let us look in more detail at the inputs. Inputs may be divided into those that are transformed resources and those that are transforming resources. Figure 3.4 shows how the inputs can be classified.

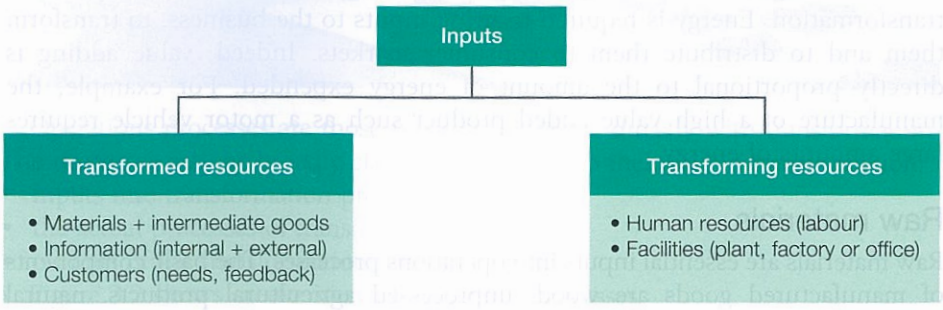


FIGURE 3.4 Inputs can be classified as transformed resources (resources that are changed or converted in the operations process) and transforming resources (resources that carry out the transformation process).

3.2.3 Transformed resources (transformed inputs)

Transformed resources are those inputs that are changed or converted in the operations process; they are transformed by the operations processes. Transformed resources are also considered the resources that give the operations process its purpose or goal. The transformed resources are:

- materials
- information
- customers.

BizWORD

Transformed resources *are those inputs that are changed or converted in the operations process.*

Materials

Materials are the basic elements used in the production process and consist of two types: raw materials and intermediate goods. When most people talk about 'materials', they are generally referring to raw materials such as oil, wood or steel. **Raw materials** are the essential substances in their unprocessed (natural or raw) state and usually come from mines, forests, oceans or recycled waste. However, materials can also refer to **intermediate goods**, which are goods manufactured and used in further manufacturing or processing.

BizWORD

Materials *are the basic elements used in the production process and consist of two types: raw materials and intermediate goods.*

Raw materials *are the essential substances in their unprocessed state.*

Intermediate goods *are goods manufactured and used in further manufacturing or processing.*

The distinction here is that there is a range of materials that are *already* transformed but still become inputs into operations processes. Consider the following: computers need integrated circuits and digital memory capacity. Complex microchips are required to store memory and to enable computers to operate. The chips are outputs from businesses that transform various raw materials (plastics, silicon, copper) into microchips. These chips are both final outputs as well as inputs for further processing. A computer manufacturer will take these transformed resources and use them as essential inputs (components) in computers. This is shown in figure 3.5.

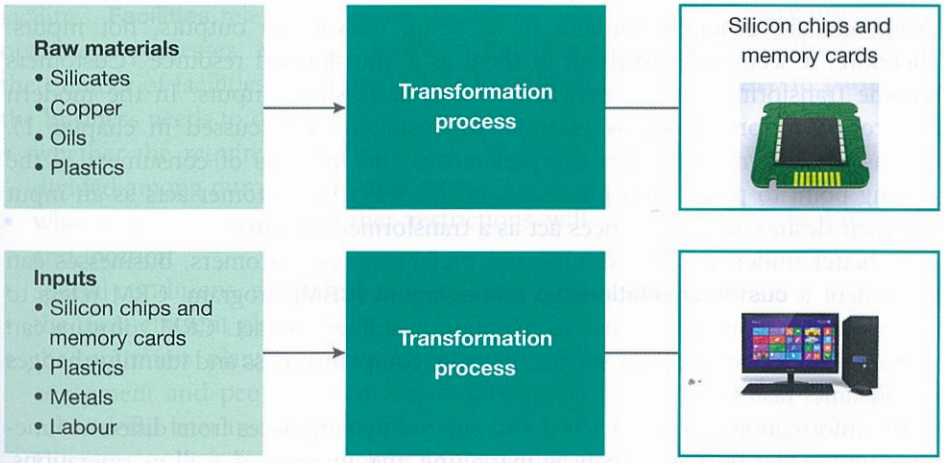


FIGURE 3.5 Transformed resources become inputs used in the production of other goods and services.

Similarly, in a service-based business, items such as stationery, computers, furniture and tools-of-trade are outputs of other businesses that become essential inputs to the delivery of services.

Information

Information is the knowledge gained from research, investigation and instruction, which results in an increase in understanding. The value of information lies mainly in its ability to influence behaviour or decision making.

BizWORD

Information *is the knowledge gained from research, investigation and instruction, which results in an increase in understanding.*

Information can be a very important input into the operations process. Information can come from two sources: internal and external. Information acts as

a transformed resource when it is used to inform how inputs are used, where they are drawn from, which suppliers and supplies are available, and so on. That is, the information is in a form that just needs to be understood or analysed, rather than compiled.

External information

This is information that comes from market reports, statistics from industry observers and industry bodies, official government statistics from the Australian Bureau of Statistics (ABS), media reports, academic papers and commentary, management journals and comparative studies. External information is an excellent and generally independent source for operations managers to use. It is very useful to integrate relevant information into operations processes. For example, information on the use of distribution centres will act as an input for inventory management. Similarly, information on new technologies can influence which machinery and technology is purchased and how it is applied to the operations function.

Internal information

Internal information comes from within the business and is gathered from internal sources such as financial reports, quality reports, and internal **key performance indicators (KPIs)** such as lead times, inventory turnover rates and production data. A further source of important internal information arises from customer feedback. This can come through an analysis of warranty data or from scanning social media threads. Internal information acts as a transformed resource when it informs processes and creates process improvements.

BizWORD

Key performance indicators (KPIs) *are specific criteria used to measure the efficiency and effectiveness of the business's performance.*

Customers

Customers are generally thought of as being relevant to outputs, not inputs. Therefore, it seems odd to think of them as a 'transformed resource'. Customers become transformed resources when their choices shape inputs. In the modern day, consumer orientation is essential to business (as discussed in chapter 1). A consumer orientation takes the preferences and interests of consumers as the starting point to production processes. In this way, the customer acts as an input and their desires and preferences act as a transformed resource.

To better understand the desires and preferences of customers, businesses can implement a **customer relationship management (CRM)** program. CRM refers to the systems that businesses use to maintain customer contact. CRM software can be used to improve customer service, increase competitiveness and identify changes in consumer tastes.

The information can be retrieved and entered by employees from different functions within the business, such as marketing and finance, as well as operations. This approach improves services (many of which are now provided directly to customers), cuts production costs and the customer feedback makes the operations process more directly responsive to customer desires.

BizWORD

Customer relationship management (CRM) *refers to the systems that businesses use to maintain customer contact.*

3.2.4 Transforming resources (transforming inputs)

The other collection of inputs to any operations processes are **transforming resources** which are those inputs that carry out the transformation process. They enable the change and value adding to occur. There are two main transforming resources, although energy and information may also be classified under this category. The two main transforming resources are:

- human resources
- facilities.

BizWORD

Transforming resources *are those inputs that carry out the transformation process.*

Human resources

Employees are said to be the single most important input into business. Staff who are well qualified, hard working and disciplined can bring great productivity and efficiency to business operations. The effectiveness with which human resources carry out their work duties and responsibilities can determine the success with which transformation and value adding occurs. This is because it is employees who coordinate and combine other resources such as machinery and technology, raw materials, and finance to produce goods and services. In this sense, employees are the most crucial of all inputs.

Let's use a simple case to illustrate. If a main business objective of a manufacturing company is to be the 'most efficient and reliable supplier', its human resource policies and practices should be aimed at attracting, retaining and motivating staff to ensure they are able to meet their customers' supply needs. Being efficient means having a reliable workforce that can do the job when required. To turn this objective into a reality, a strategy of improving employee skills through training and development may be used. In addition, setting performance objectives for individual staff members to improve their efficiency will help the business achieve its objectives. Other strategies that will assist the achievement of business objectives include adhering to work health and safety standards and ensuring staff motivation remains high.

Well-designed human resource management policies and practices can improve the performance of the operations processes. Well-considered job design, targeted and appropriate training, flexible work practices and open communication are all factors that assist in maximising operational efficiency, business performance and the capacity of the business to achieve the objectives.

Facilities

Once a business has determined the type of operations process to use, it will need to undertake a complex set of design-planning decisions involving the production facilities. **Facilities** refer to the plant (factory or office) and machinery used in the operations processes. Major decisions include the design layout of the facilities, the number of facilities to be used, their location and their capacity. In particular, the business needs to decide:

- whether the required facilities should be located in one or two large sites or divided among numerous smaller sites
- what impact zoning and other restrictions will have upon the facilities' size and location
- special conditions, such as energy and water requirements
- the most efficient plant design
- the optimum plant and process layout — the arrangement of machinery, equipment and people within the facility (process layout will be examined in more detail later in this chapter).

The plant and machinery can make a very significant difference to a business and its capacity to transform. Clearly the facilities can determine the nature of the operations environment. Modern facilities, which integrate modern technologies, are well lit, well designed and labour friendly, will be highly conducive to productive operations.

BizWORD

Facilities *refer to the plant (factory or office) and machinery used in the operations processes.*

SUMMARY

- The operations process refers to the input-transformation-output process.
- Inputs are the resources used in the transformation process and can be classified as either transformed resources or transforming resources.
- Transformed resources are those inputs that are changed or converted in the operations process and include:
  - materials: the basic elements used in the production process and consist of raw materials and intermediate goods

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Syllabus area 1
Topic 3
Concept 1

The operations process: inputs, transformation and outputs
Summary screen and practice questions

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Syllabus area 1
Topic 3
Concept 2

Inputs: transformed resources
Summary screen and practice questions

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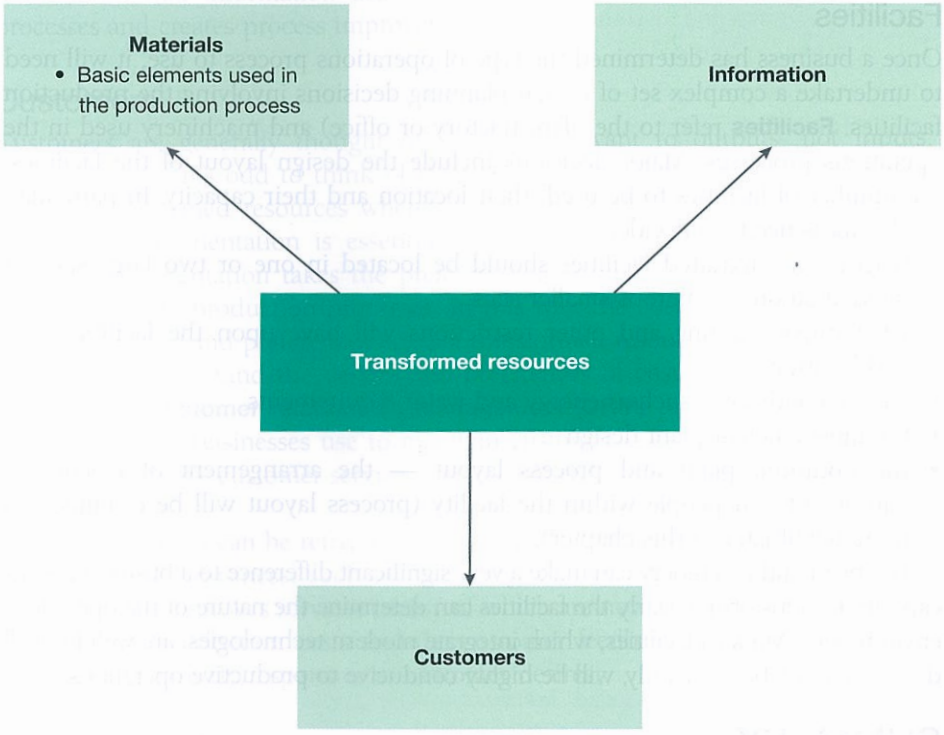
Syllabus area 1
Topic 3
Concept 3

Inputs: transforming resources
Summary screen and practice questions

  - information: the knowledge gained from research, investigation and instruction, which results in an increase in understanding
  - customers: their desires and preferences are the starting point to production processes.
- Transforming resources are those inputs that carry out the transformation process and include:
  - human resources: they coordinate and combine other resources to produce goods and services
  - facilities: the plant (office or factory) and machinery used in the operations process.

EXERCISE 3.1 REVISION

1 **What** are the three elements of an operations process?
2 **Outline** the 'input-transformation-output' process.
3 **Identify** the main inputs, transformation and outputs in an operations process such as that used by the Cadbury chocolate factory.
4 **List** the four common direct inputs and briefly **outline** each.
5 Referring to the making of takeway coffee, **construct** a diagram that **describes** the transformation process from taking the customer's order to the customer getting their coffee.
6 **How** do transformed resources and transforming resources differ?
7 Draw a concept map (started below) **summarising** the transformed resources used within the operations process.



8 **Explain** how materials may be either raw of intermediate in nature.
9 **How** can customers be classified as a 'transformed resource'?
10 **What** makes information a transformed resource, and how does it shape the operations processes?
11 Clearly **detail** the relationship between human resources and the effectiveness of operations.
12 **Define** the term 'facilities'.

13 **Recount** four decisions a business needs to consider in relation to facilities.

14 **Explore** how facilities can shape operations processes by researching two different types of production facilities

EXERCISE 3.1 EXTENSION

1 Through the use of case study and examples, **show how** the three elements that make up the operations process (inputs–transformation–outputs) are performed in all businesses. In so doing, **detail** how they are interrelated.

2 Ron's Roofing and Gutters is a large manufacturing business that employs 485 employees. **Explain** four ways Ron's management could use employees to maximise output.

3 **What** is 'capital-labour substitution'? Prepare either a written report of 400 words or an oral report of three minutes **assessing** the advantages and disadvantages of this system of production.

3.3 Transformation processes

The main factor shaping operations processes is **transformation**, which involves the conversion of inputs (resources) into outputs (goods or services). Samsung, for example, takes plastic, metal, glass and electronic parts and transforms them through design, manufacturing and assembly into numerous electronic products.

The term 'transformation' implies physical changes, but today it also includes the conversion of resources into services. For example, your school takes its main inputs — students, the syllabus, staff and buildings — and produces educated, employable graduates. Similarly, legal firms can utilise resources, experience and legal knowledge to transform a legal conflict into a resolution.

It is important to understand that the transformation process differs between manufacturing businesses and service businesses. A manufacturer transforms inputs into tangible products (goods that can be touched). A service organisation transforms inputs into intangible products (services that cannot be touched but that have effects that can be felt). The operations process of a manufacturer tends to be highly automated or mechanised. Manufacturers use machinery, robots and computers to transform inputs into outputs. Service providers rely heavily on interaction with the customer and their processes tend to be more labour-intensive; that is, staff are crucial to the operations. Service providers apply time, skill and experience in assisting consumers to improve their quality of life.

BizWORD

Transformation *is the conversion of inputs (resources) into outputs (goods and services).*

BizFACT

Many businesses continually work to improve the way they transform resources into finished products or services.

3.3.1 Transformation processes and value adding

Besides conversion of inputs into outputs, transformation processes are also directly involved with value adding. Costs are incurred when something created by manufacturing is processed or when a service is created. The addition of cost in transforming the inputs into a process, which will turn them into outputs, adds value. Thus, cost is often related to value. For example, the value of apple pies is greater than the cost of the inputs used to create those pies (flour, wheat, sugar and heat or energy to bake the mix). As inputs are added and processed into final goods for consumption, value is added. It is usually easy to see how value is added in a manufacturing situation. However, it can be much harder to see how value is added in the services sector, where value adding occurs through knowledge, skills and expertise.

An understanding of how costs are spent and value is added is very important. It helps to show the relationship between operations processes and financial goals. The processes incur cost. This cost is a financial expense. However, the expense leads to the creation of value. This means the products made can be sold for a price that both covers the cost and generates profit.

BizFACT

As a resource-rich nation, Australia has tremendous scope for growth through value adding. When we are referring to commodities, value adding refers to the process in which they have their value increased by processing, refining or transforming the original commodity before export — for example, the refining of iron ore into metal pellets or steel from the raw material. Value adding creates jobs in Australia.



FIGURE 3.6 The term 'transformation' implies physical changes, but today it includes process and service improvements. Training and accreditation boost skills and deliver services of greater overall quality and effectiveness.

There are several aspects to operations processes that are directly involved with the process of transformation. This is shown in figure 3.7.

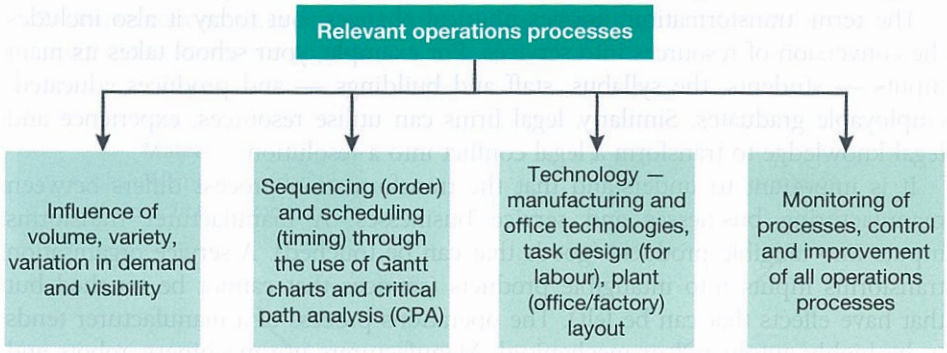


FIGURE 3.7 An overview of the operations processes relevant to transformation

3.3.2 The influence of volume, variety, variation in demand and visibility (customer contact)

A key aspect to operational processes relates to the question 'how much'? That is, in the process of transformation, decisions will need to be made about the following questions.

- How much to make — what volume of input to draw in and to process?
- How much variation — what range of outputs should be made in the process of transformation?
- How much variation in demand will there be — and how quickly can the operations processes respond to changes in demand?
- How much customer contact should there be and what, if any, role should it have on transformation processes?

BizWORD

Volume *refers to how much of a product is made.*

Lead time *is the time it takes for an order to be fulfilled from the moment it is made.*

The influence of volume

Volume refers to how much of a product is made. Volume flexibility refers to how quickly the transformation process can adjust to increases or decreases in demand. This responsiveness to the required changes in volume is essential to effectively managing **lead times**. Lead time is the time it takes for an order to be fulfilled from the moment it is made. If businesses cannot quickly adjust to changes in market demand, they can over produce, which may lead to wastage and increased

inventory costs. Alternatively, if back orders cannot be quickly fulfilled, it can lead to lost sales. A customer may, for example, go to a competing business. See the following Snapshot for an example.

Case study: Strong retail competitors in Australia — Zara, Uniqlo and H&M

Relatively new entrants in the Australian retail market have had an impact on the volume, variety and variation in demand experienced by more established businesses. Zara, Uniqlo and H&M are among the most highly sought-after clothing brands, leading to a loss of sales revenue for established brands such as Marcs, Willow and David Lawrence. Topshop, which initially experienced high sales volumes, has also lost turnover to so called 'fast fashion' (low-cost, high-volume sales of clothing).

Zara's, Uniqlo's and H&M's management of the four Vs characteristic of operations processes —volume, variety, variation in demand and visibility — is interconnected. Each of the brands is able to respond to increases in volume quickly — indicating highly responsive supply chain management. Variety, a key to success in fast fashion, is led by Zara and its high number of new designs entering the market each couple of months. Variety, as evidenced by a wide product range, can only be effectively managed when there is a very good understanding of consumer preferences.

Variation in demand, which used to be seasonal in respect to fashion, has now become characterised by shorter cycles, initiated by smart business practices. Thus, the release of new designs to market six times per year, instead of two to four times per year, helps maintain market demand.

Each of the businesses, Zara, H&M and Uniqlo, are placed in a highly visible location that has ready access to passing trade. Physically located in large shopping centres, each is also highly present (visible) on social media.

Accordingly, through effective operations processes and management of the four Vs, each of these businesses is reshaping the clothing retail sector in Australia.

SNAPSHOT QUESTIONS

1. **What** are the four Vs?
2. **Name** three businesses that are increasing sales volumes in Australia.
3. **How** does variation in demand affect the volume of product brought to the market by Zara and H&M?
4. **What** is the importance of visibility to clothing retailers?

SNAPSHOT



'. . . through effective operations processes and management of the four Vs, each of these businesses is reshaping the clothing retail sector. . .'

The influence of variety

The mix of products made, or services delivered, through the transformations process is sometimes called mix flexibility. **Mix flexibility** is known by consumers as product range or variety of choice. The influence of variety on transformation processes is: the greater the variety made, the more the operations process needs to allow for variation. This might sound like it is difficult to achieve and that a large plant may be required. However, this is not always the case as shown in the following Snapshot.

BizWORD

Mix flexibility *is the mix of products made, or services delivered through the information process.*

Whitegoods — mix flexibility

In Australia, Electrolux make the Electrolux, AEG-Electrolux, Simpson, Chef, Dishlex, Kelvinator and Westinghouse brands. These brands are attached to a range of household electrical whitegoods such as fridges, washing machines, ovens, dishwashers and dryers. Similarly, Whirlpool, a competitor, also makes this range of products. If you were to investigate the electronic components within the range of devices, you would find that there are many similarities: they heat and cool, have rotating parts and timers. So, despite the apparent diversity in these products, many of them are electronically very similar. In this way, the company

SNAPSHOT



'. . . many of them are electronically very similar.'

behind the brands can sell a variety of products made with largely similar production processes.

SNAPSHOT QUESTIONS

1. **Identify** the brands manufactured by Electrolux.
2. **Account** for why there may be a wide range of products, but the production processes may be quite narrow.

The influence of variation in demand

As seen earlier, a variation in demand can impact significantly on transformation resources. An increase in demand will require increased inputs from suppliers, increased human resources, increased energy use and increased use of machinery and technology. However, increased demand may be hard to meet if:

- suppliers cannot supply quickly enough
- labour is not flexible enough, skilled or available
- the adopted machinery cannot adjust to increased capacity quickly, either because it is not designed to or because it breaks down
- increased energy and power are not able to be readily sourced.

A decrease in demand will also require operational flexibility as staff may need to have their hours reduced, production may need to slow to avoid inventory build up and suppliers may put on pressure due to contractual agreements.

Predicting demand

All businesses will try to forecast demand so that adjustments can be anticipated and a business can act accordingly. Annually, some variations are predictable: Christmas, for example, can be a time when high toy sales can be anticipated. Seasonal factors also cause predictable variations in demand; for example, more air conditioners will be sold in late spring in anticipation of summer than are sold in mid-winter.

The influence of visibility (customer contact)

Customer contact or 'feedback' can directly affect transformation processes. This is because customers and their preferences can shape what businesses make. Customer contact may be direct or indirect. Direct contact takes the form of customer feedback given through surveys, interviews, warranty claims, letters, wikis and blogs and verbal contact. Indirect feedback comes through a review of sales data that gives an indication of customer preferences and market share data, through an observation of peoples' decision-making processes and through consumer reviews. Because businesses seek to maximise sales, customer contact is essential and ultimately shapes the transformation processes.

SUMMARY

- Transformation is the conversion of inputs (resources) into outputs (goods or services).
- Transformation differs between manufacturing businesses and service businesses.
- A manufacturer transforms inputs into tangible products.
- A service organisation transforms inputs into intangible products.
- Transformation processes also involve value adding.
- Transformation processes are influenced by:
  - volume: how much of a product is made
  - variety: the range of products made
  - variation in demand: the amount of a product desired by consumers
  - visibility: the nature and amount of customer contact (feedback).

studyon
Syllabus area 1
Topic 3
Concept 4
Transformation processes
Summary screen and practice questions

EXERCISE 3.2 REVISION

1 **What** does 'transformation' mean?

2 After reading the introduction to section 3.3, **recall** the most appropriate words from below to complete the following sentences.

outputs	manufacturing	intangible	adding
interaction	services	labour	conversion
physical	automated	tangible	customer

(a) The main concept of operations processes is transformation, which is the _____ of inputs (resources) into _____ (goods or services).
(b) The term 'transformation' implies _____ changes, but today it also includes the conversion of resources into _____.
(c) It is important to understand that the transformation process differs between _____ businesses and service businesses.
(d) A manufacturer transforms inputs into _____ products (goods which can be touched).
(e) A service organisation transforms inputs into _____ products (services which cannot be touched).
(f) The operations process of a manufacturer tends to be highly _____ or mechanised.
(g) Service providers rely heavily on _____ with the _____ and their processes tend to be more _____-intensive.
(h) Transformation processes are also directly involved with value _____.

3 **How** are transformation and value adding related?

4 **Propose** the process of value adding that occurs within a bakery that produces cakes and a range of breads and bread rolls.

5 **What** are the four Vs that relate to the transformation process?

6 'The transformation process is influenced by the four Vs: volume, variety, variation and visibility.' **Summarise** the influence of the four Vs by completing the following table. The first one has been started for you.

Influencing factor	Summary
Volume	• Refers to how much of a product is made.
Variety	
Variation (in demand)	
Visibility	

7 Imagine you are the operations manager for an ice-cream factory.
(a) **Explain** why it would be important to understand the concept of 'lead time'.
(b) **How** would you respond to the supply chain issues caused by seasonal changes in consumer demand? Share your answer with the rest of the class.
(c) **Detail** the importance of variety to the market and to the factory.

EXERCISE 3.2 EXTENSION

1 Research a manufacturing business such as ASICS or Samsung, finding out as much as you can about the transformation processes used in the business. **Synthesise** your findings and present them to the class.

2 **Investigate** what happens when a customer makes an online order for a delivered pizza at Domino's Pizza. Use this information to **create** a schematic diagram to **explain** the concept of 'lead time' with respect to Domino's Pizza.

3 **Analyse** the effect of customer contact on transformation processes. In your answer, **examine** the benefits of a business undertaking direct feedback methods such as surveys, wikis and blogs. You may refer to the Myer website or the David Jones website as a source of inspiration.

on Resources

Weblink: Domino's Pizza

3.3.3 Sequencing and scheduling

Sequencing and **scheduling** are two very important aspects that assist with structuring and ordering the transformation processes. Sequencing refers to the order in which activities in the operations process occur. Scheduling refers to the length of time activities take within the operations process. An understanding of both sequencing and scheduling is necessary for operations managers. When planning operations processes that involve activities central to transformation, various scheduling tools will be used. The two main scheduling tools are Gantt charts and critical path analysis (CPA).

BizWORD

Sequencing *refers to the order in which activities in the operations process occur.*

Scheduling *refers to the length of time activities take within the operations process.*

Gantt charts

The **Gantt chart** was created by Henry Gantt in 1917. The Gantt chart outlines the activities that need to be performed, the order in which they should be performed and how long each activity is expected to take. Gantt charts are used for any process that has several steps and involves a number of different activities that need to be performed. A typical Gantt chart is shown in figure 3.9. This chart shows the steps an electronic store would take when setting up and preparing for an opening.

BizWORD

The **Gantt chart** *is a type of bar chart that shows both the scheduled and completed work over a period of time. It is often used in planning and tracking a project.*

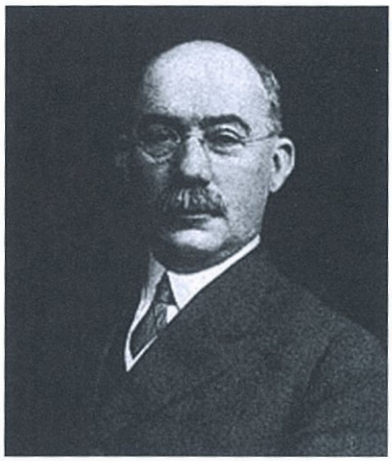


FIGURE 3.8 Henry Laurence Gantt (1861–1919) was an engineer and management consultant who developed Gantt charts — a visual tool to show scheduled and actual progress of projects. Considered as a routine project management tool today, it was quite a radical concept and an innovation of world-wide importance in the 1920s.

Gantt chart for opening of Stitched Up P/L 2018

Activity/sequence	August	September	October	November	December
Register business					
Obtain shop lease					
Refit shop					
Purchase stock and establish supply chain					
Design flyer and plan opening					
Flyers printed					
Preliminary advertising: letterbox drop					
Advertise for junior casual staff (×4)					
Contact Jemima's Clothing Distributors re: opening					
Final advertising					
Start trading					
Christmas sale					

FIGURE 3.9 Gantt chart showing sequence and scheduling (timing)

Gantt charts can be used for scheduling simple routine tasks such as completing a homework assignment and for larger, more complex projects such as building a dam. They can be used to schedule the work activities of one employee or a team of employees.

There are two main advantages of using Gantt charts. Firstly, they force a manager to plan the steps needed to complete a task and to specify the time required for each task. Secondly, they make it easy to monitor actual progress against planned activities.

Critical path analysis (CPA)

Critical path analysis (CPA) is a scheduling method or technique that shows what tasks need to be done, how long they take and what order is necessary to complete those tasks. A typical CPA is shown in figure 3.10.

BizWORD

Critical path analysis (CPA) *is a scheduling method or technique that shows what tasks need to be done, how long they take and what order is necessary to complete those tasks.*

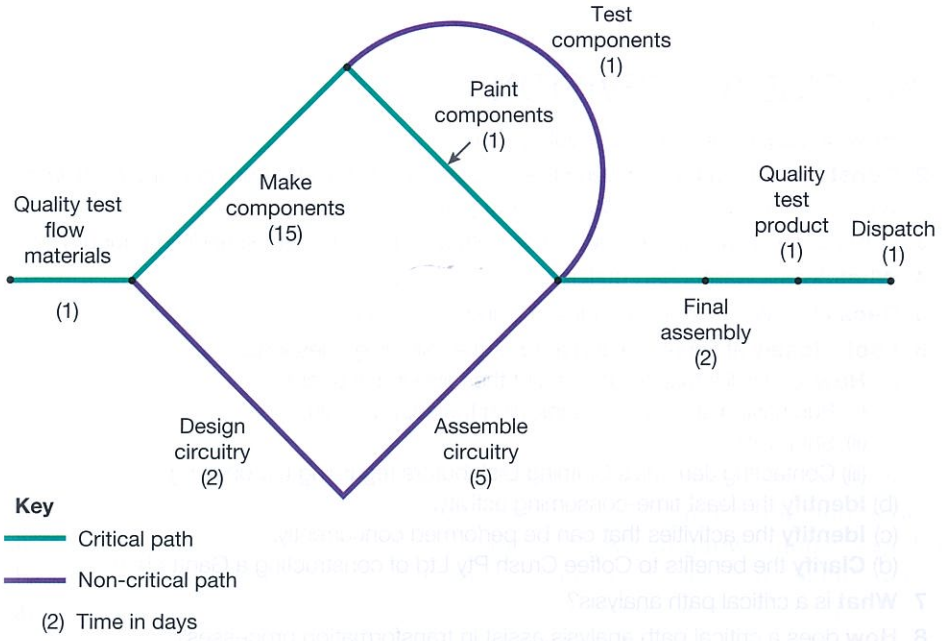


FIGURE 3.10 Critical path analysis (CPA) for the manufacture of an electronic switchgear

The critical path is the *shortest* length of time it takes to complete *all tasks* necessary to complete the process or project. Since all necessary tasks must be completed, in practical terms, the critical path will be the longest path through a process. You will see that some tasks can be performed simultaneously (for example, painting and testing components, or making the circuitry and assembling the components). Because *each activity* on the schedule must be completed to make the final product, the critical path is the path through the process that ensures all tasks have been completed. In this case, the critical path is:

(1) day	+ (15) days	+ (1) day	+ (2) days	+ (1) day	+ (1) day = 21 days
Quality test materials	Make components	Paint components	Final assembly	Quality test product	Dispatch

Note: the shortest path is *NOT* (1) + (2) + (5) + (2) + (1) + (1) = 12 days, because, though this appears to be the shortest processing path, it does not even allow time for the making of the components, which takes 15 days by itself.

It is clear from this type of analysis that scheduling enables a manager to see what needs to be done and allows the timing of tasks to be considered. With this information, a business will be able to see in what order activities need to be done. They will also be able to see which tasks can be done at the same time. In this manner, scheduling gives direction and organisation to operations processes, provides overall coordination and enables a means of control.

SUMMARY

- Sequencing and scheduling are essential activities in operations processes.
- Sequencing refers to the order in which activities in the operations process occur.
- Scheduling refers to the length of time activities take within the operations process.
- Two tools that assist with sequencing and scheduling are:
  - Gantt charts: a type of bar chart that shows both the scheduled and completed work over a period of time.
  - critical path analysis: a scheduling method that shows what tasks need to be done, how long they will take and what order is necessary to complete the tasks.

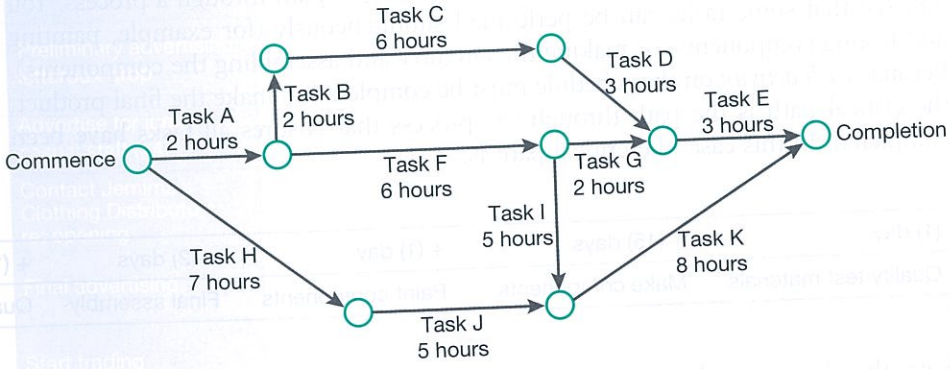
study on

Syllabus area 1
Topic 3
Concept 5

Sequencing and scheduling
Summary screen and practice questions

EXERCISE 3.3 REVISION

1 **How** do sequencing and scheduling differ?
2 **Construct** a flowchart showing the sequencing of your day commencing from when you arrived at school until you complete your last period.
3 **Outline** why your school timetable is both a sequencing and scheduling document.
4 **What** does a Gantt chart outline?
5 **Recall** the two main advantages of using Gantt charts.
6 **Look closely** at figure 3.9 and answer the following questions.
   (a) **How** long will it take to do each of the following activities?
      (i) Purchasing stock and establishing the supply chain
      (ii) Shop refit
      (iii) Contacting Jemima's Clothing Distributors regarding the opening
   (b) **Identify** the least time-consuming activity.
   (c) **Identify** the activities that can be performed concurrently.
   (d) **Clarify** the benefits to Coffee Crush Pty Ltd of constructing a Gantt chart.
7 **What** is a critical path analysis?
8 **How** does a critical path analysis assist in transformation processes?
9 If there are predictable variations in demand based on seasonal factors, **how** will this affect a critical path analysis? **Justify** your response.
10 The diagram below shows a planning tool for the creation of an advertisement by Digital Production Enterprises.



   (a) **Identify** the tool being used by Digital Production Enterprises.
   (b) Which task determines when Task K will be performed?
   (c) **Calculate** the shortest time for the completion of the task (show full working).

EXERCISE 3.3 EXTENSION

1 Using information from the internet, **examine** the evolution of the Gantt chart. **Assess** the value of a Gantt chart if you had to develop the Year 11 Business Studies assessment schedule.

on Resources

Weblink: Gantt chart

2 **Determine** the advantages of using a Gantt chart instead of a critical path analysis for a project.
3 Imagine you want to build a motorised go-kart. **Create** a Gantt chart showing a list of activities and the time taken to complete them.
4 Contact a manufacturing business and survey the methods it uses to schedule and roster staff. Specifically **examine** peak periods of work and **determine** the best leave time for employees (i.e. from the business's viewpoint).

3.3.4 Technology

Generally, technology is the application of science or knowledge that enables people to do new things or perform established tasks in new and better ways. A pair of scissors, for example, is a piece of technology that allows for the more efficient cutting of materials. More specifically, business technology involves the use of machinery and systems that enable businesses to undertake the transformation process more effectively and efficiently. Most technology affects all aspects of business, assisting employees to work more productively.

Increasingly, businesses are feeling the need to acquire up-to-date technology in order to compete effectively. In the manufacturing sector, technology can be used to speed up (shorten) processes and enable fuller utilisation of raw materials. This makes the operations processes more cost effective. In the services sector, smart devices and office and communications technology have enabled whole markets to open up and allow for a small to medium business to trade globally.

The capital cost of technology is relatively high, so businesses need to decide whether to purchase technology or to lease it. Leasing is more common because it is cheaper (lease payments are tax deductible), which allows money saved to be spent elsewhere. Additional costs that accompany technology include set-up and siting, cabling and the loss of workers who may be displaced due to the acquisition of technology. For workers not displaced, there is the cost of training or retraining, continual upgrading of skills and time lost in adapting to new work techniques.

Office technology

You will be familiar with a range of business technology. The list of business technology items that are commonplace today includes:

- computer or tablet
- keyboard and mouse
- USB and other data storage devices such as external hard drives and Cloud storage
- modem
- mobile telephones/hands-free telephones/wireless enabled phones
- paging service and answering machines
- combined printer, photocopier, scanner and facsimile machine
- ability to electronically transfer funds (EFT) and EFTPOS machines.

Developments of the above types of technology have created the opportunity for people to do more work in less time, which means a greater range of tasks can be completed in their working time. These technologies have also enabled office workers to work at a great distance from the office. Increasingly people **telecommute** and work from home. Emails are checked from home, and research and meetings can be conducted online or through video/webcam chat. In many businesses, the 'virtual office' and 'paperless trading' are becoming a reality and, as office structures change, 'hot desking' is not uncommon. In the following Snapshot, you can see how technology is central to operations processes in a service-based business.

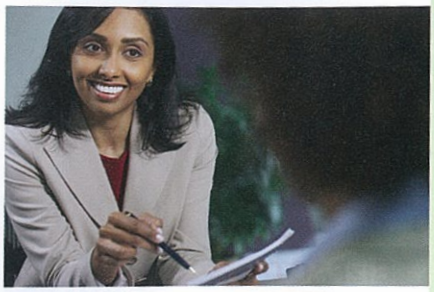
BizFACT

A pair of scissors is classified as low-technology (lo-tech) compared to computers and robotics, which are highly advanced and developed (hi-tech).

BizWORD

To **telecommute** *is to 'commute', or travel to work, electronically. This means that home or another location becomes the worksite and work is delivered via email or the internet.*

SNAPSHOT



'Email and mobile phone access enable her to reach clients with ease . . .'

BizFACT

Cloud computing is the provision of computer applications over the internet as a service to users of a particular website. Because the service provider hosts both the application and the data, the end user is free to use the service from anywhere.

BizWORD

Robotics *are used in engineering and specialised areas of research, as well as on assembly lines where a programmable machine capable of doing several different tasks is required.*

Technology — the virtual office

Mehrnoosh has a full-time job for one of the major Australian banks, working in an innovation hub. She acts as an IT specialist and that job allows her the flexibility of working either onsite in central Sydney or offsite. Working remotely means that Mehrnoosh can run her own web design business. She started this business in high school and worked on it throughout her university studies. At university Mehrnoosh won awards for her studies in technology and she was even designated one of the 'young entrepreneurs of the year'.

Mehrnoosh finds that her work for the bank allows her the time to successfully run her own business. That business is growing. The technological advances, including the use of 'cloud'-based solutions, means that Mehrnoosh can access her work from anywhere. It also means that her staff can log into email, the customer database and social media accounts from remote locations. In effect, this means that when she or her staff are travelling, work can continue uninterrupted. Technology assists the process, as a series of notifications are sent to Mehrnoosh's phone. These notifications include payments made, customer inquiries, Facebook and phone inquiries, as well as when staff log into the business accounts and when they log off. The technology also means Mehrnoosh can perform her IT functions for both the bank and her own business regardless of whether she is onsite or offsite. Email and mobile phone access enable her to reach clients with ease and mean she is always available for inquiries arising in her banking job as well as her business.

SNAPSHOT QUESTIONS

1. **Identify** the kinds of technologies that will be used by Mehrnoosh.
2. **Describe** how the use of 'cloud'-based storage allows workplace flexibility.
3. **Why** does the use of technology enable flexibility and productivity despite a staff member not being at the work site?

Manufacturing technology

Key manufacturing technologies are robotics, computer-aided design (CAD) and computer-aided manufacturing (CAM).

Robotics applies to highly specialised forms of technology, capable of complex tasks. Robots are used in engineering and specialised areas of research, as well as on assembly lines where a programmable machine capable of doing several different tasks is required. Robotics can shape transformation processes so that they are very high quality, of a consistently high standard, efficient and minimise waste.



FIGURE 3.11 Robotics are used in the car manufacturing industry.

Robotics allows a degree of precision and accuracy generally unmatched by human labour. In addition, robots work without complaint or demands for wage rises in conditions that would be repetitive, boring and often dangerous for employees. Robots and robotics, however, are very high-cost items that are unaffordable for most small and medium-scale manufacturers.

Computer-aided design (CAD) is a computerised design tool that allows businesses to create product possibilities from a series of input parameters. It is used in a range of business sizes and types. It is a computerised graphical design tool that generates three-dimensional diagrams from a set of given input data (parameters). Once the design has been created, it can be viewed from multiple angles. This assists both the designer and the end user to visualise what will be produced. This technology is very useful to transformation processes.

From the design, material usage can be calculated, as can time for the task to be completed. This enables the costing of the project to be quantified. If the cost is too high or the design is too limited, the input parameters can be altered to reflect these requirements. CAD programs are linked to printers so that 'hard', or paper, copies can be made and distributed to the client for assessment. Given the speed of CAD software, it is easy to customise a series of options that meets the client's or customer's needs. Normal drafting processes would cost much more and take longer (and be less accurate as an added bonus!). CAD software can go further still. It can design the sequence of steps that would need to be taken to create the desired product in the shortest possible lead time using the least amount of material.

Computer-aided manufacturing (CAM) is software used to allow the manufacturing process to become computer controlled. The CAD software can be linked to the CAM software to allow the instantaneous manufacturing of designs that are accepted by clients. CAM can also be used more broadly to calculate how much of each input resource would be required. The CAM software can store historic purchasing records to assist with present purchasing decisions.

BizWORD

Computer-aided design (CAD) *is a computerised design tool that allows businesses to create product possibilities from a series of input parameters.*

BizWORD

Computer-aided manufacturing (CAM) *is software that controls manufacturing processes.*

Technology in production and services

All car manufacturers use CAD and CAM when translating motor vehicle design into actual products. Architects and engineers also use these technologies. Toyota Motorsport, for example, uses a combination of CAD, CAM and CAE (computer-aided engineering) to create designs and to align production with design.

Service providers such as dentists are also increasingly using CAD. In the case of dental specialists, CAD and CAM can assist to repair damaged teeth, meaning that clients can have their dental problems addressed in one session rather than over repeat visits. This is because the technology can design and create veneers, inlays and dentures very quickly and accurately.

In undertaking the use of technologies such as these, businesses can ensure production standards are consistent, quality is maintained and wastage is minimal. For manufacturers, further benefits include direct communication between marketing (design) and operations (production), reduced lead times and minimal possibility of errors in translation between processes.

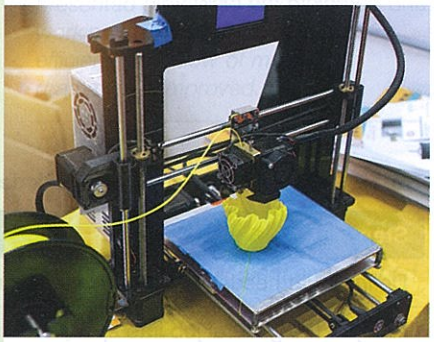
3D printing

Recently there has been significant development in 3D printing technologies. Such technologies allow a digital design to make an actual product through the use of polymers and other materials. The field of engineering and product design is being re-shaped through these new technologies that enable innovation and new methods of production to arise.

SNAPSHOT QUESTIONS

1. **What** do the acronyms CAD, CAM and CAE represent?
2. **How** are CAD, CAM and CAE utilised by businesses?

SNAPSHOT



'. . . undertaking the use of technologies . . . businesses can ensure production standards are consistent, quality is maintained and wastage is minimal.'

3. **Propose** two costs that would be associated with the use of integrated IT systems such as the use of computer integrated manufacture (CIM) technologies.
4. **Explain** the impact that 3D technologies could have on production processes.

SNAPSHOT



'the surfer can ensure the fins . . . are specific to the use of the board and the actual ocean conditions . . .'

Case study: Printing surfboard components

3D printers are now being used to print surfboard components such as fins. Due to the nature of the materials used in the manufacture of surfboards, 3D printers can be used to help surfers design and make their own customised fins. As the fin size and shape determine the manoeuvrability of the surfboard, surfers can design their own 3D printed fins to suit their purpose. In this way the surfer can ensure the fins they attach to their boards are specific to the use of the board and the actual ocean conditions — be it riding large waves in big surf or smaller waves in flatter surf. A further benefit of this new technology is that the fins are replaceable, lowering the cost of maintenance on boards. Clearly, 3D printing (also called additive manufacturing) brings significant possibilities to innovative market sectors.

The size of the market for fins is estimated to be worth over $70 million per annum in Australia alone. Thus, the creation of the 3D printed fin options takes advantage of a significant market opportunity.

SNAPSHOT QUESTIONS

1. **What** is an alternative name for 3D printing?
2. **Why** might surfers seek to take advantage of 3D printed surfboard fins?

BizWORD

Task design *involves classifying job activities in ways that make it easy for an employee to successfully perform and complete the task.*

3.3.5 Task design

Task design involves classifying job activities in ways that make it easy for an employee to successfully perform and complete the task. Task design overlaps the employment relations functions of job analysis, job description and person specification. It starts with an operations manager asking 'What needs to be done?' In the context of the business goals, task design is breaking down the work into a series of jobs in which each contributes to the final goal. (The steps involved in the task design process are shown in table 3.1.)

TABLE 3.1 The steps involved in the task design process

Step	Example
Define what needs to be done in a general statement	— A skilled competent electrician
Analyse the general job into specific duties	— Understand electrical circuits — Ability to work carefully and independently to prescribed electrical standards — Capacity to correctly install electrical devices and adjust capacity as required — Capacity to source correct parts and use in prescribed ways — Follow directions — Communicate clearly with builders and site managers
Allocate a degree of difficulty and a time element	— Supervision: 10 minutes supervision per hour — Difficulty: 8/10
Match tasks to existing state/federal awards (base)	— $30/hour first year licensed electrician
Articulate the task via job descriptors and a pay scale to allow for a range of experiences in a range of work settings. (This indicates the types of skills/experience and qualifications needed to successfully complete the task.)	— Licensed electrician $73 000 p.a. Duties: to plan and install a range of electrical items and associated circuitry into a range of building types (residential, commercial and educational).

Typically, there is a separation between manufacturing and administrative operations. In task design, it is necessary to group skills and competencies because this helps when obtaining staff. A prospective employee will be screened against these skills and competencies to ensure a match. For example, an intelligent and skilled barista who has no experience in electrical installations is unlikely to be a proficient electrician.

Attracting the right candidate for the task or job is the final part of a process that starts with task design and ends with selection, that is:

Task design → Job description → Person specification → Recruitment → Selection

A business may formalise the task design process while a job is already being done. Under these circumstances it is usual for the task to be analysed to see whether it could be done more efficiently. This involves a process called job analysis, and requires determining who does what in the business and why. The purpose of job analysis is to improve the business's productivity.

Skills audit

Sometimes, a business already has available staff. However, the staff may not have the requisite skills. Under these circumstances the managers may wish to conduct a skills audit. The **skills audit** is a formal process used to determine the present level of skilling and any skill shortfalls that need to be made up either through recruitment or through training.

BizWORD

Skills audit *is a formal process used to determine the present level of skilling and any skill shortfalls that need to be made up either through recruitment or training.*

Workplace layout

There are a number of different ways to organise the physical layout of a workplace. The method adopted by managers will depend on the type of manufacturing operations or services performed by the business. The way in which machinery and technology is orientated and arranged in the operations plant will strongly shape the operations processes. There are alternative ways to lay out machinery, depending on what is being made and what volume of production is required. The alternative layout options are the:

- process layout
- product layout
- fixed position layout.

BizFACT

Britax Childcare Pty Ltd manufactures child car restraints, and imports strollers and prams. As an innovative business, it installed new ergonomic workstations designed for the assembly areas to ensure that any part needed by operators was presented directly to them. The working environment, operator efficiency and flow of materials dramatically improved.

Process layout

The **process layout** is the arrangement of machines such that the machines and equipment are grouped together by the function (or process) they perform. The process layout is sometimes called functional layout. This type of layout is typical of hospitals, for example, where areas are dedicated to particular types of medical care, such as maternity wards and intensive care units.

BizWORD

The **process layout** *is the arrangement of machines so that the machines and equipment are grouped together by the function (or process) they perform.*

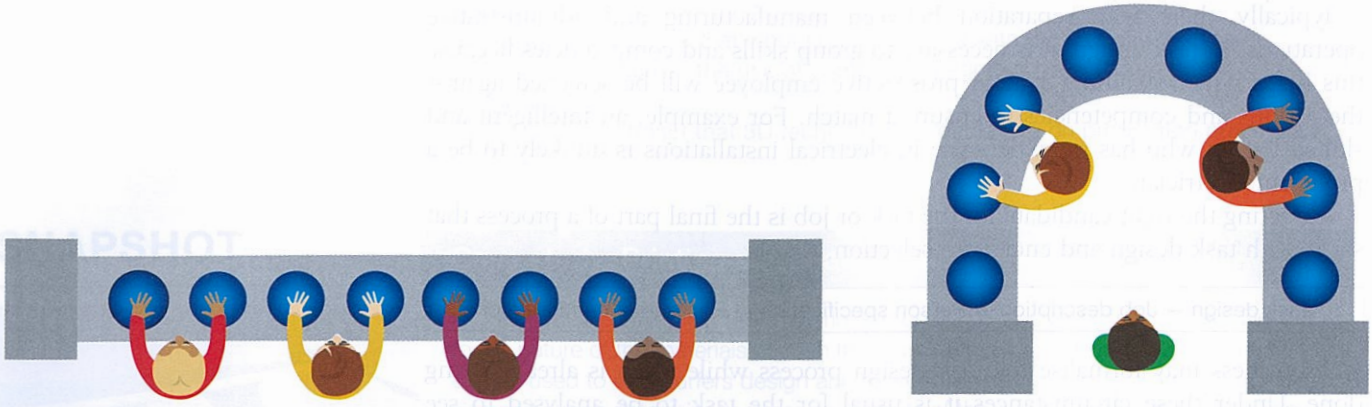
Process layout for intermittent production

Process production deals with high-variety, low-volume production. In this process, each product has a different sequence of production and the production is intermittent, moving from one department to another. The necessary machinery is arranged according to this sequence. This approach also lends itself to 'job lots' — that is, the manufacture of parts in small quantities. Many small to medium-sized manufacturers employ this process. In service businesses, such as banks or insurance companies, process layout is used to accommodate the handling of customers with different needs.

A feature of this approach, often used by businesses, is the creation of work cells or work teams (see figure 3.12). Cellular or team-based work arrangements can be used to create combinations of machinery and equipment to produce a single product or a range of similar products.

BizWORD

Process production *deals with high-variety, low-volume production.*



Current layout — straight lines make it hard to divide tasks.

Improved layout — workers have improved access. Fewer workers are needed.

FIGURE 3.12 Various work cell layouts

BizWORD

Product production *(mass production) is characterised by the manufacturing of a high volume of constant quality goods.*

Product layout *is where the equipment arrangement relates to the sequence of tasks performed in manufacturing a product.*

Product layout

Product production (mass production) is characterised by the manufacturing of a high volume of constant quality goods. An assembly line is the most common layout for this type of production because it aims to achieve the best possible combination of personnel and machine use — 'assembly line balancing'. This type of layout is referred to as **product layout** where the equipment arrangement relates to the sequence of tasks performed in manufacturing a product. Work stations are arranged to match the sequence of operations, and work flows from station to station. Operations managers must set times for the assembly task, which requires an understanding of not only the nature of the task but also the tools and skills required. Examples of this process are the assembly of motor vehicles or the production of television sets. Emphasis is placed on sequencing the flow from one work cell to another.



FIGURE 3.13 An assembly line production method is the best example of a product layout.

BizWORD

Project production *deals with layout requirements for large-scale, bulky activities such as the construction of bridges, ships, aircraft or buildings.*

Fixed position layout *is an operational arrangement in which employees and equipment come to the product.*

Fixed position layout

Project production deals with layout requirements for large-scale, bulky activities such as the construction of bridges, ships, aircraft or buildings. With project production, it is more efficient to bring materials to the site; workers and equipment come to the one work area.

A **fixed position layout** is where a product remains in one location due to its weight or bulk.



FIGURE 3.14 Project production — the inputs are brought to the site.

Office layout

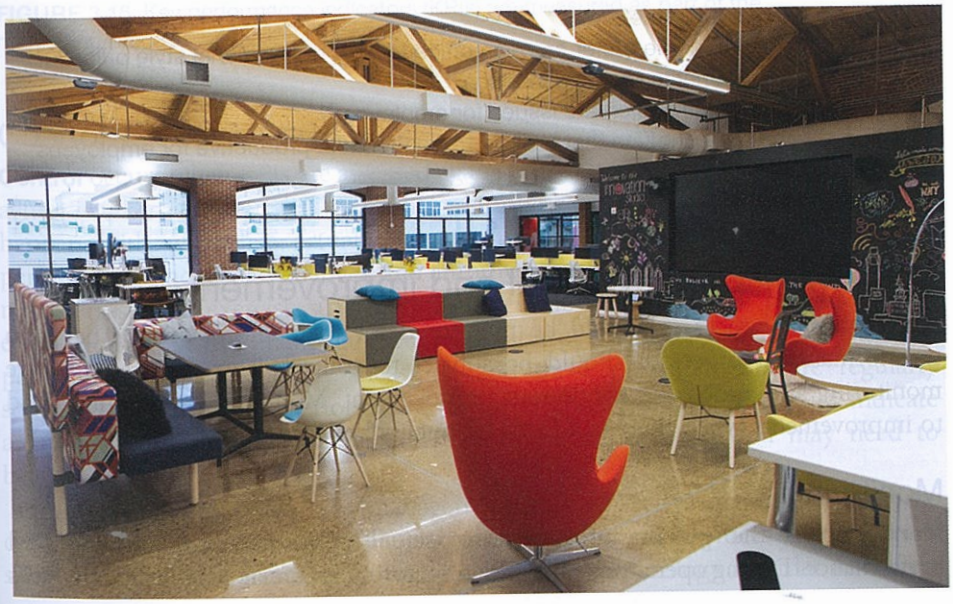
Again, the focus of an office layout is to enable the work to be performed efficiently (with minimal unnecessary disruption and time wastage) in a safe office environment. Typically an office space is organised around discrete **workstations**. This may be seen as the approach applied to a service-based business.

Office layout is tailored to meet the needs of the business. In a manufacturing business the office layout is often informal. It may even overlook the factory floor so that managers can supervise from their desk. In an accountant's office, clients need to feel welcome as they seek advice and information. In a doctor's surgery, privacy is a concern for patients so the layout of the surgery reflects this.

An office needs to be designed in a way that allows for smooth workflow; it should also provide a space (lunch room, games room) that enables employees to take a break from the work environment if required.

BizWORD

Workstations *are the desk areas required by office workers, usually fitted with access to a computer monitor, keyboard, telephone, mouse and mouse pad, storage, and close access to a printer and scanner.*



studyon

Syllabus area 1
Topic 3
Concept 6

Technology, task design and process layout
Summary screen and practice questions

FIGURE 3.15 An office layout is often organised around discrete workstations as well as break-out zones.

SNAPSHOT

'When employees and managers are equal in this way there can be improved internal communications, trust and understanding between people.'

Open offices — the latest trend in office design

In recent years there has been a movement towards the creation of open offices and collaboratively shared spaces. This means that the idea of individual offices, work cubicles and closed off rooms has been replaced with a design where everyone within an office can see everyone else in the office. Open design is a feature of most modern office spaces.

Benefits of an open design are that people within a workplace can get to know one another and therefore collaboration and teamwork can be fostered. The removal of internal barriers also saves money on the creation of walls and means that less floor space can accommodate more staff. A further benefit is the loss of a personal desk space through the application of an idea called 'unassigned seating', meaning that a sense of entitlement is removed. When employees and managers are equal in this way there can be improved internal communications, trust and understanding between people.

Increased creativity in how people work is also said to arise from the change from traditional office spaces. This is because people can decide where they sit and how they work, meaning their level of personal control or autonomy increases. This makes employees feel more valued.

However, open offices do have issues associated with them. Some employees find it difficult to concentrate on work due to disturbance from noise and visual distractions. Sometimes employees feel a loss of personal privacy, which can compromise their feeling of safety. These issues can lead to productivity loss and increased absenteeism.

Open spaces also suffer from another issue: the level of order and cleanliness can decline.

However, studies of workplaces in Australia and internationally have shown that overall the benefits outweigh the drawbacks. Nevertheless, a new design is starting to emerge where elements of traditional office spaces and open offices are being integrated in a hybrid design.

Flexible design — hybrid spaces: privacy and openness

Hybrid offices allow a business to retain the best elements of a traditional office — quiet, private spaces — with the flexibility and openness of the open office. Increasingly, businesses are opting for a balance between the traditional and the modern in order to best meet the varying needs of employees, workplace demands and business goals.

SNAPSHOT QUESTIONS

1. **What** is an open office?
2. **Why** do many people prefer an open office to a more traditional style office?
3. **Outline** four benefits of an open office.
4. **How** can open offices create issues for employees?
5. **Justify** the type of office that is likely to be the most productive for employees and managers.

3.3.6 Monitoring, control and improvement

All operations processes should be monitored for their effectiveness. The main transformational processes should be subject to control. This requires effective monitoring and a focus on continuous improvement. Monitoring and control lead to improvements when there is a focus on quality and standards.

Monitoring

Monitoring is the process of measuring actual performance against planned performance. During operations processes monitoring is crucial. Monitoring involves

BizWORD

Monitoring *is the process of measuring actual performance against planned performance.*

the measuring of all aspects of operations, from supply chain management and the use of inputs, through to transformation processes and outputs.

Monitoring typically is arranged around the needs to measure key performance indicators (KPIs). KPIs are predetermined variables that are measured so that appropriate controls to operations processes can be made.

Monitoring of the KPIs gives operations managers a chance to measure how the business is going and to assess performance against targeted levels of performance.



FIGURE 3.16 Key performance indicators (KPIs) are measured as part of the monitoring process.

Control

Control occurs when KPIs are assessed against predetermined targets and corrective action is taken if required. This means controlling compares what was intended to happen with what has actually occurred. If there is a discrepancy between performance and goals, changes and improvements can be made. All operations managers should exercise strict controls over the transformation processes. This can be done by setting challenging but reasonable performance targets. The business performance is then closely measured and those measurements are regularly scrutinised. The regular performance review is crucial because it should indicate any issues and, where possible, intervention or corrective action may need to be taken.

Control requires operations managers to take corrective action. That is, the operations manager will make changes to the transformation process such as redesigning the facilities layout or adjusting the level of technology in order to correct

BizWORD

Control *occurs when KPIs are assessed against predetermined targets and corrective action is taken if required.*

BizWORD

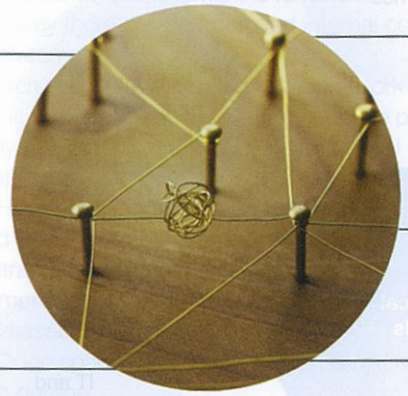
Improvement *refers to systematic reduction of inefficiencies and wastage, poor work processes and the elimination of any bottlenecks.*

A **bottleneck** *is an aspect of the transformation process that slows down the overall processing speed or creates an impediment leading to a backlog of incompletely processed products.*

the problem. Improvements in processes are often framed around quality. Quality controls, assurance and improvements are addressed fully in chapter 4.

Improvement

Improvement refers to systematic reduction of inefficiencies and wastage, poor work processes and the elimination of any bottlenecks. A **bottleneck** is an aspect of the transformation process that slows down the overall processing speed or creates an impediment leading to a backlog of incompletely processed products. Improvement typically is sought in time, process flows, quality, cost and efficiency.



Quality, through the pursuit of quality goals, measurement of product standards and quality and an assessment of returns and warranty claims.

Time, through the minimisation of bottlenecks, an assessment of the necessity in all transformations processes and wait times (including lead times).

Process flows and smoothness of transitions between transforming processes.

Cost, through an assessment of per unit costs of production, a review of expenses (fixed and variable) and an assessment of per unit costs of delivery.

Efficiency, through the reduction of waste and the creation of greater output per unit input.

FIGURE 3.17 Improvement refers to systematic reduction of inefficiencies and wastage, poor work processes and the elimination of any bottlenecks.

Continuous improvement

The concept of continuous improvement involves an ongoing commitment to achieving perfection. Although the goal of perfection will never be reached, striving for improvement is important to the business culture. The process becomes one of setting higher and higher standards in the continual pursuit of improvement. Japanese business culture applies the term *kaizen* to describe this process. 'Zero defects' is also a term used by some businesses.

SUMMARY

- Technology is the application of science or knowledge that enables people to do new things or perform established tasks in new and better ways.
- Business technology involves the use of machinery and systems that enable businesses to undertake the transformation process more effectively and efficiently.
- Office or administrative technologies include a range of computer, communications devices and software applications.
- Manufacturing technologies include:
  - robotics: a programmable machine capable of doing several different tasks
  - computer-aided design (CAD): a computerised design tool that creates products from a series of input parameters
  - computer-aided manufacturing (CAM): software that controls manufacturing processes
  - 3D printing: allows a digital design to make an actual product through the use of polymers and other materials.

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Syllabus area 1
Topic 3
Concept 7

Monitoring, control and improvement
Summary screen and practice questions

- Task design — classifying job activities so that employees can successfully perform and complete the task — is an essential aspect of transformations processes.
- Task design involves job analysis and can be done after a skills audit has been conducted.
- There are three different forms of layout for manufacturing plants.
  - Process layout: machines and equipment are grouped together by the function (process) they perform.
  - Product layout: machines and equipment relate to the sequence of tasks performed in manufacturing a product, for example assembly line arrangement.
  - Fixed position layout: employees and equipment come to the product.
- Modern office layout uses a workstation arrangement and in many cases an open office format.
- All operations should be monitored against KPIs for their effectiveness.
- Control occurs when corrective action is taken if there is a discrepancy between performance and goals.
- Improvements lead to reduction in inefficiencies such as bottlenecks.
- Continuous improvement involves ongoing commitment to achieving perfection.

EXERCISE 3.4 REVISION

1 **What** is the difference between technology and business technology?
2 **How** does technology improve the transformation process in the (a) manufacturing sector and (b) service sector?
3 **State** two benefits and two costs of manufacturing technology.
4 **Why** is robotics set to be used increasingly by businesses?
5 **Identify** two benefits and two costs of robotics.
6 **Match** each term with the correct definition.

Term	Definition
Computer-aided design (CAD)	(a) software that control manufacturing processes
Robotics	(b) a computerised design tool that allows businesses to create possibilities from a series of input parameters
Computer-aided manufacturing (CAM)	(c) highly specialised forms of technology capable of complex tasks allowing a degree of precision and accuracy unmatched by human labour
3D printers	(d) allow a digital design to make an actual product through the use of polymers and other materials

7 **Detail** how technology can be used to optimise the transformation process in large-scale businesses. Include the terms 'computer-aided design', 'computer-aided manufacturing' and 'robotics' in your answer.
8 **What** is task design and **why** is it important?
9 Look closely at table 3.1. Use it and your own knowledge to **summarise** the steps involved in the task design process.
10 **Why** does Flight Centre carefully plan the layout of its stores?
11 **What** are the most important factors to consider when determining which layout to use?
12 Consider the layout of the last three stores you have visited. **State** which aspects of layout enhanced the customer experience and which could be improved.

13 **Distinguish** between process layout and product layout.

14 **Which** form of layout would suit the building of a bridge across a wide river and **why**?

15 **Outline** the usual layout for an office.

16 **Define** each of the following terms: monitoring, control and improvement.

17 **How** would you monitor the performance of a retailer? **Support** your answer with reference to relevant examples.

18 From the list of KPIs shown in section 3.3.6 select which two you consider to be the most important. **Justify** your selection.

19 **Explain** why controls are important in the operations process.

20 **Outline** two corrective actions you could implement if sales returns and warranty claims were increasing.

21 (a) **What** would happen if a person visited a store to buy an item they wanted and the store had run out of stock?
(b) **Propose** two improvements you would implement to overcome the bottlenecks in supply that lead to lost sales.

22 **Recommend** why a business should always strive for continuous improvement.

23 **How** can a business improve both its (a) quantity and (b) efficiency?

EXERCISE 3.4 EXTENSION

1 **Demonstrate** how the use of technology can increase speed, accuracy and overall quality of the transformation process.

2 **Compare** the types of technology Telstra and Toyota use. **Explain** why the technologies they use are different.

3 'Costs are high, people seem expendable and the work environment is too clinical — apart from that technology is wonderful!' **Discuss**.

4 **Investigate** the operations needs that influence:
(a) process layout
(b) product layout
(c) fixed position layout.

5 Gemma has recently bought a fitness centre. She plans to renovate the premises and change the layout of the equipment. **Determine** the most suitable layout and **justify** your recommendation. **Create** a sketch for Gemma of the recommended layout. You may wish to use a multimedia application.

6 **Evaluate** the role of monitoring and controlling when it comes to creating improvements in transformation processes.

on Resources

- Weblink: Telstra
- Weblink: Toyota

BizWORD

Outputs *refer to the end result of the business efforts — the good or service that is provided or delivered to the customer.*

3.4 Outputs

Essentially **outputs** are the result of a business's efforts — the final good or service that is delivered or provided to the consumer (see section 1.1). So far, we have drawn a distinction between service and manufacturing operations; but in many cases, businesses carry out both types of operation. Mazda Australia, for example, separates its vehicle manufacturing operation from its customer service operation, although both elements are critical to the business's overall success. The operations manager must be able to link transformation processes to the activities performed by other areas of the business. Output must always be responsive to customer demands. Issues of quality, efficiency and flexibility must be balanced against the resources and strategic plan of the business.

The most obvious output of the operations process is the goods made or services provided. However, there are other, more subtle outputs. Customer service refers to how well a business meets and exceeds the expectations of customers in all aspects of its operations. Warranties are businesses' promises to correct any defects in their products or in the services they deliver. Combined, customer service and

warranties imply that the inputs and transformations processes are subject to scrutiny as the outputs will be assessed by consumers.

3.4.1 Customer service

You will recall from chapter 1 that a customer focus increasingly shapes operations processes. This means that inputs, transformations processes and outputs are all aimed at meeting or exceeding customer expectations. In its totality, this is **customer service**. If a customer expresses dissatisfaction with a product on account of it being defective, not meeting quality expectations, finds wait times/lead times too long or returns the product or makes a warranty claim, then the operations processes need review.

BizWORD

Customer service *refers to how well a business meets and exceeds the expectations of customers in all aspects of its operations.*



FIGURE 3.18 Customers are the life-blood of any business. Without a customer base, a business will not be able to survive. Customer service, therefore, should always be of prime concern for any business.

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Syllabus area 1
Topic 3
Concept 8

Outputs of transformations processes
Summary screen and practice questions

Central to customer service is to make sure the right good or service is delivered or provided at the right place at the right time. Recent market research has shown that businesses that provide superior customer service can:

- charge an average of 10 per cent more for the same goods and services
- grow twice as fast as their competitors
- increase their market share and profits.

To keep existing customers and attract new ones, the business needs to talk and listen to the customers — research has shown that one dissatisfied customer usually tells 11 others, who in turn will tell another five.

Customer service can no longer be regarded as merely explaining the refund policy or providing a complaints department. Rather, it is an attitude that should be adopted by all departments and employees within the business. Exceeding customers' expectations is likely to be the key in developing long-term customer relationships. Of course, such services must be able to be delivered. Failure to do so will drive customers away.

BizFACT

The word 'customer' in Japan translates to mean 'honoured guest'. Australian businesses must remember that an 'honoured guest' will lead to repeat sales.

3.4.2 Warranties

A good way to assess the effectiveness of operations processes is to measure the number of **warranty** claims. Warranty claims are made against goods that have defects

BizWORD

A **warranty** *is a promise made by a business that they will correct any defects in the goods they produce or services they deliver.*

arising from an issue in transformation. Although a small proportion of warranty claims are false, the number of claims made against a business on a particular product line or product range will give an indication of problems in the processing. Consider the example of the 2016 and 2017 recall of cars carrying Takata airbags and sold in Australia. The recall of tens of thousands of cars led to the replacement of the faulty bags. However, the rectification costs money. Operations managers need to trace the source of the fault in manufacturing and rectify it. In this way, the warranty claims lead the business to improve transformation processes.

SUMMARY

- The outputs of transformations processes include:
  - the goods made or services provided
  - customer service
  - warranties.
- Customer service refers to how well a business meets or exceeds the expectations of consumers.
- Exceeding customers' expectations is likely to be the key in developing long-term customer relationships.
- Warranties are an agreement to fix defects in products. An assessment of warranty claims can help a business to adjust transformations processes so that they become more effective.

EXERCISE 3.5 REVISION

1 **List** the three outputs of an operations process.
2 **What** is the aim of customer service?
3 'Businesses that offer high levels of customer service have a much greater chance of success.' **Explain** why this is so.
4 **Describe** how customer service influences operations processes.
5 If good customer service is so important to the success of a business, **investigate** why customers often complain about the level of service they receive. Share your answer with the rest of the class.
6 **Why** is measuring the number of warranty claims a good way to assess the effectiveness of operations processes?
7 **Research** the recall of cars carrying Takata arbags. With reference to Takata and consumer warranties, **explain** the importance of honouring warranties to business success.

EXERCISE 3.5 EXTENSION

1 **Analyse** the effect of customer service on inputs, transformation processes and outputs.
2 From your own experience, **demonstrate** a business that offers (a) exceptional customer service and (b) poor customer service.
3 Using information from the **Australian Competition and Consumer Commission (ACCC)** website, **distinguish** between 'express warranty', 'manufacturer's warranty' and 'extended warranty'.

on Resources

- **Digital doc:** Chapter summary (doc-24805)
- **Interactivity:** Chapter crossword (int-7153)
- **Interactivity:** Multiple choice quiz (int-7154)
- **Weblink:** Australian Competition and Consumer Commission (ACCC)

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