



GOPM 511

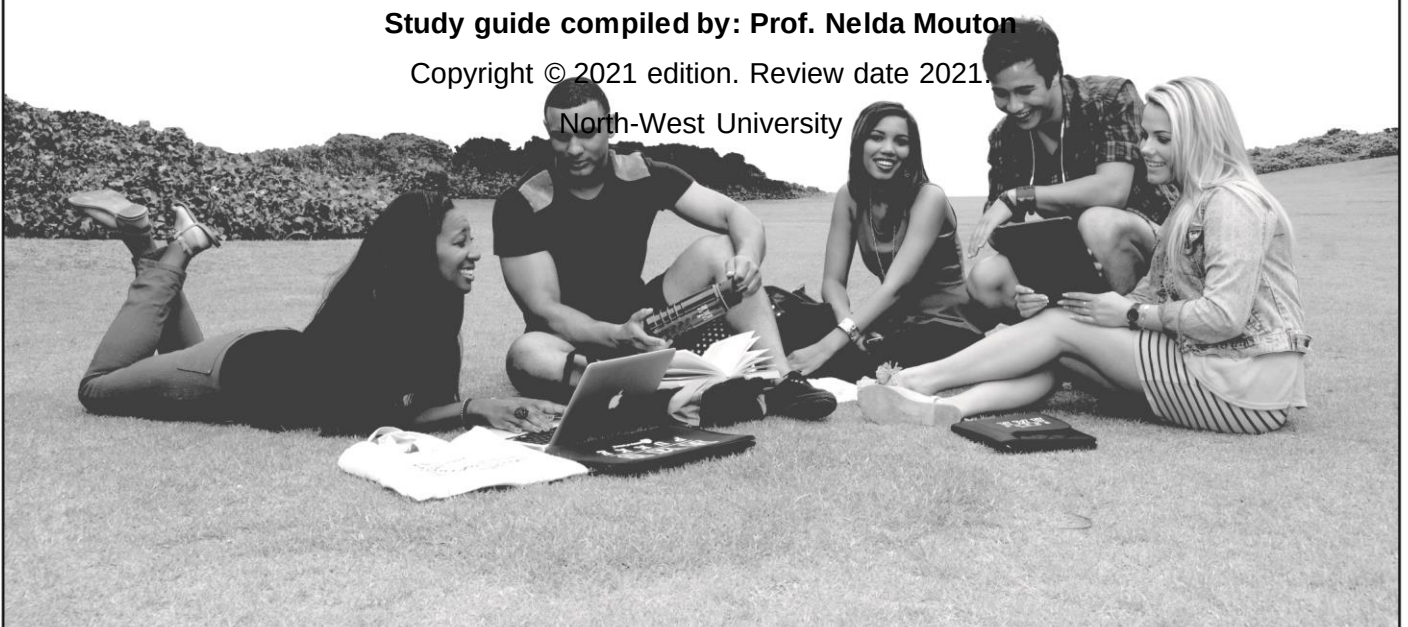
OPERATIONS MANAGEMENT

Faculty of Economic and Management Sciences

Study guide compiled by: Prof. Nelda Mouton

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North-West University



It all starts here

- Ranked in the top 5% of universities globally by the QS-rankings
- Contribute the second largest number of graduates annually to the labour market

Dit begin alles hier

- As een van die top 5% universiteite wêreldwyd deur die QS-ranglys aangewys
- Lewer jaarliks die tweede meeste graduandi aan die arbeidsmark

Gotlhe go simolola fano

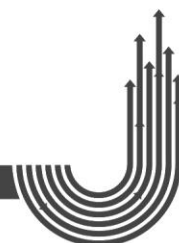
- Re beilwe mo gare ga diyunibesiti tse 5% tse di kwa godimo go ya ka peo ya maemo ya QS
- Ngwaga le ngwaga go abelwa palo ya bobedi ka bogolo ya badiri mo maketeng ya badiri

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Module information

Module code	GOPM 511
Module credits	12
Module name	Operations Management
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Consulting hours	On appointment via email

A word of welcome

I wish to extend a warm welcome to you in this module called Operations Management (GOPM 511). It is a 12-credit module, which implies that you will need approximately 120 hours of study to complete the module successfully. I trust that you will not only find the learning programme stimulating, useful and relevant, but also truly enjoyable. This module is designed to improve your knowledge and skills regarding the complex issue of operation management in any organisation. In the process you will gain the necessary insight into operations management, sustainability and supply chain management. You are cordially invited and encouraged to take part in every learning activity and opportunity provided in this module.

What does GOPM 511 entail?

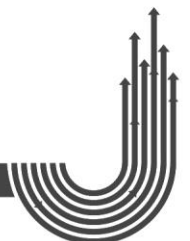
Operations management encompasses those activities designed to direct and coordinate the operations management functions within an organisation. This module is designed to increase your knowledge and insight into assessing the requirements for making decisions related to each part of the operations function in any organisation. This module deals with taking effective managerial decisions in order to ensure the effective utilisation of resources, and to understand how operations management decisions can influence the overall strategic objectives of an organisation. Case studies, video clips and practical exercises will be used to illustrate the different operations strategies and to explain how these operations strategies are developed.

Work programme

The work programme will also be available on e-fundi.

Note: Dates may be subject to change but it will be indicated on efundi.

Date	Lesson	Chapter	Heading	PoE	Assessment	Allocated point	Due date
15 Feb				PoE 7	E-fundi Introduction	10	20 March
				PoE 8	Group allocation and group introduction	10	30 March
15 Feb	1	1	Operations and productivity				20 March
1 March	2	2	Operations strategy in the global environment	PoE 1	Paragraph	20	20 March
15 March	3	6	Managing quality (and TQM)	PoE 2	Group assignment	40	10 June
5 April	4	4	Forecasting	PoE 3	Interview	20	14 May
19 April	5	12	Inventory Management/	PoE 4	Test	10	21 May
3 May	6	16	Lean Management (JIT)	PoE 5	Case study (This will cover all lessons from 1-8)	60	25 June
17 May	7	13	Aggregate Planning				
31 May	8	10	HR, job design and organisational effectiveness	PoE 6	Multiple choice	30	20 June
					POINTS (TO BE CONVERTED TO PERCENTAGE)	200	



Study material

This module will serve as your learning base, guiding you through the learning process. It will provide you with the necessary background information and will integrate all the elements of the learning process in this module.

Prescribed Textbook

- Heizer, J., Render, B. & Munson, C. 2017. *Operations Management. Sustainability and Supply Chain Management. 12th Edition*. Pearson:New Jersey (p.907). (ISBN 978 0 13 413042 2). .(Any edition will do.)

Action words

The following action verbs are regularly used during assessment and in the Study Guide. This list is provided so that you can know what is expected from you when that action verb is used in a question or assignment. The action verb also indicates whether lower or higher order cognitive skills are required to answer the question or assignment. Therefore, you have to make sure that you know the meaning of every action word very well!

- **Describe**
Give an exact description of a certain phenomenon, the characteristics of a concept or an explanation of how something works. No own opinion or argument is required.
(e.g. Describe what the management process consists of ?)
- **Discuss**
Argue the issue or phenomenon by means of existing literature. Reach a conclusion, which you have to write down in your own words. A critical discussion may include the following:
E your own interpretation of the phenomenon; and
E an indication of the relationships and differences in existing arguments about the phenomenon.
(E.g. discuss the management role of a manager pertaining the following criteria.....)
- **Explain**
Explain a concept or phenomenon insightfully and in your own words. You must prove that you understand the concept and that you are able to show the relationship between the different variables. The use of examples or illustrations is recommended.
(e.g. Explain at the hand of relevant examples the project life cycle of a business)
- **Motivate/substantiate**
Provide reasons or criteria for the point of view you hold regarding a specific matter. Your motivation must follow a logical line of argument and should be stated very clearly.
(e.g. Motivate your answer with relevant examples from the business environment)
- **Evaluate**

Air your view regarding the pros and cons of a specific concept/idea/process. You should also be able to indicate why, based on your theoretical knowledge, you evaluate a specific idea/concept/process positively or negatively.

(e.g. Evaluate the location strategies of companies in different markets, products and provinces)

- **Criticise**

Give critique on someone else's work. This means that you have to highlight the strengths and weaknesses of the work, based on your knowledge and proven by research conducted on the specific matter.

(e.g. Criticise the following statement about marketing and provide your own input)

- **Distinguish**

When you have to distinguish you have to show the characteristics that are unique to an issue. You have to establish relevance with other issues. A distinction may be done in table or paragraph format.

(e.g. Distinguish the business partner characteristics of a start-up business)

- **Analyse**

When analysing, you have to identify the main elements of a matter and describe each of these core elements.

(e.g. Analyse the following data pertaining the fixed and variable costs and answer the following questions)

- **Design**

When you need to design, you have to create something new. If, for instance, you are asked to design a questionnaire, you have to create a unique questionnaire, which meets your requirements.

(e.g. Design a better communication reporting channel network for the following medium sized business enterprise)

- **Investigate**

When you are asked to investigate, you should be able to describe a specific matter by means of research that has been conducted in this regard, consult relevant literature or utilise any other source of information.

(e.g. Investigate the following phenomenon in project managers' duties in the South African business environment)

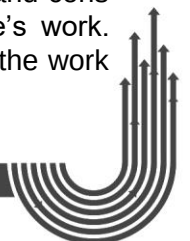
- **Report**

When you have to report on a matter, it means that you have to demonstrate your communication skills. The format in which you should do the reporting will be communicated to you by the lecturer. This may be in written, oral or visual format. This means that you have to communicate to others the knowledge you have gained, in a specific format.

(e.g. Report on the annual budget speech and provide any inputs from your side)

- **Critically evaluate**

Here you are not only expected to state your opinion regarding the pros and cons of a specific concept/idea/process. You also have to criticise someone's work. You must state the pros and cons, the strengths and the weaknesses of the work



based on your knowledge and proven by research that has been conducted on the specific matter.

(e.g. Critically evaluate the following case study and redesign the operations managers' role in improving efficiency and effectiveness)

- **Demonstrate**

The skill to demonstrate may be multidimensional. Normally you will be guided by the way in which a demonstration should take place. In this module demonstrate means that you need to provide an extensive explanation for a specific matter AND that you need to prove your explanation by means of real life examples.

(e.g. Demonstrate the importance of the PERT-principle in project management, with relevant examples)

- **Interpret**

Interpret means that you should state/explain a matter within a specific context. When you interpret, you normally say what something means within that specific context.

(e.g. Interpret the following statement, and discuss the relevance pertaining to operations management)

Continuous Assessment

As there is no examination in Operations Management, you are only requested to complete a Portfolio of (PoE) throughout the semester.

See workprogramme on page 5.

The following rules will apply:

- If you submit late for a 10 marks question (due to other responsibilities, load shedding, efundi, etc.) you miss the opportunity and get 0.
- If you submit late for a 20 mark question, you may request on efundi to submit (no emails please), and if approved you will forfeit 50% of the mark.
- You need to complete all the questions and obtain a 50% final mark to pass the module.
- Note: There is not a second or third opportunity for this module. A special opportunity may be considered in some cases.
- You have to work throughout the semester and therefore you will be allocated marks for ongoing work done.

Examination

There will not be any exam in this module as you need to complete a Portfolio of Evidence throughout the semester in online format.

Module mark

You need 50% for you PoE (all 7 questions) to pass the module. If you get 40% for the semester you may be granted a special opportunity examination where you will write a 3 hour online examination that will only be marked up to 50% for this module.

Module outcomes

On completion of this module students should be able to:

- identify the elements, purpose and scope of Operations Management (OM) and to understand how to improve Productivity in an organisation;
- identify a strategy that will assist your organisation to achieve a Competitive Advantage through operations;
- explain and apply the concepts underlying Total Quality Management (TQM) and defining the Costs associated within an organisation in the service industry;
- identify the features common to all Forecasts and to differentiate between quantitative and qualitative forecasting techniques;
- identify and define the Life Cycle of a product and understanding the Design Process of new product opportunities;
- identify and define the different Process Strategies and the various techniques used in improving the process strategy of an organisation, also explaining the different factors that determine effective Capacity;
- recognise the general procedure for making Location Decisions and the factors affecting these decisions, identifying modern trends in location strategies and understanding methods of evaluating location alternatives in an service organisation;
- explain the importance of Human Resources within operations management, identify and defining Job Design, Job Specialisation and Job Expansion opportunities in an organisation;
- identify and define the underlying elements of Supply Chain Management (SCM), explain whether to purchase or to produce a product;
- identify the requirements for effective Inventory Management and determining the Costs associated with inventory, to list the benefits of a JIT system within an organisation;
- explain how Aggregate Scheduling is done and to identify the demand and capacity options Operation Managers have at their disposal;
- provide an overview of the Materials Requirements Planning (MRP & MRP II) concepts, explain what a Master Production Schedule (MPS) is; and
- identify and define a Project, understanding the different elements of a project, defining the role and characteristics of a project manager.

General overview of this study guide

It is important that you achieve the outcomes of every study unit. To succeed in doing this, you are expected to work through every study unit in preparation for class on your



own (or as part of a group) in order to construe your own knowledge, develop skills and take part in discussions and debates in class. The role of the lecturer is that of facilitator, which means that he/she will only guide the learning process. It also means that the lecturer will not actually enter into knowledge component of this module. It is your responsibility.

Only in the case of difficult theoretical aspects will the lecturer enter the learning process and support you in achieving the outcomes yourself. Another function of the lecturer is to support you in the development of your skills with the aid of this Study Guide. The skills, which are referred to here, include cognitive skills such as the solving of problems and higher order cognitive skills.

At the end of this module you will, therefore, have the ability to analyse, synthesise and evaluate within the context of this module; in other words, be able to think in a critical and creative manner

Icons



Time allocation



Study material



Individual exercise



Example



Learning outcomes



Assessment /
Assignments



Group Activity



Reflection

Warning against plagiarism

ASSIGNMENTS ARE INDIVIDUAL TASKS AND NOT GROUP ACTIVITIES. (UNLESS EXPLICITLY INDICATED AS GROUP ACTIVITIES)

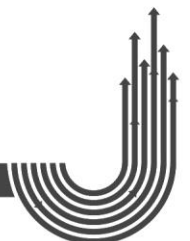
Copying of text from other learners or from other sources (for instance the study guide, prescribed material or directly from the internet) is **not allowed** – only brief quotations are allowed and then only if indicated as such.

You should **reformulate** existing text and use your **own words** to explain what you have read. It is not acceptable to retype existing text and just acknowledge the source in a footnote – you should be able to relate the idea or concept, without repeating the original author to the letter.

The aim of the assignments is not the reproduction of existing material, but to ascertain whether you have the ability to integrate existing texts, add your own interpretation and/or critique of the texts and offer a creative solution to existing problems.

Be warned: students who submit copied text will obtain a mark of zero for the assignment and disciplinary steps may be taken by the Faculty and/or University. It is also unacceptable to do somebody else's work, to lend your work to them or to make your work available to them to copy – be careful and do not make your work available to anyone!

For the NWU link for plagiarism, go to http://www.nwu.ac.za/webfm_send/25355





Study unit 1

OPERATIONS AND PRODUCTIVITY

Study hours



You will need approximately 10 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- define and outline the underlying concepts of operations management;
- explain the distinction between goods and services;
- explain the difference between production and productivity;
- calculate single-factor and multifactor productivity; and
- identify the critical variables in enhancing productivity of an organisation

Study material



Chapter 1: Operations and Productivity.

1.1 Background

Important information

The field of Operations Management has expanded since the late 1990's. A manager in a manufacturing concern is no longer responsible for only pure manufacturing. Responsibilities such as supply chain management, inventory management, basic maintenance, and many other areas are part and parcel of the daily tasks performed by an operations manager. The principles used in manufacturing can also be used in a service industry, whether it is a doctor's practice, a fast-food restaurant, or a hospital. Tasks such as scheduling, inventory management, and many others performed in manufacturing must also be performed in the service industry.

The recent development of the service industry (for example financial services, health-service provision, entertainment, and tourism-related services), underlined the need for

a new understanding of the operations management field. In this section we are going to explore the term 'operations management' to understand how it evolved to meet the changes that have happened in the past 15-25 years.

1.2 Key words and concepts

- Production - The creation of goods and services
- Operations Management (OM) - Activities that relate to the creation of goods and services through the transformation of inputs to outputs
- Operations function – The arrangement of resources that are devoted to the production and delivery of products and services
- Operations managers – The staff of the organisation who have particular responsibility for managing some or all of the resources which comprise the operation's function
- Supply chain – A global network of organisations and activities that supplies a firm with goods and services
- Process – An arrangement of resources that produces some mixture of goods and services
- Services – Economic activities that typically produce an intangible product (such as education, entertainment, lodging, government, financial, and health services)
- Service sector – The segment of the economy that includes trade, financial, lodging, education, legal, medical, and other professional professions
- Tangibility – The main characteristic that distinguishes products (usually tangible) from services (usually intangible)
- Productivity – The ratio of outputs (goods and services) divided by one or more inputs (such as labour, capital, or management)
- Single-factor productivity – Indicates the ratio of one resource (input) to the goods and services produced (outputs)
- Multifactor productivity – Indicates the ratio of many or all resources (inputs) to the goods and services produced (outputs)
- Productivity variables – The three factors critical to productivity improvement – labour, capital, and the art and science of management
- Volume – The level or rate of output from a process, a key characteristic that determines process behaviour
- Variety – The range of different products and services produced by a process, a key characteristic that determines process behaviour
- Variation – The degree to which the rate or level of output varies from a process over time, a key characteristic in determining process behaviour
- Visibility – The amount of value-added activity that takes place in the presence of the customer, also called customer contact
- Standardisation – The degree to which processes, products or services are prevented from varying over time
- Knowledge society – A society in which much of the labour force has migrated from manual work to work based on knowledge
- Stakeholders – Those with a vested interest in an organisation, including customers, distributors, suppliers, owners, lenders, employees, and community members



1.3 What is Operations Management?

Operations Management (OM) is a discipline that applies to virtually all productive enterprises. It doesn't matter if the application of goods and services is in an office, a hospital, a restaurant, or a factory, the production of goods and services requires OM.

Operations Management is the set of activities that creates value in the form of goods and services by transforming inputs into outputs. In manufacturing firms the production activities creates goods (tangible), which the consumer buys to enrich his life. Some organisations does not produce goods, but renders a service (intangible), these service can include the transfer of funds from a cheque account to a savings account, or medical services provided in hospital, or the education of a student.

1.4 Importance of Operations Management

All good managers perform the basic functions of the management process. The management process consists of planning, staffing, leading, organising and controlling. Operations managers apply this generic management process to the decisions they make in the OM function. Thus, OM is important because;

- OM is one of the three major functions of any organisation, and it is integrally related to all the other business functions. All organisations market (sell), finance (account), and produce (operate). Therefore, we study how people organise themselves for productive enterprise.
- We study OM because we want to know how goods and services are produced. The production function is the segment of our society that creates the products we use every day.
- It is important to understand what operations mangers do. By understanding what these operations managers do, we can identify the necessary skills necessary to develop as a professional in OM. This enables us to explore the numerous career opportunities in OM.
- Lastly, OM is a costly part of any organisation. OM provides the opportunities for organisations to improve its profitability and enhance its service to society.

The importance of OM in any organisation can't be emphasised enough. Organisations need to be more productive and efficient in their everyday business by constantly developing and better their OM. This will ensure a competitive position in the world of business.

1.5 What Operations Managers Do

Operations managers manage all the processes and activities leading to the production of goods and services. Operations managers apply this management process to the decisions they make in the OM function. The 10 strategic OM decisions are listed as followed;

Decision area	Issues
1. Design of goods and services	What product or service should the organisation offer?

	How should these products or services be design?
2. Quality management	Who is responsible for quality and how do we define the quality in our product or services?
3. Process and capacity design	What equipment and technology is necessary for these processes?
4. Location strategy	What is the best possible location for the facility?
5. Layout strategy	What is the best possible arrangement within the facility?
6. Human resources and job design	The provision of a friendly, safe and productive work environment
7. Supply-chain management	Should we make or buy the components needed in the manufacturing process? is the suppliers sufficient?
8. Inventory management	How much inventory is needed?
9. Scheduling	Any subcontractors needed?
10. Maintenance	Who is responsible for maintenance?

1.6 The history of Operation Management

Textbook reference:

Even though OM is a relatively young field of management, it does have a rich history. Developments over the last few years have enlarged the responsibilities of production managers to include the management of services and the supply chain, and the term '*operations management*' has been coined to encompass these changes. The following history periods outlines the significant events in OM.

The early concepts (1776 – 1880)

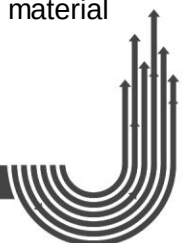
These years saw the height of the Industrial Revolution and many inventions that transformed the world. Labour specialisation and standardised parts were the main theme applied in factories for the first time.

Scientific management era (1880 – 1910)

In this period, Gantt charts was introduced as loading and scheduling aids, time-and-motion studies were introduced to help with process analysis to determine whether a process was functioning optimally, the queuing theory determined how long a job would spend in production.

The era of mass production (1910 – 1980)

In this era, the moving assembly was introduced in the manufacturing process, statistical sampling was used in quality management, economic order quantity models was also introduced to determine the correct amount for ordering materials, linear programming, programme evaluation and review (PERT) and critical path method (CPM) was introduced to determine the optimal loads for shipping and freight, material requirements planning (MRP) also appeared during this period.



The era of lean production (1980 – 1995)

In this period the Just-in-Time (JIT) principles and computer-aided design (CAD) evolved. Electronic data interchange (EDI) improve computer applications. Total quality management (TQM) became more widely used to produce goods and services of better quality.

The era of mass customisation (1995 – 2005)

In this period, globalisation became the norm for all organisations. The focus was on addressing the needs of the customer. With the arrival of the internet and e-commerce, organisations fast changed the way in which they do business. The business world saw the introduction of Enterprise resource planning (ERP), International quality standard (ISO), Scheduling, Supply-chain management, Mass customisation and Build-to-order.

Globalisation era (2005 – 2020)

This era is reknown to employ elements of Global supply chains, Transnational organisations, Improved communication media, sustainability, application of ethics in the workplace and improve logistical support.

1.7 Operations for Goods and Services

Textbook reference:

The service sector is defined differently by different people. Because definitions vary, much of the data and statistics generated about the service sector are inconsistent. However, we will define services as including repair and maintenance, government, food and lodging, transportation, insurance, trade, finance, real estate, education, legal, medical, entertainment, and other professional occupations.

1.7.1 Growth of services

Services constitute the largest economic sector in the postindustrial societies. Untill about the 1900, most of the workforce were employed in argiculture. With the increased agricultural productivity, people left the farms and seeked employment in the cities. (see table 1.5 in textbook, pp 48 for further reading).

1.7.2 Diferences between goods and services

There are many differences between goods and services that impacts on OM decisions. Although service products are different from goods, the operations function continues to transform resources into products. Indeed, the activities of the operations function are often very similar for both goods and services. For instance, both goods and services must have quality standards established, and both must be designed and processed on a schedule, in a facility where human resources are employed.

Differences between Goods and Service).

Attributes of Goods	Attributes of Services
Tangible product	Intangible product

Product can be resold/re-used	Reselling a service is unusual/once-off
Product can be inventoried	Many services cannot be inventoried
Site of facility is important for cost	Site of facility is important for customer contact
Often easy to automate	Service is often difficult to automate
Revenue is generated from the tangible product	Revenue is generated from intangible services
Some aspects of quality are measureable	Many aspects of quality are difficult to measure
Selling is distinct	Selling is often a part of the service
Product is transportable	Provider, not product, is often transportable

1.8 Productivity

Productivity is the conversion of raw materials into finished goods that can be used by the customer. Productivity is a ratio of the output (products/services) divided by the input (resources/hours) needed

$$\text{PRODUCTIVITY} = \frac{\text{OUTPUTS}}{\text{INPUTS}}$$

1.8.1 Productivity measurement

The measurement of productivity can be quite direct. Although labour-hours are the common measure of input, other measures such as capital, materials, or energy can be used. Please see the following example;

Marcouse Plastics makes 5,000 widgets each month. Total monthly labour hours are 1,250. What is labour productivity (hours per unit)?

Labour productivity =

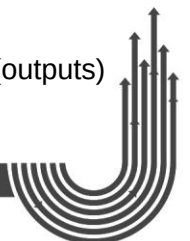
Labour hours per month (1,250)

Units produced per month (5,000)

= 0.25hrs / unit

1.8.1.1 Single factor productivity

Indicates the ratio of one resource (input) to the goods and services produced (outputs)



$$\text{Productivity} = \frac{\text{Units produced}}{\text{Labor-hours used}}$$

1.8.1.2 Multifactor productivity

It indicates the ratio of many or all resources (inputs) to the goods and services produced (outputs).

$$\text{Productivity} = \frac{\text{Output}}{\text{Labor} + \text{Material} + \text{Energy} + \text{Capital} + \text{Miscellaneous}}$$

1.8.2 Productivity variables

Productivity increases are dependent on three productivity variables;

- Labour
- Capital
- Management

1.8.2.1 Labour

Improvement in the contribution of labour to productivity is the result of a healthier, better-educated, and better-nourished labour force. (e.g. A bricklayer can lay 500 bricks per day. After improving the method, he can now lay 700 bricks per day. This is an increase of 40%)

1.8.2.2 Capital

Human beings are tool-using animals. Capital investments provide better, efficient working tools, which increase productivity of the workforce. (e.g. A forming press has a process time of 7 minutes and a load and unload time of 3 minutes. For every hour, 6 units can be produced. With an improved load and unload method, we may be able to reduce the time to 1 minute. Now production rises to 7.5 units per hour, with an increased productivity of 25%)

1.8.2.3 Management

Management is a factor of production and an economic resource. Management is responsible for ensuring that labour and capital are effectively used to increase productivity. This increase includes improvements made through the use of knowledge and the application of technology.

1.8.3 Improving productivity

There are a number of ways to improve productivity;

- Develop productivity measures for all operations, measurement is the first step in managing and controlling an operation
- Consider a system as a whole in deciding which operations to concentrate on. Find bottleneck operations in the system and try to improve them
- Develop methods for achieving productivity improvements such as getting ideas from the workers, studying how other companies have improved productivity and re-examining the way work is done
- Establish reasonable goals for improvement
- Obtain support of top management
- Measure improvements and publicize them

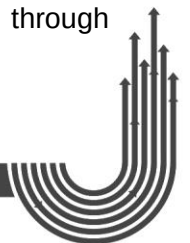
1.9 Challenges in Operation Management

Textbook reference: Chapter 1, pp 56

- **Global focus** – the rapid decline in communication and transportation costs has made markets more global. Resources in the form of labour, capital, materials, and talent are now globally available.
- **Supply-chain partnering** – shorter product life cycles, demanding customers, and fast changes in technology, materials, and processes require supply-chain partners to be in tune with the needs of end users.
- **Sustainability** – operations managers are constantly trying to improve productivity through designing products and processes that are ecologically sustainable.
- **Rapid product development** – technology combined with rapid international communication of news, entertainment, and lifestyles is dramatically chopping away at the life span of products.
- **Mass customisation** – in a world where consumers are increasingly aware of innovation and options, substantial pressure is placed on firms to respond in a creative way.
- **Just-in-time performance** – inventory throughout the supply chain requires financial resources, hides quality issues, and constrains response to ever-shorter product life cycles.
- **Empowered employees** – the knowledge explosion and a more technical workplace have combined to require more competence in the workplace. OM is responding by enriching jobs and moving more decision making to the individual contributor.

Summary of main learning points

In this chapter we are introduced to the concept of Operations Management, and how inputs are transformed into outputs. Certain key definitions in the field of OM are presented and explained. The importance of OM in today's organisations is discussed and the role which operations managers play in improving productivity through managing sustainable work environments.



Study unit 2

OPERATIONS STRATEGY IN THE GLOBAL ENVIRONMENT

Study hours



You will need approximately 10 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- better understand and define the mission and strategy of an organisation,
- identify and explain the three strategic approaches in insuring competitive advantage in an organisation,
- understand the significance of key success factors and core competencies,
- understand the importance of global operations, and
- define how global issues affect service operations.

Study material



Chapter 2: The Global environment and Operations Strategy

2.1 Background

No organisation can plan in detail every aspect of its current or future actions, but all organisations need some strategic direction and so can benefit from some idea of where they are heading and how they could get there. Once the operations function has understood its role in the business and after it has articulated its performance objectives, it needs to formulate a set of general principles which will guide its decision making. This is the operations strategy of the company. The concept of strategy itself is not straightforward, neither is operations strategy.

2.2 Key words and concepts

- Mission – The purpose or rationale for an organisation's existence.
- Strategy – How an organisation expects to achieve its missions and goals.
- Competitive advantage – The creation of a unique advantage over competitors.
- Differentiation – Distinguishing the offerings of an organisation in a way that the customer perceives as adding value.
- Experience differentiation – Engaging a customer with a product through imaginative use of the five senses, so the customer “experiences” the product.
- Response – A set of values related to rapid, flexible, and reliable performance.
- Value-chain analysis – A way to identify those elements in the product/service chain that uniquely add value.
- Five forces model – A method of analysing the five forces in the competitive environment.
- SWOT analysis – A method of determining internal strengths and weaknesses and external opportunities and threats.
- Core competencies – A set of skills, talents, and capabilities in which a firm is particularly strong.
- Outsourcing – Transferring a firm's activities that have traditionally been internal to external suppliers.
- Theory of comparative advantage – A theory which states that countries benefit from specializing in goods and service in which they have relative advantage, and they benefit from importing goods and services in which they have a relative disadvantage.

2.3 Developing Missions and Strategies

Textbook reference:

Any organisation must have a mission so it knows where it is going and a strategy so it knows how to get there. This implies to any organisation, small or large. No organisation can plan in detail every aspects of its current or future actions, but all organisations needs some strategic direction and so can benefit from some idea of where they are heading and how they could get there.

2.3.1 Mission

Mission statement provides boundaries and focus for organisations and the concept around which a firm can rally. The mission states the rationale for the organisation's existence. A mission is thus purpose or rationale for an organisation's existence.

2.3.2 Strategy

Each functional area within an organisation has a strategy for achieving its mission and for helping the organisation reach the overall mission. These strategies exploit opportunities and strengths, neutralises threats, and avoids weaknesses. Operations managers are tasks in delivering goods/services that are better, cheaper and more responsive. A strategy is thus how an organisation expects to achieve its mission and goals.

2.4 Achieving Competitive Advantage through Operations

Textbook reference:

An organisation's strategies provide the opportunity for operations managers to achieve competitive advantage over competitors. The idea to create customer value in an efficient and sustainable way, creates a competitive advantage over competing organisations. The following methods can be used by operations managers to achieve competitive advantage.

2.4.1 Competing through Differentiation

Differentiation is concerned with providing uniqueness. A firm's opportunities for creating uniqueness are not located within a particular function or activity but can arise in virtually everything the firm does. Furthermore, differentiation should be thought of as going beyond both physical characteristics and service attributes to encompass everything about the product or service that influences the value that the customers derive from it. (E.g. is the Hard Rock Cafe, which differentiate itself by providing an "experience").

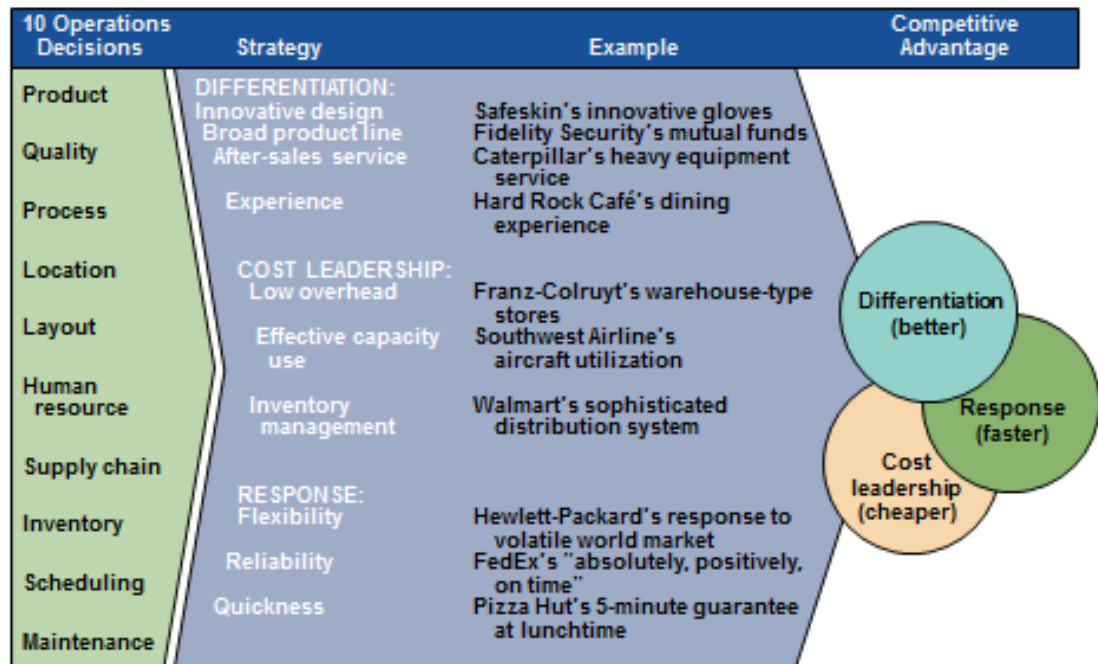
2.4.2 Competing on Cost

Low-cost strategy entails achieving maximum value as defined by your customer. It requires a relentless effort to drive down costs while meeting customers' expectations of value. A low-cost strategy does not imply low value or low quality. Example is Southwest Airlines in the USA, they cut operation cost by initialising the following; first-come, first served seating, smaller crews flying more hours, snack only or no-meal flights, etc.

2.4.3 Competing on Response

Response can be divided into three categories, flexible, reliability and quickness. Response can be defined as the entire range of values related to timely product development and delivery, as well as reliable scheduling and flexible performance. a good example is Hewlett-Packard that has demonstrated flexibility in both design and volume changes in the volatile world of personal computers. In practice, differentiation, low cost, and response can increase productivity and generate a sustainable competitive advantage. Proper implementation of the ten operations decisions will allow competitive advantages to be achieved. See table 2.1 below

OM's Contribution to Strategy



(Source: Heizer & Render, 2017:77)

2.5 Issues in Operations Strategy

Textbook reference: Chapter 2, pp 78

In addition to a competitive environment, the operations manager needs to understand that the firm is operating in a system with many other external factors. These factors range from economic, to legal, to cultural. These factors influence strategy development and execution and require constant scanning of the environment. See Figure 2.1 in the textbook for further reading.

2.6 Strategy Development and Implementation

Textbook reference:

2.6.1 Key Success Factors(KSF's) and Core Competencies

A successful strategy requires determining the firm's key success factors and core competencies. Key success factors are those activities that are necessary for a firm to achieve its goals.

2.6.2 Intergrating OM with other activities

Whatever the key success factors and core competencies, they must be supported by the related activities. The key success factors support operations and in turn are supported by other activities. The activities fit together and reinforce each other. The better the activities are integrated and reinforce each other, the more sustainable the competitive advantage.

2.6.3 Building and Staffing the organisation

Once a strategy, key success factors, and the necessary integration have been identified, it becomes important for the operations managers to group the activities into an organisational structure. This is the personnel who will get the job done, using their specialised skills, knowledge and professional talents.

2.6.4 Implementing the 10 strategic OM Decisions

The implementation of the 10 strategic operations management decisions is influenced by a variety of issues. These issues vary from product life cycle, product mix, and the competitive environment. Because each product brings its own mix of attributes, the importance and method of implementation of the strategic decisions will vary. See table 2.1 in the textbook pp 79.

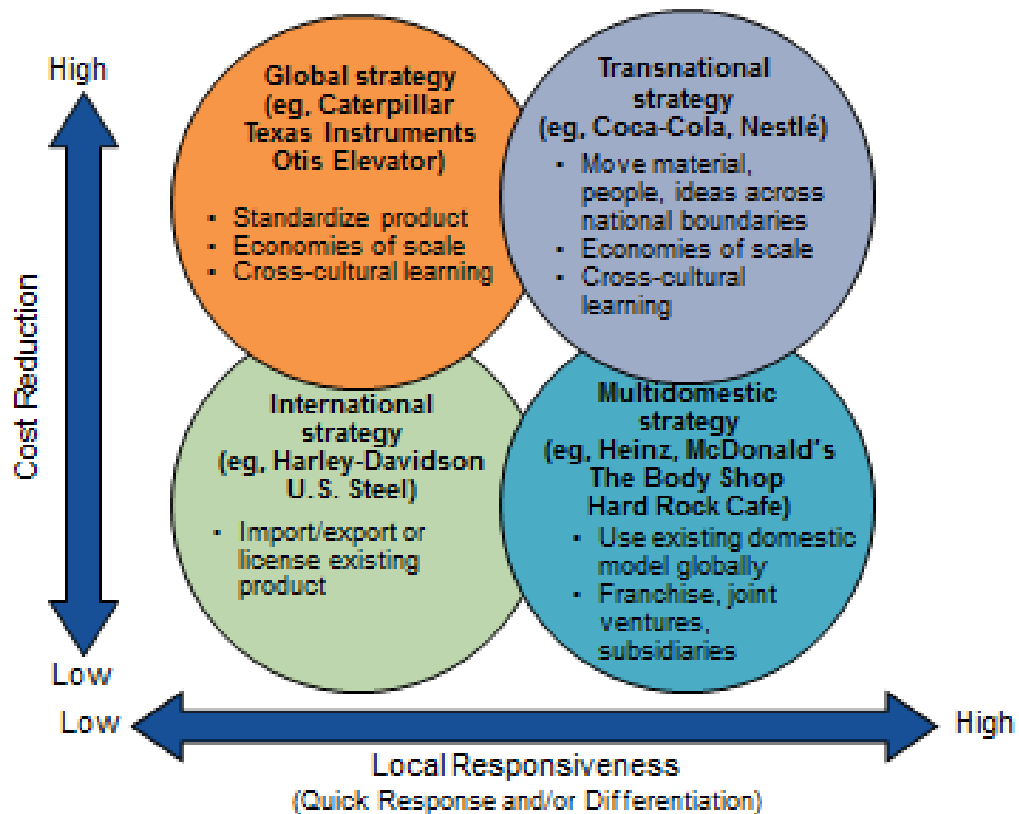
2.7 Global Operations Strategy Options

Textbook reference:

Operation managers of international and multinational firms approach global opportunities with one of four strategies;

- International,
- Multidomestic,
- Global, and
- Transnational.

In figure below the vertical axis represents the cost reduction and the horizontal axis the local responsiveness of the firm. Local responsiveness implies quick response and the differentiation necessary for the local market. The operations manager must know how to position the firm in this matrix for the best competitive advantage position over competing firms in the industry.



(Source: Heizer & Render, 2017:87)

Summary of main learning points

In this chapter we identified the challenges and opportunities for operations managers working in organisations operating in the global environment. Organisations identify their strengths and weakness, through which they develop effective missions and strategies, which complement the opportunities and threats in the environment. If this procedure is performed well, the organisation can have competitive advantage through some combination of product differentiation, low cost and quick response.



Study unit 3

TOTAL QUALITY MANAGEMENT (TQM)

Study hours



You will need approximately 10 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- define quality and total quality management (TQM)
- understand the different concepts of TQM
- identify the costs associated with quality
- apply and understand the seven tools of TQM
- comment on how TQM applies in the service industry

Study material



Chapter 6: Quality Management and International Standards, pp 254- 273.

3.1 Background

Total Quality Management (TQM) is perhaps the most significant of the new ideas which have swept across the operations management scene the last few years. Quality is a key concern for all organisations, and in some organisations a separate function is devoted exclusively to the management of quality. High quality of goods and services can give an organisation a considerable competitive edge. Good quality reduces the costs of rework, waste, complaints and returns and, most importantly, generates satisfied customers.

3.2 Keywords and concepts

- Quality – The ability of a product or service to meet customer needs.
- ISO 9000 – A set of quality standards developed by the International Organisation for Standardization (ISO).
- Cost of quality – The cost of doing things wrong, the price of non-conformance.
- Takumi – Is a Japanese character that symbolises a broader dimension than quality, a deeper process than education, and a more perfect method than persistence.
- Total quality management (TQM) – Management of an entire organisation so that it excels in all aspects of products and services that are important to the customer.
- Six sigma – A program designed to save time, improve quality, and lower costs.
- Employee empowerment – Enlarging employee jobs so that the added responsibility and authority is moved to the lowest level possible in the organisation.
- Quality circle – A group of employees meeting regularly with a facilitator to solve work-related problems in their work area.
- Benchmarking – Selecting a demonstrated standard of performance that represents the very best performance for a process or an activity.
- Quality robust – Products that are consistently built to meet customer needs in spite of adverse conditions in the production process.
- Quality loss function (QLF) – A mathematical function that identifies all costs connected with poor quality and shows how these costs increase as product quality moves from what the customer wants.
- Flowcharts – Block diagrams that graphically describe a process or system.
- Control charts – Graphic presentations of process data over time, with predetermined control limits.
- Inspection – A means of ensuring that an operation is producing at the quality level expected.
- Poka-yoke – Literally translated into “fool proof”, it has come to mean a device or technique that ensures the production of a good unit every time.
- Checklist – A type of poka-yoke that lists the steps needed to ensure consistency and completeness in a task.
- Attribute inspection – An inspection that classifies items as being either good or defective.
- Variable inspection – Classification of inspected items as falling on a continuum scale, such as dimension or strength.

3.3 Defining Quality

Textbook reference: Chapter 6, pp 255

Quality can also be define as;

“ the consistent conformance to customers’ expectations”

The use of the word ‘conformance’ implies that there is a need to meet a clear specification (the manufacturing approach), ensuring a product or service conforms to

specification is a key operations tasks. The word 'consistent' implies that conformance to specification is not an *ad hoc* event but that the materials, facilities and processes have been designed and then controlled to ensure that the product or service meets the specification using a set of measurable product or service characteristics (the product-based approach). The use of the term "customer expectations" attempts to combine the user and value-based approaches. It recognises that the product or service must meet the expectations of customers, which may indeed be influenced by price. An operations manager's objective is to build a total quality management system that identifies and satisfies customer needs.

3.4 TQM concepts

Textbook reference: Chapter 6, pp 257

TQM refers to a quality emphasis that encompasses the entire organisation, from the supplier to customer. TQM places the customer in the forefront of decision making. It also looks at the concept of internal customer and supplier. It advocates that everyone in the organisation is a customer and consume goods and services provided by other internal suppliers.

TQM stresses a commitment by management to have a continuing drive towards excellence in all aspects of products and services that are important to the customer. We are going to discuss the following seven concepts in a TQM program;

- Continuous improvement
- Six sigma
- Employee empowerment
- Benchmarking
- Just-in-time (JIT)
- Taguchi concepts, and
- Knowledge of TQM tools

3.4.1 Continuous Improvement

TQM requires a never-ending process of continuous improvement that embraces people, suppliers, material, equipment and procedures. The argument of this philosophy is that every aspect of an operation can be improved. The end objective is perfection, which is always sought but seldom achieved.

The Japanese use the word *kaizen* to describe this on-going process of improvement. In continuous improvement it is not the size of each step which is important, but rather it is the likelihood that improvements will be on-going. Thus, it is not the rate of improvement but the momentum of improvement.

Electronic Giant Panasonic's previous slogan "*the Quest for Zero Defect*"

3.4.2 Six Sigma

This is a program designed to reduce defects to help lower costs, save time, and improve customer satisfaction. Six sigma is a comprehensive system, a strategy, a discipline, and a set of tools for achieving and sustaining business success. Please see page 249 in the textbook for a more insightful explanation.

3.4.3 Employee Empowerment

This refers to the involvement of the workforce in every step of the production process. To design equipment and processes that consistently produce the desired quality would require the involvement of those who understand the shortcomings of the system. People working on the system on a daily basis understand it better than anyone else does. Techniques for building employee empowerment include;

- Building communication networks that include employees,
- Developing open, supportive supervisors,
- Moving responsibility from both managers and staff to production employees.
- Building high-morale organisations, and
- Creating formal organisation structures such as teams and quality circles.

Teams with a quality focus have proven to be cost-effective way to increase productivity as well as quality.

3.4.4 Benchmarking

This is an approach that some firms use to compare their operations with those of other firms (usually the trend-setters or market leaders in the industry). It is partly concerned with being able to judge how well an operation is doing. Benchmarking involves selecting a demonstrated standard of products, services, costs or practices that represent the very best performance for processes or activities very similar to your own. The steps for developing benchmarks are;

- Determine what to benchmark,
- Form a benchmark team,
- Identify benchmarking partners,
- Collect and analyse benchmarking information, and
- Take action to match or exceed the benchmark.

3.4.5 Just-in-Time (JIT)

JIT systems are designed to produce or deliver just and when they are needed. If implemented, JIT can reduce the amount of inventory that a firm has on hand by establishing quality and purchasing controls that bring stock into the firm just-in-time for use. JIT is related to quality in the following manner;

- JIT cuts the costs of quality, this happens because scrap and rework, damaged and stolen/lost stock are directly related to inventory on hand.
- JIT improves quality, as JIT reduces lead times, it keeps records of mistakes and source of error, and
- Better quality means less inventory and a better, easier to use JIT system. One of the reasons for holding inventory is to protect against poor production performance resulting from unreliable quality. If consistent quality exists, JIT allows organisations to reduce all the costs associated with inventory.

3.4.6 Taguchi concepts

Most quality problems are the result of poor product and process design. Genich Taguchi has provided us with three concepts aimed at improving both product and process quality;

- Quality robustness,
- Quality loss function, and
- Target-oriented quality

Quality loss function – identifies all costs connected with poor quality and shows how these costs increase as the product moves away from being exactly what the customer wants. These costs include not only customer dissatisfaction but also warranty and service costs, internal inspection, repair, and scrap costs that can best be described as costs to society.

3.4.7 Knowledge of TQM Tools

To empower employees and implement TQM everyone in the organisation must be trained in the techniques of TQM. The following seven tools or techniques can aid the operations managers to drive TQM;

- **Check Sheets** – A check sheet is any kind of a form that is designed for the recording of data. In many cases the recording is done so the patterns are easily seen while the data is being taken. Check sheets help analysts find the facts or patterns that may aid subsequent analysis. An example might be a drawing that shows a tally of the areas where defects are occurring or a check sheet showing the type of customer complaints. See example below;
- **Scatter Diagrams** – Show the relationship between two measurements. An example is the positive relationship between length of a service call and the number of trips a repair person makes back to the truck for parts.
- **Cause-and-Effect Diagrams** – Is a tool for identifying quality issues and inspection points. This type of diagram is also known as *Ishikawa* or the fish-bone chart.
- **Pareto charts** – is a method of organising errors, problems, or defects to help focus on problem solving efforts.
- **Flowcharts** – It is a graphic presentation of a process or system using annotated boxes and interconnected lines. They are simple but great tool for trying to make sense of a process or explain a process.
- **Histograms** – Show the range of values of a measurement and the frequency with which each value occurs. They show the most frequently occurring readings as well as the variations in the measurements.
- **Statistical Process Control** – Is a method used to monitor standards, to make measurements, and to take corrective action as a product or service is being produced.

3.5 Cost of Quality (COQ)

Textbook reference: Chapter 6, pp 256

There are four main areas of costs that are associated with quality. Let's have a closer look at each of these costs categories;

- **Prevention costs** – This is costs associated with reducing the potential for defective parts or services (e.g. training, design improvements, etc.).
- **Appraisal costs** – This is costs related to evaluating products, processes, parts, and services (e.g. testing, labs, inspections).
- **Internal failure costs** – These costs can result from production of defective parts or services before delivery to customers (e.g. rework, scrap, and downtime).
- **External failure costs** – It is costs that occur after delivery of defective parts or services (e.g. rework, returned goods, liabilities, lost goodwill, costs to society).

3.6 TQM in Services

Textbook reference: Chapter 6, pp 271

The personal component of service is more difficult to measure than the quality of the tangible component. Quality may also be perceived as a bundle of attributes in which many lesser characteristics are superior to those of competitors. Heizer & Render (2014:262) identifies ten general attributes or determinants of service quality namely;

- **Reliability** involves consistency of performance and dependability
- **Responsiveness** concerns the willingness or readiness of employees to provide service
- **Competence** means possession of the required skills and knowledge to perform the service
- **Access** involves approachability and ease of contact
- **Courtesy** involves politeness, respect, consideration, and friendliness
- **Communication** means keeping customers informed and listening to them
- **Credibility involves** trustworthiness, believability, and honesty
- **Security** is the freedom from danger, risk, or doubt
- **Understanding/knowing** the customer involves making the effort to understand the customer's needs
- **Tangibles** include the physical evidence of the service

Summary of main learning points

Quality is a term that means different things to different people. Defining quality expectations is critical to effective and efficient operations. Quality requires building a total quality management (TQM) environment because quality cannot be inspected into a product. We also addressed the seven TQM concepts and the different TQM tools.

Study unit 4

FORECASTING

Study hours



You will need approximately 15 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- understand and define the process of forecasting
- identify the features common to all forecasts
- understand the strategic importance of forecasting
- discuss the different approaches to forecasting
- compare quantitative and qualitative forecasting techniques
- be familiar with the various approaches to forecasting

Study material



Chapter 4: Forecasting Demand, pp 143- 179.

4.1 Background

When forecasting is undertaken, it is a preface to planning. People often want to be able to predict the future. Organisations cannot initiate the planning phase before it has been determined what the conditions will be prevalent in the future. However, forecasting is an attempt to predict that future. For example, an organisation would like to predict what the demand or sales for its product will be some time in the future. This knowledge would assist it to plan how to meet the demand. Forecasts address the following areas in an organisation;

- Broad-spectrum commerce and monetary circumstances
- Competiveness of organisations measured against competitors
- Marketplace tendencies, such as new products and the behaviour of demand
- Sourcing the money needed for marketing, sponsorship, and new product development.

4.2 Keyword and concepts

- Forecasting – The art and science of predicting future events.
- Economic forecasts – Planning indicators that are valuable in helping organisations prepare medium-to long range forecasts.
- Technological forecasts – Long-term forecasts concerned with the rates of technological progress.
- Demand forecasts – Projections of a company's sales for each time period in the planning horizon.
- Quantitative forecasts – Forecasts that employ mathematical modelling to forecasts demand.
- Qualitative forecasts – Forecasts that incorporate such factors as the decision maker's intuition, emotions, personal experiences, and value system.
- Market survey – A forecasting method that solicits input from customer or potential customers regarding future purchasing plans.
- Time series – A forecasting technique that uses a series of past data points to make a forecast.
- Naive approach – A forecasting technique which assumes that demand in the next period is equal to demand in the most recent period.
- Moving averages – A forecasting method that uses an average of the number of periods' most recent periods of data to forecasts the next period.
- Trend projection – A time-series forecasting
- g method that fits a trend line to a series of historical data points and then projects the line into the future for forecasts.
- Seasonal variations – Regular upward or downward movements in a time series that tie to recurring events.
- Cycles – Patterns in the data that occur every several years.
- Multiple regressions – An associative forecasting method with more than one independent variable.
- Tracking signal – A measurement of how well a forecast is predicting actual values.
- Bias – A forecast that is consistently higher or consistently lower than actual values of a time series.
- Focus forecasting – Forecasting that tries a variety of computer models and selects the best one for a particular application.

4.3 What is Forecasting ?

Textbook reference: Chapter 4, pp 146

Every day, operations managers make decisions without knowing what will happen in the future. They order inventory without knowing what the sales will be, purchase new equipment despite uncertainty about demand for products, and make investments without knowing what profits will be.

Forecasting is the art and science of predicting future events. Forecasting may involve taking historical data (previous sales) and projecting it into the future with mathematical model. Few business can afford to avoid the process of forecasting by just waiting to see what happens and then taking their chances. Effective planning in both the short run and the long run depends on a forecast of demand for the company's products.

4.3.1 Forecasting Time Horizons

A forecast is classified by the future time horizon that it covers. These time horizons fall into three categories, namely;

- **Short-range forecast** – This forecast has a time span of up to 1 year but is usually less than 3 months. It is used for planning purchasing, job scheduling, workforce levels, job assignments, and production levels.
- **Medium-range forecast** – Generally spans from 3 months to 3 years. It is applied in sales, production planning, budgeting, cash budgeting and analysis of various operating plans.
- **Long-range forecast** – Generally 3 years or more in time span. These forecasts are used in planning of new products, capital expenditures, facility location and research and development.

4.3.2 Types of Forecasts

Organisations use three types of forecasts in planning future operations;

- **Economic forecasts** – Address the business cycle by predicting inflation rates, money supplies, etc.
- **Technological forecasts** – Are concerned with rates of technological progress, which can result in the birth of exciting new products, requiring new plants and equipment.
- **Demand forecasts** – Are projections of demand for a company's products or services. Forecasts drive decisions, so managers need immediate and accurate information about real demand.

4.4 Strategic importance of Forecasting

Textbook reference: Chapter 4, pp 147

The forecast is the only estimate of demand until actual demand becomes known. Product demand forecasts are of critical importance in all aspects of a business and impacts on the following three activities in business;

- **Supply-chain management** – Good supplier relations and the ensuing advantages in product innovation, cost, and speed to the market depend on accurate forecasts.
- **Human resources** – The hiring, training, and laying off workers all depend on anticipated demand. If the HR-department must hire additional workers without warning, the amount of training declines and the quality of the workforce suffers.
- **Capacity** – When capacity is inadequate, the resulting shortages can lead to loss of customers and market share. When organisations can't keep up with the demand for their goods, they lose customers due to substitute products.

4.5 Steps in the Forecasting process

Textbook reference: Chapter 4, pp 148

Forecasting follows seven basic steps, namely;

- Determine the use of the forecasts
- Select the items to be forecasted
- Determine the time horizon of the forecast
- Select the forecasting model
- Gather the data needed to make the forecast
- Make the forecast
- Validate and implement the results

4.6 Approaches to Forecasting

Textbook reference: Chapter 4, pp 149

There are two general approaches to forecasting; qualitative and quantitative.

- **Qualitative** – these methods consist mainly of subjective inputs and incorporate such factors as the decision maker's intuition, emotions and personal experiences amongst other things.
- **Quantitative** - forecasts use a variety of mathematical models that are determined by historical data. In practice either or both approaches are used to determine a forecast.

4.6.1 Overview of Qualitative methods

Textbook reference: Chapter 4, pp 149 (practical examples will be discussed in class)

- **Forecasts based on judgements or opinions** – Under this method, the opinions of a group of high level experts or managers, often in combination with statistical models are grouped to arrive at an estimate of demand. This approach is often used as part of long-range planning and new product development.
- **Sales force composite** – The sales staff is often a good source of information because of their direct contact with customers. Thus, they may be aware of customer's future plans. In this approach each salesperson estimates what projected sales will be in his or her area or region.
- **Customer surveys** – This method solicits inputs from customers or potential customers regarding future purchasing plans. It can assist in not only preparing a forecast but also in improving product/service design and planning for new products. You should ensure you exercise a great deal of care in constructing a survey, administer it and correctly interpret the results in order to obtain valid information

- **Outside opinion** – Occasionally, outside opinions are needed to make a forecast. These may include advice on political or economic conditions within the region or in a global environment.
- **Delphi method** – There are three different types of participants in the Delphi Method; decision makers, staff personnel and respondents. Decision-makers usually consist of a group of five to ten experts who will make the actual forecast. Staff personnel assist decision-makers by preparing, distributing, collecting and summarising a series of questionnaires and survey results. The respondents are a group of people, located in different places, whose judgement is highly respected. This group provides input to decision-makers before the forecast is made.

4.6.2 Overview of Quantitative methods

Textbook reference: Chapter 4, pp 150-176 (practical examples will be discussed in class)

Five quantitative forecasting methods, all of which use historical data will be described. Quantitative methods can be classified into two categories, namely;

- **Time-series model** – These models predict on the assumption that the future is a continuation of the past. In other words, they look at what has happened over a period of time and use a series of past data to make a forecast. Examples is;
 - E Naïve approach
 - E Moving averages
 - E Exponential smoothing
 - E Trend projection
- **Casual model** – Incorporate the variable or factors that might influence the quantity being forecast. If the cause-effect relationship between variables can be modelled, then predictions of the factors, which influence whatever we are trying to forecast, will enable a forecast to be made. Example is;
- **Linear regression**
 - Naïve approach** – This is a forecasting technique that assumes demand in the next period is equal to demand in the most recent period. For example, if a Cell phone supplier sold 1 600 cellular phones in January, then we assume that they will sell 1 600 cellular phones in February.
 - Moving averages** – This is a forecasting method is useful if we can assume that market demands will stay fairly steady over time. A 4-month moving average is found by simply summing the demand during the past 4 months and dividing by 4.
 - Exponential smoothing** – Is another weighted-moving-average forecasting method. It involves very little record keeping of past data and is fairly easy to use. Basically it is the last period's forecast plus "smoothing/weighting" the difference between last period's actual demand and last period's forecast.
 - Trend projection** – This technique fits a trend line to a series of historical data points and then projects the slope of the line into the future for medium to long-range forecasts.

Linear regression – It is a straight-line mathematical model to describe the functional relationships between independent and dependent variables. We use this technique to verify whether our sales might be related to our advertising budget, our prices, competitor's prices or promotional strategies.

4.7 Forecasting in the Service Sector

Textbook reference: Chapter 4, pp 178

Forecasting in the service sector presents some unusual challenges. A major technique in the retail sector is tracking demand by maintaining good short-term records. A barber shop will have more clients on a Friday and Saturday, and might even call in some help, but are then again closed on Sundays and Mondays. Certain services providing firms can predict, on previous experiences and market trends, when their services are most wanted to satisfy the needs of the customers.

Summary of main learning points

Forecasts are a critical part of the operations manager's function. There are a variety of qualitative and quantitative forecasting techniques. No forecasting method is perfect under all conditions. And even once management has found a satisfactory approach, it must still monitor and control forecasts to make sure errors do not get out of hand.

Study unit 5

INVENTORY MANAGEMENT

Study hours



You will need approximately 15 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- identify the requirements for effective inventory management
- explain and use the EOQ model for independent inventory demand
- establish when to re-order inventory
- list the benefits of a JIT system
- explain JIT partnerships

Study material



Chapter 12: Inventory Management

5.1 Importance of Inventory

Textbook reference: Chapter 12, pp 528

Inventory can generally be defined as a stockpile or store of goods. Stock holding can include small items such as nuts, bolts and washers or large items such as machines, machine parts and assemblies of products. There is a school of thought that views inventory as any resource that has monetary value and is idle. Even labour and machines that are idle (not working, because there is no work) are classified as inventory. A distinction must be made between inventory and capacity for the good management of an organisation. Inventory is one of the most expensive assets of any organisation and can be as high as 50% of the total investment of an organisation. For

this reason, the proper management of inventory is of vital importance. The influence of the high costs of inventory management has forced organisations to manage their supply chains and quality more efficiently. A good indication of properly managed inventory is the number of times that inventory is turned.

5.1.1 Types of inventory

To accommodate the functions of inventory, firms maintain four types of inventories, namely;

- **Raw material inventory** – which has been purchased, but not processed.
- **Work-inProcess inventory (WIP)** – which is incomplete products or components that are no longer considered raw material but have yet to become finished products.
- **Maintenance, repair and operating materials** - which are supplies necessary to keep machines and processes productive, and
- **Finished goods inventory** – which comprises of end items and products, ready to be sold.

5.1.2 Functions of inventory

Inventory can serve several functions that add flexibility to a firm's operations. The four functions of inventory are;

- To provide a selection of goods for anticipated customer demand and to separate the firm from fluctuations in that demand.
- To decouple various parts of the production process.
- To take advantage of quantity discounts.
- To hedge against inflation and upward price changes.

5.2 Managing Inventory

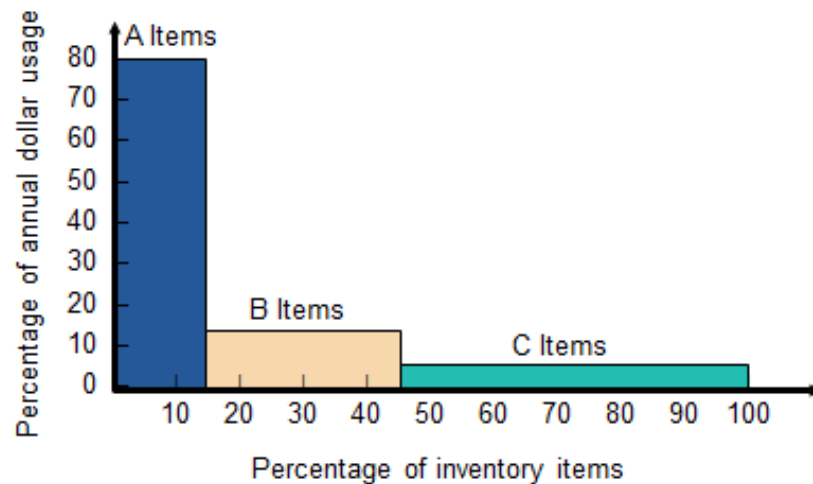
Textbook reference: Chapter 12, pp 529

Operations managers establish systems for managing inventory. We look at how inventory items can be classified and how accurate inventory records can be maintained.

5.2.1 ABC Analysis

ABC analysis is a method for dividing on-hand inventory into three classifications based on the annual demand volume. ABC analysis is an inventory application of what is known as the *Pareto principle*. The idea is to establish inventory policies that focus resources on the few critical inventory parts and not the many trivial ones. It is not realistic to monitor inexpensive items with the same intensity as very expensive items. See example in Figure below

ABC Analysis



(Source: Heizer & Render, 2017:529)

- **Items A** – Items which annual rand volume is high and represent 15% of total inventory items, they represent 70-80% of total rand usage. (e.g. expensive, top of the range bed)
- **Items B** – Items with medium annual rand volume, they represent about 30% of inventory items and 15 – 25% of total rand value. (e.g. moderate/medium beds)
- **Item C** – These items represent only 5% of the annual rand volume but about 55% of the total inventory items. (e.g. very cheap mattresses)

5.2.2 Record Accuracy

Record accuracy is a prerequisite to inventory management, production scheduling and sales. Accuracy can be maintained by either periodic or perpetual systems.

- **Periodic systems** – require regular checks of inventory to determine quantity on hand. The downside is the lack of control between reviews and the necessity of carrying extra inventory to protect against shortages.
- **Perpetual systems** – tracks both receipts and subtractions from inventory on a continuing basis. Receipts are usually noted in the receiving department in some semi-automated way, such as via a bar-code reader at the point-of-sale (POS) cash register.

Regardless of the inventory system, record accuracy requires good incoming and outgoing record keeping as well as good security.

5.2.3 Cycle Counting

Cycle counting is the continuing reconciliation of inventory with inventory records. Many firms perform as physical inventory checks (stock take). This process often means that the firm or company shuts down or close for a period, usually when there is a low demand for the product, and staff physical count the parts or material. Cycle counting uses inventory classifications developed through ABC analysis.

5.3 Inventory Models for Independent Demand

Textbook reference: Chapter 12, pp 533

Inventory models assume that the demand for an item is either independent of or dependent on the demand for other items. The demand for refrigerators is independent of the demand for toasters. However, the demand for toasters is dependent on the requirements of toaster parts. In this section, we address two important questions, namely:

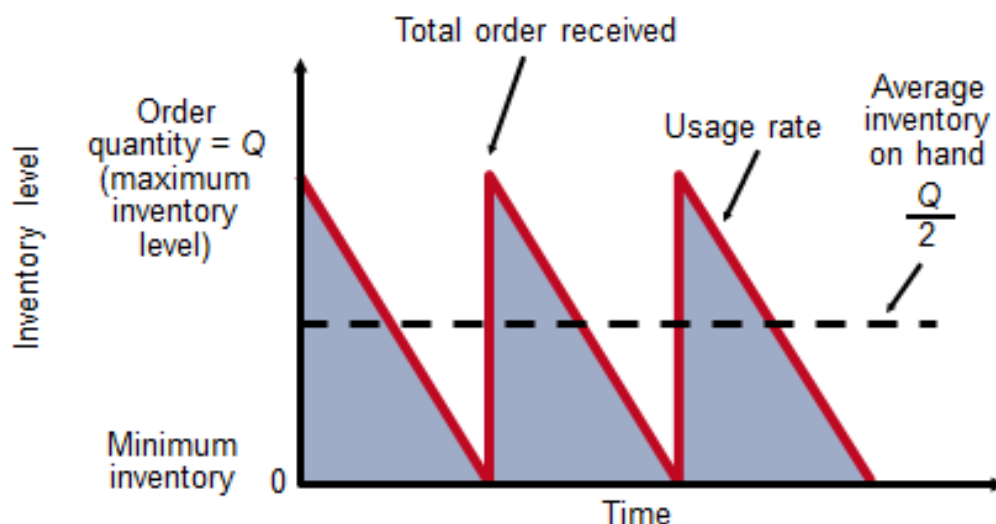
- When to order ?
- How much to order ?

5.3.1 The Basic Economic Order Quantity (EOQ) Model

The Economic Order Quantity (EOQ) model is one of the oldest, most commonly known inventory-control techniques. EOQ models identify the optimal order quantity in terms of minimising the sum of certain annual costs that vary with order size. This technique is relatively easy to use and is based on several assumptions;

- There is only one product involved
- Annual Usage (demand) requirements is known
- Usage is spread evenly throughout the year so that the usage rate is reasonably constant
- Lead time does not vary
- Each order is received in a single delivery
- There are no quantity discounts

Inventory Usage Over Time



(Source: Heizer & Render, 2017:535)

Because the demand is constant over time, the inventory drops at a uniform rate over time. Each time the inventory is received, the inventory level again jumps to the Order quantity (Q) as depicted on the vertical lines. This process continues indefinitely over time.

Study unit 6 LEAN OPERATIONS AND JIT SYSTEMS

Study hours



You will need approximately 15 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- identify the requirements for effective inventory management
- explain and use the EOQ model for independent inventory demand
- establish when to re-order inventory
- list the benefits of a JIT system
- explain JIT partnerships

Study material



Chapter 16: Just-in-time systems, pp 673 – 690.

6.1 Background

Operations managers often have an ambivalent attitude towards inventories. Inventories are costly and are tying up considerable amounts of working capital. Inventory systems are also risky because items in the system are held as stock and could deteriorate, get lost, and take up a lot of space in the operation. On the other hand, Inventory systems provide some security in an uncertain environment that can be delivered as items in stock should customers demand them. This is the dilemma of inventory management, in spite of the cost and the other disadvantages associated with holding stocks, they do facilitate the smoothing of supply and demand. Inventories exist because supply and demand are not exactly in harmony with each other. Just-in-time (JIT) systems also called 'lean operations', is a philosophy of operations planning

and control. JIT systems concentrate on arranging for the delivery of goods (sometimes services) only when the goods/services are needed by internal or external customers.

6.2 Keywords and concepts

- Raw material inventory – Materials that are usually purchased but have yet to enter the manufacturing process.
- Work-in-progress inventory – Products or components that are no longer raw materials but have yet to become finished products.
- Finished-goods inventory – An end item ready to be sold, but still an asset on the company's books.
- ABC analysis – A method for dividing on-hand inventory into three classifications based on annual dollar volume.
- Cycle counting – A continuing reconciliation of inventory with inventory records.
- Shrinkage – Retail inventory that is unaccounted for between receipt and sale.
- Pilferage – A small amount of theft.
- Economic order quantity (EOQ) model – An inventory-control technique that minimises the total of ordering and holding costs.
- Just-in-time – Continuous and forced problem solving via a focus on throughput and reduced inventory.
- Lean operations – Eliminates waste through continuous improvement and focus on exactly what the customer wants.
- Variability – Any deviation from the optimum process that delivers perfect product on time, every time.

6.3 Just-in-Time (JIT) Systems

Textbook reference: Chapter 16, pp 678

Just-in-Time (JIT) is a philosophy of continuous problem solving. With JIT, supplies and components are 'pulled' through a system to arrive where they are needed, when they are needed in the right quantity. JIT systems are excellent tools to assist operations managers add value by eliminating waste and unwanted variability. Because there is no surplus inventory, costs associated with unwanted inventory are eliminated and throughput improved. JIT provides a powerful strategy for improving operations.

6.4 Key Elements of a JIT system

JIT systems are designed to achieve a smooth flow of production using minimal inventories. The systems are fairly flexible, with a high degree of worker participation. The most important aspect of a JIT system is that quality is built into the system. The key elements of a JIT system are;

- High quality levels
- Production smoothing
- Low inventories
- Small lot/batch sizes
- Quick, low-cost setups
- Layout
- Preventative maintenance and repair

- Multi-skilled workers
- A cooperative spirit
- Few, reliable suppliers
- Problem solving approach
- Continuous improvement

6.5 Benefits of a JIT system

JIT is a disciplined approach to improving overall productivity and eliminating waste. It provides for the cost-effective production and delivery of only the necessary quantity of parts at the right quality, at the right time and place, while using a minimum amount of facilities, equipment, materials and human resources. A key philosophy of JIT is simplification and the benefits are;

- Reduced levels of in-process stock, purchased and finished goods
- Less space required
- Increased product quality and reduced scrap
- Reduced manufacturing lead times
- Greater flexibility in changing the production mix
- Smoother production flow
- Increased productivity and utilisation of plant and equipment
- Worker participation in problem solving
- Good relationship built with suppliers
- Reduced need for indirect labour such as materials handlers.

Summary of main learning points

Inventory represent a major investment for many firms. The importance of the ABC analysis, record accuracy and cycle counting was discussed. JIT is a philosophy of continuous improvement and focuses on respect for people and standards in the workplace. The expectation of JIT and lean operations is that employees work with committed management to build systems that respond to customers with ever-lower cost and higher quality.

Study unit 7 AGGREGATE PLANNING

Study hours



You will need approximately 10 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- define aggregate planning
- define sales and operations planning
- identify demand and capacity options operations managers have at their disposal
- understand aggregate planning in the service sector

Study material



Chapter 13: Aggregate Scheduling, pp 567 – 583.

7.1 Background

Aggregate planning can be seen as matching demand with supply. It is the capacity planning of the following 3 – 18 months, for example the efforts SABMiller is trying to plan for the higher than usual demand as a result of a warmer summer. An operations manager attempts to meet the demand by juggling variables such as production rates, labour, the levels of stock holding, and even subcontracting jobs when necessary. This type of planning is necessary to set policies about what to manufacture and when. The aggregate plan is the departure point from which the master production schedule is derived.

7.2 Keywords and concepts

- Aggregate plan – A plan that includes forecast levels for families of products of finished goods, inventory, shortages, and changes in the workforce.
- Master production schedule (MPS) – A timetable that specifies what is to be made and when.
- Disaggregation – The process of breaking an aggregate plan into greater detail.
- Chase strategy – A planning strategy that sets production equal to forecast demand.
- Level scheduling – Maintaining a constant output rate, production rate, or workforce level over the planning horizon.
- Revenue (yield) management – Capacity decisions that determine the allocation of resources to maximise revenue or yield.

7.3 Aggregate Scheduling

Textbook reference: Chapter 13, pp 572

Aggregate scheduling also known as aggregate planning, is essentially a approach to planning. The main focus is to determine the quantity and timing of production for the intermediate future. Operations managers try to determine the best way to meet forecasted demand by adjusting production rates, labour levels, inventory levels, overtime work, subcontracting rates and other controllable variables. The following requirements are needed for aggregate planning, namely;

- A logical overall unit for measuring sales and output
- A demand forecast for the intermediate planning period
- A method of determining the various costs
- A model that combines forecasts and costs so that scheduling decisions can be made for the planning period.

Often aggregation is done by product groupings, where products (or services) with similar requirements are lumped together for planning purposes. For example, let consider how aggregate planning might work in a large departmental store. The manager may decide to allocate 20% of the available space to men's clothing, 50% to female clothing, 20% to children's clothing and 10% to cosmetics. As you can conclude from this example, no mention is made as to what type, size, colour, etc. of clothing is to be stocked.

7.4 Sales and Operation Planning

Textbook reference: Chapter 13, pp 572

Good intermediate planning requires the coordination of demand forecasts with functional areas of a firm and its supply chain. With the limitations and constraints of any firm's supply chain, the coordination can be difficult. This coordination planning effort has evolved into a process known as sales and operations planning (S&OP). The sales and operations planning receive input from a variety of sources both internal and external.

Any limitations, both within the firm and in the supply chain, must be reflected in an intermediate plan that brings day-to-day sales and operational realities together. The output of S&OP is called the aggregate plan, which is concerned with determining the quantity and timing of production for the intermediate future. Besides being representative, timely, and comprehensive, an effective S&OP process needs the following four additional features to generate a useful aggregate plan, namely;

- Logic unit for measuring sales and output,
- A forecasts of demand for a reasonable intermediate planning period,
- Method to determine the relevant costs
- A model that combines forecasts and costs so scheduling decisions can be made for the planning period.

7.5 The nature of Aggregate Planning

Textbook reference: Chapter 13, pp 572

The objective of aggregate planning is to meet the forecast demand while minimising cost over the planning period. Concentrating on low cost isn't the only focus point, but looking at employment issues, inventory levels or even the high prices of services, needs to be address. In a manufacturing environment, the process of breaking the aggregate plan down into greater detail is called disaggregation. Disaggregation result in a master production schedule which will enable the operations manager to purchase the right amount of components for production purposes. It is not a sales forecast, detailed work schedules for people and priority scheduling for products result in the production planning system.

7.6 Aggregate Planning Strategies

Textbook reference: Chapter 13, pp 573

Aggregate planning seeks to address the balance between supply and demand. If supply and demand are not in balance, the organisation will incur certain cost penalties. There will be added costs of adjausting the system as well as opportunity costs. There are five capacity options, which tries to absorb the demand fluctuations. There are also demand options which tries to smoothen the changes in the demand pattern.

7.6.1 Capacity options

The following is basic capacity options;

- Changing inventory levels – increasing inventory levels in period of low demand to meet future high demand.
- Varying workforce size by hiring of layoffs – idea is to match production wokers to production rates, which is measure in cost per unit produced.
- Varying production rates through overtime or idle time – workers need to be deployed according to the high and low demand of products. Overtime can kill profits and to many workers siiting around during idle time too.
- Subcontracting – temporary capacity can be increase through subcontracting during peak periods of demand.
- Usinf part-time workers – Especially in the service sector, with differential labour needs during the year (restuarants, retail, etc.)

7.6.2 Demand options

The demand options are;

- Influencing demand – when the demand is low, firms usually advertise discounted prices to try increase the demand.
- Back ordering during high-demand periods – back orders are order for goods/services that a firm accepts but is unable to fill at the present moment. The customer is usually willing to wait without the loss of their goodwill.
- Counterseasonal product and service mixing – good example is companies that produce a mix of counterseasonal product, like producing furnaces and air conditioners and or lawnmowers and snowblowers.

7.7 Aggregate Planning in Services

Textbook reference: Chapter 13, pp 583

With the demand management taking a more core active role, service organisations conduct aggregate planning in exactly the same manner as in manufacturing organisations. Controlling the cost of labour in service firms is critical and some techniques include the following;

- Accurate scheduling of labour-hours to assure quick response to customer demand
- An on-call labour resource that can be added or deleted to meet unexpected demand
- Flexibility of individual worker skills that permits reallocation of available labour
- Flexibility in rate of output or hours of work to meet changing demand

7.8 Revenue Management

Textbook reference: Chapter 13, pp 585

Most operations models, like business models, assume that firms charge all customers the same price for a product. Many firms charge different prices for the same product or services. The idea is to match capacity and demand by charging different prices based on the customer's willingness to pay. Revenue management is the management planning process of allocating the company's scarce resources to customers at prices that will maximise revenue.

For example, in the 1980's American Airlines used the reservation system (SABRE) which allowed the airline to alter tickets prices, in real time and on any route, based on the demand information. If it looked like demand for the expensive seats was low, more discounted seats were offered. If the demand for full-fare seats was high, the number of discounted seats was reduced. (see example on page 575 in textbook for further reading).

Summary of main learning points

Sales and planning is responsible for coordinating the functional areas of a firm as well as ensuring good communication between partners in the supply chain. An aggregate plan provides both manufacturing and service firms the ability to respond to changing customer demands and produce with a competitive strategy. The aggregate plan is an important responsibility of an operations manager and a key to efficient use of existing resources.



STUDY UNIT 8

HUMAN RESOURCES, JOB DESIGN AND ORGANISATIONAL EFFECTIVENESS

Study hours



You will need approximately 10 hours to master this Study Unit and to achieve the learning outcomes

Learning outcomes



Upon completion of this Study Unit you should be able to

- identify the constraints on the human resource strategy
- identify and define the major issues in job design
- identify ergonomic and work environmental issues
- use the tools of method analysis
- identify the different ways in establishing labour standards

Study material



Chapter 10: Job Design and Work Measurement, pp 446 – 468.

8.1 Background

Operations management is often presented as a subject with its main focus on technology, systems, procedures and facilities – in other words the non-human parts of the organisation. This is not true of course. On the contrary, the manner in which an organisation's human resources are managed has a profound impact on the effectiveness of its operations function. This chapter identifies the elements of human

resource management which are traditionally seen as being directly within the sphere of operations management. These are the activities which influence the relationship between people, the technology they use and the work methods employed by the operation. This is usually called job design and fits into the overall model of operations activities.

Keywords and concepts

- Labour planning – A means of determining staffing policies dealing with employment stability, work schedules, and work rules.
- Job design – An approach that specifies the tasks that constitute a job for an individual or a group.
- Labour specialisation – The division of labour into unique tasks.
- Job enlargement – The grouping of a variety of tasks about the same skill level, horizontal enlargement.
- Job rotation – A system in which an employee is moved from one specialized job to another.
- Job enrichment – A method of giving an employee more responsibility that includes some of the planning and control necessary for job accomplishment, vertical expansion.
- Employee empowerment – enlarging employee jobs so that the added responsibility and authority are moved to the lowest level possible.
- Ergonomics – The study of the human interface with the environment and machines.
- Method analysis – A system that involves developing work procedures that are safe and produce quality products efficiently.
- Flow diagram – A drawing used to analyse movement of people or material.
- Process chart – Graphic representations that depict a sequence of steps for a process.
- Activity chart – A way of improving utilisation of an operator and a machine or some combination of operators and machines.
- Operations chart – A chart depicting right-and left hand motions.
- Labour standards – The amount of time required to perform a job or part of a job.
- Time study – Timing a sample of a worker's performance and using it as a basis for setting a standard time.
- Work sampling – an estimate, via sampling, of the percentage of the time that a worker spends on various tasks.

Human Resource strategy for Competitive Advantage

Textbook reference: Chapter 10, pp 448

Good human resource strategies are expensive, difficult to achieve, and hard to successful sustain. A sustainable competitive advantage can be built through a proper HR strategy. The objective of a HR strategy is to manage labour and design jobs so people are effectively and efficiently utilised. The focus of the HR strategy is mainly to ensure that people are;

- Efficiently utilised within the constraints of other operations management decisions,

- Have reasonable quality of work life in an atmosphere of mutual commitment and trust.

By reasonable quality of work life, means a job that is not only reasonably safe and for which the pay is equitable but that also achieves an appropriate level of both physical and psychological requirements. When management has a genuine respect for the employees and their contribution to the firm, establishing a reasonable quality of work life and mutual trust is not particularly difficult. Many decisions made about people are constrained by other decisions. The effective operations manager understands how certain decisions blend together to constrain the human resource strategy. The optimum goal is to ensure an efficient system in which both individual and team performance are enhanced through an optimum job design. See the figure below,

Constraints on Human Resource Strategy



(Source: Heizer & Render, 2017:449)

Labour planning

Textbook reference: Chapter 10, pp 449

Labour planning is determining staffing policies that deal with employment stability, work schedules and work rules. Employment-stability deals with the number of employees maintained by an organisation at any given time. There are two basic policies for dealing with stability;

- **Follow demand exactly** - Following demand exactly keeps direct labour costs tied to production but incurs other costs. These other costs include, hiring and layoff costs, unemployment insurance, and premium wages to entice personnel

to accept unstable employment. This policy tends to treat labour as a variable cost.

- **Hold employment constant** – Holding employment levels constant maintains a trained workforce and keeps hiring, layoff, and unemployment costs to a minimum. However, with employment held constant, employees may not be utilised fully when demand is low, and the firm may not have the human resources it needs when demand is high. This policy tends to treat labour as a fixed cost.

Maintaining a stable workforce may allow a firm to pay lower wages than a firm that follows demand. This saving may provide a competitive advantage. However, a fluctuating workforce may best serve firms with highly seasonal work and little control over demand. Firms must determine policies about employment stability. The above policies are only two of many that can be efficient and provide a reasonable quality of work life.

Job Design

Textbook reference: Chapter 10, pp 450

Job design specifies the tasks that constitute a job for an individual or a group. A proper job design comprises of the following factors, namely;

- Job specialisation,
- Job expansion,
- Psychological components,
- Self-directed teams, and
- Motivation and incentive systems.

8.2 Job specialisation

The importance of job design as a management variable is important, and can be seen as a division of labour, also known as labour specialisation. With job specialisation the costs in reducing labour costs can be accomplished in the following ways;

- Development of dexterity and faster learning by the employee because of repetition.
- Less loss of time because the employee would not be changing jobs or tools.
- Development of specialisation tools and the reduction of investment because each employee has only a few tools needed for a particular task.

There is also a fourth consideration, paying exactly the wage needed for the particular skill required. If the entire job consists of only one skill, then the employer only pay for that one skill. These four advantages of labour specialisation are still valid in today's business environment.

8.3 Job expansion

There has been an effort to improve the quality of work life by moving from labour specialisation toward more varied job design. Driving this effort is the theory that variety makes the job more enjoyable and that the employee therefore enjoys a higher quality of work life. It is assumed that this flexibility thus benefits the employee and the organisation. Jobs can be modified in a variety of ways, namely;

- **Job enlargement** – Which occurs when a task is added requiring a similar skill to an existing job.
- **Job rotation** – Is a version of job enlargement that occurs when the employee is allowed to move from one specialised job to another.
- **Job enrichment** – Which adds planning and control to the job design. Job enrichment is a vertical expansion, as opposed to job enlargement, which is horizontal.
- **Employee empowerment** – Is an extension of job enrichment. The practice is to enrich the jobs so that employees accept responsibility for a variety of decisions normally associated with staff specialists. Empowering employees helps them take ownership of their jobs so that they have personal interest in improving performances.

8.4 Psychological components of job design

An effective human resource strategy also requires consideration of the psychological components of job design. These components focus on how to design jobs that meet some minimum psychological requirements

- **Hawthorne studies** – These studies found the dynamic social system and distinct roles played by employees to be very important. Also individual differences in what employees expect from a job were interesting.
- **Core job characteristics** – five desirable characteristics of a job design have been identified, namely;
 - E Skill variety
 - E Job identity
 - E Job significance
 - E Autonomy
 - E Feedback

8.5 Self-directed teams

Many organisations have adopted teams to foster mutual trust and commitment, and provide core job characteristics. These teams may be organised for long-or short term objectives. Teams are effective primarily because they can easily provide employee empowerment, ensure core job characteristics, and satisfy many of the psychological needs of individual team members.

If job designs that enlarge, enrich, empower, and use teams are so good, why are they not universally used? Here follows a few limitations of expanded job designs;

- Higher capital cost (additional equipment and capital)
- Individual differences (employees differ)
- Higher wage rates (certain jobs may well require higher average wages)
- Smaller labour pool (job requirements have increased)
- Higher training costs (job expansion requires training)

8.6 Motivation and incentive systems

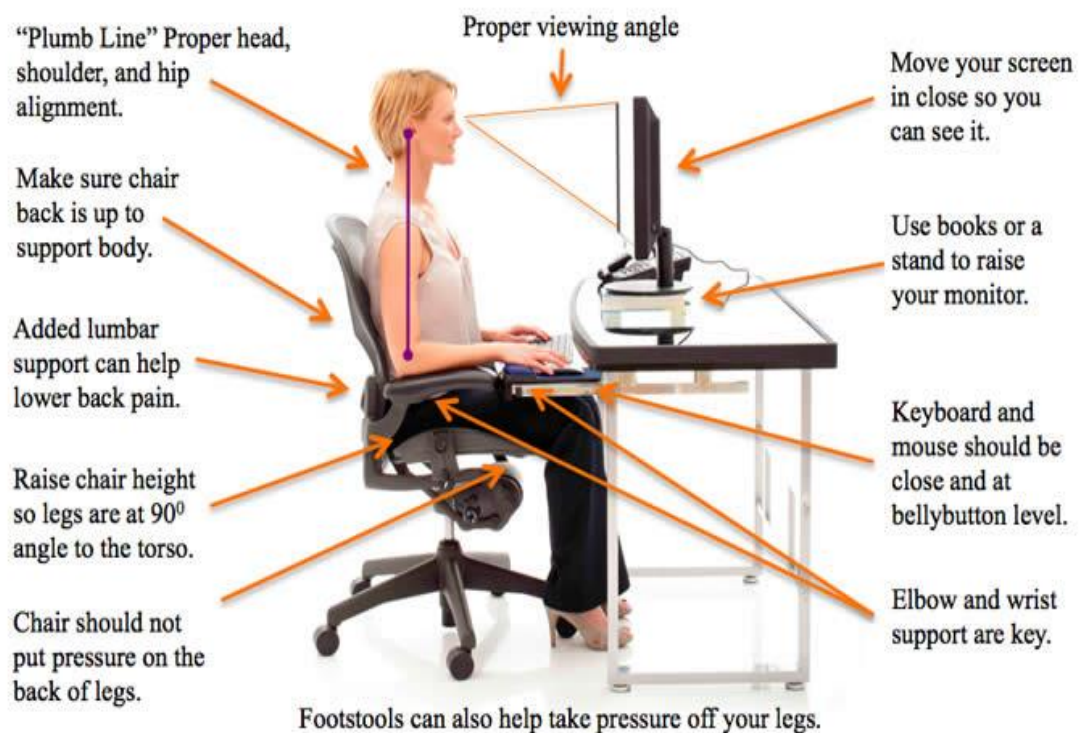
The discussion of the psychological components of job design provides insight into the factors that contribute to job satisfaction and motivation. In addition to these psychological factors, there are monetary factors. Money often serves as a psychological as well as a financial motivator. Examples of monetary rewards are;

- **Bonuses** – typically in cash or stock options, are often used at executive levels to reward management.
- **Profit-sharing** – systems provide some part the profit for distribution to employees.
- **Gain-sharing** – a variation of profit sharing, but rewards the employees for improvements made in an organisation's performance.
- **Incentive systems** – the system requires employees or crews to achieve production above a predetermined standard.

Ergonomics and work methods

Textbook reference: Chapter 10, pp 453

There has been a body of knowledge provided with respect to people's capabilities and limitations in the workplace. This knowledge is necessary because humans are hand/eye animals possessing exceptional capabilities and some limitations. The operations manager is interested in building a good interface between human and machine. Ergonomics means the 'study of work'. Male and female adults come in limited configurations. Therefore, design of tools and the workplace depends on the study of people to determine what they can and cannot do. See figure below



(source: www.theofficeeffect.com)

- **Operator input to machine** – Operator response to machines, be they hand tools, pedals, lever or buttons, needs to be evaluated. Operations managers need to be sure that operators have strength, reflexes, perceptions and mental capacity to provide necessary control. Such problems as carpal tunnel syndrome result when a tool as simple as a keyboard is poorly designed.
- **Feedback to the operators** – Feedback to operators is provided by sight, sound, and feel. the mishap at the Three Mile Island nuclear facility in USA, was in large part the result of poor feedback to the operators about reactor performance. Non-functional group of large, unclear instruments and inaccessible controls, hundreds of warning lights, contributed to the nuclear failure.
- **The work environment** - The physical environment in which employees work affects their performance, safety, and quality of work life. Illumination, noise and vibration, temperature, humidity, and air quality are work-environment factors under the control of the organisation and the operations manager.

Methods Analysis

Textbook reference: Chapter 10, pp 455

Methods analysis focuses on how a task is accomplished. Whether controlling a machine or making or assembling components, how a task is done makes a difference in performance, safety and quality. Using knowledge from ergonomics and methods analysis, engineers are charged with ensuring that quality and quantity standards are achieved efficiently and safely. Methods analysis and related techniques are useful in office environments as well as the factory. Methods techniques are used to analyse;

- Movement of individuals or material
- Activity of human and machine and crew activity
- Body movement (primarily arms and hands)

Flow diagrams – are schematics used to investigate movement of people or material

Process charts – use symbols, to help management understand the movement of people or material.

Activity charts – are used to study and improve the utilisation of an operator and a machine or some combination of operators and machines.

Summary of main learning points

Firms know that their human resource strategy can yield a competitive advantage. An operations manager is required to build an environment with mutual respect and commitment and a reasonable quality of work life. Successful organisations have designed jobs that use both the mental and physical capabilities of their employees. Regardless of the strategy chosen, the skill with which a firm manages its human resources ultimately determines its success.

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