MNO301D/101/3/2011

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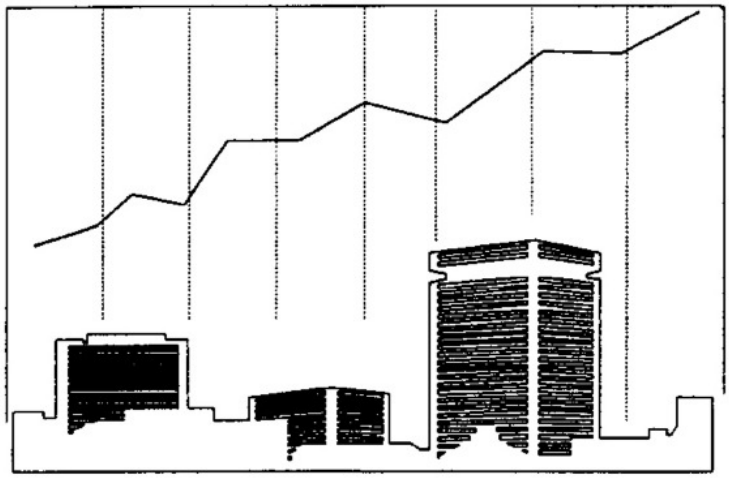
DEPARTMENT OF BUSINESS MANAGEMENT



BUSINESS MANAGEMENT MNALL2-K

PRODUCTION AND OPERATIONS MANAGEMENT (MNO301D)

TUTORIAL LETTER 101/3 MNO301D/2011

***A friendly request: the lecturers prefer communication by e-mail. It is effective and saves time. Thank you for you cooperation.**

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Dear Student

1 A WORD OF WELCOME

We have pleasure in welcoming you to this module on **Production and operations management** (POM) and trust that you will have a pleasant, stimulating and most successful year of study. If you grasp the potential economic impact of "adding value", then you will agree that a country's economic growth depends directly on this. The importance of this subject discipline can therefore only be fully appreciated if the contribution of productive transformation processes in the economy is understood.

The study material is an **integrated package**. Do not merely study the text book. The assignments (Annexure A) are also based on additional material (the **Case studies** in Annexure B). Your study guide can be regarded as your "lecturer" – please follow the guide (with additional activities/examples) as it divides the paper into 16 study units with very specific learning outcomes. The entire module is divided into the following three parts:

- Part 1: Developing POM strategies for competitive advantage (with two topics)
- Part 2: Designing, planning and controlling the POM system for world-class performance (with five topics)
- Part 3: Improving POM for the emerging challenges of the 21st century (with three topics).

This tutorial letter refers to module **MNO301D, Production and operations management**, and contains specific information on the assignment, the availability of lecturers, et cetera.

It is imperative to study Tutorial Letter MNALLEQ/301/4/2011 thoroughly as it provides important information on general matters pertaining to all undergraduate modules.

2 TUTORIAL MATTER

The tutorial matter for this module (MNO301D) consists of the following:

- **Supplied by Unisa**
  - one study guide
  - a number of tutorial letters

- **Prescribed study material**

The compulsory prescribed book, which you must acquire yourself is:

Slack, N., Chambers, S. & Johnston, R. 2007. Operations management. 5th edition. Harlow, England: FT Prentice Hall Pearson Education.

NOTE: **WE STRONGLY ADVISE YOU TO ACQUIRE THE PRESCRIBED BOOK IMMEDIATELY TO AVOID ANY POSSIBLE DELAY IN YOUR STUDIES. Note: the fourth edition is NOT prescribed and cannot be used.**

The study guide serves both as a manual for studying the prescribed book, and as a source of additional information about certain aspects of the syllabus.

3 COMPULSORY ASSIGNMENTS AND YEAR MARK

Consult Tutorial Letter MNALLEQ/301/4/2011 about the following:

- administrative matters concerning the assignment
- guidelines for answering essay questions
- key concepts in examining

IMPORTANT NOTICE: For students to fully benefit from our formative tuition and assessment, the Management of the University decided to introduce TWO **compulsory assignments** in all modules. The marks will contribute towards your year mark.

You are required to submit the first compulsory assignment to obtain admission to the examination – both assignments will eventually contribute to your year mark. Admission and a year mark will be obtained by submitting the compulsory assignments **on time**.

Please ensure that the assignments reaches the University **before the due date - late submission** of the first assignment (01) will result in you **not being admitted to the examination!**

PLEASE DO NOT CONTACT LECTURERS REGARDING ASSIGNMENT SUBMISSION / LATE SUBMISSION.

3.1 Compulsory assignments and due dates

UNISA has adopted a policy of **compulsory assignments** for all modules for 2011. Both multiple choice question (MCQ) assignments 01 and 02 for MNO301D are compulsory assignments. The third assignment includes MCQs and "essay-type" questions – this assignment is voluntary for self-assessment purposes.

Assignment 01 has a dual purpose - you must submit ASSIGNMENT 01 in order to obtain admission to the examination and secondly it contributes to the year mark. Admission will be obtained by your submission of **ASSIGNMENT 01** on time and not based on the mark you obtain for it. However, failure to submit **ASSIGNMENT 01** on / before the due date will mean that you will not be admitted to the examination, regardless of whether or not you have submitted Assignment 02 and obtained a year mark.

You will receive feedback on both the assignments in **Tutorial Letter MNO301D/201/3/2011.**

VERY IMPORTANT

Please ensure that your assignments reach us on or before the due dates. You will not be admitted to the examination if **Assignment 01** is submitted later than the due date. Please do not phone us with a request to be admitted to the examination if you did not submit **Assignment 01**, or if you submitted it later than the due date.

Different **unique numbers** are allocated to the two assignments for the **first** and the **second** semesters. Please make sure that you provide the correct unique number on the **mark-reading sheet.**

Both the compulsory and self-assessment assignments for 2011 for the module MNO301D are set out in **Appendix A** of this tutorial letter. The same assignments are set for **both semesters**.

Assignment number	First semester		Second semester	
	Due Date	Unique number	Due Date	Unique number
01	14 March 2011	**270007**	22 August 2011	**371786**
02	11 April 2011	**351262**	19 September 2011	**213489**

3.2 Year mark for MNO301D

Note: Assignment performance can primarily be to the benefit for students. It can benefit everyone (to be better prepared for the examination) and the assignment mark can also benefit those with a relative low examination mark between 46 and 50%. Please take note that **no assignment mark will be added for students with an examination mark below 40%.** Irrespective of the year mark obtained a sub-minimum of 40% must be obtained in the examination. You can therefore not pass the module if your examination mark is less than 40%.

These two assignment marks (percentages) will be combined as an **average percentage mark** referred to as your year mark. The year mark and your examination mark (the mark that you achieve in the examination) will be combined to calculate your final mark. **Your final mark for this module will therefore consist of a combination of the year mark (average assignment mark / percentage) and the examination mark**. The year mark will contribute 10% to the final mark for the module, while the examination mark will contribute 90%.

Please study the following examples of how the year mark may contribute to the final mark:

Example 1:

The learner submits both the compulsory Assignments 01 and 02 and earns an average year mark of 50%. This year mark of 50% is then multiplied by 0,1 which equals 5% of the final mark. If the learner obtains 35 out of a possible 70 marks in the examination (ie 50%), this percentage is then multiplied by 0,9 which equals 45% of the final mark. The year mark and the examination mark are then combined (5% + 45%) to give a final mark of 50% for the module.

Example 2:

The learner submits both the compulsory Assignments 01 and 02 and obtains an average year mark of 60%. This year mark multiplied by 0,1 gives 6% of the final mark. The learner then obtains 44 out of 70 marks (or 63%) in the examination. This figure is then multiplied by 0,90 to give 56.7%. The two results are then combined to give a final mark of 63% (6% + 56.7%) for the module.

Example 3:

The learner submits both the compulsory Assignments 01 and 02 and earns an average year mark of 30%. This year mark of 30% is then multiplied by 0,1 which equals 3% of the final mark. If the learner obtains 35 out of a possible 70 marks in the examination (ie 50%), this percentage is then multiplied by 0,9 which equals 45% of the final mark. The year mark and the examination mark are then combined (3% + 45%) to give a final mark of 48% for the module. This learner thus does not pass the module although he/she passed the examination. Your year mark can thus be critical for determining whether you pass or fail the module!

Example 4:

The learner submits both the compulsory Assignments 01 and 02 and earns an average year mark of 100%. This year mark of 100% is then multiplied by 0,1 which equals 10% of the final mark. If the learner obtains 31 out of a possible 70 marks in the examination (ie 44%), this percentage is then multiplied by 0,9 which equals 40% of

the final mark. The year and the examination mark are then combined (10% + 40%) to give a final mark of 50% for the module. This learner passes the module although he/she failed the examination – the student did, however, obtain a mark above the sub-minimum of 40% for the examination. Again your year mark can thus be critical for determining whether you pass or fail the module!

Example 5:

The learner does not submit Assignment 01 although he/she obtains a mark of 100% for Assignment 02. Because the learner did not submit Assignment 01 he/she will not be admitted to the examination and thus receives an examination mark of 0%. The learner will be awarded a final mark of 5% (0% for Assignment 01 + 100% for Assignment 02 = 100 divided by 2 = 50% multiplied by 0,1 = 5% [year mark] + 0% [examination mark] = 5% [final mark]).

The completion of assignments provides an excellent opportunity for you to ensure that the work you do during the course of the year contributes towards you final assessment mark. If you should decide not to use this opportunity in full you will be at a definite disadvantage compared to those learners who grab the opportunity with both arms. You are therefore advised and encouraged to do ALL the assignments and obtain a good year mark in order to get the full benefit of this system of assessment.

4 AVAILABILITY OF LECTURERS

The lecturers prefer communication by e-mail. The lecturers for this module in 2011 are as follows:

Any POM lecturer	Contact address
Mr R Dirkse van Schalkwyk	dirksr@unisa.ac.za
Dr. R Ramphal	Ramphrr@unisa.ac.za

The lecturers' offices are situated on the third level in the AJH van der Walt Building which is on Unisa's Main Campus in Muckleneuk Ridge.

Personal visits must please be pre-arranged by appointment. If lecturers are in consultation and not available, please leave a message by e-mail or with another lecturer in the department. We will then contact you.

A final request: Please do not wait until the last moment before contacting us. Usually it is only a day or two before the scheduled examination date that we receive literally thousands of desperate calls!

NOTE: **Please do not contact lecturers for administration matters -** you should only contact the lecturers about **academic matters**. Any other enquiries must rather be taken up with the relevant department or section concerned. Use the guidelines in Tutorial Letter (MNALLEQ/301/4/2011).

5 FORMAT AND GUIDELINES FOR THE EXAMINATION

Please note that the examination will cover the whole syllabus (all parts, topics and study units) for the module MNO301D. The examination is a "closed book" examination and you must therefore know, understand and be able to apply **ALL** the work including, formulas, etc. We therefore urge you not to leave out or ignore any part of the study material in your final preparations for the examination.

The format of the examination paper that you will be required to write for the module is very similar to the format that you encountered in the last two assignments during the semester (that is a combination of both multiple-choice and essay-type questions will be used).

The examination paper is, however, worth 70 marks and will consist of two sections. Section A contains the multiple-choice questions (10 questions will be asked which will count 1 mark each, in all 10 out of the examination total of 70 marks or 14%). Section B contains the essay questions. There will be three questions, each of which will count 30 marks, the questions will have subsections as in the assignments, and you will have to select two (for 60 marks out of the examination total of 70 marks or 86%). The duration of the examination will be two hours.

The examination papers of **previous years ARE NOT AVAILABLE**. However, both the multiple-choice and essay type questions in the examination are similar to those in the assignments.

6 CONCLUDING REMARKS

We wish you a successful year of study and we hope that you will find this module interesting and stimulating. We are convinced that this module can make a significant contribution to both your personal and professional development. Feel free to consult us at any time, should you encounter any problems in your studies.

Kind regards

Mr. Riaan Dirkse van Schalkwyk
Dr. Roy Ramphal

DEPARTMENT OF BUSINESS MANAGEMENT

Unisa

ANNEXURE A: ASSIGNMENTS FOR 2011

ASSIGNMENT 01 COMPULSORY ASSIGNMENT	
1ST SEMESTER: DUE DATE	**14 MARCH 2011**
UNIQUE NUMBER:	**270007**
2ND SEMESTER: DUE DATE	**22 AUGUST 2011**
UNIQUE NUMBER:	**371786**

This assignment for module MNO301D consist of **ten** multiple-choice questions (MCQs) for topic 1 (study units 1 and 2), topic 2 (study unit 3) and topic 3 (study units 4 and 5).

The assignment is applicable to both the first and second semesters.

MULTIPLE-CHOICE QUESTIONS

Answer the following ten (10) multiple-choice questions. Each question is of equal value and is allocated one (1) mark. No negative marking will be applied.

TOPIC 1	**STUDY UNIT 1**

1 Which **three** of the following statements are **correct**?

a All operations of all types of businesses produce goods or render services, or a mixture of the two, by a process of transformation.

b Transformed input resources comprise the following: materials, information and customer/clients.

c The difference between transforming and transformed input resources, respectively, lies in their position in relation to the output resources.

d A dominant transformed material resource, such as a factory plant, would be found in all types of manufacturing operations.

e After having gone through either materials, information or customer processing, outputs emerge in the form of goods or services which are generally different because of tangibility, storability, transportability and customer/client contact.

1 abc
2 bcd
3 cde
4 ade
5 abe

2 Which **three** of the following statements are **incorrect**?

a The activities of production/operations management encompass five direct responsibilities, namely to understand the operation's strategic objectives, to develop a production/operations strategy, to design, to plan and control, and to improve the production/operations system.

b The general model of production/operations management consists of two components: an input-transformation process-output model, which has a management overlay consisting of the direct and indirect responsibilities of production/operations managers.

c The production/operations system hierarchy consists of the internal reporting relationships between high-level, middle-level and low-level managers, supervisors and shop-floor workers.

d An internal customer is a person or group of people who over many years has/have reached the status of preferred trading party (ie VIP customer), while an internal supplier has also reached preferred trading status and acts as an extension of the primary business.

e One of the advantages of buffering the production/operation system against disruptions originating in the external environment is the business's ability to significantly reduce stocks of input and output resources.

1 abc
2 bcd
3 cde
4 abe
5 acd

TOPIC 1	**STUDY UNIT 2**

3 Which **one** of the following statements is **correct**?

1 In order to understand the contribution of the production-/operations function to the business, it is necessary to answer the following questions: What is the role of or what part is the function expected to play in the business and how much can personnel working in the production/operations section of the business influence its budget?

2 The role of the production/operations function in a business is threefold, namely to support, implement and drive the strategy of the business, and these roles correspond with the function of acting as a "follower", an "effector" and a "leader".

3 In stage 3 of Hayes and Wheelwright's four-stage model, the contribution of the production/operations function to a business's competitive position is neutral and principally attempts to avoid making mistakes in its production-/operations processes.

4 If the production/operations function plays the role of an "effector", this is in line with Hayes and Wheelwright's competitive position of internal neutrality.

5 The "best" position or role that the production/operations function may attain is one where the function becomes both internally neutral and supportive and becomes the best in

the marketplace.

4 Which **one** of the following statements is **incorrect**?

1 The performance objectives of the production/operation system embody what the expectations of the business towards this function are and what contribution it could make to the business's competitiveness or strategic direction.

2 Achieving the production/operations performance objectives of high quality, speed and cost and greater flexibility and dependability helps the business to exploit so-called "production/operations-based advantages"

3 Production/operations-based advantages may be seen as the result of something that the production/operations function did well and that contributes to the long-term survival of the business.

4 A flexibility rather than a speed advantage could be gained by the business if customers/clients receive their goods and services on the due dates as promised.

5 If the production/operations function of a business is able to reduce the total transaction time it takes to complete a purchase, the beneficial result could be regarded as speed advantage.

TOPIC 2	**STUDY UNIT 3**

5 Which **two** of the following statements are **correct**?

a The operation's competitive role and position, together with the articulation of the specific performance or strategic objectives it hopes to achieve, largely influence the content of the production/operations strategy of the business.

b The hierarchical position of the production/operations strategy in relation to the corporate or business strategy depends on how management view the potential of the production/operations function in contributing to the long-

term success of the business.

c The process aspects of the production/operations strategy largely determine the relative priority of the performance objectives of the business and further relate to each of the specific decision areas in the design, planning and control, and improvement of the production/operations management system.

d The relative importance that a business attaches to specific performance objectives is determined by the influence that customers/clients may have on the business, its competitors and the stage of the business's products or services in their life cycles.

e The operation's infrastructural strategy areas are primarily influenced by the design activities (ie similar to the "hardware" of a computer system) while the structural strategy areas are influenced by the planning and control and improvement activities (ie similar to the "software" of a computer system).

1 ab
2 bc
3 cd
4 ad
5 ae

6 Study case study 1 entitled "Improvement strategies at Rover" in annexure B of this tutorial letter and then indicate which **two** of the following statements are **incorrect**:

a A significant element of Rover's improvement strategy was the attention given to its human resources by recognising that the workforce was the most important resource in the company and the driver of all continuous improvement efforts.

b Rover's improvement strategy primarily focussed on the re-organisation of the company structure and the introduction of re-engineering principles for the adoption of Japanese best-working practices.

c Rover improvement strategy further emphasised the performance objectives of low cost, dependability and good service.

d Competitor benchmarking at Rover meant the company was to get to "know its enemy".

e "Roverization" meant that the company dedicated itself to an improvement strategy that would move its products to the top of each product class. The elements of the programme included training the entire workforce in the philosophies and tools of total quality management (TQM) and the company's endeavours to achieve "extraordinary customer satisfaction", et cetera.

1 ab
2 bc
3 cd
4 de
5 ae

TOPIC 3 **STUDY UNIT 4**

7 Which **three** of the following statements are **correct**?

a A general guideline for effective design is that the number of components of the product or operations of the service be minimised to reduce costs, improve on the quality of product/service and generally facilitate production or service.

b General guidelines for effective design in production/-operations management may be classified under the three main headings of: general guidelines; quality guidelines; and producibility/operability guidelines.

c Avoidance of special complicated fasteners and/or connectors for products or off-line elements of the service that may interrupt it, is a producibility/operability guideline well worth pursuing.

d A quality guideline holds that designs should concentrate on the robustness of the product (ie “should not break easily”) and avoid designs that require a great deal of attention during manufacture or delivery (ie “one could make the product or provide the service with one’s eyes closed”).

e Key questions in assessing the feasibility of a design for a product/service are as follows: Are the necessary skills or quality of resources available? Are the financial resources and financial return acceptable? Does the business have the organisational capacity or quantity of resources to cope with the specific design option?

1 abc
2 bcd
3 cde
4 bde
5 abe

8 Which **three** of the following statements are **incorrect**?

a Performance objectives of the design activity include producing: error-free designs, designs that are moved from concept to specification in as short time as possible, designs that do not consume excessive amounts of resources during the creation process, et cetera.

b The primary purpose of the design activity is the requirement for a high degree of compatibility between the design of the product/service and the design of the processes for their manufacture or provision.

c The overlap between the design of the product and the design of the process for its manufacture is generally greater than for the design and provision of services because in the case of manufacturing, the high degree of automation makes greater coordination necessary.

d The design activity for high-volume, low-variety operations should emphasise the product/service design if the degree of standardisation is high, the process flow is continuous and

the staff skills are task specific.

e The aspects of the production/operations management system that need to be designed are: the design of the products/services themselves, the design of the production/-operations network, the design of the layout and the work flow of the manufacturing or service provisioning facility, the choice and selection of process technology, and job design and work organisation.

1 abc
2 bcd
3 cde
4 abe
5 acd

TOPIC 3 **STUDY UNIT 5**

9 Which of the following statements is/(are) **correct**?

a Process technology comprises all the machines, equipment and devices used in the operation during the transformation process of materials, information and customers/clients to manufacture products and provide services.

b The distinction between product or service technology and process technology is more difficult to make in the case of the manufacture of a highly advanced product such as a video recorder than in the case of an amusement park.

c During the introduction of a new product or service, the rate of innovation is high, consequently the emphasis on process technology is greater than on the product/service technology as in the case of personal computer (PCs).

d Process technology may conveniently be classified according to its primary transformed resource under the headings of materials, information and customer/client processing of which the second mentioned has been the dominant since the 1980s because of the availability of low-cost micro-processing and is largely present in the other two types.

e The design dimensions of process technology primarily focus on the degree of automation (ie how much labour is substituted by technology), the scale (ie how large the capacity is to perform tasks) and the degree of integration (ie how different parts of technology are connected together and interact with each other) of the technology.

1 a
2 bc
3 bde
4 ae
5 ade

10 Which of the following statements is/(are) **incorrect**?

a In case study 2 entitled "AGVs at new international, Wapping" in annexure B of this tutorial letter, the process of delivering the paper reel to the printing press and loading the paper into position are fully automated by the use of AGVs.

b In case study 3 entitled "FMS at Yamazaki Mazak" in annexure B of this tutorial letter, the factory at Worcester in the UK won the Management Today "Best Factory Award" by installing the greatest possible number of robotic assembly tools and by utilising them fully unmanned for overnight production.

c In contrast to material and information processing technologies where production/operations managers are mainly concerned with the interaction between their staff and the technology itself, customer/client processing technology involves a three-way set of interactions, in addition to the two above also with the customers/clients themselves.

d Developments in material processing technologies include: more sophisticated numerically controlled machine tools, robotics, AGVs, FMS, CIM; in the case of information processing technologies there is a strong movement to merge with telecommunications technologies such as EDI.

e In case study 4 entitled "Technology at the Robeco Group" in annexure B of this tutorial letter, the primary interaction between technology is direct and active through telephonic financial advice.

1 b
2 bc
3 be
4 adc
5 ade

TOTAL: ASSIGNMENT 01 10 x 1 mark = 10 marks

ASSIGNMENT 02 COMPULSORY ASSIGNMENT	
1ST SEMESTER: DUE DATE	**11 APRIL 2011**
UNIQUE NUMBER:	**351262**
2ND SEMESTER: DUE DATE	**19 SEPTEMBER 2011**
UNIQUE NUMBER:	**213489**

This assignment consist of **ten** multiple choice questions (MCQs) for topic 4 (study units 6 and 7), topic 5 (study unit 8), topic 6 (study units 9 and 10) and topic 7 (study units 11 and 12).

The assignment is applicable to the both the first and second semesters.

Answer the following ten (10) multiple choice questions. Each question is of equal value and is allocated one (1) mark. No negative marking will be applied.

TOPIC 4	**STUDY UNIT 6**

1 Which **three** of the following statements are **correct**?

a The planning and control activities in production/operations management reconcile the supply of the operation's products or services with the demand for them by customers/clients.

b The resources of the operation need to be planned and controlled to ensure their availability in the right quantity, at the right time and with the appropriate quality.

c The constraints placed on the planning and control task in operations include cost, quality and speed, which are the result of an infinite supply of resources which must be met by limited demand.

d Planning and control in operations go hand in hand. Long-term control is, however, more important than short-term planning because of the potential to influence decisions.

e In case study 5 entitled "Operations control at British Airways" in annexure B of this tutorial letter, the performance of the operations control team is evaluated in terms of the regularity and punctuality of all BA flights.

1 abc
2 abe
3 acd
4 cde
5 bcd

2 Which **three** of the following statements are **incorrect**?

a The nature of the decisions that are taken to plan and control an operation will largely depend on the extent of uncertainty in supply and demand.

b Dependent demand planning and control can only be exercised where the demand for the item based on some other known factor is reasonably certain and predictable.

c The demand time D (length of time that customers must wait for the product) will always be greater than the throughput time P (the time it takes the operation to deliver the product to the customer) in "make-to-stock" operations.

d The scheduling activity as part of the planning and control task in operations must determine which tasks must be performed before (or have priority over) others.

e In case study 6 entitled "The hospital Triage system" in annexure B of this tutorial letter, the hospital follows a strict FIFO sequencing and scheduling priority system.

1 abc
2 abe
3 acd
4 cde
5 bcd

TOPIC 4 **STUDY UNIT 7**

3 Which **three** of the following statements are **correct**?

a Materials requirements planning systems reconcile the supply of products and services with the demand for them by calculating the volume and timing of materials flow in independent demand conditions.

b Inputs to the MRP process include the demand management inputs (comprising known customer orders and realistic forecasts of demand in the future), the bills of materials and inventory records.

c In case study 7 entitled “Overcoming forecast problems at Racal recorders” in annexure B of this tutorial letter, problems of demand forecast followed the independent nature of demand of customer orders.

d Outputs of the MRP process include purchase orders (both the quantity and time required), materials plans and works orders.

e In case study 8 entitled “Staedtler: manufacturing and the use of MRP” in annexure B of this tutorial letter, the MRP system is initially analysed to ensure that the weekly loadings on each work centre are realistic.

1 abc
2 cde
3 bde
4 acd
5 bcd

4 Study the example of the level master production schedule as illustrated in the table below. If the quantity of sales orders is 9 in week 5, what would the quantity of available to promise (ATP) for week 7 be?

Week number

	1	2	3	4	5	6	7	8	9
Demand	10	10	10	10	15	15	15	20	20
Sales orders	10	10	10	8	4				
Available	31	32	33	34	30	26	22	13	4
ATP	31	1	1	3	7	11	11	11	11
MPS	11	11	11	11	11	11	11	11	11
On hand 30									

1 16
2 11
3 5
4 2
5 7

TOPIC 5 **STUDY UNIT 8**

5 Which **two** of the following statements are **correct**?

a JIT or just-in-time refers to both a philosophy behind production and operations management and a distinct method of production/operations planning and control.

b Just-in-time production/service means that products/services are manufactured/provided only a few days before they are needed by a customer/client - not too many days beforehand because they then become inventory - and not too many days late because then the customer/client has to wait too long.

c The JIT approach differs from the more traditional approaches to manufacturing where inventory is kept at each successive stage rather than delivery on request.

d Reducing the level of inventory, means that production and operations management must deal with an increased amount of work-in-process, fewer defective deliveries, more scrap and rework but less downtime.

e JIT as a philosophy holds that all forms of waste should be eliminated, all employees should be involved, improvements should continuously be made, and high utilisation of production capacity should be maintained.

1 ae
2 ad
3 ac
4 bc
5 be

6 Which **two** of the following statements are **incorrect**?

a JIT requires a high standard in all of the operation's performance objectives, specifically in high quality, fast speed, high dependability and flexibility.

b Basic working practices in line with the JIT principles include: discipline, equality and development of personnel, line stop authority, problem solving and quality of work life.

c In case study 9 entitled "Flexibility helps JIT at L'Oréal" in annexure B of this tutorial letter, the company was able to increase batch sizes to more economical production runs which improved the overall logistics of purchasing materials, production, storage and distribution of their products all over the world.

d In case study 10 entitled "Toyota's production system" in annexure B of this tutorial letter, the specific JIT planning and control techniques used were "assembly line broadcasting" for components and smaller subassemblies but conveyance kanban for major subassemblies such as engines, push scheduling and *Jidoka*.

e Though JIT may be described as a "pull" system of planning and control and MRP as a "push" system, the two may be used in combination (ie JIT for "runners" and "repeaters" and MRP for "strangers").

1 ab
2 bc
3 cd
4 de
5 ce

TOPIC 6	STUDY UNIT 9

7 Which **one** of the following statements is **correct**?

1 Quality today is everybody's business. Most businesses now realise that high-quality products and services can give the organisation a considerable competitive edge.

2 The operation's view of quality is primarily manufacturing-based and focuses on "error-free" products.

3 The most significant quality gap and the one that the production/operations management function is primarily responsible for preventing, is the customer's/client's specification-operation's specification gap where there is a mismatch between what the customer/client thinks he/she is getting and what the operation thinks the customer/client wants.

4 The organisational responsibility for closing the actual quality-communicated image gap lies with the production/operations function because it is not providing the quality of product/service that the customers/clients expect.

5 Quality is like beauty - it lies in the eyes of the beholder.

TOPIC 6	STUDY UNIT 10

8 Which **three** of the following statements are **incorrect**?

a Quality gap number 3 is the primary responsibility of production/operations management because it concerns the mismatch between the actual quality of the product or service manufactured or provided by the operation, and the quality it supposedly sets out to provide or deliver - this gap is also known as the "conformance to specification" gap.

b Quality planning and control comprise a number of sequential steps, one of which is to set quality standards for each quality characteristic and thereafter decide how to measure the quality characteristic itself.

c In case study 11 entitled "Entrepreneurial quality" in annexure B of this tutorial letter, quality is defined as "making customers happy" for which the following quality standards are set: size of each pie (large), sufficient filling (minimum of 100 mg per pie), appearance (appetising), smell ("one whiff and all resistance crumbles") and durability (pies must stay fresh for at least 3 days after baking).

d In step 4 of quality planning and control, actual quality is controlled against the quality standards set for each quality characteristic. Of some concern during this process is the possible occurrence of type I errors (ie where action is not taken to prevent quality problems when it should be taken) and type II errors (ie where action is taken to prevent quality problems, when it should not in fact have been taken).

e In SPC, control charts for variables monitor the sample average or mean and range while for attributes the number or proportion of defective or wrong products is monitored.

1 abc
2 bcd
3 ade
4 bcd
5 cde

TOPIC 7 **STUDY UNIT 11**

9 Which of the following statements is(are) **incorrect**?

a Project operations involve complex, large-scale activities or endeavours that have defined beginning and end points which are high in volume but low in variety.

b A possible match between the elements of a project and the factors that contribute to successful project management could be (note: the element numbers 1 to 6 below refer to the general characteristics of projects namely, an objective, complexity, uniqueness, uncertainty, temporary nature and life cycle while the factors for project management success, numbers 1 to 11 below, are described on page 499 of your prescribed book):

ELEMENTS OF A PROJECT	FACTORS FOR SUCCESSFUL PROJECT MANAGEMENT
(1)	(1)/(3)/(9)
(2)	(7)/(4)
(3)	(2)
(4)	(10)/(6)
(5)	(8)
(6)	(5)(11)

c Projects with a high level of complexity need to be planned particularly well in comparison with projects with high uncertainty where the emphasis should rather be on project control.

d If the "earned-value" method of project control is applied for a project of which the ACWP is R750 000, the BCWP is R600 000 and the BCWS is R700 000, the project is R150 000 over budget but R100 000 ahead of schedule.

e In case study 12 entitled "The channel tunnel" in annexure B of this tutorial letter, the project would be considered one with high complexity because many different organisations of different countries being involved, and one with medium uncertainty in terms of meeting its objectives with regard to time, cost and technical performance.

1 ac
2 b
3 ad
4 bcd
5 de

TOPIC 7 **STUDY UNIT 12**

10 Which of the following statements is(are) **correct**?

a The most common method of scheduling is by use of a Gantt chart. In figure 10.10 on page 306 of chapter 10 of your prescribed book, a Gantt chart illustrates a schedule for jobs at each process stage.

b A precedence network for the example of the project for implementing a new logistics operation is illustrated in figure 16.20 on page 521 of chapter 16 in your prescribed book. Should activity 5 be delayed by four days, the whole project will be delayed by three days (ie the total number of days to complete the project then becomes 96 days).

c Following the use of the CPM method, an activity with a duration of five days, whose ES (earliest start time) and LF (latest finish time) are 6 and 20 days respectively, its EF (earliest finish time) will be 11 days while its LS (latest start time) will be 15 days.

d In case study 13 entitled "Once in a lifetime" in annexure B of this tutorial letter, the Giotto project was only regarded as partly successful because the time objective was met (ie the spacecraft was shipped on time to the launch site and launched), the quality or technical performance was as good (ie the comet was intercepted as planned and thereby contributed to scientific knowledge about such phenomena) but sadly the project failed to meet its cost objective (ie the final cost of developing and constructing the craft overshot its budget by 10 per cent).

e The CPM network analysis method is highly suited to projects with high uncertainty and the PERT method, which is more popular and frequently used, assumes that time estimates of activity durations are deterministic. Furthermore, CPM uses the AoN method and PERT the AoA method for drawing the network diagrams.

1 ace
2 de
3 ad
4 bcd
5 abc

SUBTOTAL: 10 x 1 = 10 Marks

ASSIGNMENT 03

SELF-ASSESSMENT ASSIGNMENT

This assignment for module MNO301D consists of ten multiple choice questions (section A) that covers topic 8 (study units 13 and 14), topic 9 (study unit 15) and topic 10 (study unit 16) and the essay type questions (section B) covers all topics at random (90 marks).

The assignment is applicable to both the first and second semesters.

SECTION A: MULTIPLECHOICE QUESTIONS

Answer the following ten (10) multiplechoice questions. Each question is of equal value and is allocated one (1) mark. The relative weight of section A is thus 10 out of the assignment total of 100 marks or 10%.

TOPIC 8 STUDY UNIT 13

1 Which **three** of the following statements are **correct**?

a The improvement of the production/operations management system follows after the system has been designed and its activities planned and controlled.

b Improvement activities of production/operations management may be treated as a process involving three stages, namely to understand the approaches and techniques used for improvement, to prevent failure but know how to recover when failures occur, and to support the whole improvement process through the TQM approach.

c The performance objectives of quality, speed, dependability, flexibility and cost, are the main performance standards for the improvement of the production/operations management system.

d A disaggregated, partial measure for the performance objective of high quality is: the level of customer/client complaints.

e A performance standard is much the same as a performance measure, that is, it describes how to measure the performance of the production/operations management system against which criteria.

1 ace
2 bce
3 abd
4 bcd
5 abe

2 Which **three** of the following statements are **incorrect**?

a Typical standards of performance include the following: historical standards, target performance standards, competitor performance standards and absolute performance standards.

b Benchmarking is a good example of an absolute

performance measure because it clearly indicates the position a business is occupying in industry.

c In case study 14 entitled “Xerox benchmarking” in annexure B of this tutorial letter, the company found that a prerequisite for success was setting realistic standards of performance for itself at both strategic and operational level.

d Deciding on improvement priorities for the operation involves looking at what customers/clients want (ie which performance objectives should be deemed important in the operation) and the performance and activities of competitors (ie how the business is currently performing in comparison with its competitors).

e In case study 15 entitled “EXL Laboratories” in annexure B of this tutorial letter, the company found that it clearly performed better than its competitors in terms of technical solutions but that this aspect of its service was “hardly ever considered by its customers” - thus the priority for improving in this regard was considered to be “low”.

1 ace
2 bce
3 abd
4 bcd
5 abe

3 Which **three** of the following statements are **correct**?

a Again referring to case study 15 entitled “EXL Laboratories” in annexure B of this tutorial letter, the company clearly needs to pay urgent attention to improving the cost and communications aspects of its service to customers.

b After determining the priority of improvement for a part or parts of the production/operations management system based on the importance to customers/clients and its performance compared with competitors, the strategy or approach to improvement needs to be decided upon.

c Breakthrough improvement efforts are seen as more dramatic, greater in scope and risks than continuous improvement efforts which are long term, long lasting and gradual and incremental.

d In case study 16 entitled "Nissan Motors (UK) Ltd" in annexure B of this tutorial letter, the company adopted *kaizen* principles to teamwork and improvement which are more reminiscent of a "breakthrough approach".

e If the concept "Deming wheel" is reversed in its implementation, the resulting focus would be a "breakthrough" or BPR approach to improvement rather than a continuous approach.

1 abc
2 bcd
3 cde
4 bde
5 acd

TOPIC 8 **STUDY UNIT 14**

4 Which **three** of the following statements are **correct**?

a TQM is a good example of a continuous improvement technique which together with cause-effect diagrams may significantly help diagnose quality-related problems.

b TQM may have a great impact on businesses, which goes way beyond its current fashionability because it inherently has a great intuitive attraction to many people since most of them want "high quality" products and services, and the approach has proved in many cases that it can lead to dramatic increases in operational effectiveness.

c Without the contributions of the "quality gurus" such as Feigenbaum, Deming, Juran, Ishikawa, Taguchi and Crosby, TQM as an improvement philosophy and as an

organisational approach to manage improvement efforts, would never have materialised.

d Crosby's contribution to "quality thinking" may be traced back to the phrases of "zero defects" as an absolute performance standard, measuring the "price of non-conformance" and "fitness for use" as a user-based approach to quality.

e TQM may be viewed as a managerial philosophy, "a way of thinking and doing", primarily concerned with meeting the needs and expectations of customers/clients. It moves the focus and responsibility for quality away from merely the production/operations function to a major concern for the whole business or organisation.

1 abe
2 cde
3 adc
4 bce
5 abc

5 Which **three** of the following statements are **incorrect**?

a TQM can be viewed as a natural extension of earlier approaches to quality management - originally quality was achieved by inspection. Thereafter, through quality control, a more systematic approach to detecting quality problems was developed including the treatment, and finally to quality assurance where the responsibility for quality was widened and included other functions and also made greater use of statistical analysis.

b Fundamentally, TQM is concerned with meeting the needs and expectations of customers/clients, getting "things right the first time", developing systems and procedures to support quality (ie ISO 9000), and finally advancing the practice of the continuous approach to improvement.

c In case study 17 entitled "Hewlett-Packard's internal customer checklist" in this tutorial letter, the emphasis on

their application of the concept primarily supported the TQM principles of (i) meeting the customers/clients needs and expectations and (ii) that the costs of quality, including the internal costs of failure, should be considered.

d A criticism of the traditional quality cost model which the TQM model overcomes by changing the way quality costs are viewed in business from an appraisal to a design-in driven approach involves the overestimation of the costs of failure and underestimation of the costs of prevention and appraisal in the traditional model.

e In case study 18 entitled "ISO 9000 at Sasol synthetic fuels" in annexure B of this tutorial letter, TQM lost its effectiveness because management at first incorrectly selected ISO 9002 which primarily dealt with a quality systems model for design, production, installation and servicing.

1 acd
2 bde
3 ace
4 abc
5 cde

6 Which **three** of the following statements are **correct**?

a Any TQM improvement programme in a business will have only a one out of two chance of immediate success if it is not implemented effectively, and furthermore, if it is not continuously supported by top management.

b A factor that appears to influence the eventual success of a TQM improvement programme is recognising any success formally and rewarding the effort and initiative.

c The heart of a TQM improvement programme is training. Not only should the programme have an appointed training manager as the prime mover but all the staff of a business also need to learn of quality techniques.

d TQM loses its effectiveness when the initial enthusiasm

wears off after the "levelling off" phase of the programme and needs to be either "rebolted" or again "kick started" with more motivational slogans and exhortations such as "Quality is life - make sure you get yours!".

e The Deming Prize and Malcolm Baldridge National Quality Award serve as examples of how quality awareness and improvement may be stimulated in countries and their businesses.

1 acd
2 bde
3 bce
4 abc
5 cde

TOPIC 9 **STUDY UNIT 15**

7 Which **two** of the following statements are **correct**?

a Some businesses or operations can afford to be somewhat indifferent to failure. In other cases, dependability is not only desirable but essential as in the cases of a taxi transport service or hot water geyser at home.

b Though production/operations managers should always attempt to minimise the likelihood of failure, they should recognise that they will inevitably occur. In such situations they should learn from them and put plans in place to help the operation to recover from them.

c A failure in a particular product or service is usually more serious than a failure in the production/operations process because the customer/client will immediately complain.

d In case study 19 entitled "Failures puncture Hoechst's reputation" in annexure B of this tutorial letter, the failures were primarily technical in nature and directly attributable to a design failure in the chemical plant.

e In case study 20 entitled “Failed philosopher” and in case study 21 entitled “Two million to one” in annexure B of this tutorial letter, the type of failure in the first case was primarily a design failure while in the second case, it was attributable to staff failures.

1 ab
2 bc
3 cd
4 be
5 ce

8 Which **two** of the following statements are **incorrect**?

a When measuring failure in a production/operations systems, the focus could be on failure rates (ie the number of failures divided by the total operating time), reliability (ie own component’s reliability multiplied by each of the other interdependent components of the system) and availability (ie MTBF divided by MTBF+ MTTR).

b Three specific activities of production/operations managers relating to failure are (i) finding out what is going wrong and (ii) stopping things from going wrong and (iii) repairing and coping with things that have gone wrong.

c The purpose of failure detection and analysis is to check whether the customer/client is “happy” with the product or service and if not, find out how it may be improved.

d The causes and effects of failure must first be understood by production/operations managers, so that measures can be taken to prevent them from occurring in the first place. Failures may, however, be prevented if the reliability of the operation itself is improves.

e Designing-out fail points, building redundancy into the operation, fail-safe(ing) and maintenance are examples of methods whereby an operation may recover from failure in the most cost effective manner.

1 ab
2 bc
3 cd
4 ae
5 ce

TOPIC 10 **STUDY UNIT 16**

9 Which of the following statements is(are) **correct**? Refer to case study 22 entitled "The operations challenge - 1995 first edition perspective" in answering the question.

a Some of the strategic production/operations challenges that production/operations managers are likely to face in the future are: to develop ethical production/operations strategies, to consider the international dimension in them, to be creative in devising new strategies, and to implement the chosen strategies effectively.

b The content-related issues of production/operations strategies deal with how or they way in which they are formulated, while the process- related issues focus on what they entail in practice in a business organisation.

c Based on Sweeney's classification of generic production/-operations strategies which involves the classification of manufacturers based on the dimensions of the approach to process design and customer/client service criteria, the "reorganiser" and "marketer" follow similar strategies in terms of enhancing their structure but dissimilar in terms of improving on their infrastructure.

d The Hill methodology for the formulation of a production/-operations strategy involves a five-step iterative process where the customers'/clients' viewpoint of the competitive factors that are deemed important, determines the focus of the operation.

e In the final analysis, after the formulation of production/-operations strategies, they need to be appropriate,

achievable, adjustable, affordable and acceptable.

1 de
2 ad
3 d
4 bcd
5 ab

10 Which of the following statements is(are) **incorrect**? Refer to case study 22 entitled "The operations challenge - 1995 first edition perspective" in answering the question.

a If a production/operations strategy is to be ethical, it must be accepted by the community as "legally justifiable". Without such a condition being met, the business could be forced by government legislation to "transform" itself.

b Production/operations strategies that reflect their international nature deal with issues such as where the production-/operations facilities will be located and how the production/operations network will be managed over national boundaries.

c The use of "creative" production/operations strategies offers the opportunity to avoid falling into the Atrade-off paradigm "by rather Araising the pivot" rather than "altering the balance" between different performance objectives.

d At the end of the day, production/operations strategies must be implemented effectively if they are to have any effect on the efficient functioning of the production/operations function.

e To achieve effective implementation of production/-operations strategies, one should know when to start, where to start, how fast to proceed and how to coordinate the whole programme. Furthermore, top management support and a time-framed project management approach to implementation are vital.

1 a
2 ab

3 abc
4 abcd
5 abcde

SUBTOTAL: SECTION A: 10 x 1 = 10 marks

SECTION B: THREE ESSAY QUESTIONS x 30 MARKS = TOTAL: 90

QUESTION 1 (30 MARKS)

1.1 Over recent years there has been a resurgence of interest in operations management, in universities but especially in business. Why do you think this is? [5]

1.2 Illustrate the concept of a Stage 4 company by explaining how a Stage 4 operations function within the following organizations could contribute to their long-term competitive success:

a salted snack manufacturer
an airline
a parcel delivery service
an hotel. [10]

1.3 Illustrate how the strategy hierarchy would operate in a 'not-for-profit' organization such as a charity which provides hostel accommodation and other welfare services to vagrants.

[5]

1.4 Explain the importance of the volume-variety dimension as a way of understanding operations and their approach to design. [5]

1.5 Discus the relationship between product/service and process technology for a product or service of which you are familiar. [5]

QUESTION 2 (30 MARKS)

2.1 Identify as many applications of automation as you can in the following operations: a hospital and a university.

[5]

2.2 What is meant by a closed-loop MRP system?

[5]

2.3 Discuss the advantages and disadvantages of working just-in-time.

[5]

2.4 A factory uses two machines to slice plastic extrusions. The specification range for the output of machine 1 is 16.7 to 17.3 cm and is 22 to 26 cm for machine 2. The outputs of the machines are normally distributed around 17 and 24 cm respectively with standard deviations of 1.7 and 2.1 cm. The normal variation in the two machines is known to be 0.5 and 1.9 cm respectively. The operations manager has the budget to upgrade one of the two machines this year. Which one would you recommend is replaced on the basis of its ability to do the job?

[5]

2.5 Construct a network diagram which satisfies the following relationships:
A, B, and C are the first activities of the project and can start simultaneously.
A and B precede D.
B precedes E, F and H.
F and C precede G.
E and H precede I and J.
C, D, and J precede K.
K precedes L.
I, G and L are the terminal activities of the project.
(Note: use the CPM method of analysis.) [10]

QUESTION 3 (30 MARKS)

3.1 Explain the differences between breakthrough improvement and continuous improvement. Discuss the advantages and disadvantages of each. [5]

3.2 Find more out about one of the "quality gurus". Describe his background, his approach to quality and his key contributions to the subject. Refer to pages 651 - 652 in chapter 20 of your prescribed book. (Note: clearly show the probable contribution of the said person to the total quality management (TQM) approach.) [10]

3.3 A 24-hour ATM machine outside a bank was closed down between the following times during a seven-day period:

11.00 am Monday - 2.00 pm Monday
1.00 am Monday - 10.30 am Tuesday
4.00 am Tuesday - 10.00 am Wednesday
3.00 pm Friday - 10.00 am Saturday

Calculate the ATM's failure rate (in time), the mean time between failures, and its availability. [5]

3.4 If a busy operations manager said to you, 'Why should I spend time and effort on putting an operations strategy together? I already have enough to do as it is, if I devote any time to such luxuries I would fail to satisfy our customer's immediate needs. This would put us out of business and no operations strategy is going to help us then!', how would you make a case to the operations manager which convinced him that operations strategies formulation was worthwhile? Refer to case study 22 "The operations challenge - 1995 first edition perspective" in answering the question on the formulation of production/ operations strategies. (Note: also indicate why you think such strategies should be "ethical".) [10]

SUBTOTAL: SECTION B **90 marks**
TOTAL: SECTIONS A & B **100 marks**

ANNEXURE B: MNO301D CASE STUDIES FOR 2011

The following cases were selected to enrich the study material and also for purposes of the assignments.

Note: all case studies contained in this annexure were taken from the **Southern African Edition** of the Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston first edition textbook, titled *Operations management*, which was adapted by Pycraft, M, Singh, H & Phihlela, K and published by Pitman Publishing in 1997. Full acknowledgement for the contributing authors is given.

CASE STUDY 1: IMPROVEMENT STRATEGIES AT ROVER

During the 1960s and '70s large parts of the British motor industry came together in a vast conglomerate. The resulting (nationalized) company's structure was messy, its factories relatively inefficient, and its products were failing to compete against Japanese imports to Europe. By 1994 the company, now know as The Rover Group, had been turned round to become a successful and respected company within BMW, the up-market German automobile manufacturer.

Rover's improvement strategy had responsible for this change. It started with what the company called *Roverrization* - meaning that it moved its products to occupy the top of each product class. Between 1989 and 1993 Rover also embarked on what was to become the most intensive new model introduction programme in its history. But, most important, underpining the development of attractive new products was a revolution in the company's manufacturing operations. This improvement strategy had a number of elements.

These included a *quality strategy* which formed part of the foundations of all the company's activities. It involved training the entire workforce of more than 30 000 people in the philosophies and tools of total quality management. Not only did the strategy emphasize the use of improvement tools, it helped to create an appropriate environment of a 'step change' in quality and working practices withing the company. Fundamental to its quality strategy was a concept of how the company wanted its customers to react. It summarized this in the phrase *extraordinary customer satisfaction* - a phrase which Rover's Chief Executive described as the three most

important words in the company.

Competitor benchmarking was also an important element in Rover's improvement strategy - what some in the company called 'knowing your enemy'. In looking outside the company it was influenced by the experiences of North American manufacturers in their own home market. For every Japanese-owned factory which had opened, an American manufacturer's plant had closed. By studying the performance and methods of Japanese motor manufacturers, Rover knew just how good it had to be in order to compete. Its long association with Honda, recognized as a world-class company, was a considerable help in understanding how Japanese 'lean' operations practices could be adapted to a Western environment.

Perhaps though, the most significant element of Rover's improvement strategy was the revolution in how it approached its *human resources.* A reorientation towards seeing the workforce (or associates as Rover calls them) as the most important resource in the company and the driver of continuous improvement was supported by a belief that people needed to work not just harder but smarter as well. The *Rover Tomorrow* programme involved briefing all employees about the company's plan for the future. People policies also included:

- total flexibility in working practices and between jobs;
- single status for all associates no matter what their job within the company.

The reason why improvement strategies were so central to Rover was very simple - the company might not have survived without them.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 94-95. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 2: AGVs AT NEWS INTERNATIONAL, WAPPING

The News International plant at Wapping, in London, produces three daily newspapers and two Sunday papers. Together these have a weekly circulation of around 25 million papers. The facilities at the plant include 16 printing presses, which run through the evening and into the night at full speed, to ensure the completion of the run before

the early morning delivery deadlines. To the production staff at News International it is vital to achieve high levels of dependability and reliability: Their major objective during the print run each night is to minimize downtime which could have repercussions on their achieving their production volumes and times.

Each of the 16 printing presses uses one roll of paper every 20 minutes during the seven hour production period. These rolls of paper each weigh about one tonne. The paper is delivered form the nearby warehouse daily, and once checked, is stored for collection at the plant entrance. The process of delivering the paper reel to the press and loading the new reel into position has been automated by the use of AGVs. These AGVs are basically cradles designed to carry one roll of paper. They are guided by a predetermined metal strip in the floor and controlled by an information system which links the vehicles to the presses. A sensor on each press will request a new reel once the previous spare has been loaded for use. An AGV arrives at the press and loads the reel into an initial position which is checked for alignment by the operator before the final loading is started. Once the roll reaches a lower limit, the new reel can be brought up to speed, ready for automatic change-over.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 269. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 3: FMS AT YAMAZAKI MAZAK

When the Japanese tool manufacturers, Yamazaki, opened their new European factory at Worcester in the UK, it represented at , 35 million investment, and was seen as the company's gateway into the European Union. They had already established successful bases in Japan and the United States. Fifteen million pounds of the initial costs was taken up by the installation of four fully computer-integrated FMS, making the factory one of the most advanced machine tool manufacturing operations in Europe.

The complete FMS which Yamazaki developed allow overnight unmanned production and thereby make the most of its investment in the technology. Of course, the Yamazaki products are built by an entirely Yamazaki FMS.

Behind the decision to invest in this system was the need to compete directly with European manufacturers. With a wide range of over 60 products, individual volumes are small. Because of this the company wanted an operation that would be so flexible it would not matter in which order items were processed. High utilization would be maintained by having very fast set-ups, which would also reduce the need for large batches. The operation can make individual pieces to suit its tight production schedules. This enables the company to offer typical order lead times of only four weeks, in comparison to competitors' lead times of eight or more for similar products.

All component workpiece are loaded into fixture mounted on special pallets. The operators prepare enough work to enable the system to run overnight unsupervised. At the center of the FMS is a host computer which schedules and controls the activity of each machining center and the materials handling devices. The computer predetermines the pallet locations and, as the machining centers becomes free, an automatic pick/load device will select the next workpiece from the waiting queue and will place it into the available machine. Each machine is capable of handling almost any of the components, so that bottle-necks do not develop at any point in the system. Spare tools used for the machining centres are stored in a central tool bank at the ends of the area and are transported to the required machine when requested by the system. The tools are delivered by a holding device on a highway which runs above the machining centres. At the end of the shift, the incoming operator can consult the computer for a print-out of the tools that have been used and which may subsequently need to be replaced in the tool bank. Many of the materials are delivered from the warehouse to the factory by AGVs, which pick up the items on request from the central scheduling system and travel along a sunken wire track around the factory. This again allows unmanned production during the night.

The factory has won the *Management Today*. 'Best Factory Award' in its category and the Queen's Award for Export Achievement, with around 85 per cent of its output shipped overseas, a third of which goes to Germany. It has also been labeled as 'Best in the World' by the Royal Swedish Academy of Engineering Sciences.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 270-271. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 4: TECHNOLOGY AT THE ROBECO GROUP

The Robeco Group, a Netherlands-based financial services group, sells investments and offers its customers financial advice by telephone. With three central offices in Rotterdam, Paris and Geneva, the company deals with over 350 000 calls every year at each office. With almost half a million customers, Robeco relies on technology to give a prompt and efficient service each time one of them phones to seek advice, enquire on his or her account status, or to conduct a transaction (buying or selling shares in mutual funds). In addition, customers can obtain leaflets on particular financial products.

To transact their business, customers call investment advisers in the company. Each adviser is linked through the company's computer system to various sources of information and advice covering such issues as interest-rate movements, stock markets around the world, economic forecasts, business news and political developments which could affect investments. When a customer phones, the investment adviser can access all information regarding the customer's account: for example, the financial return the customer has been getting for his or her investment (by month or by year), the transactions associated with the account and a full record of advice given and literature sent to the customer. Access to this shared information enables any investment adviser to respond to any customer (although very large customers have their own assigned account adviser). The computer system includes expert systems and models which help the adviser respond to sometimes very general enquiries. For example, if a customer asks about the impact on his investments of a change in the London housing market, the system might include a list of factor which impact the customer's investments, the proportion of the funds invested in London and so on.

Robeco staffs its lines from 8.00 am to 9.00 pm and attempts to answer all calls in the shortest possible time. All responses made by advisers to customers' specific enquiries are noted in the customer's account files and any brochures sent out by the adviser (through another department which stocks the brochures) are dispatched on the same day the enquiry was received.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S,

Harland, C, Harrison, A, & Johnston, R. 1997: 287. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

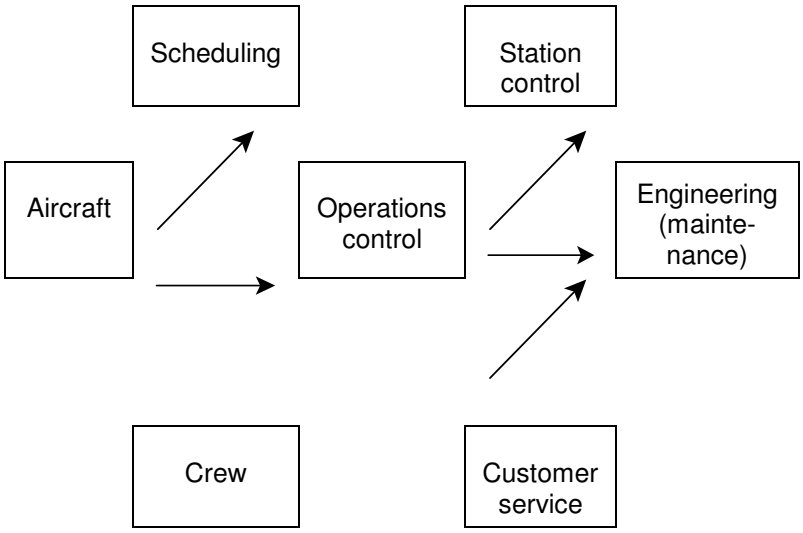
CASE STUDY 5: OPERATIONS CONTROL AT BRITISH AIRWAYS

British Airways (BA) is the world's largest international airline operator, with 240 aircraft flying between 155 destinations in 72 different countries. A BA flight takes off somewhere around the world, on average, every 90 seconds. The difficulties in planning a schedule which involves the world-wide resources of British Airways and ensuring that every flight leaves on time must be one of the most complex planning and control tasks in any operation.

The BA headquarters at Heathrow Airport near London is its busiest hub. It is there that you will find a small, but vitally important department known as Operations Control, which handles the seven days prior to take-off for long-haul flights, and the three days prior to take-off for short-haul flights. It is a full-time operation because there are flights in the air around the clock all over the world. Initial flight schedules are produced up to two years in advance, and the route schedules are negotiated at a six-monthly global conference. The planning and scheduling group at BA will then manage the production of a flight timetable, taking account of the longer-term implications of allocating certain aircraft types to each route. Any new routes or timings agreed are passed to Operations Control for comment on the practicalities of what is being proposed.

Operations Control inherits this final flight schedule, and can only make minor changes in order to cope with unexpected situations arising during the period prior to take-off. It is responsible for coordinating the three main resources required to provide the flight services, which are the schedule, the aircraft and the crew. They also are responsible for managing the knock-on effects of any delays, shortages or disruption to any of these inputs. The Operations control team is effectively still in charge of every flight until it lands, when departments such as engineering and Station control can take over. This handover is illustrated in Figure 1.

Figure 1 British Airways - Operations control centre



The performance of the Operations Control team is evaluated in terms of the *regularity* and subsequent *punctuality* of their flights. Regularity is defined as the percentage of flights actually taking off compared with the number scheduled. Passengers need to have total confidence that their flight will actually operate and current performance is almost 99 per cent (canceling a flight is the very last resort for Operations Control). Punctuality is the measure of the timing of the take-offs. BA sets an internal standard whereby a flight is considered late if it does not take off at the time defined in the schedule. Thus a flight can only be early, dead-on-time, or late. Current performance standards are about 60 per cent punctuality.

The IATA standards allow for a 15-minute buffer the scheduled take-off time before a flight is defined as 'late'. Measured in this way, British Airways achieve a much higher punctuality figure.

Operations Control is organized such that staff work in teams of two. One focuses his or her efforts on continuous improvement, and the other takes control of the current activities. Peter Saxton, the Operations Control Manager, feels that the combination of these two perspectives ensures that both the day-to-day activities, and the longer-term thinking, are dealt with in equal proportions in a part of the

business that has traditionally been viewed as reactive.

'Traditionally, the job in Operations control has been about fire fighting and that is what the staff have grown up with and enjoy doing. Now we are trying to switch the emphasis more towards developing systems that are more flexible, looking for longer-term issues, using more information to make better informed decisions, and building better relationships with our service partners in the British Airports Authority and Air Traffic Control, as well as other internal BA departments.'

Other component parts of the Operations Control Centre are the Emergency Procedures Information Centre (EPIC) and the Operations Control Intelligence Centre (OCIC) back-up centres. These are unmanned areas, set up to deal with certain types of incident at the 'press of a button'. The staff who would operate the centres are nominated, and are well trained in advance, even down to having simulated exercises on a regular basis. The EPIC centre is activated should BA, or any other contracted airline (there are over 60 subscribers to the service) be involved in an accident or serious incident, and it acts as a contact point for the public, and as a focal point for information regarding those on board. The OCIC centre is used only when a serious global incident, such as war, is affecting the entire BA business. Again the centre is manned by specially trained staff and headed by a BA board director. The team will then be on 24-hour action stations until the crisis has been resolved. These two crisis centres have become well known, and EPIC is frequently used by other organizations.

The strategy of having independent crisis centres means that the day-to-day business units do not have to cater for every eventuality.

They continue to work in die knowledge that an emergency situation will not be their responsibility, and they can thus focus more efficiently on the core operation.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 348-349. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 6: THE HOSPITAL TRIAGE SYSTEM

One of the most difficult-to-schedule environments in a hospital is the Accident and Emergency Department, where patients arrive at random, without any prior warning, throughout the day. It is up to the hospital's reception, and the medical staff, to devise very rapidly a schedule which meets most of the necessary criteria. In particular, patients who arrive having had very serious accidents, or presenting symptoms of a serious illness, need to be attended to urgently. Therefore, the hospital will schedule these cases first. Less urgent cases - perhaps where patients are in some discomfort, but their injuries or illnesses are not life-threatening - will have to wait until the urgent cases are treated. Routine non-urgent cases will have the lowest priority of all. In many circumstances these patients will have to wait for the longest time, which may be many hours, especially if the hospital is busy. Sometimes these non-urgent cases may even te burned away if the hospital is too busy with more important cases.

In situations where hospitals expect sudden influxes of patients, they have developed what is known as a *triage system*, whereby medical staff hurriedly sort through the patients who have arrived to determine which category of urgency each patient fits into. In this way a suitable schedule for the various treatments can be devised in a short period of time.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 364. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 7: OVERCOMING FORECAST PROBLEMS AT RACAL RECORDERS

Racal Recorders manufactures recording systems which are used in a wide variety of applications, from recording emergency telephone conversations through to recording automobile performance on the test track for later analysis. The technology of these products is sophisticated and the task of controlling their manufacture complex. Racal Recorders, through a combination of production of product superiority and manufacturing professionalism, are the market leaders with a turnover of around R250 million per annum.

One of its major production planning and control problems is how to coordinate the production and movement of all the parts which go into its product when virtually all products and systems are configured to meet the requirements of individual customers. An MRP system is needed to translate orders and forecasts into works instructions for purchasing and manufacturing parts, sub-assemblies and finished products. Its main problem was that after running the MRP process, the finished goods were put into stock to await customer orders. Yet the orders when they came never exactly matched what had been manufactured based on the forecast of demand. Some products remained in storage while others had to go back to the workshops to be re-manufactured to form the configurations which customers really did want.

Racal's solution to this was to analyse the common elements within its systems and manufacture 'models' which could be built up to make systems. Forecasts were prepared for the modules which, when manufactured, were kept on the shop floor until orders were firm. On the receipt of the confirmed order the modules could be assembled to form the finished system as specified by the customer.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 500. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 8: STAEDTLER: MANUFACTURING AND THE USE OF MRP

Staedtler is one of the world's premier manufacturers and suppliers of writing instruments with an annual turnover in the region of over R1,5 billion, and employing almost 4000 people. The Staedtler range extends from standard, high-volume consumer products such as pens, pencils, crayons and erasers, to highly specialized items designed for specific technical applications and for professional users. As the range has expanded, Staedtler has found that it can achieve very high-quality production by careful selection of raw materials, and by using the latest precision manufacturing techniques. The technologies employed include wood and graphite processing, injection moulding and extrusion of plastics, and the fine engineering of metals. Modern automated assembly machines allow the low-cost

mass-production of volume products such as ball-point pens.

In managing the production of its complex range of over 6000 products, Staedtler has been aided by the use of a well-tried MRP system. While some items, such as standard pencils, have a bill of materials with only a few levels, some of the more involved products require a breakdown of up to seven levels.

An example of a typical Staedtler bill of materials is shown in Table 1. This illustrates the different levels of production involved in manufacturing a '110-HB Tradition Pencil in Dozen Box' (level 0). The top level on the bill (shown as .1) gives all the items involved in the final packaging, including the finished pencil itself - coded FTRAD. The next levels in the bill are all required in the production of pencils themselves, with level 2 being the materials required to label the pencils with the Staedtler name and the paint for the dipping to give the traditional 'dipped end' on the end of the pencil. At level 3 are the lacquers and paints required to coat the basic pencil and finally level 4 details the raw materials, slats of wood, pencil lead slips, and glue which are used in the initial production of the pencil.

The bills of materials for every end product are stored on the MRP system, as well as routing and standard times for the products through each manufacturing and assembly process. An inventory file is kept for every end item, at every level. The master production schedule is initially analysed to ensure that the weekly loadings on each work centre are realistic, and then the full MRP output is created, which schedules all the production requirements at each level. Once a production order has been completed and booked back on to the system, the inventory levels of all items mentioned on the bill of materials are deducted accordingly. The production control staff at Staedtler has recognized that the key to running a successful MRP operation is to have simple, user-friendly systems. This will be their highest priority when they come to design and specify improvements to the system in order that the operations remain efficient, and the data accurate.

Table 1

Indented explosion	Sales Unit	Parent/Sales Number		Parent description
	GS	110-HB		Tradition pencil in dozen box
Pro-duction level	Com-ponent quality	Com-ponent unit	Component number	Component description
.1	12.000000	PC	V12TI	Tradition inners
.1	0.000600	PC	V12TF	Tradition Shrinkwrap
.1	0.050000	PC	V12C	Tradition carton
.1	1.000000	GS	FTRAD	Pre-packing tradition pencils
..2	0.007000	KG	DLW	White dip lacquer
..2	0.020000	KG	DLB	Black dip lacquer
..2	0.023000	PC	GFT	Tradition gold foil
..2	1.000000	GS	PTRAD	Pre-finishing tradition pencils
...3	0.100000	KG	PLR	Red polishing lacquer
...3	0.030000	KG	SLB	Black stripe lacquer
...3	1.000000	GS	RTRAD	Pre-polishing tradition pencils
....4	0.050000	PC	CCP2	Wood slats - CCP
....4	0.000600	KG	RASKG	Wood glue Tradition
....4	1.000000	GS	STRAD	pencil slips

Units: PC = Suppliers' unit KG = Kilogram
GS = Gross of pencils

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 509-510. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 9: FLEXIBILITY HELPS JIT AT L'ORÉAL

L'Oréal cosmetics is now world's largest toiletries and cosmetics group, with a presence in over 140 different countries. In the UK the 45 000 square metre purpose-built facility in mid-Wales produces 1300 product lines in a spotlessly clean environment which is akin to a pharmaceutical plant in terms of hygiene, safety and quality. The plant has 55 production lines and 45 different production processes, and the manufacturing system employed are of a flexibility that allows them to run each of the 1300 production lines every two months. That means over 150 different lines each week. But the plant was not always as flexible as this. It has been forced to enhance its flexibility by the requirement to ship over 80 million items each year. The sheer logistics involved in purchasing, storing and distributing the volume and variety of goods has led to its current focus on introducing JIT principles into the manufacturing process.

To help achieve its drive for flexibility and for just-in-time production, L'Oréal organized the site into three production centres, each autonomous and focused within technical families of productions. Their processes and production lines are then further focused within product sub-divisions. Responsible for all the activities from pre-weighing to dispatch within his area is the Production Centre Manager and his role encompasses staff development, training and motivation. Within the focused production centres, improvement groups have been working on improving shop-floor flexibility, quality and efficiency. One of the projects reduced the set-up times on the line which produces hair colourants from 2.5 hours to only 8 minutes. These new change-over times mean that the company can now justify even smaller batches and it gives them the flexibility to meet market needs just-in-time. Prior to the change in set-up time, batch size was 30 000 units; now batches as small as 2000 to 3000 units can be produced cost effectively.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 540. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 10: TOYOTA'S PRODUCTION SYSTEM

Toyota's version of JIT, which it calls the Toyota production System (TPS), has been the driving force behind its advance into what has been called a 'truly great manufacturing company'. The 'two pillars'of TPS are (and have always been):

3) *FIT pull scheduling*. The production and conveyance of what is needed, when it is needed in the amount that is needed.
4) *Fidoka*. Stopping the operations process in the event of problems, either by the staff who are process owners (who use a 'line-button), or by the machines themselves (which sense abnormalities automatically). In this way, defects cannot be passed on the next process and inspection is eliminated.

To Toyota the key control tool is their kanban system. The kanban is seen as serving three purpose:

1) It is an instruction for the preceding process to send more.
2) It is a visual control tool to show up show up areas of over-production and lack of synchronization.
3) It is a tool for *kaizen* (continuous improvement). Toyota's rules state that 'the number of kanbans should be reduced over time'.

Toyota uses two of the basic types of kanban to support JIT pull scheduling: the 'production' kanban and the 'move' kanban (what we call the conveyance kanban).

The number of parts per container is governed by factors such as part size and commonality between processes. Toyota believes that it is usually best that the number is divisible by 8 to facilitate hourly synchronization. This also means that the number of parts per container should be standardized where possible. The number of containers (hence the number of kanbans) is influenced by demand per hour, the lead time for the part and the number of parts per container. This is increased by a factor to allow for disruptions like breakdowns and absenteeism. This is increased by a factor to allow for disruptions like breakdowns and absenteeism. The number of kanbans should of course never be fixed, but subject to *kaizen*.

Major sub-assemblies like engines are not controlled by kanban. There are numerous different end options for such major sub-

assemblies, and inventory would simply be generated if separate kanbans were used for each one. Engines are therefore controlled by a different method. They are sequenced by *assembly line broadcasting*. In this approach, the exact customer requirements for a vehicle are broken down to major components and communicated ('broadcast') to the relevant production section. The procedure, therefore, is to sequence control major sub-assemblies, and to use kanbans for components and smaller sub-assemblies.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 549. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 11: ENTREPRENEURIAL QUALITY

In December 19195, Mr and Mrs Essay received some had news. One of their very profitable business had to be down as the owner of the property was going to demolish it within a short period of time. Mr Essay, an optimist by nature, saw this as an opportunity rather than a hurdle. Within no time he began scouting around for an alternative business.

After considering a number of options, he heard through the business network that a franchise was for sale. Crown Pies, as the name suggests, was a manufacturer of a variety of pies, based in the Carlton Centre in central Johannesburg. The existing owner was willing to sell the franchise for a reasonable amount. Considering that it was going concern, Mr Essay immediately knew that with a little creativity and a lot of hard work, the business could be successful. Since he took over, in January 1996, his business has been prosperous. Initially, due to a shortage of manpower, he had to assist with production, baking and delivering of pies. However, due to efficient organization, and trial and error, many of his problems and delivering of pies. However, die to efficient organization, and trial and trial and error, many of his problems have been overcome.

Crown Pies now employs a workforce of ten people. Each day they begin their work at 8.00 am and end at 5.00 pm. Mr Essay, however, since he is the owner of the business, has to put in additional hours in order to make his business, and, on average, he works 11 hours per

day. During busy periods, casual labourers are called in to help meet demand.

Since a pie is a consumable product, quality is a very important aspect of production. As a result, it is vital that each pie fulfils the function of satisfying a customer's hunger. Mr Essay ensures that each pie is large enough and provides sufficient filling to meet the customer's expectation. In terms of their appearance, the pies look exceptionally appetizing, and if customers are still not convinced, one whiff and all resistance crumbles. Since each pie is made to a standard, the product is exceptionally reliable. Customers are aware that the same standard of quality will be obtained each time a purchase is made. In addition, each pie is reasonably durable for such a product. Baked pies can last for approximately three days and can be reheated to obtain a fresh-baked taste just prior to consumption. Frozen pies, which are delivered to wholesalers, last for up to three months in the refrigerator.

Crown Pies is a high-contact operation insofar as the majority of its 'value-adding' activities take place with the customer present. Customers in this type of operation have a relatively short waiting period. They are hungry people and will walk out if they are not served within a reasonable period of time. Quick service is vital and Crown Pies ensures that customers are seen to within a minute or less. Accordingly, Mr Essay emphasizes to his staff that *'the customer is always right'.* He believes that a satisfied customer is a regular customer B and a great advert. If the customers perceive that a member of staff is discourteous to them, they are likely to be dissatisfied. Given this, Mr Essay makes it his duty to train his staff to acquire good customer skills. Crown pies has to ensure that it produces a high-quality, satisfying and inexpensive product.

Mr Essay is constantly filled with new and creative ideas. He realizes that if he can expand his business by focusing more on the wholesale area, he could find his business being more profitable in the long run. In order for him to do this, however, additional premises will have to be acquired for the sole purposes of preparation, baking and storage. From here, pies can be dispatched. In the meantime, Mr Essay aims to concentrate entirely on his current procedures. He constantly seeks customer suggestions and almost always implements beneficial improvements accordingly. He constantly seeks customer suggestions and almost always implements beneficial improvements

accordingly. After all, says Mr Essay, '*To make customers happy takes a lifetimes, but to lose them takes just one day!'*

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 618. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 12: THE CHANNEL TUNNEL

The channel Tunnel project was the largest construction project ever undertaken in Europe and the biggest single investment in transport anywhere in the world. For years there had been talk of linking the UK and France with a tunnel and it was only in 1986 that the two governments came to an agreement which allowed the project to get underway. The project, which was funded by the private sector, made provision for a 55-year concession for the owners to design, build and run the operation. The Eurotunnel Group (technically two holding companies, one French and one in the UK) awarded the contract to design and build the tunnel to TML (Trans-Manche Link), a consortium of ten French and British construction companies. The plan was for about half the capacity of the tunnel to be given to the national rail networks of the UK and France and the other half to be devoted to the local rail service 'Le Shuttle', to be run by Eurotunnel themselves. The finished operation was planned to be the busiest railway line in the world.

For the project managers it was a formidable undertaking. The sheer scale of the project was daunting in itself. Two main railway tunnels, split by a service/access tunnel, each 7.6 metres in diameter, run 40 metres below the sea bed. In total there are in excess of 150 kilometres of tunnel in the total project. The project was also subject to various types of uncertainty. During the early negotiations, political uncertainty surrounded the commitment of both governments. In the planning phase geological uncertainty had to be reduced by a complex series of tests. The financing of the project, which required investment by over 200 banks and finance houses, as well as over half a million shareholders, resulted in periodic financial uncertainty. Finally, the technical problems, both in the drilling itself and, more importantly, in the commissioning of the tracks and systems within the tunnel, needed to be overcome in order to reduce technical uncertainty.

The historic breakthrough came on 1 December 1990 when the French and English teams working on the service tunnel met at a point 22.3 kilometres from the UK and 15.6 kilometres from France. The real breakthrough came in 1994, however, when first freight, and then passenger services started to connect two countries through perhaps the greatest civil then passenger services started to connect two countries through perhaps the greatest civil engineering project management achievement of all time.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 583. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 13: ONCE IN A LIFETIME

The opportunity to carry out some projects comes once in a lifetime. Such projects cannot be late. The Giotto project was of this type. Giotto was the name given to the spacecraft designed to intercept Halley's Comet when it was 100 million miles away from Earth on 2 July 1985. The project was funded and managed by the European Space Agency and concentrated out in the main part to British Aerospace. The accepted payload consisted of ten experiments which were designed to establish, in more detail than ever before, the exact characteristics and composition of the comet. If the project missed the launch date significantly the whole project would have been judged a massive waste of million of ECU.

The ten experiments on board were contributed by various groups in 11 different member countries. Although this enhanced the international image of the project, it also added to the complexity of a project which was dominated by a demanding and inflexible completion requirement. Leading up to the delivery of the spacecraft, the project moved through four phases which were termed (1) concept, (2) sub-system definition and bids, (3) project definition and formal bid for delivery and (4) procurement and assembly. During the project, emphasis was placed by all parties on co-operation between the management team from the ESA and its international partners. The cost management involved initial capital proposals and then a re-assessment of the costs after the first two phases of the project. All the activities which made up the programme of work were planned in

fine detail and all planning information placed on a central computer system which was visible to all involved. Any modifications were dealt with very quickly. The policy was never to have more than three or four outstanding modifications over any three-week period, so as to reduce the amount of uncertainty in the project. This relied on the team paying particular attention to ensuring visible and efficient contact or relationships. The team makes considerable use of network planning methods such as PERT which were particularly useful in keeping all information on the current of, and the future plans for, the project fully visible.

Like many large scientific organizations, the European Space Agency has an intricate hierarchy of standards and approval procedures, all of which are time consuming. The project could never have been completed to schedule if the agency had not adopted a 'fast-track' procedure for getting approval through its various committees. It screened, in principle, aspects of technical compliance, feasibility and the financial resources backing any proposal.

The spacecraft was eventually shipped, on time, to the launch site on 29 April 1985 for trials and the final count-down to launch on 30 June 1985. The project itself was very successful, intercepting the comet as planned and contributing enormously to scientific knowledge and analysis of such phenomena. The final cost of developing and constructing the craft did overshoot its budget by about 10 per cent, which at the time was a relatively small amount for a project of this type. Good project planning and control, a clear project definition and disciplined project management had all played their part.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 591. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 14: XEROX BENCHMARKING

Possibly the best known pioneer of benchmarking in Europe is Rank is Rank Xerox, the document and imaging company, who created the original market for copiers. The virtual monopoly the company had in its sector almost become its undoing, however. By 1980 the threat to Rank Xerox from the emerging Japanese copier companies had become clear. An in-depth study within the company recognized that

fundamental changes were needed. To understand how it should change, the company decided to evaluate itself externally B a process which became known as competitive benchmarking. The results of this study shocked the company. Its Japanese rivals were selling machines for about what it cost Xerox to make them. Nor could this be explained by differences in quality. The study found that, when compared with its Japanese rivals, the company had nine times more suppliers, was rejecting ten times as many machines on the production line and taking twice as long to get products to market. Benchmarking also showed that productivity would need to grow 18 per cent per year over five years if it was to catch up with its rivals.

Rank Xerox sees benchmarking as helping it achieve two objectives. At a strategic level it helps set standards of performance, while at an operational level it helps the company understand the best practices and operations methods which can help it achieve its performance objectives.

It experience of using this approach has led Xerox to a number of conclusions:

4) The first phase, planning, is crucial to the success of the whole process. A good plan will identify a realistic objective for the benchmarking study which is achievable and clearly aligned with business priorities.
5) A prerequisite for benchmarking success is to understand thoroughly your own processes. Without this it is difficult to compare your processes against those of other companies.
6) Look at what is already available. A lot of information is already in the public domain. Published accounts, journals, conferences and professional associations all can provide information which is useful for benchmarking purposes.
7) Be sensitive in asking for information from other companies. The golden rule is ‘Don’t ask any questions that we would not like to be asked ourselves’.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 656. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 15: EXL LABORATORIES

EXL Laboratories is a subsidiary of a large defence electronics organization which carries out research and development contracts and technical problem-solving work for a wide range of companies. Although a large number of its customers are companies within the same group, it operates as a profit centre and charges full commercial rates for the investigations it undertakes. EXL is particularly keen to improve the level of service which it gives to its customers. As the first stage of this improvement process it had discussions with all of its most important customers and based on these discussions it devised a list of the most important aspects of its service.

- *The quality of its technical solutions.* This means the perceived appropriateness of the results of its research and development projects.
- *The quality of its communications with customers. This means the frequency and use fullness of the information which it gives to customers while it is carrying out the investigations.*
- *The quality of post-project documentation. This means the appropriate and usefulness of the instructions and documentations which it hands over to customers together with the final results of the investigation.*
- *The delivery speed of its investigations. This means the time between a customer requesting an investigation to be carried out and the final results of the investigation being delivered.*
- *The delivery dependability of the investigations. This means the ability of the laboratory to estimate the final project completion date accurately and deliver to that date.*
- *The delivery flexibility with which it conducts the investigation. This means the ability of the laboratory to speed up or slow down the investigation so as to deliver it to a revised delivery date.*
- *The specification flexibility of the investigation. This means the ability of the laboratory to change its investigation to cope with revised requirements from the customer.*
- *The price of the investigation. This means the total amount of money* charged to the customer for carrying out the investigation.

Again, based on its discussions with customers, the laboratory manages to assign a score to each of these factors on the 1 to 9 scale, where 1 means that the factor is extremely important to customers and 9 means that it has no importance (*see* Fig 1).

Figure 1 A nine-point scale of importance

Order winner	Strong	**1**	Provides a crucial advantage
	Medium	**2**	Provides an important advantage
	Weak	**3**	Provides a useful advantage
Qualifier	Strong	**4**	Needs to be up to good industry standard
	Medium	**5**	Needs to be up to median industry standard
	Weak	**6**	Needs to be within close range of the rest of the industry
Less important	Strong	**7**	Not usually of importance but could become more so
	Medium	**8**	Very rarely considered by customers
	Weak	**9**	Never considered by customers

Figure 2 shows how the managers of the laboratory rated the factors. This represents the 'profile of importance' of the various factors as far as the customer is concerned (as perceived by EXL's managers).

Figure 2 Rating 'importance to customers' on the nine-point scale

	Importance to customers								
	1	2	3	4	5	6	7	8	9
Technical solution	X								
Communi-cations		X							
Documentation						X			
Delivery speed					X				
Delivery dependability				X					
Delivery flexibility						X			
Specification flexibility			X						
			X						
	1	2	3	4	5	6	7	8	9

Judging performance against competitors

At its simplest, a competitive performance standard would consist merely of judging whether the achieved performance of an operation

is better than, the same, or worse than that of its competitors. However, in much the same way as the nine-point importance scale was derived, we can derive a more discriminating nine-point performance scale, as shown in Fig. 3.

Figure 3 A nine-point scale of performance

Better than Competitors	Strong	**1**	Considerably better than competitors
	Medium	**2**	Clearly better than competitors
	Weak	**3**	Marginally better than competitors
Same as Competitors	Strong	**4**	Sometimes marginally better than competitors
	Medium	**5**	About the same as most competitors
	Weak	**6**	Slightly lower than the average of most competitors
Worse than Competitors	Strong	**7**	Usually marginally worse than most competitors
	Medium	**8**	Usually worse than competitors
	Weak	**9**	Consistently worse than competitors

The management of EXL turned their attention to judging the laboratories' performance using the same factors as they had identified as being of relevance to their customers. Although they could not exactly judge how good all their competitors were on every aspect of performance, they could make some initial estimates. These are shown in Figure 4.

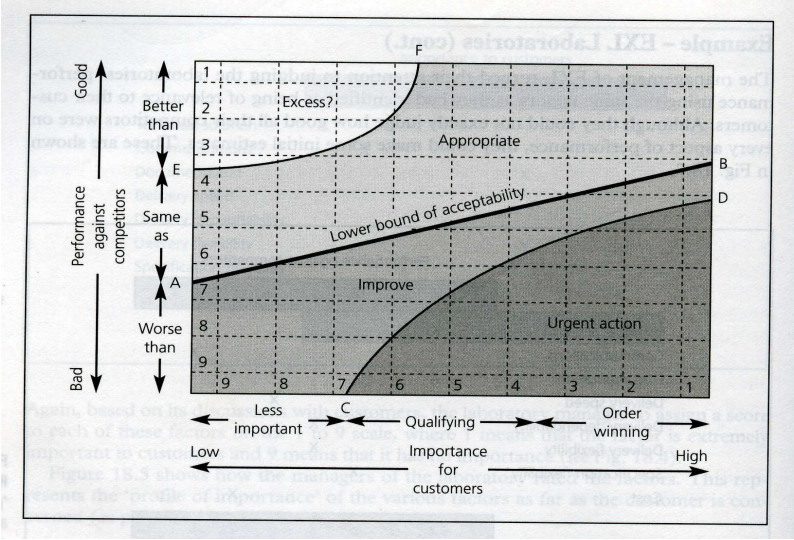
Figure 4 Rating 'performance against competitors' on the nine-point scale

	Performance against competitors								
	1	2	3	4	5	6	7	8	9
Technical solution		X							
Communi-cations								X	
Documentation		X							
Delivery speed						X			
Delivery dependability					X				
Delivery flexibility					X				
Specification flexibility				X					
							X		
	1	2	3	4	5	6	7	8	9

The importance-performance matrix

The priority for improvement which each competitive factor should be given can be assessed from a comparison of their importance and performance. This can be shown on an importance-performance matrix which, as its name implies, positions each competitive factor according to its scores or ratings on these criteria. Figure 5 shows an importance-performance matrix divided into zones of improvement priority. The first zone boundary is the 'lower bound of acceptability' shown as line AB in Figure 5. This is the boundary between acceptable and unacceptable performance. When a competitive factor is rated as relatively unimportant (8 or 9 on the importance scale) this boundary will in practice be low. Most operations are prepared to tolerate performance levels which are 'in the same ball-park' as their competitors (even at the bottom end of the rating) for unimportant competitive factors. They only become concerned when performance levels are clearly below those of their competitors. Conversely, when judging competitive factors which are rated highly (1 or 2 on the importance scale) they will be markedly less sanguine at poor or mediocre levels of performance. Minimum levels of acceptability for these competitive factors will usually be at the lower end of the 'better than competitors' class. Below this minimum bound of acceptability (AB) there is clearly a need for improvement, above this line there is not immediate urgency for any improvement. However, not all competitive factors falling below the minimum line will be seen as having the same degree of improvement priority. A boundary approximately represented by line CD represents a distinction between an urgent priority zone and a less urgent improvement zone. Similarly, above the line AB, not all competitive factors are regarded as having the same priority. The line EF can be seen as the approximate boundary between performance levels which are regarded as 'good' or 'appropriate' on one hand and those regarded as 'too good' or 'excess' on the other. Segregating the matrix in this way, results in four zones which imply very different priorities.

Figure 5 Priority zones in the importance-performance matrix



The 'appropriate' zone

This zone is bounded on its lower edge by the 'lower bound of acceptability', that is the level of performance which the company, in the medium term, would not wish the operation to fall below. Moving performance up to, or above, this boundary is likely to be the first-stage objective for any improvement programme. Competitive factors which fall in this area should be considered satisfactory, at least in the short to medium term. In the long term, however, most organizations will wish to edge performance towards the upper boundary of the zone.

The 'improve' zone

Any competitive factor which lies below the lower bound of the 'appropriate' zone will be a candidate for improvement. Those lying either just below the bound or in the bottom left-hand corner of the matrix (where performance is poor but it matters less) are likely to be viewed as non-urgent cases. Certainly they need improving, but probably not as a first priority.

The ‘urgent-action’ zone

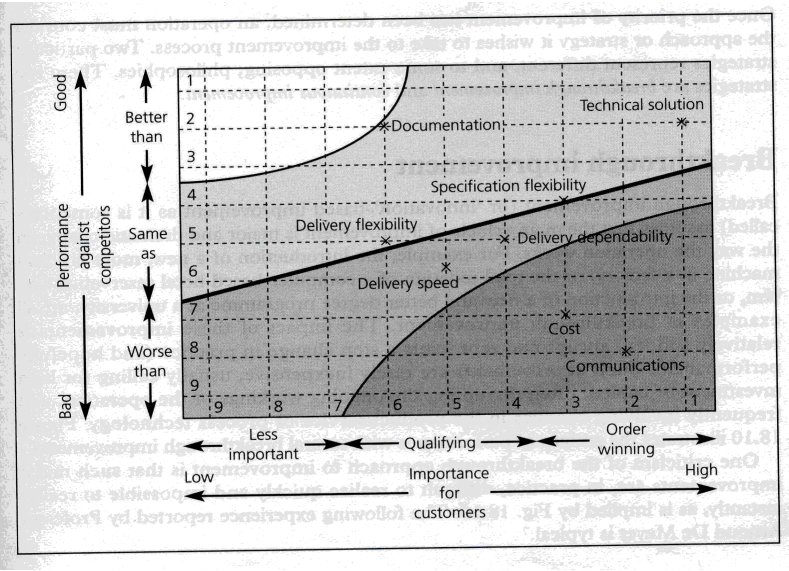
More critical will be any competitive factor which lies in the ‘urgent-action’ zone. These are aspects of operations performance where achievement is so far below it ought to be, given its importance to the customer, that business is probably being lost directly as a result. Short-term objective must be, therefore, to raise the performance of any competitive factors lying in this zone at least up to the ‘improve’ zone. In the medium term they would need to be improved beyond the lower bound of the ‘appropriate’ zone.

The ‘excess’ zone

The question mark is important. If any competitive factors lie in this area their achieved performance is far better than would seem to be warranted. This does not necessarily mean that too many resources are being used to achieve such a level, but it may do. It is only sensible therefore to check if any resources which have been used to achieve such a performance could be diverted to a more needy factor B anything which falls in the ‘urgent-action’ area, for example.

The laboratory plotted the importance and performance ratings it had given to each of its competitive factors on an importance-performance matrix. This is shown in Figure 6. It shows that the most important aspect of competitiveness B the ability to deliver sound technical solutions to its customers B falls comfortably within the appropriate zone. Specification flexibility and delivery flexibility are also in the appropriate zone, although only just. Both delivery speed and delivery dependability seem to be in need of improvement as each is below the minimum level of acceptability for their respective importance positions.

Figure 6 The importance-performance matrix for EXL Laboratories



However, two competitive factors, communication and cost/price, are clearly in need of immediate improvement. If the manager's estimates of their importance and performance ratings are realistic, both could be losing business for the laboratory. These two factors should therefore be assigned the most urgent priority for improvement. The matrix also indicated that the company's documentation could be regarded as 'too good'.

The matrix did not reveal any total surprises to the laboratory staff as such. The competitive factors 'communication' and 'cost/price' were known to be in need of improvement. However, the exercise was regarded as useful for two reasons.

- It did help to discriminate between many factors which were in need of improvement. Prior to the exercise, the factors 'delivery dependability' and 'delivery speed' were also regarded as equally in need of improvement.
- The exercise gave a purpose and structure to a rather ill-defined debate on improvement priorities which had been ongoing for

some time. It was the process of performing the exercise, as much as the results, which was regarded by the managers as being particularly useful.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 659-664. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 16: NISSAN MOTORS (UK) LTD

The first and most publicised of the Japanese motor company's European manufacturing 'implants', the Nissan Motor Manufacturing (UK) plant in the North-East of England is widely admired for its quality.

'They are the McDonald's of manufacturing,' said the Chief Executive of the local development corporation. *'Everyone was striving for quality before they arrived but no one had set their aspirations quite so high.'*

Their arrival had a significant impact on competitors, who saw the new European plant as posing a considerable challenge.

Nissan's approach and commitment to improving its already excellent reputation for operations performance was not the least of the reasons for the competitors regarding it in this way. Quality improvement was quite explicitly put forward, along with team-working and flexibility, as part of its core philosophy. From the beginning the company's local management decided on three guiding principles for its quality and improvement policy.

- First, any programme had to be about more than quality. It needed to be integrated into the overall company activity instead of being a 'bold-on'. Its purpose was partly instrumental, seen

  'as a means of improving individual and team development and the participation of staff in the general day-to-day running of their work areas'.

- Second, it should be a natural extension of the way teams would normally operate. Team orientations, says Nissan, create the environment in which quality and improvement can prosper. For example, five minutes at the beginning of each shift is spent in the team meeting. Quality problems and potential solutions are discussed, along with the results of the product audit known as VES (vehicle evaluation system). This evaluates quantitatively the quality of several vehicles from each shift. Results are analysed and immediately fed back to the relevant teams.

- Third, quality should not be swamped by an external quality bureaucracy. There is a Quality Assistance Department at Nissan but its main objectives are to provide support and feedback to the rest of the company. Similarly the (unavoidable) steering committee operated with the minimum necessary formality and was firmly under the chairmanship of the Director of Production.

  Choosing an overall approach and philosophy of improvement which would support these three principles was clearly an important decision for the company. Paradoxically, staff at the British plant chose the Japanese term 'Kaizen' teams, rather than the better known Quality Circles', to describe their team-based activity. Kaizen conveys the idea that all improvement should be a continuous process which may involve the use of analytical techniques to solve problems and certainly does involve team-based problem solving. Teams even have access to 'Kaizen workshop' B areas of the plant where manufacturing staff can go to make improvements.

  Nissan South Africa has gone through some rather traumatic changes recently. The fiercely competitive car market in South Africa has brought its problems and as a result there is now much greater Japanese participation in the company. There have been many top management changes. It remains to be seen how improvement will be achieved at their manufacturing facility just outside Pretoria.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 669. *Operations management*. Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 17: HEWLETT-PACKARD'S INTERNAL CUSTOMER CHECKLIST

The computer industry has always been in the forefront of developing and utilizing quality concepts. Quality failures of hardware, software or service are both immediately obvious to customers and seriously damaging to their trust in the supplier. Hewlett-Packard, the world-wide information systems company, is no exception. It was one of the first companies to make a success of the internal-customer concept in its operations. One part of the way it used the concept was a short, but effective, checklist 'pocket guide' which came out of its South Queensferry plant in Scotland. The Pocket Guide which it developed was distributed throughout the company. It suggests each part of the organization should ask itself seven questions which it regards as fundamental to the operation:

- Who are my customers?
- What do they need?
- What is my product or service?
- What are my customers' expectations and measures?
- Does my product or service meet their expectations?
- What is the process for providing my product or service?
- What action is required to improve the process?

H-P then went on to device a problem-solving methodology, based on its seven questions, the stages for which were as follows:

Select the quality issue.	Collect and analyse the data.
Write an issue statement.	Identify the major cause of the quality issue.
Identify the process.	Plan for improvements.
Draw a flow chart.	Take the corrective action.
Select a process performance measure.	Collect and analyse the data again.
Conduct a cause-and-effect analysis.	Are the objectives met? If yes, document and standardize the changes.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S,

Harland, C, Harrison, A, & Johnston, R. 1997: 739. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 18: ISO 9000 AT SASOL SYNTHETIC FUELS

Although ISO 9002 certification was a competitive advantage for those who had it five years ago, it is now a competitive disadvantage for those who do not have it. This is one of the reasons why Sasol Synthetic Fuels decided to seek ISO 9000 certification. Sasol Synthetic Fuels in Secunda started the ISO 9002 journey with those production units and supporting functions that produce, handle, test and dispatch high-volume, high-value, mostly export products. It was decided that all new plants would be included in the programme. A large number of support functions are centralized which means that Sasol had to include the relevant ones in the programme. They are now certified for the production and delivery of chemical solvents, anode and green coke as well as hydrogen-rich and methane gas.

Sasol Synthetic Fuels has 60 000 drawings, kept, copied and distributed from a central point away from the plant. Three microfilms, one hard copy master and a further 18 additional copies are made for approval of all new and revised drawings. An average of 39 000 copies are made per month. Anybody that wants a drawing has to fill in a request, wait at least three hours, and more likely drive there by car, pick-up or motor cycle. It is, therefore, not surprising that people in the plant did not destroy their drawings after use, but hung on to them for future use. Small modifications were marked up on these private drawings, but were not fed back to the drawing office. Before implementing ISO 9000 people used to spend hours driving up and down in search of relevant documents in order to do their job. Sasol had 250 procedure libraries when Sasol Two and Sasol Three were still managed as two separate plants. This was reduced to 190 when they were combined into Sasol Synthetic Fuels (Pty) Ltd. Sasol developed and implemented computerized indexing systems to control and manage documentation, equipment and records and the changes thereto.

> *"It has become evident to Sasol,'* says Jan Hatting, Total Quality Manager, *'that you cannot become a world-class producer if you do not, among other things, have proper control over and trust in the accuracy of your documentation, data and records. Complying with the ISO 900 standard requirements has helped Sasol*

Synthetic Fuel achieve that goal. We believe that ISO 9002 is a good minimum standard foundation on which to build a total quality management programme. The same applies for the compilation and continuous improvement of our manufacturing policy, strategy, procedures and work instructions."

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 749. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 19: FAILURES PUNCTURE HOECHST'S REPUTATION

The spring of 1993 was not a happy time for Hoechst, the giant German chemical company. For years it had been justly proud of its reputation for safety and environmental protection. The previous year it had spent DM1.3 billion on environmental protection. Then between 22 February and 2 April the company was hit by three serious accidents and 15 less serious safety failures. The first involved the company contaminating part of Frankfurt with 10 tonnes of toxic chemicals. A night-shift operator had neglected to switch on a stirrer in a reaction tank. This resulted in an uncontrollable build-up of pressure which caused the explosion and the resulting pollution. The second accident also involved an explosion and this time one worker was killed and another seriously injured. The final serious incident resulted in several hundred kilograms of fuming sulphuric acid leaking into the environment. All the accidents involved human failure of some sort, although, technically, they were all dissimilar. No single technology failure could be blamed for the trio of disasters. Human failure was also the root cause of the barrage of criticism which Hoechst faced during and after the accidents. Its response was seen by some as being arrogant, disorganized and defensive. Partly because of communication failures, the company's staff underestimated the seriousness, especially of the first accident. To compound the impression of aloofness, the Chairman of the company did not give a press conference or make any statement until ten days after the first accident. By the time of the third serious accident on 2 April the company had learnt some lessons. It immediately made all the board of the company jointly responsible for safety. Even so, a reputation built up over the years had been damaged in a few weeks.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 695. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 20: FAILED PHILOSOPHER

Sleek, fast and smooth, the TGV trains of France's SNCF rail look more like aircraft than the traditional train. They provide a service which speeds passengers throughout Europe at speeds in excess of 175 mph. Inside, too, the trains show the influence of air travel. Seats are wide and comfortable with space for leg-stretching relaxation. Descriptions in the French press described the TGV as being like 'an airbus on rails'. SNCF also decided to emulate the airlines by buying a high-tech seat reservation and ticketing system which they named after the Greek philosopher Socrates. That was when their problems began. Design flaws in the booking systems software, combined with inadequate training of SNCF staff, caused chaos for months after the system was introduced. Socrates refused to believe in the existence of some places. Suddenly it refused to issue tickets for Rouen or Barcelona, insisting that neither city existed. It also failed at times to recognize the existence of several of the trains which ran between Paris and Lyon. As a result the trains made the trip with only four passengers on board. However, these straightforward system design errors have been compounded by over-complexity of some parts of the system: the automatic ticket-vending machines often stand unused by passengers because they have given up trying to understand how to use them. The graffiti outside the Gare de Lyon station reads 'One hour from Lille to Paris Y one hour to buy a ticket!' Although the problems were eventually sorted out, the reputation of what was essentially a fast and efficient operation took longer to recover.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 696. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

CASE STUDY 21: TWO MILLION TO ONE

As the number of people travelling by air has grown, the chances

of suffering a fatal accident have fallen substantially. Air crashes still do happen, however. Predominantly, the reason for this is not mechanical failure but human failure such as pilot fatigue. Boeing, which dominates the commercial airline business, has calculated that over 60 per cent of all the accidents which have occurred in the past ten years had flight crew behaviour as their 'dominant cause'. In other words, the accidents probably would not have happened had there not been some error by the aircraft's crew.

The chances of an accident are still very small, however. One kind of accident which is known as 'controlled flight into terrain', where the aircraft appears to be under control and yet still flies into the ground, has a chance of happening only *once in two million flights.* For this type of failure to occur a whole chain of minor failures must happen. First, the pilot at the controls has to be flying at the wrong altitude B there is only one chance in a thousand of this. Second, the co-pilot would have to fail to cross-check the altitude B only one chance in a hundred of this. The air traffic controllers would have to miss the fact that the plane was at the wrong altitude (which is not strictly part of their job) B a one-in ten chance. Finally, the pilot would have to ignore the ground proximity warning alarm in the aircraft (which can be prone to give false alarms) B a one-in-two chance.

Small though the chances of failure are, aircraft manufactures and airlines are busy working on procedures which make it difficult for aircrew to make any of the mistakes which contribute to fatal crashes. For example, if the chances of the co-pilot failing to check the altitude are reduced to one in 200, and the chances of the pilot ignoring the ground proximity alarm are reduced to one in five, then the chances of this type of accident occurring fall dramatically to one in ten million.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 697. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

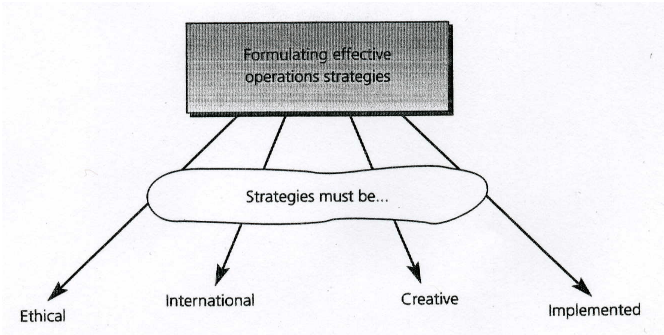
CASE STUDY 22: THE OPERATIONS CHALLENGE - 1995 FIRST EDITION PERSPECTIVE

22.1 INTRODUCTION

In the preceding 20 chapters we have outlined the nature, purpose and decisions of operations management, and we are now in a position to pull together some of the threads which have run through our treatment of the subject. We have chosen to do this in *two ways*. First, we return to the strategic view of operations and discuss the *process* of operations strategy B that is the way in which operations strategies are formulated. Second, we identify some of the challenges which face all operations managers in their continuing attempts to cut through the complexity which characterizes most operations can develop their own operations strategies appropriate for the modern world. Of course the list strategic 'challenges' could be very long, but we have identified four in particular for attention B the moral imperative to develop *ethical* operations strategies, the necessity to consider the *international* dimension of operations strategies, the need for *creativity* in devising operations strategies and finally the ultimate challenge of *implementing* the chosen strategies.

Figure 1 illustrates these issues.

Figure 1 Issues covered in this discussion



22.2 OBJECTIVES

This discussion will examine:

- why and how operations strategies are put together;
- the way in which the decisions resulting from operations strategies have an ethical dimension;
- how operations managers need to consider their operations strategies from an international perspective;
- why achieving creative operations strategies involves challenging the trade-off paradigm of operations;
- how operations managers need to set an 'implementation agenda' to put their strategies into practice.

22.3 THE STRATEGY CHALLENGE

In Chapter 3 we distinguished between the *content* of operations strategy (the priorities and decisions which would determine the overall direction of the operation) and the *process* of operations strategy (the way in which these decisions are made). Content is the output from operations strategy; process is the act of creating the strategy. This is where the challenge lies. The acid test for operations managers is not just their understanding and command of the detailed complexity of all the operations decisions which we have outlined in this book (important though these are). Rather it is whether they can make enough sense of the operation to fit it into a strategic context, reshape and improve it, and then make sure that its contribution to competitiveness is both clear and ongoing.

22.3.1 All operations should have a strategy

So why should operations go to the bother of putting a strategy together? It requires considerable effort and time. All the operations' senior management need to be involved for at least part of their time over a period which has been variously estimated at between four to 18 months. The obvious answer is that an effective operations strategy helps the organization to compete more effectively. There is some empirical evidence to support this. For example, an organization's technology strategy, among other things, shapes the integration between different parts of its processes. Its planning and control strategy has to work within the constraints imposed by the technology. A shared strategy allows not only both areas to measure their own decisions against the common purpose, but also allows the implications of each other's strategy areas to be explored. In this

way a formally constructed operations strategy gives the basic structure which ensures that the many individual decisions taken around the organization all point in the same direction.

22.3.2 Difficulties in formulating operations strategy

Even a cursory study of the previous 20 chapters of this book should have made the point that operations management is a complex business, so trying to make strategic sense of any operation will always be a difficult task. Four particular difficulties affect most attempts at the formulation process. The first is the dispersal problem. Operations managers are central to the strategy formulation process, yet they, more than most, are likely to be geographically dispersed among the company's sites. As one operations director of a food-processing company put it,

'My marketing colleague has her senior people all within a few steps of her office. By contrast, my senior people are spread around Europe. The effort of getting them together is not something we can go through every week'.

Second, operations managers operate in 'real time'. They can only allow their attention to drift from the running of the operation for relatively short periods. This responsibility for the day-to-day running of the operation means that they operate under a 'need to deliver' from which only the most important strategic pressures can divert them. Third, the inertia of operational resources imposes a certain amount of conservatism on whoever manages them. With the majority of the organization's resources under their control, no operations manager will, or can, change operational direction without very good reason. Understandable though such caution might be, it does, at times, retard imaginative strategic change.

22.3.3 Generic operations strategies

Before looking at the process by which operations strategies can be formulated, it is worthwhile examining what some people have called 'generic operations strategies'. These are common approaches to organizing the operation which have been observed to be adopted by different types of organization. So, if the operations strategies of many different organizations were reviewed (as they have been in some research studies) it becomes evident that the strategies of the individual organizations can be clustered into groups within which the strategies are similar, or possess common elements. So, for example, the Hayes and Wheelwright four-stage model which we described in Chapter 2 could be considered to be a generic operations strategy classification. All operations could be placed in one of the four categories which they identified.

A more useful and somewhat broader categorization is provided by Mike Sweeney of Cranfield University. This is shown in Figure 2. Based on his own and several other researchers" investigations, he categorizes operations (more strictly, manufacturing operations) on two dimensions. The first dimension concerns the approach the company takes to process design. Some organizations take a traditional approach to designing their process which do not include many of the innovations in technology, layout ,job design, organization, and so on, which we have described elsewhere in this book. Others have developed a more enhanced approach to process design which includes such innovations as business process re-engineering, cellular manufacture, JIT organization, etc. The other dimension relates to the approach which the organization takes towards providing service to its customers. The resulting four-way classification results in generic operations strategies which are termed caretaker, marketeer, reorganizer, and innovator strategies.

The caretaker strategy

This strategy is often employed when an organization believes that there is little competitive advantage to be gained by differentiating itself from its competitors. The operations function is expected to provide as efficient and reliable a service to the rest of the organization as possible without much investment, change or disruption. Operations managers are expected to make sure things do not go wrong, rather than provide much in the way of innovation or creativity.

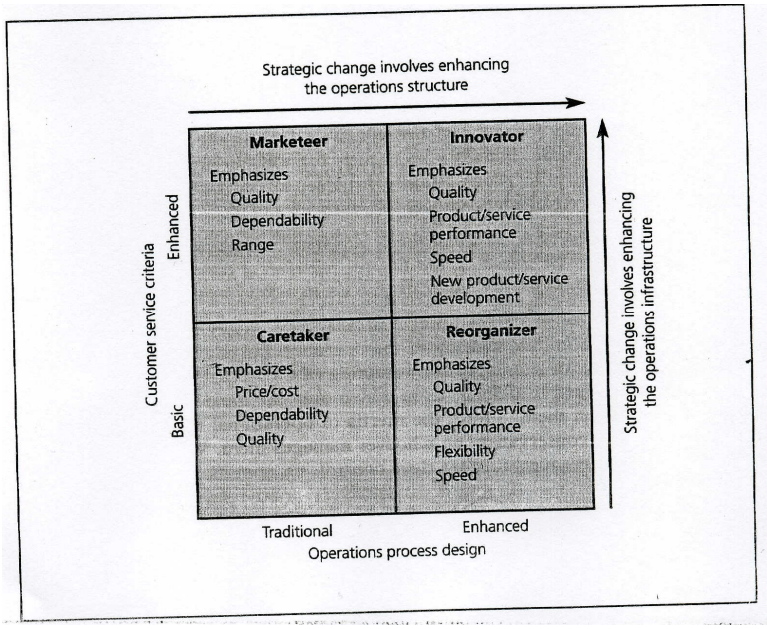
The marketeer strategy

Marketeer strategies are often used by organizations which experience increased competition and respond by enhancing or extending the level of customer service which they offer. This might include such things as broadening the range of their products or services, increasing quality levels or giving delivery guarantees. No fundamental change has been made to the physical design and organization of the operation itself but it is expected to respond to marketing-led changes in competitive stance. The operations function tries to do this by developing its infrastructural resources such as planning and control systems, working practices, or quality management methods.

The reorganizer strategy

This strategy implies a change in the way an organization designs and manages its processes. This could mean investment in new technology and (more significantly) a different way of organizing its methods of producing goods and services. Companies adopting JIT and cellular manufacturing principles are typical of organizations adopting this strategy. The new processes give the enhanced flexibility which allows the operation to respond quickly and effectively to changes in marketing strategy.

Figure 2 Sweeney's generic strategies



The innovator strategy

The innovator strategy is a combination of the marketer and the reorganizer strategies. Not only has the organization adopted an enhanced approach to designing its operations, it also expects enhanced customer service from its operations function. In other words, it has enhanced not only its structure but also its infrastructure. Usually this means a very high degree of integration between product or service design, operations, and marketing in order not only to be flexible in the short term in response to competitive pressure, but also to introduce new products and faster and more effectively than competitors.

Those organizations adopting either a caretaker or a marketer strategy are recommended first to enhance their operations structure to achieve a reorganizer strategy, after which they can undertake the more difficult infrastructural changes towards an innovator strategy.

22.3.4 Formulation procedures

Most organizations, even if they finish up adopting one of the generic strategies described above, will want to formulate their own operations strategy to cope with what they see as their individual competitive circumstances. There are several alternative procedures which have been suggested as providing the outline framework for developing an operations strategy. Most consultancy companies have developed their own frameworks, as have several academics. Two well-known procedures are briefly described her to give the flavour of how operations strategies are formulated in practice. These are the Hill methodology and the Platts-Gregory procedure.

The Hill methodology

One of the first, and certainly most influential, approaches to operations strategy formulation (although once again its development is largely connected with manufacturing operations) is that devised by Professor Terry hill of London Business School. The so-called 'Hill methodology' is illustrated in Figure 3. Hill's model, which is here adapted to the terminology used in this book, follows the well-tried approach of providing a connection between different levels of strategy making. Step one involves understanding the long-term corporate objectives of the organizations so that the eventual operations strategy can be seen in term of its contribution to these corporate objectives. Step two involves understanding how the making the strategy of the organizations has been developed to achieve corporate objectives. This step, in effect, identifies the products/service markets which the operations strategy must satisfy, as well as identifying the product or service characteristics such as range, mix and volume which the operation will be required to provide. Step three translates marketing strategy into what we have called in Chapter 3 'competitive factors'. These are the things which are important to the operation in terms of winning business or satisfying customers. Hill goes on to divide the factors which win business into order-winners and qualifiers (again we have explained this distinction of Hill's in Chapter 3). Step four is what Hill calls 'process choice'. This is similar to the volume-variety analysis which we carried out in Chapter 4. Its purpose is to

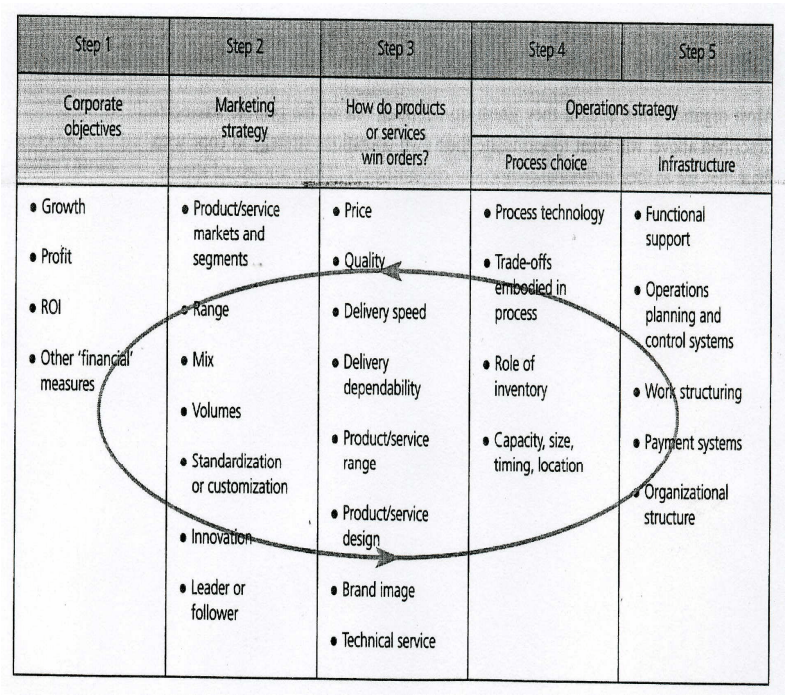
define a set of structural characteristics of the operation which are consistent with each other and appropriate for the way the company wishes to compete. Step five involves a similar process but this time with the 'non-process' infrastructural features of the operation.

Hill's methodology is not intended to imply a simple sequential movement from step one to step five, although during the formulation process the emphasis does move in this direction. Rather, Hill sees the process as an interactive one, whereby operations managers cycle between an understanding of the long-term strategic requirements of the operation and the specific resource developments which are required to support strategy. In this interactive process the identification of competitive factors in step three is seen as critical. It is at this stage where any mismatches between what the organization's strategy requires and what its operation can provide, become evident.

The Platts-Gregory procedure

Another influential process is that developed by Ken Platts and Professor Mike Gregory of Cambridge University. The framework for their approach is shown in Figure 4. The procedure has three stages. Stage one involves developing an understanding of the market position of the organization. This is done by assessing the opportunities and threats within the competitive environment. More specifically it also involves identifying the factors which are required by the market and compares these to the level of achieved performance (in terms of the operation being able to satisfy the market). This is an important part of the Platts-Gregory procedure and is different in emphasis from the Hill methodology described previously. Whereas the Hill methodology places its main emphasis on an operations strategy being developed from the customers' between what the market wants and how the operation performs. In this way it is similar to the importance-performance matrix described in Chapter 18. Instead of a matrix the procedure uses 'profiles' of market requirements and achieved performance to show up the gaps which the operation strategy must address. Figure 5 illustrates the use of these profiles.

Figure 3 The Hill methodology of operations strategy formulation



Source: Adapted from Hill,T. (1993) Manufacturing Strategy (2nd ed), Macmillian

Figure 4 The Platts-Gregory procedure

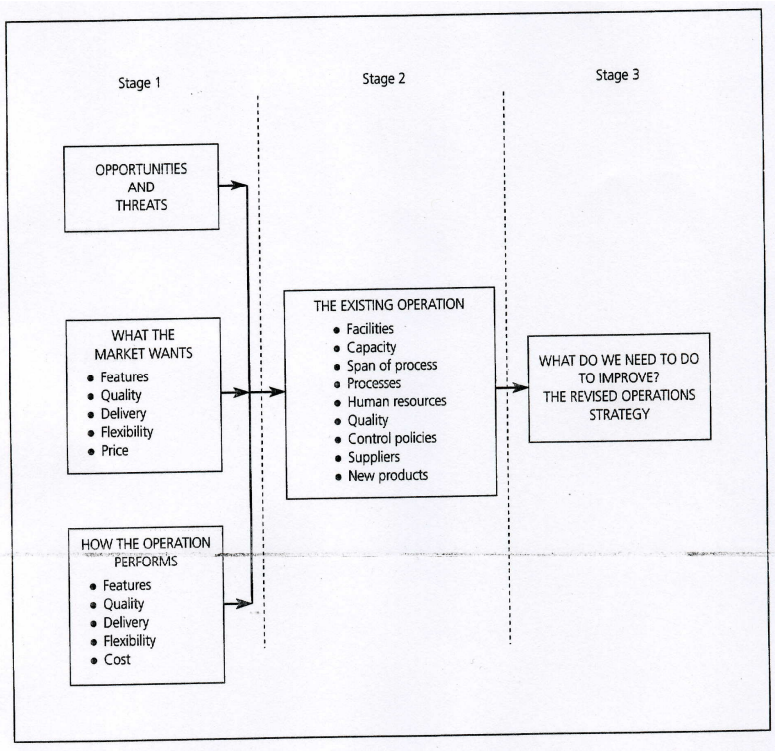
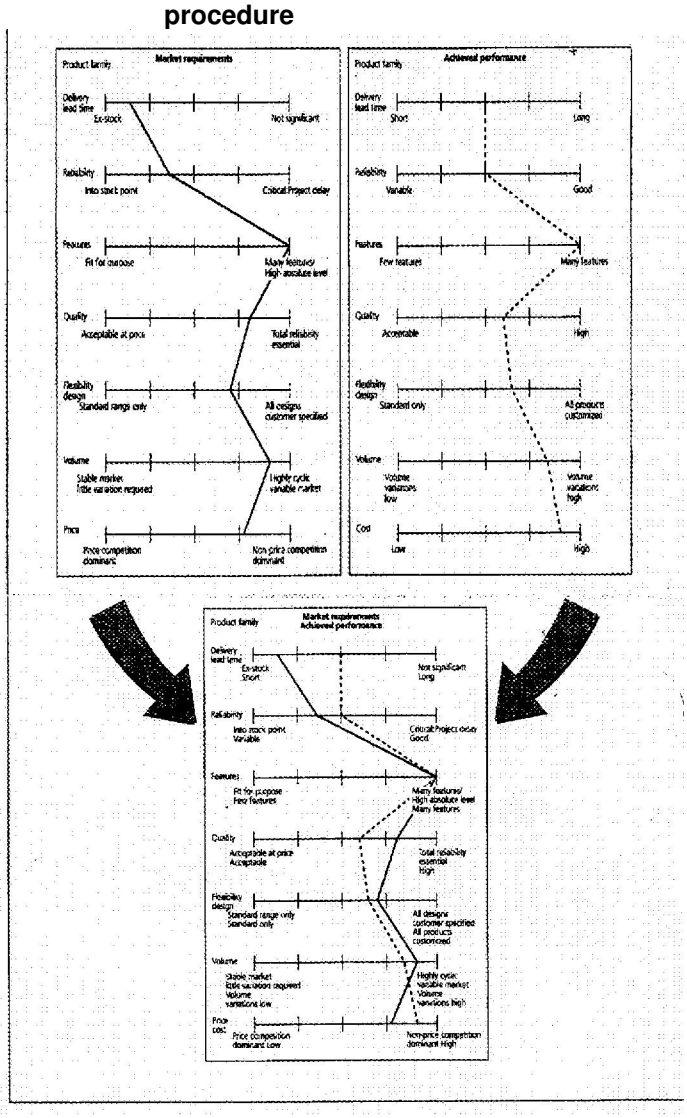


Figure 5 Uses of profiling in the Platts-Gregory procedure



Stage two of the procedure involves assessing the capabilities of the operation. Its purpose is to identify current operations practice and assess the extent to which this practice helps to achieve the type of performance which was indicated as being important in stage one.

Stage three concerns the development of new operations strategies. This stage involves reviewing the various options which are available to the organization and selecting those which best satisfy the criteria identified in the two previous stages.

Common elements of operations strategy procedures

The two formulation procedures described here are broadly representative of those available. Yet neither includes all the various points and issues which, taken together, operations strategy formulation procedures address. Typically many of the formulation processes include the following elements:

- a process which formally links the total organization strategic objectives (usually a business strategy) to resource level objectives;
- the use of competitive factors (called various things such as order winners, critical success factors, etc) as the translation device between business strategy and operations strategy;
- a step which involves judging the relative importance of the various competitive factors in terms of customers' preference;
- a step which includes assessing current achieved performance, usually as compared against competitor performance levels;
- an emphasis on operations strategy formulation as an interactive process;
- the concept of an 'ideal' or 'green field' operation against which to compare current operations. Very often the question asked is

'If you were starting from scratch on a green field site how, ideally, would you design your operation to meet the needs of the market?'

This can then be used to identify the differences between current operations and this ideal state;

- A ‘gap based ‘approach. This is a well-tried approach in all strategy formulation which involves comparing what is required of the operation by the market place against the levels of performance which the operation is currently achieving.

Judging the effectiveness of operations strategy

An effective operations strategy should clarify the links between overall competitive strategy and the development of the company’s operations resources. It should be able to answer the important ‘so what’ questions. For example,

‘We intend to compete through aggressive pricing B so what does that imply for the way we develop process technology?’ Or *‘We have customers with different requirements for different*

Product groups - so what does that imply for the way in which we set performance target?’ Or ‘We operate in a turbulent market with frequent product changes B so what does that mean for the organize the production, service design-operations interface?’

More specifically, an operations strategy should be:

- *Appropriate.* If the formulation process is to connect operations to the organization’s concept of competitiveness then above all it must provide appropriate improvements. In other words, the strategy should direct operations change in a direction which on balance is the most likely to provide the performance which best supports the company’s competitive strategy.
- *Comprehensive.* An operations strategy cannot define every minor operational decision but it does have to indicate how all parts of the operations function are expected to perform. No part of the operations function is without influence on performance, therefore no part should be left without guidance.

- *Coherent.* Including all parts of the operation in the strategy is a necessary but not sufficient condition for effectiveness. The policies recommended for each part of the function must all point roughly in the same direction. Potential conflicts between the various areas will need addressing directly.
- *Consistent over time.* While no organization benefits from an overly rigid strategy, the lead time of operations improvement means that consistency must be maintained over a reasonable time period. Failing to provide consistency confuses the organization, but worse it leads to cynicism Y

'Last year was the year of quality, this year it's flexibility, what will be in fashion next year?'

- *Credible.* A strategy which is not regarded as achievable by the organization will not be supported. Its subsequent failure could merely reinforce the perceived futility of the whole process, therefore strategic change should be seen as feasible.

22.4 STRATEGIES MUST BE ETHICAL

The concept of ethical decision making permeates operations management. There are ethical implications in almost every decision area described in this book. Table 1 identifies just some of these ethical considerations.

Table 1 Some ethical considerations of operations management decisions

Decision area	***Some ethical issues***
Product/Service design	• Customer safety • Recyclability of materials • Energy consumption
Network design	• Employment implications of location • Employment implications of plant closure • Employment implications of vertical integration • Environmental impact of

	location
Layout of facilities	• Staff safety • Disabled customer access • Energy efficiency
Process technology	• Staff safety • Waste and product disposal • Noise pollution • Fume and emission pollution • Repetitive/alienating work • Energy efficiency
Job design	• Staff safety • Workplace stress • Repetitive/alienating work • Unsocial working hours • Customer safety (in high contact operations)
Planning and control (including MRP, JIT and project planning and control)	• What priority to give customers waiting to be served • Materials utilization and wastage • Unsocial staff working hours • Workplace stress • Restrictive organizational cultures
Capacity planning and control	• 'Hire and fire' employment policies • Working hours fluctuations • Unsocial working hours • Service cover in emergencies • Relationships with sub-contractors • 'Dumping' of products below cost
Inventory planning and control	• Price manipulation in restricted markets • Energy management • Warehouse safety • Obsolescence and wastage
Supply chain planning	• Honesty in supplier relationship • Transparency of cost data

and control	• Non-exploitation of developing country suppliers • Prompt payment to suppliers • Minimizing energy consumption in distribution • Using recycled materials
Quality planning and control and TQM	• Customer safety • Staff safety • Workplace stress • Scrap and wastage of materials
Failure prevention and recovery	• Environmental impact of process failures • Customer safety • Staff safety

For our purposes ethics can be considered as the framework of moral behaviour which determines whether we judge a particular decision as either being right or wrong. In operations management, as in other areas of management, ethical judgements are not straightforward. What might be unremarkable in one country's or company's ethical framework could be regarded as highly dubious in another's.

Customers' welfare is directly affected by many of the decisions made by operations managers. The first and most obvious effect is that their safety might be compromised by poor operations management decisions. If a product is badly assembled or if the equipment used in a service (such a rail transport system) is not maintained, customers can come to harm. But customer safety is influenced by more than good manufacturing or maintenance practice, it could also be affected by the degree to which an operation discloses the details of its activities. When should an airline admit that it has received bomb threats? Should all the components or ingredients in product be fully disclosed? For example, one company used very small amounts of grated peanuts in a pie topping in order to make it look brown and attractive. The company failed however to disclose this ingredient on the package. Subsequently, one of its customers, who was allergic to peanuts, died through eating what she regarded as a safe product. At a less serious level, the ethical framework of operations decisions can affect the equity and fairness with which customers are treated. For example, should a bank discriminate between different customers in

order to give priority to those from whom they make more profit?

Staff are constantly exposed to the ethical framework of the organization throughout their working lives. Organizations have a duty to their staff to prevent their exposure to hazards at work. This means more than preventing catastrophic physical injuries; it means that organizations must take into account the longer-term threat to staff health from, say, repetitive strain injury (RSI) due to short cycle, repetitive work motions.

Suppliers are always a source of an ethical dilemma for the operation. Is it legitimate to put suppliers under pressure not to trade with other organizations, either to ensure that you get focused service from them, or to deny competitors this source of supply? Also do you have any right to impose your own ethical standards on your suppliers, for example, because you would not wish to exploit workers in developing countries? How much effort should you put in to making sure that your suppliers are operating as you would? More significantly, would you be prepared to pay a higher price for their product or service if it meant them abandoning what you regard as unethical practice? The recent increase in the transparency expected from suppliers also poses ethical dilemmas. If you are expecting your supplier to be totally honest and transparent in opening up their costing calculations to you, should you be equally transparent in revealing to them your own internal costings?

The *community* also has a right to expect its organizations to adopt a responsible attitude. At its obvious level, organizations have a direct impact on levels of environmental pollution I the community. All manufacturing processes have waste emissions of some sort. What then should be the balance between an operation's responsibility to minimize its pollution-causing activities on one hand, and the cost of doing this on the other? Most countries have legislation which sets minimum standards for such decisions, but should an organization try to achieve a better standard if it is technically possible to do so? The ethical dilemma is similar for a company's products after they have been sold. To what extent should an organization ensure that its products are easily disposed of, or recycled, or perhaps even made so durable

that they do not need replacing for a long time? Clearly this last option could have a negative effect on a company's revenues. The responsibility to the community means more than pollution and recycling. It also means sharing responsibility for other groups and organizations within the community such as schools, hospitals, groups representing special interest and so on. To what extent should an operation fund or take part in projects with these groups within the community?

Finally, *shareholders* and owners are also due some ethical duties, even though it may be obvious to state them. They are entitled to a reasonable return on their investments, although what constitutes 'reasonable', and whether the return should be judged in the short-term or long-term, are both open to interpretation.

Company values

Some decisions take on greater ethical implications, in particular in operations. For example, deciding on staffing levels in a television manufacturing operation is largely a matter of economics, whereas in a hospital, staffing levels can have life and death implications. Of course, staffing level decisions are also a matter of economics in the hospital; that is exactly what makes the staffing level decision difficult for the operations managers in the hospital. Indeed, very few of the ethical dilemmas described above are straightforward, but no operation can afford to ignore them. Those organizations which understand the importance of the ethical dimension to operations decisions tend to take a proactive approach to their own ethical stance. This involves deciding the principles upon which they will make ethically-sensitive decisions by developing an explicit set of principles which allow organizations to avoid ethically ambiguous activities and gradually build up an ethical framework which becomes accepted within the organizational culture of the operation. Typically such organizations adopt an explicit and public set of values. Table 2 shows the mission statement for the University of Port Elizabeth, a regionally based university in the Eastern Cape. The mission statement consists of a long-term statement of the university's vision and various 'statements of strategy'. Some of these statements of strategy have quite clear ethical undertones, for example 'afford all members of staff, as the University's most

important resource for the pursuance of its mission, irrespective of creed, race or sex, opportunities for personal growth in a stable, challenging and congenial working environment'. However the core values which the university sees itself as promoting are identified separately.

22.5 STRATEGIES MUST BE INTERNATIONAL

Few organizations can afford to limit their operations strategies to within their national boundaries. Only the smallest organizations do not buy any of their supplies from abroad, or do not sell any of their products and services abroad, or should not be, at least, considering doing so. For operations managers the 'environment' within which they make their decision is, increasingly, a global one. This is especially true for large multinational organizations, who have four types of strategic operations decisions to make:

1. Where should their operations facilities be located?
2. How should their operations network be managed across national boundaries?
3. Should operations in different countries be allowed to develop their own way of doing business?
4. Should an operations practice which has been successful in one part of the world be transferred to another?

22.5.1 International Location

The location decision has been discussed in general terms in Chapter 6 as part of the design of the overall network. Networks of operations can spread across several geographic regions. Large global companies such as Mercedes, the vehicle manufacturer, or Kodak, the photographic materials company, have operations all over the world. However, not all organizations will choose to design their international networks to the same pattern. Different configuration strategies have been identified in the location behavior of international companies.

Table 2 The mission statement of the University of Port Elizabeth

The mission of the University of Port Elizabeth is to provide tertiary education at the highest level for the community, with admission on an equitable basis, taking into account existing educational inequalities. All students, irrespective of creed, race or sex, are afforded the opportunity of developing themselves to their full intellectual and personal potential.

To realize this mission the University strives:

- To provide teaching with appropriate support services that take into account the needs of all students;
- To provide continuing education for personal growth;
- To achieve excellence in research;
- To generate and disseminate knowledge relevant to community needs;
- To involve staff and students, in collaboration with the Eastern Cape community, in service programmes based on the University teaching and research resources;
- To employ the expertise and innovative ability of staff and student in addressing issues confronting society;
- To promote the development of students by the fostering of leadership ad critical thinking skills;
- To encourage freedom of thought, expression and association and the recognition of freedom of religion;
- To provide support structures for subject societies' cultural, sporting and social life;
- To afford all members of staff, as the University's most important resource for the pursuance of its mission, irrespective of creed, race or sex, opportunities for personal growth in a stable, challenging and congenial working environment;
- To create structures and/or opportunities, where appropriate, for consultation with Students, staff and the community in the determination of university policy.

Corporate values

Academic excellence

- Teaching and research of high quality through the maintenance of a balanced integration of scientific excellence, social relevance and the personal growth of students and staff.

Academic freedom

- Learning and working, without fear of any harm, in an open, empowering and creative organizational culture.

Equity

- Equity through the maintenance of the principle of equality and through affirmative action aimed at the equalization of opportunities and outcomes.

Democracy

- Representative and meaningful participation in decision making.

Institutional integrity

- Pursuing the full realization of the institution's potential in dynamic interaction with its environment.

Accountability

- Demonstration of public and internal responsibility through openness in decisions and processes, as well as responsible action by the Council, staff and students.

Development

- The democratic enablement and empowerment of staff, students and community, as well as the conservation of the natural environment.

Organizational effectiveness

- The efficient achievement of appropriate objectives.

Strategy 1 - Home country configuration

The simplest strategy for an organization trading around the world is not to locate plants outside its home country and to export its products to foreign markets. In effect any organization adopting this strategy is avoiding the necessity of location any part of the network over which it has direct control outside its own home country. The reason for adopting this strategy might be, for example, that the technology employed in the product is so novel that it needs to be manufactured close to its Research and Development headquarters. Alternatively, the home location of the company might be part of the attraction of a product such as high fashion garments from Paris.

Strategy 2 - Regional Configuration

An alternative strategy is to divide the company's international markets into a small number of regions: for example, the European region, the Pacific region, and the American region. Any company adopting this strategy might the try to make each region as self-contained as possible. So for example, the European region's market would be served by operation or operations in the European region. This can only be achieved if each region has the full range of operations capabilities needed to make the full range of products marketed in the region. Companies adopting this strategy usually do so because their (often industrial) customers demand speedy delivery and prompt after-sales service. If products or services were created outside the region it would be difficult to provide such a level of service, although regional warehouses and service centers could go some way to achieving the required customer service.

Strategy 3 - Global coordinated configuration

The converse of the regional strategy, for companies with world-wide locations, is termed the global coordinated configuration. Here the various operations concentrate on a narrow set of activities and products and then distribute their products to the markets around the world. So, for instance, a company might take advantage of low labour costs in one region and allocate products with a high labour content to its operations in that region might have a well developed technical support infrastructure and so is allocated products which have higher technological requirements. This strategy therefore seeks to exploit the particular advantages of each site or region, but by doing so it does place a coordination requirement on the headquarters of the company. All products allocations, operations capacities and movement of products need to be planned centrally.

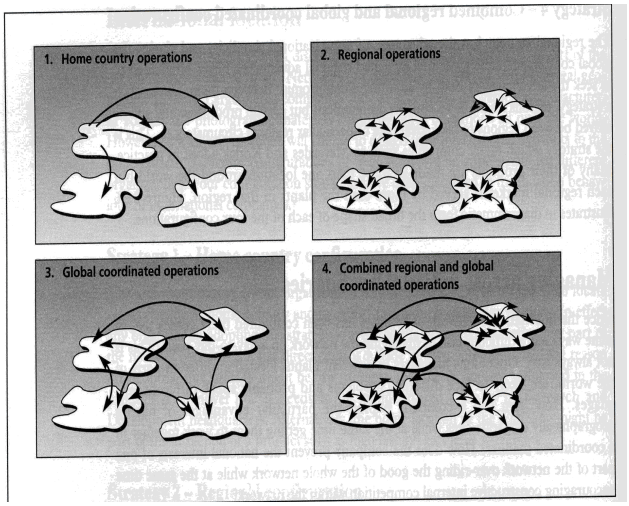
Strategy 4 - Combined regional and global coordinated configuration

The regional strategy has the advantage of organizational simplicity and clarity, the global coordinated strategy of well-exploited regional advantages. Firms often attempt to seek the advantages of both by adopting a compromise between them.

Under such a strategy, regions might be reasonably autonomous but certain products could still be moved between regions to take advantage of particular regional circumstances. This is the strategy, which many companies such as Mercedes and Kodak adopt in practice.

Many of their products are made in more than one location around the world but. Figure 6 illustrates in diagrammatic form the broad shape of each of the four configurations.

Figure 6 Four broad types of international operations network configurations



22.5.2 Managing across national boundaries

Once the international network of facilities has been configured there comes the, in some ways more difficult, task of managing the network on a day-to-day basis. This is not always easy. Operations managers are in different plants. How then can a company exploit the particular advantages of having geographically disparate sites while at the same time getting them to work together in a coordinated manner? How does the company prevent the national interests of one part of the network over-riding the good of the whole network while at the same time encouraging constructive internal competition within the network?

Kodak, for example, maintains a global operations performance measurement system which allows all Kodak plants to assess their own performance against other Kodak plants around the world. So if one plant was dissatisfied with its own performance in (say) delivery reliability, it could consult the international database to find the Kodak plants who were performing particularly well in this area and then seek advice from them. The plants which have the best performance in each performance measure (called 'Kodak class' plants) are expected to be cooperative in terms of helping other Kodak plants to emulate their own success. Of course, such a system is not without its costs. The amount of effort and coordination which goes into running the performance database and the expertise necessary to interpret it in a sensible manner is available only to relatively and sophisticated organizations. The ability to compare plants around the world can be a major asset for multinational companies. It enables them continually to keep abreast of good operations practice and it prevents their individual plants from becoming either parochial or complacent.

It is the ability of multinationals to compare the performance of plants in different parts of the world that helps them develop a global and multi-cultural perspective. Multi-culturalism is the goal to which many multinational firms aspire. It means that the company sees itself as being a part of all the communities in which it is involved rather than as being primarily associated with its original country of origin. Asea Brown Boveri (ABB), the Swedish-Swiss electrical engineering company, is one such example. The company has a board of eight directors from four different nationalities and an executive committee of eight senior managers from five different countries who run its day-to-day business. With a headquarters in Zurich, English is its corporate language while its financial results are reported in US dollars. It also moves its business around the world in response to global changes. In the first half of 1994 its workforce in the Asian region increased by 8500.

22.5.3 Different regions B different practices

Different parts of the world, because of their differing cultures, economic conditions, history, market needs, demography and so

on, are likely to develop different operations practices. The most obvious example is the way just-in-time and 'lean manufacturing' practice grew up in Japan in the aftermath of the Second World War (*see* Chapter 15). The question, therefore, which multinational have to face is,

Should we allow our facilities in different parts of the world to develop their own operations strategies to suit their own conditions, or should we encourage a uniformity of practice which reflects our corporate values?'

For example, linking this back to our discussion of ethics in the earlier part of this chapter, should an organization which originates in a culture where any kind of gift or bribe is highly unethical, prevent its operations from giving small gifts to potential suppliers or customers in a country where this is culturally acceptable? Similarly, should an organization which has built up a strong world-wide brand image allow this to be adapted in different regions? For example, McDonald's, the fast-food chain, developed a rigorous and highly standardized way of organizing its operations, which was one of the main reasons for its world-wide success. Yet eventually it had to allow a certain amount of discretion to local managers to adapt for local tastes (for example, serving Teriyaki burgers in Japan, or serving wine in Lyons).

22.5.4 Transferring operations practices

Different parts of the world, because of their different conditions, develop their own approach to operations management, so can the practices which grew up under one set of conditions transfer successfully to parts of the world where conditions might be very different? Again Japanese manufacturing industry provides us with an example. When just-in-time manufacturing began to be noticed by the rest of the world it was common to hear the view expressed that although it was fine for Japan it would never work 'over here'. North American, European and South African cultures especially were considered to be unsuitable for Japanese methods of manufacture. With hindsight this view was flawed in two ways. First, it failed to distinguish between the 'technical' aspects of just-in-time (such as kanban control, or set-up time reduction) which were relatively easily transferable, and the way in

which just-in-time was implemented by harnessing certain 'cultural' factors of Japanese life (such as the emphasis on consensus decision making). While just-in-time manufacture has now spread throughout the world it is not always applied in exactly the same way in North America or South Africa, for example, as it is in Japan. Some of the technical aspects may be identical but the way it is put into practice has often been tailored suit national culture. Second, it is an over-simplification to assume that all countries within one region of the world have the same work culture.

Yet sometimes an operational practice which is wildly successful in one part of the world does not transfer easily. For example, the Federal Express Corporation in America practically invented the overnight express delivery service. Its 'hub-and-spoke' operations structure in the United States enables it to guarantee overnight delivery from any part of the country to any other part by routing all packages through a single hub in Memphis, Tennessee. Influenced partly by the moves towards greater European integration, Federal Express attempted to duplicate its US operation in Europe. However, Europe is far from being a single integrated economic entity in the same way as is the US. Differences in language, currency, culture, tax rates and so on, posed problems which were not experienced in the US. After some years of struggling to develop the overnight express business it gave up the struggle and closed this part of its business.

22.5.5 Long-term transfers of operations practice

In the long term one can trace the movement and development of operations management practice as it responds to conditions in one part of the world and then is adopted by other parts. Let us return to the example of just-in-time or 'lean' manufacturing. In fact lean manufacturing is just one stage in what might be an ongoing process of development. Figure 7 illustrates this for the case of automobile assembly. Automobiles were originally made by craft-based processes. Each car would be built individually (as horse-drawn coaches had been prior to the development of the internal combustion engine). This was also true in the early years of automobile manufacture in the United States. It was only when demand grew to the point that warranted the development of

mass production methods by Henry Ford and others, that the 'standard' way of producing motor cars moved to the assembly-line based mass production system. So effective was this method of manufacture that it spread from the USA to Europe and later to Japan. As we have already mentioned, the conditions and culture of Japan led to the further development of manufacturing with the adoption of just-in-time methods and continual improvement on to the basic framework of mass production. Again the appropriateness of this new method of manufacturing to late twentieth-century conditions led to its transferring both back to the USA and to Europe. However, in some parts of Europe some elements of the original craft-based production had survived, either in the luxury end of the motor car business, or where some of the negative factors of mass production were less acceptable. Most notably Scandinavian manufactures, both of motor cars and trucks, had adopted what has been termed a 'dock' system of manufacture (which we described in Chapter 7 as a 'short fat' layout). There are some attempts to combine the economic efficiency of lean manufacturing with the more acceptable social ideals of dock manufacturing. This has been termed 'reflective manufacturing'.

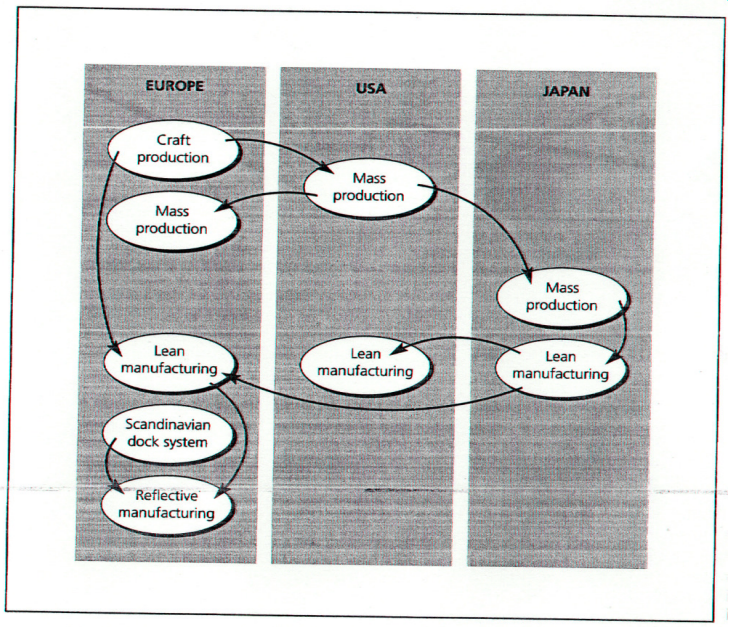
22.6 STRATEGIES MUST BE CREATIVE

The operations strategy formulation procedures which we described earlier in this chapter provides a structure and a logical process which help operations managers to move in a sensible direction. However, they will not provide the single best strategic solution. They tell operations managers how to go about developing a strategy; they do not tell them what to do. Different sets of operations managers faced with exactly the same set of circumstances will probably come out with very different strategic solutions. Some might follow fairly conventional and orthodox routes (which may well provide adequate solutions), while others might be more imaginative and creative in coming up with their own original strategic solutions, or at least developing ones which embody some original idea. Many successful operations are successful because they thought of an original way of creating their products and services. Federal Express, the parcel delivery company which we described earlier in this chapter, is a good example of this. It was the first to use the 'hub and spoke' principle, whereby all parcels are routed through a central hub, to

provide overnight parcel delivery. It is now an 'obvious' solution which is used throughout the world. But it only became obvious after Federal Express thought of it.

The issue which marks the boundary between orthodox and pedestrian operations strategies on one hand, and original, creative and imaginative strategies on the other, is that of how operations managers view the relationship between performance objectives. One way of characterizing this relationship is called the trade-off paradigm. We shall describe this and put forward the hypothesis that only by overcoming the trade-off paradigm will operations strategies be sufficiently creative to provide a significant competitive advantage.

Figure 7 The transfer of operations practice in theautomotive industry



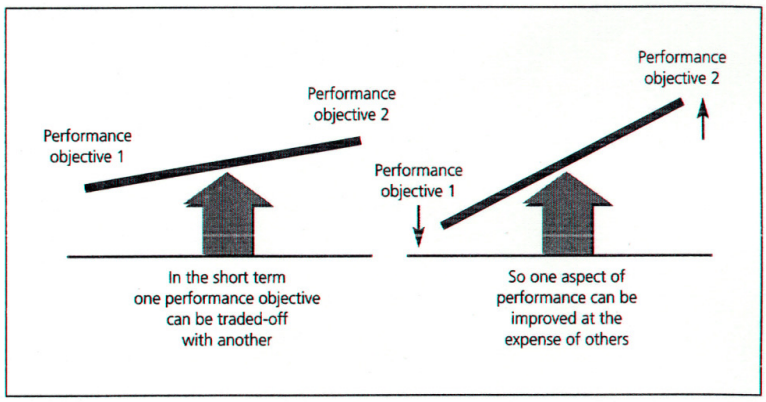
22.6.1 Do performance objectives trade-off?

One of the important questions which any operation has to decide is the relative priority of its performance objectives. To do this it must consider the possibility that one way in which it can improve its performance in one objective is to sacrifice some performance in another. Put another way, it must consider trading-off one aspect of performance with another. This idea is called the *trade-off paradigm* of operations, and, taken to its extreme, it implies that improvement in one aspect of an operation's performance can only be gained at the expense of performance in another. 'There is no such thing as a free lunch' could be taken as a summary of the trade-off theory (*see* Figure 8). Probably the best known summary of the trade-off idea comes from Professor Wickham Skinner, the most influential of the originators of the strategic approach to operations. He said:

most managers will readily admit that there are compromises or trade-offs to be made in designing an airplane or truck. In the case of an airplane, trade-offs would involve matters such as cruising speed, take-off and landing distances, initial cost, maintenance, fuel consumption, passenger comfort and cargo or passenger capacity. For instance, no one today can design a 500 passenger plane that can land on an aircraft carrier and also break the sound barrier. Much the same thing is true in manufacturing.'[11]

Yet this trade-off model of performance objectives has been challenged - mainly by companies who have managed to give 'the best of both worlds' to their customers. Perhaps the most dramatic example is how the supposed 'trade-off' between quality and cost was challenged and overcome by many types of operation. At one time a high-quality, reliable and error-free automobile was inevitably an expensive automobile. Now, with few exceptions, we expect even budget priced automobiles to be reliable and almost free of any defects.

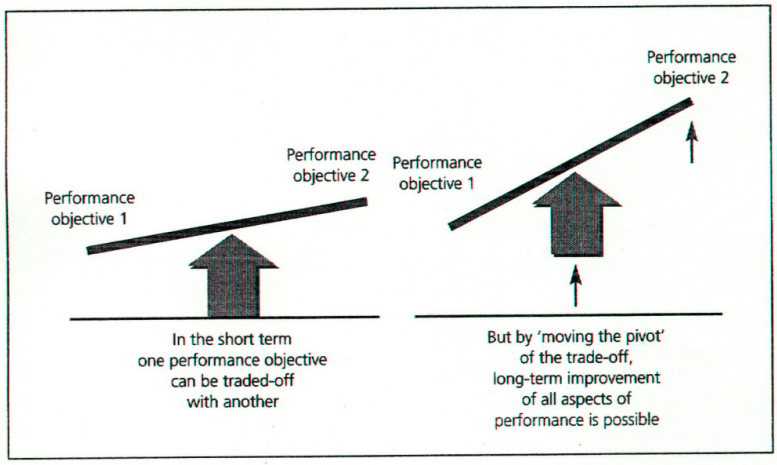
Figure 8 The trade-off paradigm



It is mainly the attitude of operations managers which has changed. Taking their lead from pioneering Japanese manufacturers, most manufacturers found that not only could they reduce the number of defects on their vehicles without necessarily incurring extra costs, but they could actually reduce costs by reducing errors in manufacture. They changed their view of quality from one of 'screening the bad products out', to one of 'stopping the mistakes being made in the first place'. Put in terms of the 'lever' model in Figure 8, there are two ways to improve the position of one end of the lever. One is to depress the other end B in other words improving one aspect of performance at the expense of another. But the other way is to raise the pivot of the lever. This would raise one end of the lever without depressing the other end. Alternatively it could raise both ends. The 'pivot' in real operation is the set of constraints which prevent both aspects of performance being improved simultaneously. Sometimes the constraints are technical, sometimes attitudinal. But the 'pivot' is stopping one aspect of performance improving without it reducing the performance of another. It should therefore be the prime target for any

improvement process and the basis for developing creative strategic solutions in the operation. Figure 9 illustrates this.

Figure 9 Challenging the trade-off paradigm by 'raising the pivot'



The approach which has been generally adopted in this book is that, although there are some situations where (especially in the short term) trade-offs between performance objectives have to be made, one of the main jobs of operations managers is to change whatever in the operation is causing one performance objective to deteriorate as the other improves. In fact the 'pivot' of the trade-off is the main target of continuous improvement in operations.

22.6.2 Reducing the trade-off

Even what seem to be inevitable trade-offs can be reduced to some extent. For example, one of the decisions that any supermarket manager has to make is how many check-out positions to open at any time. If too many check-outs are opened there will be times when the check-out staff do not have any customers to serve and will be idle. The customers however will have excellent service in terms of little or

no waiting time. Conversely, if too few check-outs are opened the staff will be working all the time but customers will have to wait in long queues. There seems to be a direct trade-off between staff utilization (and therefore cost) and customer waiting time (speed of service). Yet even the supermarket manager deciding how many check-outs to open can go some way to affecting their trade-off between customer waiting time and staff utilization. The manager might, for example, allocate a number of 'core' staff to operate the check-outs but also arrange for those other staff who are not performing other jobs in the supermarket to be trained and 'on-call' should demand suddenly increase. If the manager on duty sees a build-up of customers at the check-outs these other staff could quickly be used to staff check-outs. By devising a flexible system of staff allocation they can both improve customer service while keeping staff utilization high. Chapter 11 examined other ways of dealing with demand fluctuations.

22.6.3 Blocks to creativity

Although creativity in operations strategy is seen to be a desirable condition, one can, without too much effort, identify a variety of factors which either block creativity or create a climate in which there is little encouragement for staff to demonstrate their creative abilities. These blocks to creativity range from the way in which staff jobs are structured to the way in which we, as individuals, all respond to each other's ideas. The factors which inhibit creativity include the following:

- Developing operations control systems which emphasize efficiency over creativity.
- Dividing jobs into those who are expected to be creative and those who are not.
- Expecting certain functions in the organization (such as research and development or marketing) to be creative while other functions (such as operations and finance) are not expected to be creative.
- Expecting only staff above a certain organizational level to contribute new ideas.
- Not recognizing or rewarding those staff who generate creative solutions to operations strategy.

22.6.4 Socialization into non-creativity

Many staff, especially in large organizations, do not often take part in decision-making activities where they are called upon to exercise some degree of discretion. They are often engaged in carrying out activities that depend on decisions which have already been made by other staff elsewhere in the organization. Even when they do exercise choice it may be with little or no discretion. The alternative courses of action between which they choose may have already been identified and the decision process may merely consist of following a pre-set rule. Under these circumstances individual staff may become *socialized* into an attitude towards their work in which creativity plays little or no part. They just so not see their jobs as being, in any way, creative. This makes the task of harnessing the potential of all staff in the creative particularly difficult for operations managers. They must themselves then be creative in encouraging creativity.

22.7 STRATEGIES MUST BE IMPLEMENTED

Too often operations strategies fail at the implementation stage. A strategy may set the direction of the operation but implementation defines how it gets there, which is a more difficult task. Operations managers need to start the task by addressing their implementation agenda B the list of general questions, the answers to which set the basic plan for implementation. The questions are:

- When to start?
- Where to start?
- How fast to proceed?
- How to coordinate the implementation programme?

When to start?
There is probably only absolute rule here, which is not to start until all the issues on the implementation agenda have been addressed. Starting off without a reasonably clear idea of how the strategy is to be implemented is a sure way to reduce the chances of success. The implementation agenda in effect charts how progress is supposed to be made. Nevertheless, some start times are better than others. Implementation should ideally be started when one can be sure of resourcing it adequately (for example, when the operation's engineers and managers can devote enough time to the project).

Where to start?
There are two schools of thought here. The first recommends starting where the operation will get most direct benefit, by being rational and putting effort and resources where the likely return, in terms of improved performance, will be maximized. This could be either where performance is so poor that relatively small improvement gives a disproportionate benefit, or where the potential for dramatic improvement is high. The second favours starting where the operations managers believe there is the best chance of succeeding, preferably in a relatively calm backwater of the operation where any problems will not set back the whole strategy. By doing this, managers can start small and build up experience, learn as they go, keep mistakes small scale and, above, all, maintain credibility in the organization. By the time the really important parts of the operation are being tackled, the implementation team will have both the authority and the experience, if not to guarantee success, to make it far more likely. Both approaches are perfectly legitimate, though the second has much to commend it when the improvement programme is inherently risky or when the implementation team has little experience of the type of change being made.

How fast to go?
Managing the speed of improvement means understanding (and often combining) the two modes of improvement B breakthrough improvement and continuous improvement, which are described in Chapter 18.

How to coordinate the programme?
An operations strategy implementation is like any other project in that it needs managing using the principles which are described in Chapter 16. The organizational environment in which the programme will have to fight for attention and resources needs to be predicted. Operations managers must answer questions such as, what conditions will the programme have to cope with during its implementation? For example, are there product/service modifications or new product/service launches planned for the period? If so, how will they interfere with the programme? Are there organizational (or system) changes planned by any other functions, which could affect the programme?

When to start?
There is probably only one absolute rule here, which is not to start until all the issues on the implementation agenda have been addressed. Starting off without a reasonably clear idea of how the strategy is to be implemented is a sure way to reduce the chances of success. The implementation agenda in effect charts how progress is supposed to be made. Nevertheless, some start times are better than others. Implementation should ideally be started when one can be sure of resourcing it adequately (for example, when the operation's engineers and manages can devote enough time to the project).

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22.7.1 SUCCESSFUL IMPLEMENTATION B THE KEY ELEMENTS

In the several studies of operations strategy implementation, both successful and unsuccessful, a number of key elements recur regularly, either as important prerequisites of success or as omissions which seriously harmed implementation success.

Top management support
This always comes out as being important, especially at times of 'breakthrough' improvement where the 'champion' role requires top management to allocate and coordinate resources. Continuous improvement requires a different kind of support, emphasizing a long-term continuing expectation of improvement.

Business driven
All operations strategy change is only a means to an end B improved competitiveness. The organisation's overall competitive imperatives must be clearly linked to every part of the operations strategy programme throughout its life.

Strategy drives technology
Not the other way round. Competitiveness should drive operations strategy, so in turn, operations strategy determines the way technology is developed.

Change strategies are integrated
Successful operations strategy programmes involve change several fronts, technological, organizational, cultural. Only considering one aspect is too limiting a view. Integrating improvement strategies so that they support each other gets the operation 'firing on all cylinders'.

Invest in people as well as technology
Some organizations are reluctant to invest in their human resources even a fraction of the cash they do in technology. Yet changes in methods, organization or technology must be supported by changes in attitude by all employees B especially the managerial structure. Technological 'retooling' must be accompanied by 'social retooling'.

Manage technology as well as people
Conversely, organizations often seem reluctant to 'manage' technology after the investment decision has been made. Technology needs integrating into the operation on strictly managerial criteria.

Everybody on board
Any effective operations strategy must be understood and supported throughout the organization, particularly the management structure. Without this, changes are implemented into 'unreformed' traditional structures, attitudes and work practices.

Clear explicit objectives
If staff know what is expected of them it is easier to succeed. An obvious point maybe, but since operations strategy usually involves cross-functional change, the need for explicit communication of overall purpose becomes vital.

Time-framed project management
Keeping control is a prerequisite for maintaining support. Objective setting, schedules, resource plans, and milestones are as important here as for any other project.

Source: Pycraft, M, Singh, H, Phihlela, K, Slack, N, Chambers, S, Harland, C, Harrison, A, & Johnston, R. 1997: 766-791. *Operations management.* Southern Africa Edition. Johannesburg: Pitman.

ANNEXURE C: SOLUTIONS TO AND FEEDBACK ON ASSIGNMENT 03/2011

ASSIGNMENT 03	**SELF-ASSESSMENT**
This assignment for module MNO301D consists of multiple choice questions (section A) that covers topic 8 (study units 13 and 14), topic 9 (study unit 15) and topic 10 (study unit 16) and the essay type questions (section B) covers all topics at random. The assignment is applicable to the both the first and second semesters.	

SECTION A: MULTIPLE CHOICE QUESTIONS (10 MARKS)

You were asked to answer 10 multiple-choice questions. All the questions were of equal value and counted one mark.

Question 1

Alternative 3 is correct because options (a), (b) and (d) are all correct. Option (c) is incorrect because the performance objectives listed are actually performance **measures** (ie they are the criteria against which measurement takes place) rather than performance standards (ie one or other performance level set for comparison purposes). Furthermore, we should note that the listed performance objectives in themselves, would not really be considered "practical" performance measures. They are composites of much smaller measures. As pointed out in your prescribed book, it is highly unlikely that one (or all five) such single, simple measure(s) would be used to judge the performance of the production/operations management system with a view to its improvement. Instead a "bundle" of partial measures for each of the main listed performance objectives would be used. Option (e) is also incorrect because of the distinct differences between a performance standard and a performance measure. The measure against which the performance of the operation is judged (ie, say, the partial measures of purchasing, marketing and production/-operations efficiency, staff productivity, etc B for the overarching performance objective of cost) describes "what is measured" and

does not indicate on its own whether the performance was good, bad or indifferent in terms of a certain level or standard of performance.

Question 2

Alternative 2 is correct because options (b), (c) and (e) are incorrect. Options (a) and (d) are, however, correct. Option(b) is incorrect because benchmarking would be viewed as a "competitor performance standard" because one business's operation is compared with others. Furthermore, the objective of benchmarking is not really to determine or indicate "the position of the business in industry" but to judge how well an operation is doing, and in this process, by looking both internally and externally, better understand the connection between external market needs and internal production/operations processes. Option (c) is incorrect because Xerox saw the prerequisite for benchmarking success, not the objective of setting realistic standards of performance (usually the objective at strategic level), but rather the need to thoroughly understand its processes. Option (e) is incorrect because although their performance was rated as a point 2 (ie their performance is clearly to be considered better than their competitors), this aspect of the service was not regarded as a less important factor (ie one that was "hardly ever considered by customers") but ranked as number 1 (ie an order winning factor which provides a crucial advantage). Given the ranking of importance to customers and the performance of the company in this area, the priority for improving the technical solutions would fall into the "appropriate" zone of the importance-performance matrix used in the prescribed book. This means that the operation's performance is considered to be "acceptable" but it would not want to move below the lower boundary line of this zone and would over the long term want to move up to towards the upper boundary line.

Question 3

Options (a), (b) and (c) are correct; therefore alternative 1 is correct choice. Option (d) is incorrect because Nissan's adoption of *kaizen*, which conveys the idea that all improvement should be a continuous process, follows the continuous improvement approach rather than breakthrough improvement approach. Option (e) is incorrect because there would be no credible or defensible reason to "reverse" the concept behind the Deming wheel (ie PDCA cycle) thus to first act, then check, then do, and lastly plan. The PDCA cycle methodology is associated with the continuous improvement approach and its

"reverse" cannot make it a breakthrough or BPR approach.

Question 4

Alternative 3 is correct because options (b), (c) and (e) are correct. Option (a) is incorrect because TQM cannot be equated to a continuous improvement technique. It is much more. Although one of the concerns of TQM is the development of a process of continuous improvement, it cannot be regarded as a mere technique. Note that the latter part of the statement about the use of cause-effect diagrams to diagnose quality-related problems, is true (ie these diagrams are particularly effective in helping find the root cause of problems). Option (d) is incorrect because while Crosby's contribution does include a focus on "zero defects", which incidentally is an example of an absolute performance standard, and the focus of his work is on the costs of quality (ie the phrase referring to the price of nonconformance is relevant), the other phrase on the fitness for use and movement towards a user-based approach to quality is credited to Juran. Crosby's work on quality is associated with the value-based approach to the definition of what quality entails, and this is why it is considered to be so important.

Question 5

Options (c), (d) and (e) are incorrect; therefore alternative 5 is correct. Options (a) and (b) are correct. Option (c) is incorrect because the second point listed (ie that the costs of quality, including the internal costs of failure be considered), although it is a specific concern of TQM, does not really feature in HP's internal-customer concept. Option (d) is incorrect because while the TQM model does change the way quality costs are viewed from an appraisal-driven (inspect-in) to design-in ("getting it right the first time") approach, it addresses the underestimation of the costs of failure (ie the costs associated with the disruption that errors cause, although difficult to measure, must be included) and notes that the increased cost of quality provision moving towards zero defects (ie the costs of appraisal and prevention) would not be as dramatic (ie cost curve would not be as steeply inclined) as portrayed by the traditional model of the "optimum-quality" theory. Option (e) is incorrect because nothing is said about TQM losing its effectiveness in the company but rather that the ISO 9002 was a "good minimum standard foundation" on which to build a total quality management programme. Furthermore, ISO 9002 deals with the quality systems model for quality assurance in production and installation only and not as ISO 9001 in addition to,

design/development and servicing.

Question 6

Alternative 3 is correct because options (b), (c) and (e) are correct. Option (a) is incorrect because the chances for immediate success of any TQM improvement programme appear to be far less than one out of two or 50 percent. In all the quoted surveys listed in your prescribed book, the companies that reported meaningful success were only between 20 and 33 percent of those surveyed. Furthermore, critical factors that affect TQM implementation involve (1) the effective **introduction** and implementation and (2) the commitment and continuous support of top management. Option (d) is incorrect because TQM loses its effectiveness at the start of the "disillusionment" phase of the programme (ie at the end of the levelling-off phase) and should not be "rebolted" (ie TQM is not a "bolt-on" attachment to a business) or "kick-started" (which implies a hasty, stop-start type of introduction of TQM to a business). Furthermore, while it may be tempting to exploit the motivational "pull" of TQM, slogans and exhortations like the one quoted in the statement should be avoided.

Question 7

Options (b) and (e) are correct; therefore alternative 4 is correct. Option (a) is incorrect because NO business really should be indifferent to failure. While dependability is not only desirable but essential in some cases, the examples of the taxi transport service and hot water geyser at home included in the statement, do meet this definition. Here reference should rather be made to air transport in flight and hot water in emergency wards or operating theatres in hospitals. Option (c) is incorrect because failures in a particular product/service are not necessarily more serious than failures in the production/operations system. It is true that a customer/client is more likely to immediately complain should a failure occur in the product/service because of his/her direct contact/interaction B we should note that all, with the possible exception of customer/client originated failures, are in effect production/operations system's failures. Businesses therefore need to distinguish between various types of failures and anticipate the possible impact of critical failures on the whole operation. Option (d) is incorrect because the three serious failures described in the case exercise were primarily human and technically dissimilar. No single technology failure could be blamed for the disasters and it thus appears that the accidents are not

directly attributable to design failure in the chemical plant.

Question 8

Options (c) and (e) are incorrect; therefore alternative 5 is correct. Options (a), (b) and (d) are all correct. Option (c) is incorrect because the purpose of failure detection and analysis is much broader and is to ensure that failures are detected when they occur and through analysis, understand why they did occur. Whether the customer/client is "happy" with the product/service and finding out how it may be improved, are definitely worthwhile objectives per se, but are too "narrow" in scope with regard to the purpose of failure detection and analysis. Option (e) is incorrect because the methods listed are designed to try and prevent failures from occurring in the first place or improving on the reliability of the whole operation. Although it should be done parallel with preventing failures from occurring, recovery from failure or failure planning (ie the POM activity of devising procedures which allow the operation to recover) is different from improving the operation's reliability.

Question 9

Options (a) and (d) are correct; therefore alternative 2 is correct. Option (b) is incorrect because the description of the content and process focus points of the production/operations strategy were switched around. In other words, the content-related issues deal with the determination of the specific strategies that govern day-to-day decision making in the operation (or otherwise stated: what they practically entail in the business) while the process issues are concerned with how or the way in which these strategies were actually determined or formulated. Option (c) is incorrect because the "reorganiser" and "marketer" do not follow similar strategies in terms of their structure (ie in terms of enhancing their production/operations process design). However, they are dissimilar in terms of improving their infrastructure. The "reorgniser" thus enhances its structure (improved production/operations processes) and retains a traditional approach to its infrastructure. The "marketeer" enhances its infrastructure (increased level of service to its customers) and retains a traditional approach to its structure. Option (e) is incorrect because while some of the criteria included in the statement by which the effectiveness of production/operations strategies are judged, may appear convincing, they are not really relevant. In this regard, the criteria of affordability and acceptability may be mentioned. The criteria listed in the prescribed book deal with whether the strategies

are appropriate, comprehensive, coherent, consistent over time and credible.

Question 10
Alternative 1 is correct because only option (a) is incorrect. All the other options are thus correct. Option (a) is incorrect because while the community is indeed one of the stakeholders to be considered (the others are the customers/clients, staff, suppliers and shareholders), the question whether the strategy is "legally justifiable" does not (or should not) feature in this particular stakeholders area of interest. With regard to the government forcing businesses to "transform" themselves by legislation -- it should be realised that "anything is possible" but not necessary advisable. A cornerstone of Western-style capitalistic economies is supposedly nongovernment interference, or at least, the minimum where market forces are absent or not seen to be effective.

SECTION B: ESSAY-TYPE QUESTIONS (90 MARKS)

QUESTION 1 (30 marks)

Question 1.1
This question asked your opinion on possible reasons for a resurgence of interest in production and operations management (POM) at universities and business over recent years. You may have either agreed or disagreed with the statement. In both cases, however, it is difficult to know exactly or predict what your reasons were. If we were to assess your answer to this question, our emphasis would be on judging how well you justified your reasons rather than on simply identifying a "right" or "wrong" reason.

We, of course, wholeheartedly agree with the statement on the resurgence of interest in production/operations management. We receive increasingly more enquiries from students and businesses interested in sending their employees for an introductionary course in production and operations management. However, it would be more convincing to consider some of the following points:

(1) Many popular or "fashionable" managerial concepts have their origin in the POM function such as BPR (business

process re-engineering), TQM (total quality management), et cetera.

(2) The realisation that the potential of this function can "add value" which has a positive impact on securing competitive advantages for the business.

(3) The central nature of this function and the prominent role it fulfils has again been emphasised by supply chain management and this reminds businesses of the importance of this function.

(4) There is an inherently strong link between this function and the essence of a business, namely to produce/deliver products/services that meet the needs of customers/clients.

(5) Any person working in a business, other institution or organisation should have at least a basic knowledge of the strategic importance, role and activities of this function.

Award yourself one mark for each of the reasons you provided and convincingly justified.

Your own assessment of your answer = __ marks out of 5

Question 1.2
This question asked you to illustrate how the production/operations function of four different examples which operate at stage 4 of Hayes and Wheelwright's four-stage model, could contribute to their long-term competitive success. Before illustrating the operation of each of the four examples, it is important to first explain what is meant by a "stage 4 production/operations function". According to Hayes and Wheelwright's four-stage model, if a company or business's production/operations function is seen to be operating at stage 4 (ie being externally supportive) this means that the function itself becomes the foundation of the business's future competitive success. In this case, production/operations-based strategies are developed to enable the business to compete in future markets. [Two marks would be awarded for this part of your answer]. Hereafter the application in the case of each example should follow. [Each example would be awarded two marks]. In the example of an airline, we could refer to a company like SwissAir where the emphasis typically reflects a stage 4 operation (ie they emphasise their extensive network of flight destinations [they use the slogan ASail smoothly through the united

skies of Europe" and serve 200 destinations in Europe alone and 300 worldwide], the reliability of their operation, the quality of service, etc, rather than factors such as the "friendliness of cabin staff", variety of cuisine and alcoholic beverages, etc).

Your own assessment of the four examples = __ marks out of 10

Question 1.3

This question asked you to illustrate how the strategy hierarchy would work in a "not-for-profit" organisation such as charity organisation. As a first step in answering this question, it is important that we first consider what is meant by the concept "a strategy hierarchy". Basically, this refers to the different levels at which strategic decisions about the positioning of a business or organisation in its environment are made. Typically three levels are identified for large businesses comprising the corporate strategy, the business strategy (or strategies where more than one business unit exists) and functional strategies. [Two marks would be awarded for this part of your answer.] In the case of the "not-for-profit" organisation, we believe that a strategy hierarchy similar to the one described above is appropriate and will thus be used to answer this question. At corporate level, the decisions would also concern the positioning of the charity within its global environment (ie the environment affected by broad political, social, economical, technological, etc influences) while at business level, the concern would once again similarly be directed towards guiding the organisation through its environment consisting of its customers/clients, "competitors", "market", et cetera. We use these words in inverted commas ("") because they are normally not associated or used in the context of nonprofit organisations. Though we are not sure exactly how welfare organisations are functionally structured they are sure to perform financial, operations, public relations, purchasing, et cetera activities, but because of the size of the organisation, one or more may be grouped together under one functional department. Strategies that will guide the actions of the various functional departments in the organisation (referred to as functional strategies) will thus also need to be formulated and implemented. [One mark should be awarded for each of the explanations of the three strategy levels.]

Your own assessment of your answer = __ marks out of 5

Question 1.4

This question asked you to explain the importance of the volume-variety dimension as a way of understanding operations and their approach to design. In chapter 1, section 4 of the prescribed book entitled “Types of operations”, four measures used to distinguish between different types of operations were described. They included the dimensions of volume, variety, variation and degree of customer/client contact. As mentioned later in chapter 4, section 5 of the prescribed book entitled “The volume-variety effect on design”, the first two dimensions listed above namely, volume and variety, usually go together. In this regard, high-volume operations are usually associated with low variety in products/services while low-volume operations with high variety in products/services. [One mark should be awarded if you made this point.] remember, however, that different approaches can be found even within a single operation. Viewed in this way, the actual volume-variety position that a particular operation occupies, will provide a significant clue about or insight into how the resources within it, are or should be arranged. [One mark should be awarded.] Similarly, the particular volume-variety position of an operation will affect the approach adopted for the design of its products or services and the processes for their manufacture/provision. [One mark should be awarded.] In this regard, the various aspects of the design activity namely, design emphasis (product/service versus process design), product/service standardisation (high verus low), location (decentralised versus centralised), flow (intermittent versus continuous), process technology (general purpose versus dedicated) and staff skills (task specific versus systems oriented) all will be influenced by the particular position with regard to the volume-variety continuum. [Two marks should be awarded.]

Your own assessment of your answer = __ marks out of 5

Question 1.5

This question asked you to discuss the relationship between product/service and process technology for a product or service with which you are familiar. Since we do not know exactly what example you chose, we will use the example of a motor vehicle to discuss this particular relationship. As a starting point, however, it is important that we briefly explain, firstly, what product/service technology, and secondly, what process technology entail. For instance, in the case of a motor vehicle, the electronics used in their engine systems these days to monitor and control fuel mixtures, revolutions, et cetera, are

an example of product/service technology. On the other hand, the technology used in the actual manufacture of the vehicle such as robotic welding arms, automatic overhead-carrier assembly line, are examples of process technology. [Two marks should be awarded.] The relationship between these two may be described by focussing on the comparative paths of their distinctive life-cycles. In this regard, the emphasis during the introduction stage of the product/service falls on the product/service technology itself, while later, during the maturity stage of the product/service, the emphasis would fall on the process technology utilised. [Two marks should be awarded.] Finally, it should be mentioned that it is much easier to distinguish between product technology and process technology in the case of products that are manufactured than services that are rendered. [One mark should be awarded.]

Your own assessment of your answer = ___ marks out of 5

QUESTION 2 **(30 marks)**

Question 2.1

This question asked you give as many applications of automation as you could for the operations at a hospital and a university. Note: the emphasis of your answer should be on identifying applications of **automation** (ie typically a manual process which, through the use of some form of technology, is now performed automatically). A useful framework which could be used to list various examples of automation at the hospital and university follows the categorisation of the three types of processing technologies suggested in your prescribed book (ie materials, information or customer/client processing). One mark was awarded if you used an appropriate framework to structure your answer, and two marks for an example (2 mark for each application of automation you identified in the case of the hospital and university). For example, at the university, we could identify examples of automated material-processing technologies in the production and distribution of study material (ie the machines that print, cut and staple study guides and tutorial letters), examples of automated information-processing technologies in the computerised network of electronic communication between all staff (ie the PC link by means of network and GroupWise) and examples of automated customer/client-processing technologies at student registrations (ie computerised registration and issue of study material).

The assessment of your answer = ___ marks out of 5

Question 2.2
This question asked you to explain what was meant by a closed-loop MRP system. Two marks were awarded if you first briefly explained what a MRP system (material requirements planning) entails (see fig 14.4 in ch 14 of your prescribed book) and what its purposes was (ie to reconcile the supply and demand of resources by deciding on the volume and timing of materials flow in dependent demand conditions). Next you had to explain specifically what a closed-loop MRP system entailed (ie feedback loops for checking whether the planned production plan were actually achieved) [one mark awarded] and also have described two of its applications (ie either two of the resource requirements plan [RRP], the rough-cut capacity plans (RCCP] or the capacity requirements plan [CRP]) [three marks awarded].

The assessment of your answer = ___ marks out of 5

Question 2.3
This question asked you to discuss the advantages and disadvantages of working just-in-time. Working "just-in-time" basically means that we "only do something when it is asked for" (ie manufacture a product or render a service only when the customer/clients asks for it, not earlier or before it is needed and not later) [one mark awarded]. Primarily, its application would mean zero or low inventory levels (clearly a saving in working capital). It also enhances the operation's ability to improve on its intrinsic efficiency (this allows the operation to address productivity problems of high work-in-process, defective deliveries, high downtime, rework, scrap, etc, more effectively) [one mark awarded]. Just-in-time or JIT, however, may be seen as an overall philosophy of production and operations management (POM) but also includes a collection of tools and methods which support its aims. It concerns three overlapping elements from which its advantages may be derived, namely the elimination of waste of all forms, the inclusion of all staff in the operation in its improvement and that the improvement should be on a continuous basis [two marks awarded]. Finally, one or more possible disadvantages could be described for one mark. Here you could have mentioned the need created by JIT for a much closer reliance on suppliers (ie a business could not truly follow JIT principles if its suppliers do not follow suit).

The assessment of your answer = ___ marks out of 5

Question 2.4
This question asked you to recommend which of the two machines (machine 1 or 2) used to slice plastic extrusions should be replaced on the basis of its ability (or lack of) to do its job properly.

To determine which machine has the best capability to do the job (thus noting that the machine with the "lowest ability" to do the job is likely to be the best candidate to be replaced), we may calculate the process capability or Cp index for each machine.

Machine 1
Specification range = 17,3 - 16,7 = 0,6 cm

Natural variation in process = 6 x standard deviation or equal to the normal variation = 0,5 cm

$$Cp = \frac{UTL - LTL}{6s}$$

Cp = 0,6) 0,5 = 1,2 [Two marks awarded]

Machine 2
Specification range = 26 - 22 = 4 cm
Natural variation in process = 6 x standard deviation or equal to the normal variation = 1,9 cm

$$Cp = \frac{UTL - LTL}{6s}$$

Cp = 4) 1,9 = 2,1 [Two marks awarded]

While a Cp value greater than 1 generally indicates that the process is "capable", machine 2 is "more" capable than machine 1. Machine 1 is thus likely to be replaced first [one mark awarded]. Finally, although not specifically asked (and with the very limited information given in the problem), it appears that the actual outputs from the machines (ie machine 1 which produces items which are normally distributed

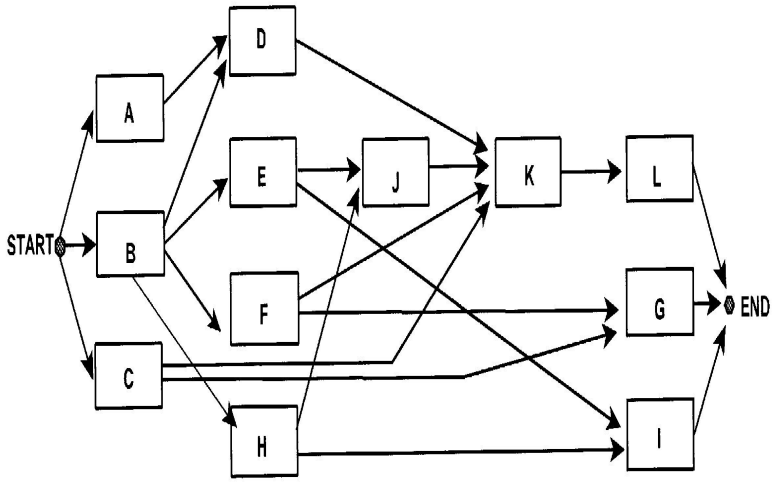
around 17cm with a standard deviation of 1,7cm and machine 2 which produces items which are normally distributed around 24cm with a standard deviation of 2,1 cm) in many cases would not fall within the specification limits (ie for machine 1 17,3 - 16,7 cm and for machine 2 26 - 22 cm) that have been set. Thus, while both machines may be "capable" of meeting the specification limits, the actual outputs due to assignable causes of variation which will have to be eliminated, in many cases appear to be "unacceptable". This matter would need to be investigated further.

The assessment of your answer = ___ marks out of 5

Question 2.5
This question asked you construct a network diagram based on the precedence relationships given in the problem according to the CPM method of analysis. Your answer would look something like the diagram which follows (note it might not look exactly because the placement of the activity nodes could differ and therefore also the arrows which link them to indicate the precedence relationships).

One mark would be awarded for correctly showing each of the precedence relationships of A, B, C, D, E, F, H and J [8 marks] and a half mark for correctly showing the relationships for G, I, K, L (2 x 4 = 2 marks), thus in total 10 marks for the diagram.

To quickly check whether a constructed diagram shows the required precedence relationships between the different activities correctly, we may draw up and compare it against an immediate follower activity list which would look something like this:



ACTIVITY	IMMEDIATE FOLLOWER(S)
A	D
B	D , E , F , H
C	G , K
D	K
E	J , I
F	G , K
G	END OF PROJECT
H	I , J
I	END OF PROJECT
J	K
K	L
L	END OF PROJECT

The assessment of your answer = ___ marks out of 10

QUESTION 3 **(30 marks)**

Question 3.1

This question asked you to explain the differences between break-through improvement and continuous improvement and discuss the advantages and disadvantages of each. As a starting point, you should point out that the production/operations activity of improvement entails measuring the performance of the operation, selecting improvement priorities and deciding which approach or strategy to improvement will be adopted. With this in mind, both breakthrough and continuous improvement thus represent somewhat different and even opposing views or philosophies to improvement. [One mark should be awarded.] Next you should have briefly described what each approach entails -- ie breakthrough improvement being "innovation-based" with major, dramatic changes taking place in the way the operation works and continuous improvement (also known as *kaizen*) involving much more gradual, slower, incremental steps or changes in the operation. Some of the distinctive features of the two approaches could further be included as part of your description. [Two marks should be awarded.] Finally, you had to discuss some of the advantages and disadvantages of each approach. You could refer to some of the features listed in table 18.3 in your prescribed book (page 597) from which you could deduce both advantage and disadvantages of each approach. [Two marks should be awarded - one mark for an advantage and disadvantage for each approach.]

Your own assessment of your answer =___ marks out of 5

Question 3.2

This question asked you to find out more about one of the so-called "quality gurus", describe his/her background, approach to quality, key contribution(s) to the subject and probable contribution to TQM. Again, unfortunately, we would not know exactly which one of the "quality gurus" you selected in order to answer this question. However, your answer could have more or less reflected the following basic structure:

- a description of the person's background (ie where the person is from, qualifications, work experience, etc) [Two marks to be awarded.]
- a description of his/her approach to quality (ie how the person views quality) [Two marks to be awarded.]

- a description of the key contributions that the person made to quality [Four marks to be awarded.]
- an explanation of how the person's the approach and key contribution(s) to quality fit and form part of the TQM philosophy [Two marks to be awarded.]

Your own assessment of your answer =___ marks out of 10

Question 3.3
This question asked you to calculate the failure rate, the mean time between failures and the availability of the example of an ATM machine outside a Bank.

To calculate the failure rate (in time) (FR) we need to take the number of failures and divide it by the operating time. The number of failures and the duration of the failures were as follows:

Failure 1	3	hours
Failure 2	33½	hours
Failure 3	30	hours
Failure 4	19	hours
4 failures	85½	total duration

The operating time equals the total time minus the nonoperating time Total time = 24 hours x 7days = 168 hours and the nonoperating time = 85½ hours, thus the operating time is 168 - 85½ = 82½ hours

$$FR = \frac{4}{82\frac{1}{2} \text{ hours}}$$

= 0,04848 [Two marks to be awarded.]

To calculate the mean time between failures (MTBF) which is the reciprocal of the failure rate (in time), this time we merely need to take the operating time and divide it by the number of failures.

$$MTBF = \frac{82\frac{1}{2} \text{ hours}}{4}$$

= 20,625 hours [One mark to be awarded]

To calculate the availability (A) of the machine we need to take the mean time between failures (MTBF) and divide it by itself (MTBF) plus the mean time to repair (MTTR). Unfortunately, in the problem we are not given any indication of how long time its takes to repair the machine thus we cannot calculate the MTTR or the availability based on this formula. Note it would not be a fair assumption to assume that the nonoperating time equals the MTTR. However, given the definition of availability, that is "the degree to which the operation (the ATM machine is this case) is ready to work" we could, with reasonable justification, calculate the availability as the operating time divided by the total time.

$$A = \frac{82\,1/2 \text{ hours}}{168 \text{ hours}}$$

$$= 0{,}4911$$ [Two marks to be awarded.]

Your own assessment of your answer =___ marks out of 5

Question 3.4

This question asked you to explain why the formulation of a production/operations strategy was important and worthwhile for a business. Furthermore, you had to indicate why such as strategy had to be ethical. Your answer could have included some of the following arguments (see case study 22 in annexure B of this tutorial letter). Firstly, you could point out that it is agreed that the ultimate goal of a business is "to satisfy customers' immediate needs" BUT in order to do this, the business needs to formulate a production/operations strategy which it must also successfully implement. [One mark to be awarded.] Next, the point made is that an effective production/operations strategy helps the business to compete more effectively because it provides a basic structure or central core around which all individual decisions in the business may be linked in order to point in the same direction. [One mark to be awarded.] You could then point out the potential of the production/operations function in terms of its increasing competitive role of internal neutrality, external neutrality, internally supportive and ultimately of externally supportive (see Hayes & Wheelwright's four-stage model), the generic

production/operations strategies labelled "caretaker", "marketer", "innovator" and "reorganiser" suggested by Sweeney's classification - all of which emphasise the importance of production/operations function and therefore its strategies. [Four marks to be awarded.] Next you could describe the formulation procedures (ie the Hill methodology and Platts-Gregory procedure) for individual production/operations strategies that will take a business's own competitive circumstances into account. [Two marks to be awarded.] In summary, you will have to integrate and logically explain all the aspects mentioned above to enable you to make a case to a production/operations manager why he/she needs to spend time and effort formulating a production/operations strategy for the business. Finally, as part of the strategy challenge for the future, it is essential that such production/operations management strategies are seen as "ethical". This means they should, against a framework of moral behaviour, be judged as either right or wrong. Obviously, this makes the formulation extremely difficult because frameworks for moral behaviour differ from country to country, in societies and even between individuals. [Two marks to be awarded.]

TOTAL: 90 + 10 = 100