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CHAPTER 1

Operations Management

1.1 Introduction

Teaching the material in Chapter 1 of the book is both the most important and the most difficult part of an operations management course. Most important because it is vital that students develop an enthusiasm for the subject and this is the best attempted early in the course. Difficult because one has to establish some key principles before the 'building blocks' of the subject have been taught. We have found it useful always to work from whatever experience the students have. For post-experience students like MBAs, this is not difficult. One can always ask them to describe the nature of operations in the companies they have worked for. One can even explore some of the prejudices they might hold about operations management (dull, obstructive, always screwing things up, etc.) and base discussions on that. Undergraduates are more difficult because they usually have less experience, but even so they have experienced many different operations from a customer's point of view. Therefore, one can ask them about recent experiences as a customer (both good and bad) and base a discussion on the importance of operations management around those experiences.

Key teaching objectives

- To enthuse students with the 'hands-on' excitement that can be gained from an understanding of operations management *('... I want to prevent you ever enjoying a theatre performance, restaurant meal, or shopping experience ever again. I want you continually to be looking for the operations implications of every operation you enter. You are going to be turned into sad people who cannot go anywhere without thinking of how you could improve the process').*

- Convince students that **all** organisations really do have an operations function; therefore, operations management is relevant to every organisation.

- Convince students that **all** managers are operations managers because all managers manage processes to produce outputs. *('Even marketing managers are operations managers. What you learn as marketing in business school is really the 'technical' side of marketing. Of course this is important, but marketing managers also have to produce marketing reports and information, without mistakes in them, on time, relatively quickly, flexibly enough to contain the latest information, and without using an army of marketing analysts to do so. In other words, they are producing services for internal customers').*

- To introduce the some key ideas in the chapter, namely,

    - Operations managers manage transformation processes, with inputs and outputs.

    - Operations can be analysed at three levels; the level of the supply network, the level of the operation itself (sometimes called the level of the organisation) and the level of individual processes.

- Operations differ in terms of Intangibility, Heterogeneity, Inseparability and Perishability.
- Operations differ in terms of their volume, variety, variation and visibility (the four Vs).
- Operations managers engage in a set of activities, devising operations strategy, designing operations, planning and controlling operations, improving operations.

1.2 Exercises/discussion points

There are many cases and exercises which one could use to introduce operations management. You might like to try some of these ideas, all of which we have used.

Exercise – A useful exercise for demonstrating the ubiquitous nature of operations is to ask the class to identify every service they have encountered from waking up in the morning through to going to bed at night. The radio alarm that wakes them up depends on the operations of the radio station. The water in which they wash (presumably) was delivered by a water utility. The public transport operation transported them to college, etc. through to the bar, or other place of entertainment that they finish the day with.

Teaching tip – YouTube is a hugely valuable resource for finding videos of operations that can form the basis of class discussion. Many television programmes also can be recorded off-air, which illustrate operations. Looking 'behind the scenes' of well-known operations, such as airports, is a favourite topic for TV producers. Any of these could be used to promote group discussions on what operations management might be like in such operations.

Exercise – The four Vs dimensions of operations can be used for many types of exercise. For example, one could ask different groups to identify different types of restaurant, food retailer, car servicing operation, cinema, club or pub, etc. and plot the 'similar but different' operations on the four dimensions.

Exercise – For residential courses, especially of post-experience students, an evening could be spent 'on the town', where syndicates are required to sample the services of a restaurant, a retail operation, and an entertainment operation, and report back the following morning. This is a great way of giving participants a change of scene on the Thursday of a one-week course.

Teaching tip – Remember 'role-play' can be used effectively in an introductory session. The lecturers can role-play two operations managers managing separate similar but different operations. For example, the chief tailor of a 'fashion label' custom tailor and the production manager at a mass-produced 'off-the-peg' garment factory manager. The differences in the types of resource (people and equipment), the operation's objectives, the four Vs, etc. can all be emphasised during the role play.

Exercise – All the chapters have 'Operations in practice' examples. It is often a good idea to ask the students to read through one or more of these, then use them to promote a discussion on the topic. In this chapter, the LEGOLAND/LEGO example is great for discussing the similarities and differences between operations.

CHAPTER 1

Case study teaching note

Kaston-Trenton Service (KTS)

Case synopsis

Kaston-Trenton Service (KTS) was a UK domestic heating boiler maintenance company, run jointly by Ros, who looked after all marketing, sales and finance, and Mark, who looked after operations and supply issues. The company offered three services – maintenance and repair services to domestic customers, servicing for business customers and designing and installing HVAC systems for business customers. KTS had a small administrative office that managed accounting, HR, invoicing, contract maintenance and purchasing activities, a workshop shared by the 26 domestic boiler and the 16 business boiler technicians, who are '*reasonable about helping each other out'*. It is generally easier for the business service technicians to serve domestic customers than vice versa. The installation venture has had '*mixed success'*. Customers were satisfied, but the extra costs meant that the service was not profitable. In the short to medium term, the firm could possibly offer a more 'servitised' offering. In the longer term, there was uncertainty regarding governmental policies towards climate change targets that could profoundly affect the firm.

Using the case

This is an introductory case that can be used to make one or two fundamental points about the role of operations management in general, or if wished, it could be used to introduce several important secondary discussion points that usually arise later in an operations management module.

The case is a 'soft' exercise in that many of the issues are in the form of opinion. It is also quite a complex case in some ways. Its purpose is not to provide students with an opportunity to 'solve a problem'. Rather, it is an introductory case that can be used to open up a number of issues for discussion. Its overall purpose is to introduce students to the richness and complexity of many problems within operations management.

The fundamental points are as given below:

- The needs/expectations of customer groups dictate what operations resources and processes should try to achieve.
- Different product/service offerings often require different types of performance from the operations part of an organisation (simply called 'operations' in future).
- One way of thinking about these differences is by using the 'four Vs' that describe the conditions applying to each product/service offering (volume, variety, variation and visibility).

- Another way is to use the various categories of performance that each customer group requires.
- Even for an operation that is unambiguously a 'service' operation, there is a trend towards a wider concept of 'service' (in this case, the idea of 'servitisation').
- When the business environment changes, operations will need to change to accommodate the new circumstances.

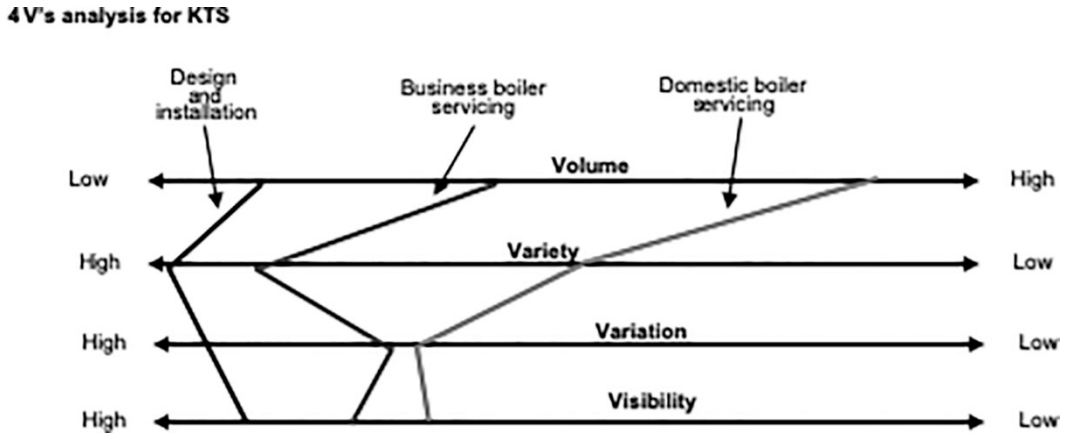
Some secondary points are given below:

- Different types of service can vary in their 'variability' (predictability of the time to do the job),. which will have a significant effect of planning work.
- The demand (from customers) for service does not always match the (convenient) availability of an operation's capacity to do the work.
- Customers can vary in their interest in understanding the exact details of the service being offered.
- Forecasting can usually be improved, but the longer ahead a forecast looks, the less reliable it will be.

Questions

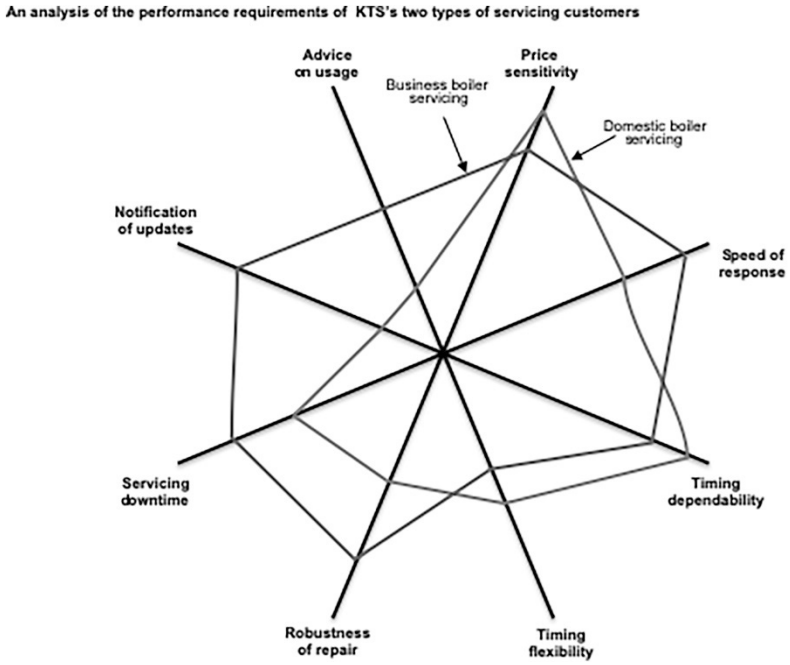
1. How would you position each of KTS's services on the four 'V' dimensions of volume, variety, variation and visibility?

The point of the four Vs analysis is not primarily to compare very different offerings but to compare similar, but different things. The three types of offering are shown below. While the design and installation offering is very much at the left side of the spectra (which usually means that creating this type of service has a relatively high cost) the other two services are positioned more to the right (cheaper to produce). However, all KTS offerings are relatively high variation (because of the unexpected nature of some servicing) and especially high-visibility (because of the service has to be performed at the customer's premises).

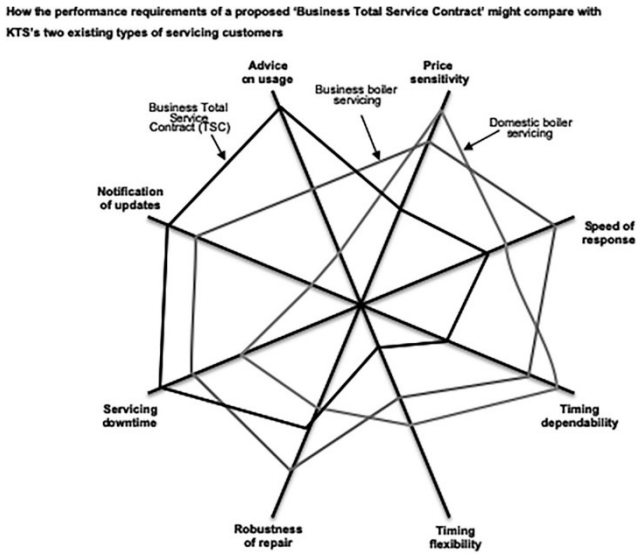


2. What aspects of performance are important for KTS to win more servicing business?

There are many ways to answer this question. Perhaps most useful is to use a polar diagram similar to the one shown here. The types of performance are obviously chosen to suit the circumstances, but each is mentioned in the case.



3. How would you evaluate the potential of offering a 'total' service like the KTS customer had been offered?



The total service is clearly a broader service with changes in the balance of risk between the customer and KTS. It demonstrates the concept of 'servitisation' is not something that applies only to physical goods producers. Here is a service provider who is also considering taking over responsibility for a 'total' service in term of what the service provides. So instead of selling 'the servicing of boilers', KTS would move to selling 'the continuity of heating'.

Some points that could be raised include the following:

- Servitisation often involves new and ill-understood risks. These include the risks inherent in diverting financial resources away from other activities.
- Servitisation involves significant cultural issues.
- Servitisation can expose costing deficiencies. In particular, life cycle costing was seen as a very approximate activity that would have to be improved significantly if servitisation was to avoid unacceptable risks.
- Servitisation redefines risk management. There can be strains regarding the unquantified but probably significant increase in risk in taking over activities previously performed by customers. It may be that at some point the marginal extra risk incurred will outweigh the marginal benefits of increased profit potential.
- Servitisation will impact technology strategy. The value of new but less reliable technologies could decrease when servitisation involves taking on more explicit risk.
- Servitisation poses new opportunities for knowledge transfer mechanisms. Generating knowledge is a key task, especially for front line staff, yet most companies were dissatisfied with their ability to feed back this knowledge, especially into product design activities.

4. What should KTS be doing to prepare for possible longer-term changes in their industry?

The nature of the future of both domestic and business heating is likely to be affected by increased measures to limit carbon levels in order to meet the UK's target to reduce emissions (as with most other European countries). What is uncertain is the speed and extent of any legislative changes. This is an 'open' question, which is best used to steer students to considering what could be done in advance of any changes.

CHAPTER 1

Operations Management

Question 1

Quentin Cakes make about 20,000 cakes per year in two sizes, both based on the same recipe. Sales peak at Christmas time, when demand is about 50 per cent higher than in the quieter summer period. Its customers (the stores that stock its products) order its cakes in advance through a simple internet-based ordering system. Knowing that Quentin Cakes have some surplus capacity, one of its customers has approached the company with two potential new orders.

The *Custom Cake* Option – this would involve making cakes in different sizes where consumers could specify a message or greeting to be 'iced' on top of the cake. The consumer would give the inscription to the store, which would email it through to the factory. The customer thought that demand would be around 1,000 cakes per year, mostly at celebration times such as Valentine's Day and Christmas.

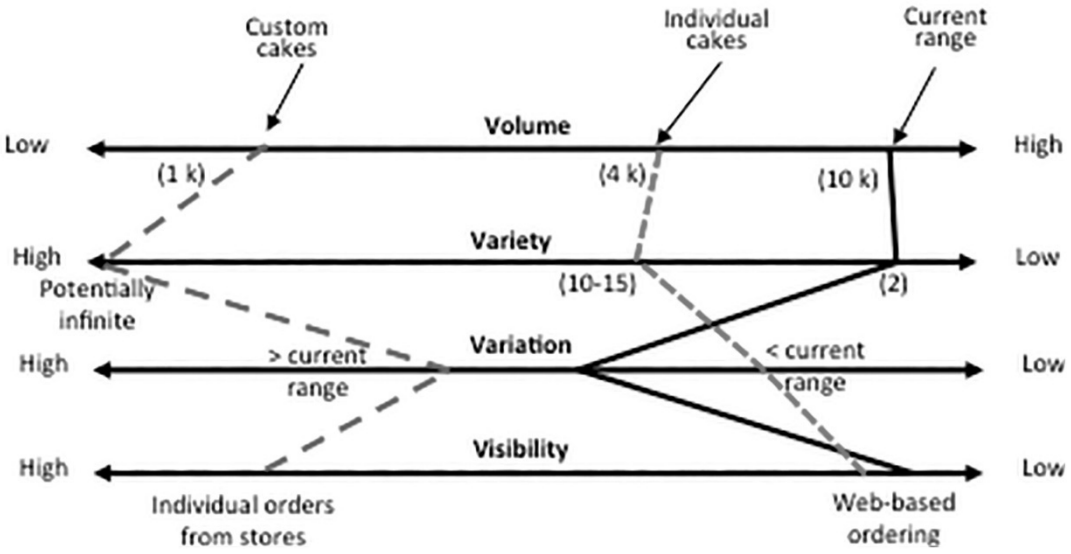
The *Individual Cake* Option – this option involves Quentin Cakes introducing a new line of about 10–15 types of very small cakes intended for individual consumption. Demand for this individual-sized cake was forecast to be around 4,000 per year, with demand likely to be more evenly distributed throughout the year than its existing products.

The total revenue from both options is likely to be roughly the same and the company has capacity to adopt only one of the ideas. But which one should it be?

Question 1 – analysis

This question involves comparing the existing product range of Quentin Cakes with the two proposed extensions to their (currently limited) range. Given that, the revenue from each of the options is roughly the same, the most profitable option is likely to be the one with the lowest cost. And in the absence of any detailed cost data, the best way to gain an estimate of costs is to look at the position of each option on the 'four Vs' and compare them with the existing range of cakes. The figure below shows this analysis:

4 V's analysis for Quentin Cakes



	Current range	Custom cakes	Individual cakes
Volume	About 20,000 cakes per year	Around 1,000 cakes per year	Around 4,000 per year
Variety	Two sizes	Every cake is different	About 10–15 types
Variation	Peak to trough of 50 per cent	Likely to be higher	Likely to be lower
Visibility	Remote web-based ordering from stores	Would need more communication between stores and factory	Probably remote web-based ordering from stores

Given that, other things being equal, the further to the right on the four Vs chart an option is, the lower cost it is likely to be, then 'individual cakes' will be less costly to produce than 'custom cakes'. So, unless there are other reasons (such as a shift in the companies overall strategy), the 'individual cakes' option seems preferable.

Question 2

Re-read the 'Operations in practice' examples on LEGOLAND and LEGO. What kinds of operations management activities at each of these operations might come under the four headings of direct, design, deliver and develop?

Question 2 – analysis

This is not an exhaustive list, and is a bit speculative, but typical operations-related decisions could include the following:

Direct	Design	Deliver	Develop
Competitive priorities (quality, freshness, product innovation and social responsibility) Store location Store capacity Operating structure (no central kitchen)	Store layout and design Customer flow pattern Human resource policies	Store staffing levels Opening times Ingredient ordering levels Inventory levels (low because of freshness policy) Supplier selection and liaison	Quality of service standards Quality monitoring (they use 'mystery shopper' systems) Reward schemes

Question 3

Here are two examples of how operations try to reduce the negative effects of having to cope with high levels of variety. Research each of them (there is plenty of information on the web) and answer the following questions. (a) What are the common features of these two examples? (b) What other examples of standardisation in transport operations can you think of?

Example 1 – The Mumbai Tiffin Box Suppliers Association (search under dabbawallas) operates a service to transport home-cooked food from workers' homes to office locations in downtown Mumbai. Workers from residential districts must ride commuter trains to work. They can be conservative diners, who may also be constrained by cultural taboos on food handling. Their workers, known as dabbawallas, pick up the food in the morning in a regulation tin 'tiffin' box, deposit it at the office at lunchtime, and return it to the home in the afternoon. The dabbawallas take advantage of public transport to carry the tins, usually using otherwise underutilised capacity on commuter trains in the mid-morning and afternoon.

Example 2 – Ports have had to handle an infinite variety of ships and cargoes with widely different contents, sizes and weights, and protect them from weather and pilferage, while in transit or in storage. Then the transportation industries, in conjunction with the International Organisation for Standardisation (ISO), developed a standard shipping container design. Almost overnight the problems of security and weather protection were solved. Anyone wanting to ship goods in volume only had to seal them into a container and they could be signed over to the shipping company. Ports could standardise handling equipment and dispense with warehouses (containers could be stacked in the rain if required). Railways and trucking companies could develop trailers to accommodate the new containers.

Question 3 – analysis

(a) What are the common features of these two examples?

- As the question implies, both are methods of dealing with complexity. Both address an operations problem where there is, theoretically, an infinite variety of transformed resources to be processed into an infinite variety of products (different destinations). Anything that can control this complexity must have very significant operational advantages.

- Both also address what was a growing need at the time. The dabbawallas catered for the growing number of clerical workers who were needed to staff the huge Indian government bureaucracies. The ISO container was developed to cope with the growing volume of world trade.

- A third commonality is that both deal with the considerable complexity mentioned earlier. Quite simply, the services could not operate at anything like an affordable cost if variety was not controlled.

- Another similarity is that the return journey of the containers is simply a mirror image of the outward journey. The routing information on the containers allows simple routing and allows containers to be returned to the same place (far more important in the example of TBSA than in the ISO containers).

- Finally, both containers provide 'protection' for their cargoes. Containers can be left out in the rain and tiffin boxes keep the food warm and protect it from contamination.

(b) What other examples of standardisation in transport operations can you think of?

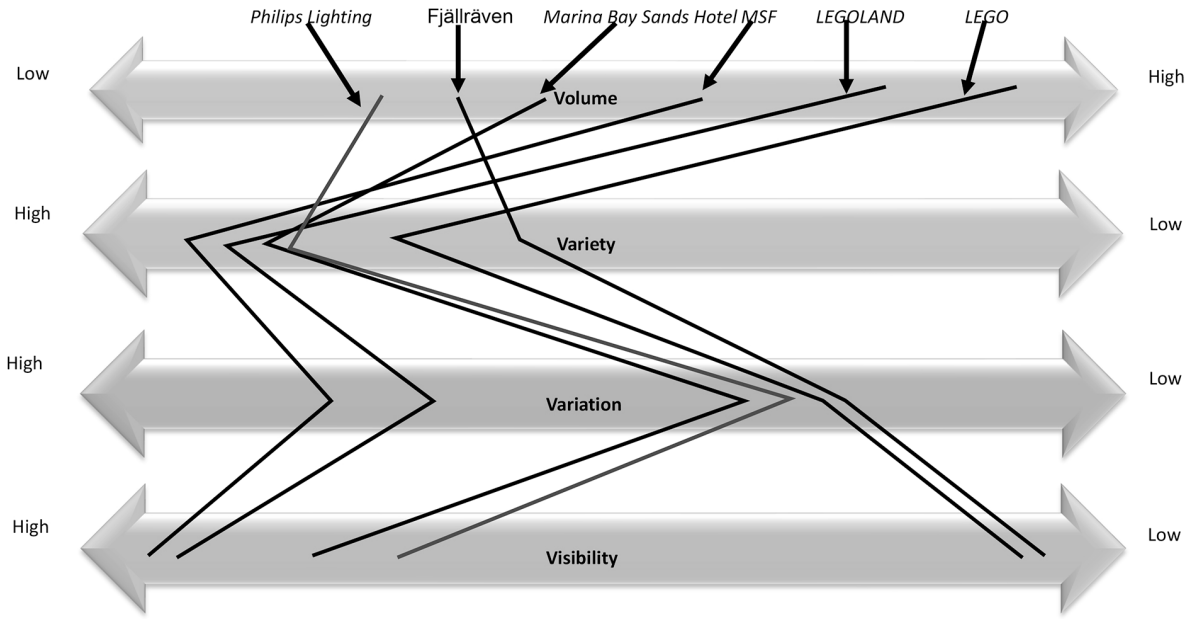
The transport industries of the world often focus on standardisation so as to limit exposure to variety. For example, some document courier services will limit the size of the package that they will carry. They may also provide a standardised package free to their customers to ensure standardisation of size, labelling, etc. Similarly, a passenger airline will transport multiples of basic units like people and ensure that cabin baggage conforms to a maximum size and weight. Attempting to take a wheelchair, bicycle or llama (!) on a scheduled flight causes problems because of their non-standard nature.

Question 4

Figure 1.12 compares two hotel types on the four Vs dimensions. Where would the other 'Operations in practice' examples used in this chapter be positioned on these dimensions?

Question 4 – analysis

There will inevitably be some speculation needed to answer this question because there is insufficient information given in the 'Operations in practice' examples. Nevertheless, it is a useful exercise to make 'informed guesses'.



In terms of…

Volume – Philips lighting is probably the lowest volume operation. As essentially a consultancy, it will probably have relatively few clients. At the other extreme, LEGO is clearly a very high-volume operation, as is LEGOLAND (although not as high as LEGO).

Variety – Most of the operations in this chapter are relatively high variety businesses. MSF's emergency response operation can never predict *exactly* what it will have to deal with. LEGOLAND and Marina Bay Sands Hotel deal with customers who could potentially have an infinite variety of requests (although they will attempt to limit them through the design of their operations). Philips lighting will probably have different lighting solutions for each client. The outlier is Fjällräven, which will have more standardised products.

Variation – Arguably, MSF will have the greatest variation because it will have periods of intense activity at times of crisis, followed by relatively quiet periods in between emergencies. Holiday and weather-related demand, such as that which LEGOLAND has to cope with will also be subject to high variation. At the other extreme, the manufacturing operations of Fjällräven and LEGO can use inventories to smooth demand on their production facilities.

Visibility – The high-contact operations like MSF, LEGOLAND and Marina Bay Sands Hotel will have very high visibility, with again, the manufacturing operations of LEGO and Fjällräven having operations that are not usually visible to their customers.

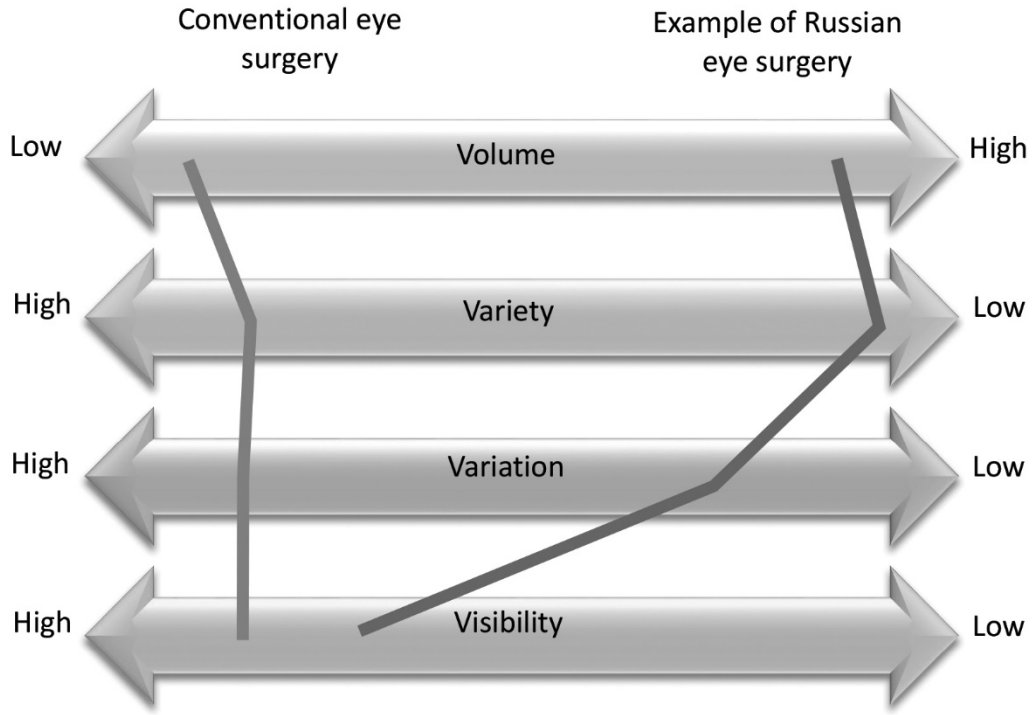
Question 5

Not all surgery conforms to our preconceptions of the individual 'super-craftsperson', aided by their back-up team, performing the whole operation from first incision to final stitch. Many surgical procedures are fairly routine. An example is the process that was adopted by one Russian eye surgeon. The surgical procedure in which they specialise is a revolutionary treatment for myopia (short-sightedness) called 'radial keratotomy'. In the process eight patients lie on moving tables arranged like the spokes of a wheel around its central axis, with only their eyes uncovered. Six surgeons, each with their own 'station', are positioned around the rim of the wheel so that they can access the patients' eyes. After the surgeons have completed their own particular portion of the whole procedure, the wheel indexes round to take patients to the next stage of their treatment. The surgeons check to make sure that the previous stage of the operation has been performed correctly and then go on to perform their own task. Each surgeon's activity is monitored on TV screens overhead and the surgeons talk to each other through miniature microphones and headsets. (a) Compare this approach to eye surgery with a more conventional approach. (b) What do you think are the advantages and disadvantages of this approach to eye surgery?

Question 5 – analysis

(a) Compare this approach to eye surgery with a more conventional approach.

One way of comparing these two processes is to use the four Vs, volume, variety, variation and visibility. The figure below positions each process on the four dimensions:



Volume – the Russian method is devoted to a single type of eye surgical procedure carried out at high volume. Conventional eye surgery is likely to have far lower volume for each type of eye surgery, partly because it has a higher variety of surgical procedures.

Variety – as implied above, conventional eye surgery could deal with any sort of eye complaint, the Russian method specialises in one type.

Variation – some types of eye surgery will be performed as emergencies, trauma injuries to the eye for example. These cannot be predicted in advance and are likely to cause turbulence in planning and some variation in demand level. The Russian method, on the other hand, is used on non-urgent cases which can be queued (stored) as inputs to the process which will level demand on the process.

Visibility – both processes are relatively high visibility because the patient has to be there to be 'processed'. However, the extra diagnostics and possibly multistage surgery required in conventional eye surgery could be seen as higher visibility.

(b) What do you think are the advantages and disadvantages of this approach to eye surgery?

The advantages are largely concerned with the low cost of processing patients under the Russian method, which will result in lower prices for the surgery. The repetition involved may also allow industrial process control methods to improve the process technically and ensure a high level of conformance in the operation (that is, fewer mistakes). The limitations are that the process is extremely inflexible; it cannot cope with high variety. It could also be boring for surgeons, a class of labour who usually prefer the excitement of variety.

The advantages of conventional surgery are the mirror image of the disadvantages above. Namely that conventional eye surgery can cope with a wide variety of possible eye complaints. The diagnosis procedure may also be more sophisticated and therefore more likely to detect non-obvious symptoms. The disadvantages are that because of its low volume, high variety, high variation and high visibility, it will be expensive.

Question 6

Write down five services that you have 'consumed' in the last week. Try and make these as varied as possible. Examples could include public transport, a bank, any shop or supermarket, attendance at an education course, a cinema, a restaurant, etc. Try to identify how these services are different and how they are similar.

Question 6 – analysis

Obviously, this question will depend on exactly which services are chosen. However, for each of these services, one could usefully ask the following questions:

- Did the service meet your expectations? Is so what did the management of the service have to do well in order to satisfy your expectations? If not, where did they fail? Why might they have failed?

- If you were in charge of managing the delivery of these services, what would you do to improve the service?

- If they wanted to, how could the service be delivered at a lower cost so that the service could reduce its prices?
- How do you think that the service copes when something goes wrong (such as a piece of technology breaking down)?
- Which other organisations might supply the service with products and services? (In other words, they are your 'supplier', but who are *their* suppliers)?
- How do you think the service copes with fluctuation of demand over the day, week, month or year?

These questions are just some of the issues that the operations managers in these services have to deal with. Think about the other issues they will have to manage in order to deliver the service effectively.

Question 7

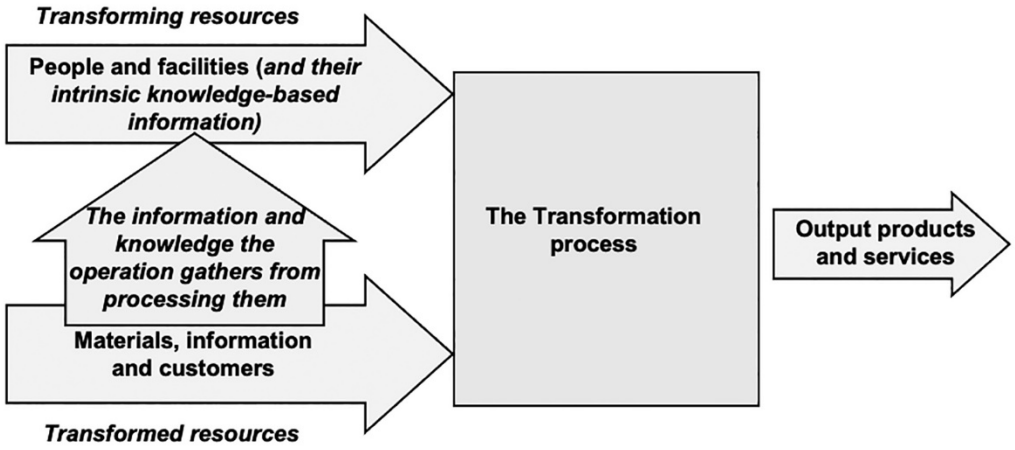
The transforming resources of the input–transformation–output model of operations management are classified as 'facilities' and 'staff'. Should the information needed to make the transformation also be included?

Question 7 – analysis

The answer (like so many answers to questions of this type) is 'yes and no'. In our simple model of the transformation process (Figure 1.6 in the 10th Edition), information is shown as a 'transformed resource'. And indeed, for many operations, it is the primary transformed resource. Banks, accountants, news services and research operations are cited as businesses that add value by processing information. So, in that sense, information is a transformed resource. Yet the people who do the transforming and the facilities that they use, do not operate in a knowledge vacuum. And much of the knowledge that is necessary to transform inputs into outputs comes in the form of information. The question, therefore, is 'where does this knowledge come from?

Some will be 'on legs'. In other words, it comes in the form of the skills and knowledge possessed by the people that are hired by the operation. Other knowledge will be contained within the facilities bought (or hired) by the operation. When one buys a technology, one is not buying it for its silicon, steel and plastic, but for the capabilities it possesses. So, again, information can be seen as an intrinsic attribute of an operation's transforming resources.

Although input resources to the transformation process are conventionally divided into transforming and transformed resources, there is usually some information / knowledge that is gathered from transformed resources that, in effect, contributes to transforming resources



However, all (or almost all) operations know the value of learning from their ongoing activities of transforming the materials, information or customers that are the basis of their value adding for customers. For a hotel, the experience of serving guests, for an accounting firm, the experience of auditing accounts, for a factory, the experience of producing goods, all build knowledge which can contribute to 'upskilling' their staff or improving their facilities. So, in that sense, information becomes, in effect, a transforming resource.

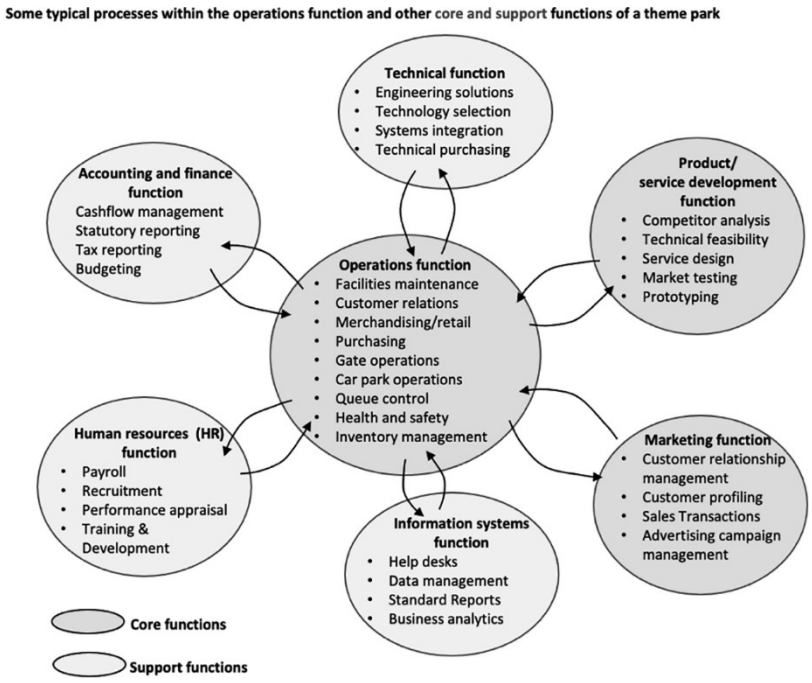
A further argument in favour of information being included as a transforming resource, is that, unlike material and customer transformation, information can remain in the operation as well as being processed for the benefit of the customer. For example, when a bank processes information for its customers, the customer is given the results of the processing (in the form of a current financial statement), but the bank also retains that information which can be used to make future decisions (such as 'should we agree a loan to this customer?'). Again, the information is being used as a transforming resource.

Question 8

What might be the 'back-office' processes in a theme park such as LEGOLAND?

Question 8 – analysis

There are almost certainly (literally) hundreds of 'back-office' processes on which a theme park such as LEGOLAND depends. One way of thinking about the type of such processes is to use Figure 1.2 in the chapter. One could then 'brainstorm' the types of responsibilities placed on the various functions. The figure below shows one such attempt:



But remember these points:

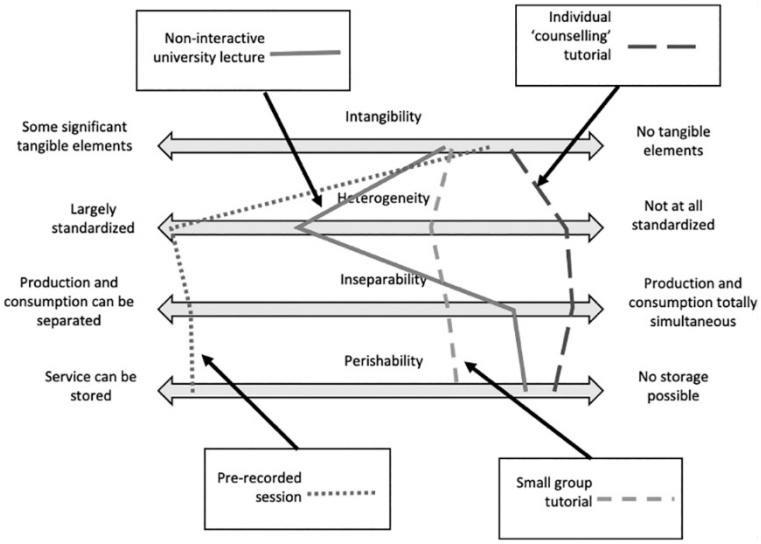
- This is simply an attempt to identify some of the likely processes. It is not a 'right answer'. In fact, there will not be a 'right answer' as such, all parks will be different.
- Even if the processes themselves are a good representation of typical processes, the boundaries between functions are likely to be different in different operations.

Question 9

Position pre-recorded lectures, non-interactive university lectures, small group tutorials and individual 'counselling' tutorials on the IHIP scales.

Question 9 – analysis

Again, no definitively 'right answer', but most people would position the services something like the figure here:



Question 10

Why do some people think that analysing enterprises in terms of their processes 'takes the humanity out of the way in which we think of the organisation' as outlined in the final 'Critical commentary' in the chapter?

Question 10 – analysis

Good question!! It is usually because some people have a very narrow view of what the words 'process' and 'operation' mean. It is not helped by some academics making a distinction between 'people' in an operation and what they term (mistakenly) 'technology' (meaning everything that is not 'people'). As we say in Chapter 9, '*operations management is often presented as a subject, the main focus of which is technology, systems, procedures and facilities – in other words, the non-human parts of the organisation. This is not true, of course. On the contrary, the manner in which an organisation's human resources are managed has a profound impact on the effectiveness of its operations function'.*

As we also point out in Chapter 9 when we look at the concept of sociotechnical systems, '*the idea that operations management is primarily concerned with 'technical' issues is as widespread as it is false. Any practicing operations manager will confirm both the importance of people-related issues and the high proportion of their time devoted to them. Effective operations management demands both 'technical' and human understanding*'.