



Chapter One

The Nature of Operations and the Strategic Dimension

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Learning Objectives

After studying this chapter, you will be able:

To define Operations Management

To define the role of Operations Management

To assess operations as a strategic activity.

To define the differences between manufacturing and service operations

To describe the volume variety model of operations classification

Introduction

Without operations we have nothing to sell. So we need to understand the crucial role operations play in business life. This guide covers the principles rather than the detailed, quantitative aspects of the topic. The objective is that you understand the scope of operations, recognise its central role, and can answer some of the questions facing operations managers.

Operations management is a vital discipline and one that covers a wide range of skills. It ranges from the mathematics of forecasting and production control to the black arts of leadership and people management. Operations managers have to balance huge production responsibilities to their customers, while also negotiating with powerful interest groups such as trade unions or local authorities.

At its root, production and operations management covers activities that relate to the creation of goods and services. It concerns what happens to *transform* inputs of labour, raw materials and energy into outputs of value of customers. This understates the huge importance of the subject – without operations management there will be no products, and without effective operations management there will be no efficiency or quality.

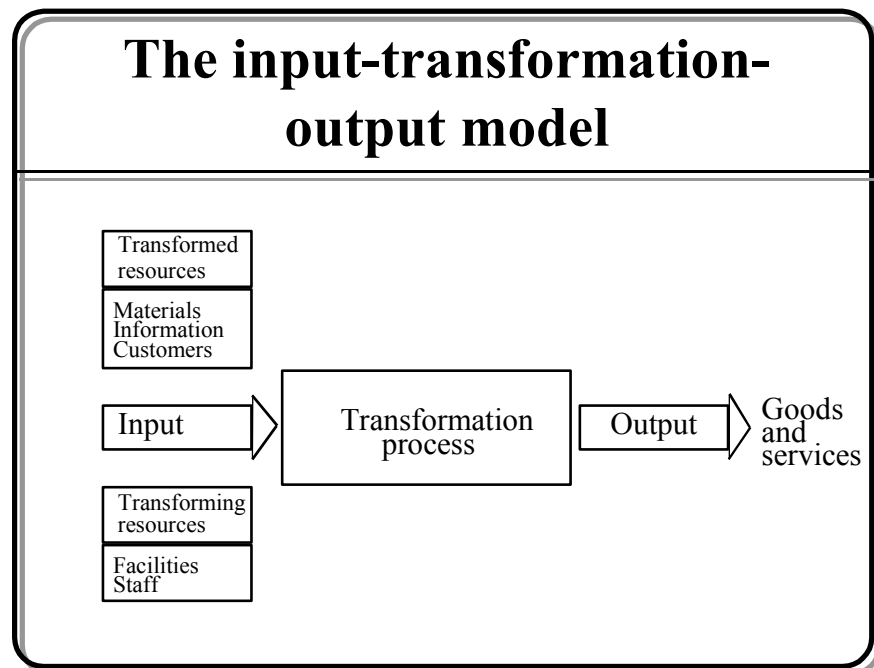
For manufacturing companies, the emphasis is on production management. For organisations in the service sector, the production function is less obvious as there may be no tangible outputs. The activities that go into managing and growing an investment, delivering an airline passenger to their destination, or guarding a building, are, nevertheless, the domain of operations management.

Substantially the same issues and methods apply to both types of organisation, despite the difference in their types of outputs. For the

purposes of this course, we will use operations management to cover the management of both production and service operations.

The Nature Of Production Operations

Irrespective of the type of industrial activity, the mechanism of production operations is a conversion process which transforms inputs (of raw materials) into physical outputs (of products). In addition to the inputs for conversion, other physical resource inputs of people, materials, plant, equipment, heat, light, power etc. are also required and, in a sense, get 'used up' in the conversion process, even though they may not manifest themselves in any recognizable physical form in the physical product output. In addition, the conversion process requires information inputs without which the processing could not be carried out or controlled. As a result of the conversion process, information outputs are generated in an analogous manner to the physical outputs.



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The process of costing product output based on the consumption of inputs is not as straightforward as it might initially seem. Some inputs, such as the material used in creating a product are simply dealt with as a direct cost per unit of product. The costs of other inputs, such as plant or supervision, are consumed on a time basis and arise whether or not any product is produced: these costs, therefore, are only indirectly related to the product output and their apportionment to it is unavoidably an arbitrary process, governed more by accepted rule or convention rather than actuality.

Organisation	Inputs	Operation	Outputs
Restaurant	customers, food, waiters, drinks	preparation, cooking, serving	meals, happy customers
Oil Refinery	crude oil, chemicals, energy	refining, distribution, processing	petrol, plastics, oil
Airline	planes, passengers, travel agents	booking, flying, catering	goods and passengers moved

Within a manufacturing environment, operations management takes a high priority. For companies such as Toyota, this is the root of their competitive advantage. In strategic terms, it is their core competence. However important production design and performance may be, highly efficient operations are the key to keeping costs down and achieving high levels of quality.

Sadly, the services sector has been slower to catch on to the value of operations management, particularly for companies with relatively smaller customer volumes and fewer opportunities for standardisation and process control.

However, this means that those service companies that do focus on sound operations management will reap real competitive benefits. Direct Line, the

direct marketing insurance offshoot of Royal Bank of Scotland in the UK has been a market leader as a result. There is nothing unique about their products, but the cost base their approach has achieved (and the competitiveness of their premiums) has provided a strong platform for mass marketing. As a result Direct Line went from being market entrants to leaders in a very short time.

The e-commerce revolution has re-emphasised the importance of operations management. One of the key benefits that this channel of distribution offers is the ability to handle information such as orders far more quickly, this encourages the use of streamline operations which can radically cut cost.

The Background to Operations Management

Operations management has a long heritage. It draws on a variety of disciplines, many of which have a strong scientific base such as production engineering, industrial engineering, the physical, information and management sciences.

Some notable players in the history of operations include:

Eli Whitney (1800)

Eli Whitney pioneered standardisation and quality control in manufacturing. As with so many advances, the catalyst was war. He supplied the US government with muskets and was able to charge a premium price because of their interchangeable parts.

Frederick W Taylor (1881)

Known as the father of *scientific management*, he believed in the importance of improving work methods. As a result, he focused on planning, scheduling and personal factors such as motion study and personnel selection.

Henry Ford (1913)

Henry Ford recognised the opportunity to develop the assembly line concepts of the meat packing industry for use with manufacturing more

generally. As a result, he brought unheard of levels of efficiency to what had previously been seen as craftsmen processes.

W. Edwards Deming

Deming is often seen as the father of modern quality control. He represents a group of quality gurus which have transformed operations management and firm performance by concentrating on matching activities and processes to the needs of customers.

Taiichi Ohno

Seen as the creator of the just in time system. As a production manager at Toyota, Ohno faced uncertain supply of materials and crippling cash shortages. This prompted the development of a low stock, high quality production system the principals of which are much emulated.

Operations and Strategy

Production and operations managers are often not consulted on corporate policy matters until a late stage (often too late). In this situation they become reactive rather than proactive. Their vision is also usually restricted to narrow functional issues and not that of the corporation overall. This is partly a problem of lack of vision, experience, training etc. This often results from top management's perception of production and operations management as detailed and technical and concerned only with 'nuts and bolts' activities. This is compounded by production and operations management's corresponding similar view of itself.

Corresponding to the achievement of the overall corporate strategy it is essential that the marketing and production and operations functions jointly determine and develop compatible and supportive strategies.

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Production and operations strategy should be concerned with specifying, in broad terms, the necessary means of production, namely:-

1. The physical facilities
2. The human resources
3. The other resources

and the manner in which they are to be:

4. Selected
5. Deployed
6. Managed and controlled.

Focusing Operations Strategy For Competitive Advantage

Manufacturing operations have not uncommonly in the past been seen mostly as constituting behind the scenes, necessary, but mainly support activities, to marketing and sales. It is only relatively recently that the view of manufacturing operations has switched from an inward to an outward facing orientation, with links to the customer and hence a focus on an ability to contribute to the achievement of higher level corporate objectives.

An appropriate operations strategy is thus essential to this task of achieving competitive advantage and should be concerned with specifying, in broad terms, the physical facilities and the human and other resources required, and the manner in which they are to be selected and deployed.

It is of paramount importance that the right strategic decisions are made, because their consequences will be with the firm for a very long term and it is often impossible, or at the very least difficult and expensive, to reverse them in the short run.

"Manage the structure not merely the operations. Tailor the structure to the strategic task. Don't focus on operations management

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techniques such as MRP or total quality control or other fads without determining the proper structure of manufacturing. Manage the structure first to serve strategic, competitive needs." (Gaither, (1992)

"The purpose of thinking and managing strategically is not just to improve performance or defend market share. It is to gain competitive advantage. It implies an attempt to mobilise manufacturing capability to help gain this competitive edge." (Ohmae, (1982)).

".....what ought to be routine manufacturing decisions frequently come to limit the corporation's strategic options, binding it with facilities, equipment, personnel and basic controls and policies to a non-competitive posture which may take years to turn round." (Skinner, (1969)).

Setting World Class Standards

Japanese companies recently set the following standards against which others judged their performance as aspiring world class performers.

1. Products:
 - Sophisticated in design and of the highest technical specification.
 - Reliable in operation.
 - Competitively priced.
2. Technology:
 - Leading edge technology employed in both products and in the manufacturing facilities.
 - Widespread use of sophisticated electronics.
 - High degree of automation employed in manufacturing:
 - Flexible manufacturing systems (FMSs)
 - Flexible assembly systems (FMAs)

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3. Operations:
 - Just-in-time delivery and manufacturing systems
 - Single sourcing
 - Flexible workforce
 - Group working
 - Focused operations
 - Statistical process control SPC
 - Employee improvement (EI) groups or quality circles
4. Management:
 - Consensus decision-making
 - Total quality management (TQM)
 - Lifetime employment

To establish and maintain a worldwide competitive edge Japanese firms are imbued with the concept of continuous improvement, Kaizen.

The world has been beating a path to Japan's door to copy, to buy, to license from, and to seek joint ventures with, as once it did to Britain following the industrial revolution, and then the USA in the period from the turn of the century. The wheel of innovation is still continuing to turn, but its global location is currently moving from the West to the Pacific rim.

Among the Japanese practices that have not been widely employed in the West are consensus decision making, corporate paternalism, company based unions, company uniforms and company song.

Automobile manufacturers use the term 'lean production' to describe the minimalist approach to organizing production and other operations by stripping out all unnecessary waste, resources and over production to meet output requirements in the most streamlined and cost-effective manner. Lean production is synonymous with Just-in-time (JIT) and 'non-stock' production.

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In the UK Rover Cars has successfully adopted the Japanese-inspired approach to running operations. So too has the Ford Motor Company although the commitment to lifetime employment has been breached.

Nissan is an example of a Japanese car company that is employing most of its home-based practices in its overseas subsidiaries.

At the Mitsubishi engine plant at Koyoto, in Japan, multiple daily deliveries are made to within plus and minus three minutes of schedule and the parts are supplied immediately to the production line. Because of unloading restrictions however, the vehicles may have to circle around on one or other of various routes round the factory in order to make their deliveries to the required scheduled time. It is interesting that the vehicles act as temporary storage facilities containing work in process. Not all waste is eliminated, even in the most efficient of Japanese companies.

At the same plant spaces are left at capacity bottleneck points in the very compact space containing the highly automated production line. This is to allow for the future expansion of capacity of the line by the rapid installation of additional facilities at these bottleneck positions without the need to physically change any of the rest of the line. Changing the whole line would be a difficult and time consuming operation, which would be very costly, because it would mean a complete close down of production during the period in which the change took place.

Electronic 'smart cards' are attached to the engine blocks as they enter the flexible manufacturing system FMS. The FMS communicates with the 'smart card' and thus determines what type of engine it is and what operations need to be performed on it. The engine is then automatically progressed from machine to machine until manufacture is completed, at which point the data from the smart card, which records the history of the work, is downloaded to

be filed. The machines themselves are monitored and controlled by computer, with automatic gauging and tool replacement taking place as required. The company expect eventually to replace the removable 'smart card' with a smaller device which will be affixed permanently to the engine and will continue to be used to automatically record the service history of the engine in the field.

Competitive Advantage – The Need For Continuous Innovation And Change

Success has continually to be strived for and earned. Too many managers, in currently successful and profitable businesses, act as though success is a destination and not a journey. As a result they fail to recognise changing customer needs. In good times they become complacent about the need for change and innovation and in bad times it is often too late to rectify omissions of the past.

Competitive advantage in product, process, management systems etc. can only be of limited time duration because of the normal processes of worldwide diffusion of innovation.

Unless organizations are responsive to the need for innovation and change they will ultimately wither and die. Continuous improvement is necessary in all areas - services, products, processes and operations. This is especially so for organizations competing on a global basis and aspiring to achieve and retain World Class status..

Peters and Waterman (1960), examined many successful major companies in an effort to determine what was the source of their excellence and, as a result, identified two essentials for achieving success:-

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1. Taking care of your customers, by superior performance and quality.
2. Constant innovation.

The major Japanese manufacturing companies employ the notion of 'the customer is the next process'. By so doing they emphasise the essential requirement that only defect free items must be allowed to be passed on from one process to another inside the factory. If this is achieved, then clearly the quality of the finished product will be assured for the ultimate customer.

The Rise of Service Industries

The importance of operations management in the service sector has risen with the significance of this sector of the economy. Developed countries have outsourced manufacturing activity to the developing economies where labour and land are much cheaper. Much more manufacturing is automated, reducing the emphasis on labour.

In the UK, over 75% of the workforce are employed in the service industries. Not only are service businesses a larger proportion of the economy, but also, manufactured products have a major, greater element of service built into the total product concept. For example, Ford makes more profit from finance, leasing and servicing than from the sale of the car.

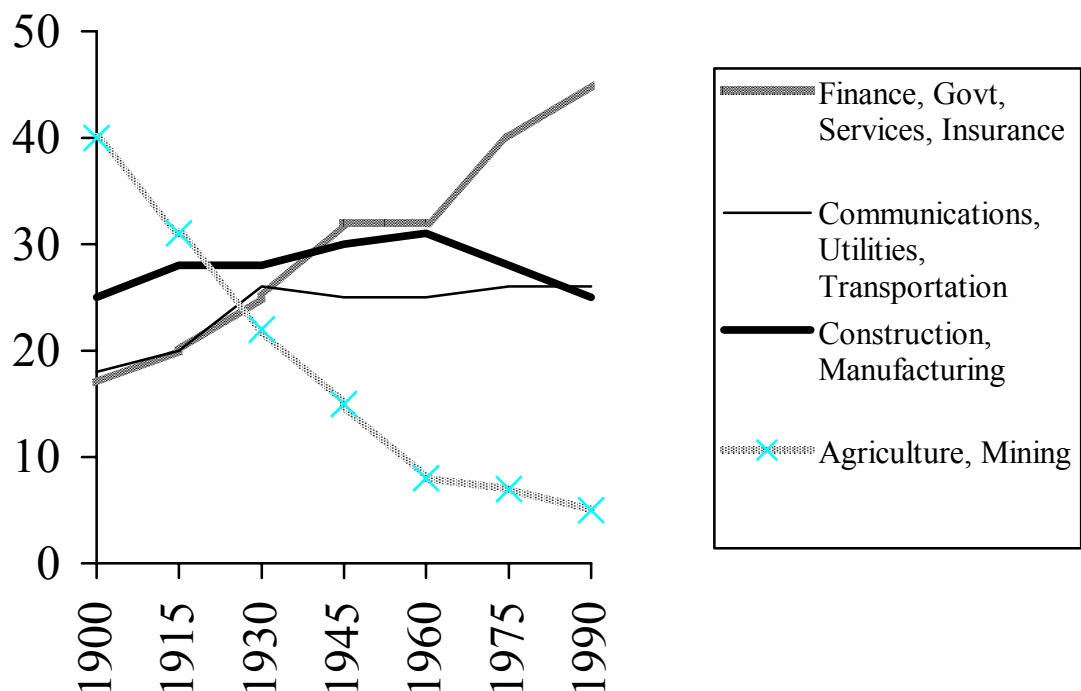


Figure: US Employment by Sector (Source: Gaither, 1992)

Service is also regarded as a key differentiator in the search for competitive advantage. For a hotel chain like the Ritz-Carlton to win the prestigious

Malcolm Baldrige Quality award in the USA was highly significant. The importance of a smooth and responsive individual service to clients was seen as more important than the tangible quality of the facilities or food on offer.

The Difference Between Manufacturing and Services

It is important to think about the differences between manufacturing activities and services. The key factors are the nature of the product and the effect this has on the operations which are to be managed. Think about a manufactured product such as a motor car and how this differs from a service such as banking or insurance.

Manufacturing operations characteristics:

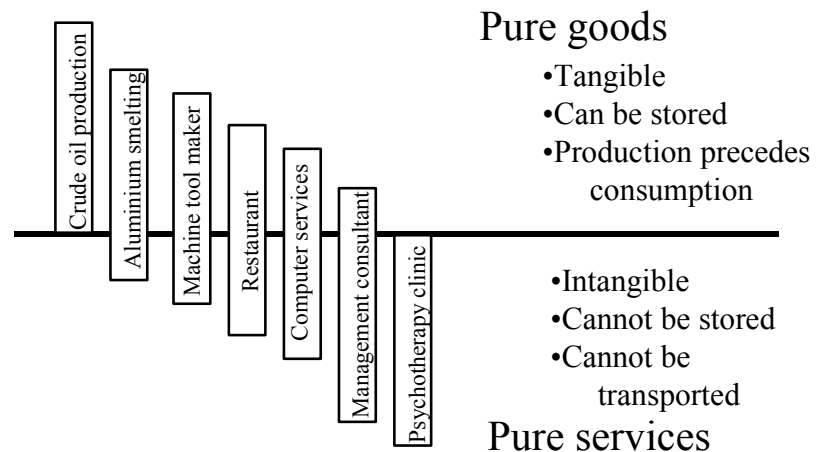
- Product is tangible
- Ownership transferred at time of purchase
- Product can be resold
- Product can be demonstrated before purchase

Service operations characteristics

- Service is intangible
- Ownership is generally not transferred
- No resale is possible
- Product does not exist before purchase

However, it is rare for a firm to offer products without service or services without any physical products involved at all.

The output from most operations is a mixture of goods and services



MANZONI, P. (1998), 14/19

Typologies within Operations

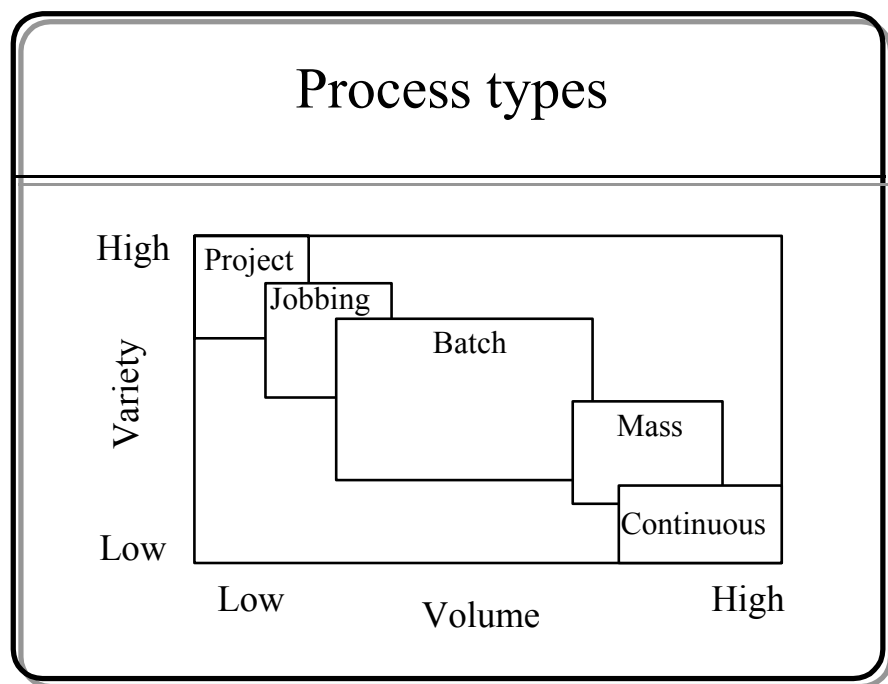
As with all academic disciplines, there is a need for a common understanding of the fundamental factors which influence the decisions and processes within operations management. A popular approach used within POM is to consider the relationship between volume and variety. Using this framework, it is possible to examine the nature of the operations involved and construct some sort of typology or model of expected solutions for any given operation.

Volume and Variety Model

A major influence on the process design and equipment required for any manufacturing or service operation is that of volume. Different approaches are required to design equipment and manage processes with different volumes. Consider a process to produce penny numbers of bicycles and how this might differ if we chose to manufacture thousands. We would adopt more formal and complex manufacturing and management systems as the volume increases, and would start considering more expensive and automated equipment which the increasing volume allows us to justify.

Similarly, the choice of approach changes as the variety we produce alters. If we only make one model of cycle, then we can have a very rigid and low complexity system. However, if we introduce more models of cycles in our facility and do not alter the number we make, more complex equipment and management processes are needed to control the operation.

Actually there is a well understood relation between volume and variety in operations management. The model was first proposed by Hayes and Wheelwright (1979), and has been extended to cover service operations as well. The basic framework and the names given to the types of processes it relates to are shown in the diagram below.



The different groups given by the operations classification system of volume and variety have overlapping but readily identifiable characteristics.

Project Management

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This approach to production utilises simple and flexible equipment to produce unique products in single units. The classic example is building, but possibly more influential today is the development of software.

Job Shop

As the volume increases, we tend to find a drop in the variety in the products made. The job shop (or jobbing shop) produces families of similar, but unique parts. Take for example the craft of making pots. Each one thrown by the potter is different, but he is following a similar design. The equipment the potter uses is very flexible as he can manufacture a range of products in his workshop.

Batch Manufacturing

With batching we produce identical items in a set number (this could be 2 or several million). The equipment is generally more specialised than that used above and normally more expensive but still fairly flexible. A typical engineering workshop can produce a wide variety of parts in batches by repeating the process and following a route through the different activities on different machines. The benefit is that costs per unit tend to be quite low. This is the system used in the manufacture of most products we see today and the management tools used to optimise the system are highly developed and concentrate on cost and quality control and timing or coordinating the activities.

Mass production

If we start producing in very large numbers, we need to radically redesign the production process. By arranging the machinery to match the flow of steps through the manufacturing process, we can produce still greater numbers of products at lower cost. This is the Henry Ford moving production line. However, a car plant can only manufacture a very limited range of cars and so has a very limited scope in terms of variety. As the equipment is very expensive to design and install, particularly if we introduce automation to reduce employees and increase consistency, the key measure used by managers is the utilisation of the equipment.

Continuous Processes

Some items are not discrete and are produced using industrial processes which run constantly. Take an oil refinery for example. This is a very specialised piece of equipment which can only process oil, but in order to recoup the high cost of the equipment, it is run very intensively, 24 hours a day and produces many litres of petrol.

Summary

- Operations Management covers a wide spectrum of activities
- Operations is a key part of the organisation
- There are typologies of operations which share characteristics and can guide managers in decision making
- There are differences between services and manufacturing operations
- There is no one best strategy, but the best strategies must include all the key areas of the firm, with operations as the core

Self Test Questions

1. Give a basic definition of operations management?
2. What did Eli Whitney do to move forward the manufacturing process?
3. Who pioneered 'scientific management'?
4. If Henry Ford is credited with large scale production line manufacturing, where is he thought to have got his inspiration from?

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5. Give one reason why operations management should always be a source of focus from the point of view of profitability.
6. What differentiates service from manufacturing operations?
7. Select a product you know and use the volume-variety model to determine what type of production process is used in its manufacture.

Exercises

1. Operations strategy

Read the paper: *A. Pilkington, “Manufacturing Strategy Regained: Evidence for the Demise of Best-Practice”, *California Management Review*, (1998) Vol. 41, No.1, pp.31-42, and answer the following questions:

- a) What is meant by lean production?
- b) How does the operations strategy at Toyota differ from Honda?
- c) Considering Rover and Nissan, can operations alone generate sustainable competitive advantage?

2. Service operations

Read the paper: *R. Johnston, “Service Operations Management: Return to Roots,” *International Journal of Operations and Production Management*, (1999) Vol. 19, No. 2, pp. 104-24, and answer the following questions:

- a) Why did service operations management emerge in the 1980s?
- b) Who championed the production line approach to services and what does it mean?
- c) Is it more critical for service operations to focus on the customer than their manufacturing cousins?

* Papers follow after chapter

Core Text

Reading Slack, N., Chambers, S., Harland, C., Harrison, A., and Johnston, R., (2001), *Operations Management, (3rd edition)*, Pitman, London.

Chapter 1, 2 and 3

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