CHAPTER 1

Operations management: theoretical underpinnings

Peter Jones

Associate Dean (International) and
ITCA Chair of Production and
Operations Management
Faculty of Management & Law,
University of Surrey
Guildford, Surrey, UK

Introduction

Operations Management (OM) is the study of how goods get manufactured and service gets delivered. Originally, it was founded on studies of how best to organize factories manufacturing automobiles and other consumer goods. But from the 1970s onwards, a greater emphasis was placed on understanding service operations. A seminal contribution to this was the publication of *The Management of Service Operations* (Sasser et al. 1978) by three distinguished Harvard professors. This book recognized that service firms were playing a greater and greater role in a nation's economic activity and suggested that managing such firms and their operations may be different to practice in manufacturing – an issue we explore later in this chapter.

Johnston (1994) defines OM and its scope and role within an organization. He states: 'operations management … is a body of knowledge, experience and techniques covering such topics as process design, layout, production planning, inventory control, quality management and control, capacity planning and workforce management' (Johnston 1994: 21).

As an academic discipline, OM is highly applied, to the extent that some have argued that it is almost atheoretical (Schmenner and Swink 1998). The applied nature of OM is further illustrated when it is applied to the hospitality industry. Very rarely are managers assigned job titles as 'Operations Managers'. Rather than this generic title, managers with operations responsibility are given specific roles such as Rooms Division Manager, Food and Beverage Manager, Restaurant Manager and so on.

In this introductory chapter, we first consider the general OM theory and identify how this has been applied in the hospitality industry. Key operational trends in the industry are identified, along with the operational strategies firms have adopted. The chapter goes on to discuss the extent to which hospitality is different to other industries, as well as the extent to which it is homogenous or made up of sectors that have features distinctive to each other. Finally, an overview of the OM literature in hospitality is provided in order to identify the scale and scope of research in this field.

Operations management theory

Until the late 1990s, OM was an applied subject, with very little theory. However, based on contributions from Hayes and Wheelwright (1979), Schmenner (1986), Schmenner and Swink

(1998) and Johnston and Jones (2005), five main theories can be identified, for the purposes of this chapter:

1. Theory of Process Choice
2. Theory of Swift and Even Flow
3. Theory of Lean Manufacturing
4. Theory of Performance Frontiers
5. Theory of Service Experience

Each of these theories will now be explained, along with their related propositions or 'laws'.[1] Their relevance and application to the hospitality industry will be explored and hospitality research into these theories will be summarized.

Theory of Process Choice

Hayes and Wheelwright (1979) identified that firms adopted different types of process in order to manufacture products. In their original analysis, they saw this as evolutionary. Firms in an industry would start with hand-making articles, applying craft skills in 'job-shop operation', move on to batch production and then adopt mass production principles. However, it was quickly realized that in some industry sectors, firms did not follow this evolutionary path, but simply adopted the process that best matched their product and their market. Hayes and Wheelwright's analysis was subsequently simplified and process types became distinguished in terms of two main criteria – volume (how many were produced) and variety (the number of different products made). These were generally seen as a trade-off. Firms could produce a wide range of different products, but if they did so, they were likely to have a relatively low volume of output, as in the job-shop operation. Or firms could go for high-volume output, but doing this minimizes the variety of products they produce, as in mass production. A similar analysis has been applied to services (Silvestro et al. 1992).

[1] The terms 'proposition' and 'law' have different meanings. Here, 'proposition' is used to denote a generally applicable rule that may have exceptions, whereas a 'law' is used to denote something that always applies. In all instances, 'law' has been used where the authors of the theory have used the term. However, it should be recognized that 'laws' which are applied to social settings, such as operations, may not have the same rigour as the scientific or natural laws found, for instance, in physics or chemistry.

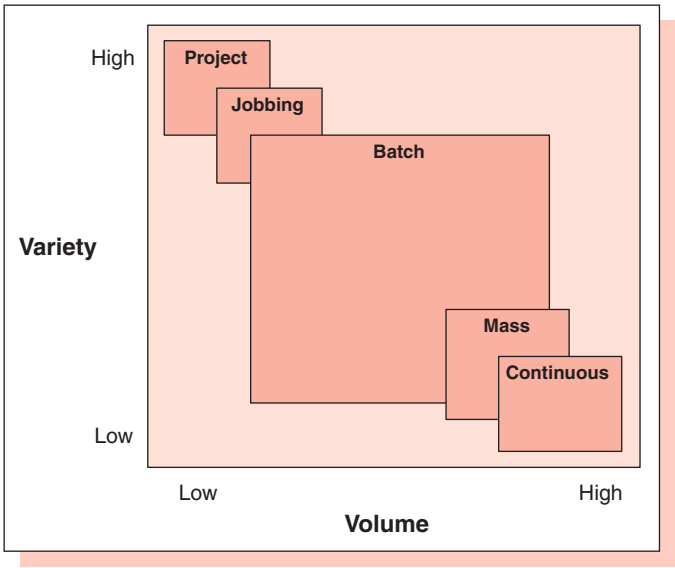

Figure 1.1
Process types in operations (*Source*: Based on Silvestro et al. 1992).

Propositions associated with the Theory of Process Choice

There are two key propositions related to this theory. First, it is proposed that firms have a choice over the type of process they adopt to manufacture their products or deliver their services. The choice they make derives mainly from an assessment of their core capabilities and market demand. Second, it is proposed that there is a trade-off between producing volume *or* variety, as illustrated in Figure 1.1. Across all industries, a major trend has been the so-called *shift along the diagonal* from job shop (low volume, high variety) towards mass production (high volume, low variety). This has been going on throughout the twentieth century and is epitomized by Henry Ford's development of automobile manufacturing.

Process choice in the hospitality industry

In hospitality operations process design, Jones (1988) identified a number of trends, two of which relate to process choice: production lining and decoupling. *Production lining* refers to the concept of breaking down production activities into simple tasks so that they may be organized on a production-line basis, just as Henry Ford production lined the motor manufacturing

process in the 1920s. It has long been argued (Levitt 1972) that services, in general, are moving towards more industrialized processes. Indeed, this has actually been termed the McDonaldization of society (Ritzer 2000).

Decoupling refers to the idea of separating, both in place and in time, back-of-house activity from front-of-house activity. Often, the rationale for doing so is that one or the other (usually back-of-house) can be production lined. For instance, a number of health authorities in the UK have created one large central production kitchen for a number of hospitals and introduced cook-chill, so that the kitchen may produce 5,000–6,000 meals for transportation to five or more different hospitals the following day.

Process choice research

There has been no empirical research of process choice in the hospitality industry. However, evidence from industry suggests that the propositions identified above are well understood. A good example of this has been the emergence of budget hotels that greatly reduced the variety and complexity of hotel operations and which have been hugely successful throughout the world.

Theory of Swift and Even Flow

The Theory of Swift and Even Flow 'holds that the more swift and even the flow of materials through the process, the more productive the process is' (Schmenner and Swink 1998). This applies to all types of operation, whether they are job shops, batch production or assembly lines producing goods, or they are professional, batch or mass service operations.

Laws within the Theory of Smooth and Even Flow

There are three laws associated with the Theory of Swift and Even Flow (Schmenner and Swink 1998). These are as follows:

1. Law of variability 1 – the greater the randomness of the process, the lower the productivity.
2. Law of variability 2 – the greater the variability of the requirements of the process, the lower the productivity.
3. Law of bottlenecks – the greater the difference in the rate of flow through stages in a process, the less productive the process.

To these we can add a fourth law:

4. Law of prioritization – in operations of inherent instability, the greater the instability, the greater the prioritization of orders (Westbrook 1994).

Swift and even flow in the hospitality industry

Ensuring 'balance' at all stages of the process is a key feature of designing and operating hospitality operations. When hotels and restaurants are designed, the capacity of each part should match the expected operational needs. For instance, the car park should have sufficient spaces for guests driving to the property; the number of restaurant seats should accommodate the demand for dining; and so on. Likewise, operations seek to reduce randomness and variability. For instance, most hospitality companies adopt standard operating procedures. They also encourage their customers to book ahead, which enables the operation to schedule its labour to meet forecast levels of demand.

Related research

In the hospitality industry, these laws are implicitly understood and applied, but there has been no specific empirical research on them.

Theory of Lean Manufacturing

This theory basically states that productivity is enhanced by applying principles designed to eliminate waste of all kinds. The Japanese guru Taiichi Ohno, former Chief Engineer for Toyota, has identified seven types of waste:

1. doing too much
2. waiting
3. transporting
4. too much inflexible capacity or lack of process flexibility
5. unnecessary stocks
6. unnecessary motions
7. defects

By tackling each of these, Japan has achieved global dominance in a wide number of industry sectors such as motorcycles and electronic goods.

Laws associated with the Theory of Lean Manufacturing

Four laws are associated with the Theory of Lean Manufacturing. These are as follows:

1. Law of scientific methods – labour productivity is improved by applying scientific management principles.
2. Law of quality – productivity improves as quality improves, since waste is eliminated. This is a controversial law that may not hold in all cases, although there is widespread anecdotal evidence that it is generally true.
3. Law of limited tasks – factories that perform a limited number of tasks will be more productive than similar factor-ies with a broad range of tasks.
4. Law of value added – a process will be more productive if non-value-added steps are reduced or eliminated.

Lean manufacturing in hospitality

A major trend that has been in all industries is automation, which is the gradual replacement of a human workforce with machines such as computers and robots. In the hospitality industry, this has been most marked with regard to information processing. Examples of this include front-office operations in hotels, point of sale in fast food restaurants and procurement and inventory management. It can be argued that the McDonalds service delivery system, along with many other delivery systems derived from this, applied many of the ideas developed by Ohno. These ideas were also applied by Taco Bell in the 1980s in redesigning their concept and units and by Ritz Carlton in the 1990s after winning the Malcolm Baldridge Award.[2] But the industry sector that has most recently adopted lean manufacturing is the flight catering sector. Flight kitchens are large-scale producers of inflight meals and engage in a great deal of equipment handling. Operators have significantly improved 'cycle time' (total production time) and reduced waste by the adoption of just-in-time principles.

Hospitality research in lean manufacturing

The Rimmington and Clark (1996) study of hospital catering is an example of research based on this theory, but there has been very little other empirical research.

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[2] See Chapter 13.

Theory of Performance Frontiers

Schmenner and Swink (1998) propose the Theory of Performance Frontiers. The theory is called so because the authors use a production function or performance frontier curve to illustrate this theory. Production function methodology maps 'the maximum output that can be produced from any given set of inputs, given technical considerations'. Schmenner and Swink (1998) expand this economic model by defining inputs to include 'all dimensions of manufacturing performance', as well as defining technical considerations as all choices affecting the design and operation of the manufacturing unit. They suggest, consistent with the OM thinking, that a distinction can be drawn between the 'operating frontier', which represents operational activities within a given set of assets; and the 'asset frontier', which reflects the infrastructural elements or asset utilization of the operations. In effect, the operating frontier models the most effective and efficient use of inputs and the asset frontier models the best design and configuration of transformation inputs.

Laws of the Theory of Performance Frontiers

Within this theory, there are a number of proposed laws:

- Law of cumulative capabilities – an improvement in one manufacturing capability leads to improvements in others. Schmenner and Swink (1998) suggest that such improvements are made over time. Moreover, there may be certain sequences or trajectories of improvement that build one upon the other; for instance quality leads to lower cost, followed by increased speed of delivery.
- Law of diminishing returns – 'as improvement (or betterment) moves a manufacturing plant nearer and nearer to its operating frontier (or asset frontier), more and more resources must be expended in order to achieve each additional incremental benefit'.
- Law of diminishing synergy – the law of cumulative capabilities suggest there is synergy between policies and procedures. This synergy diminishes as a plant approaches its asset frontier.

Application to the hospitality industry

Jones (2002) identified two further process trends in the industry, consistent with this theory – the development of so-called

micro-units and the dual- or multi-use of physical infrastructure. Micro-units are food-service outlets of very small size aimed at serving often limited and/or captive markets. They include outlets in petrol-filling stations, cinemas, sports stadia, the workplace and so on. Their growth derives from the fact that more traditional sites are now unavailable and the demand for eating out continues to grow. The final trend of dual- or multi-use of infrastructure is sometimes a consequence of devising micro-units. When a brand is enabled to be delivered inside a small 'footprint', it can be incorporated into an existing outlet.

Performance frontier research in hospitality

De facto, some of the research in the hospitality field that uses data envelopment analysis (DEA) is exploring this theory. DEA is a powerful non-parametric, multivariate, multiple linear programming technique that benchmarks units by comparing their ratios of multiple inputs to produce multiple outputs at the same time. DEA constructs a frontier function in a piecewise linear approach by comparing like units (the decision-making units, DMU) taken from the observed dataset. Since DEA uses the production units that are 'best in its class' as reference material, the method is very much in line with the Theory of Performance Frontiers. DEA has been used for performance and productivity benchmarking in the hotel industry (Johns et al. 1997).[3]

Theory of Service Experience

Hence customers are different to materials in that they sense and respond to their environment. Hence, they interact with the operation and form opinions about their experience.

The following are the laws associated with the Theory of Service Experience (Johnston and Jones 2005) are as follows:

- Law of adaptive experience – a customer process is more productive when customer feedback adapts the process, both immediately (during the transaction) and over the long term.
- Law of matching expectations – a customer process will be more productive if customer expectations are matched with their perceptions.
- Law of cumulative effect – productive customer processes have a cumulative effect on customer expectations.

[3] For a detailed discussion of this, see Chapter 12.

Service experience in hospitality

Another trend identified by Jones (1988) is customer participation, otherwise known as self-service. Many hospitality operations now enable their customers to do things for themselves that were previously done for them. It is possible to check into a hotel by using a swipe card system, select salad items for a self-help salad bar and check out of a hotel using the in-room television set.

Hospitality research in service experience

This theory is so new that there is no specific research that has tested the proposed laws. However, research into the servicescape (Chapter 3), self-service (Chapter 5) and service encounter (Chapter 6) has some relationship with this theory.

Distinctive features of the hospitality industry

Within the OM field, there are a number of debates which directly relate to the hospitality industry. These debates focus on the extent to which all operations are the same and whether or not differences between them are significant enough to justify theorizing, researching and managing them differently. The three major areas of debate are as follows:

1. General differences between service and manufacturing.
2. Differences between processing customers and processing materials.
3. Specific differences between cost structures of manufacturing, retail and service.

Differences between services and manufacturing

In 1978, Sasser et al. published their textbook *The Management of Service Operations* and identified four ways in which services differed, to which a fifth (ownership) has since been added:

1. Intangibility – a service is a deed, performance or effort and as such has no physical dimensions that make it objectively measurable,
2. Perishability – services cannot be stored; capacity (such as airline seats, hotel rooms) needs to be filled on each occasion when it is available,

3. Heterogeneity – judgements about service are based on the perception by each individual customer on each individual occasion they purchase the service,
4. Simultaneity – service delivery (by the provider) and consumption (by the customer) happen together, both physically and in real time,
5. Ownership – having purchased the service, customers do not possess any tangible good to show for their expenditure.

However, even when identifying these differences, Sasser et al. (1978) acknowledged that there were very few pure services. Most operations were a bundle of both tangible products and intangible services. Furthermore, many 'manufacturers' provide service and many service firms make things. This has led to a long debate amongst academics, researchers and some practitioners as to the extent to which manufacturing and services are different (see for example Lovelock 1981; Brown et al. 2000; Lowson 2002).

Differences between processing customers and processing materials

Morris and Johnston (1988) suggest there are basically three types of processing:

1. Materials processing operation (MPO) – more commonly referred to as manufacturing.
2. Customer processing operation (CPO) – typically described as a service.
3. Information processing operation (IPO) – mostly considered as services.

Clearly, the Theory of Swift and Even Flow applies to materials processing. However, there is prima facie evidence that it may not apply to customer processing. For instance, Roth and Menor (2003: 146) argue that 'many service management problems are fuzzy and unstructured; are multi-dimensional and complex; and are less conducive to normative, analytical modelling'. They go on to note the ongoing challenges to the management of productivity in services and that further study of the design and delivery of service productivity is warranted. One reason that studying service productivity is challenging is the inherent difficulty in managing such productivity (Johnston and Jones 2004). The Theory of Swift and Even Flow is potentially insightful to the management of operations because it is

process focused and built around process issues salient to productivity, for example variability, bottlenecks, quality and so on. The theory undoubtedly proves useful for understanding 'back-room' or 'decoupled' operations, but what about 'front-office' operations, where a critical component of the delivery process is the customer and the customer's direct experience of the service process? Johnston and Jones (2005) argue why the Theory of Service Experience is needed.

Differences between cost structures

It is suggested that service, manufacturing and retail operations have different cost structures and that in hospitality these can be represented by the housekeeping function (rooms), kitchen operation (food) and bar operation (beverage) (Harris and Mongiello 2001). A typical cost structure for each of these functions in a four-star hotel is illustrated in Table 1.1; whilst identifying the relationship between fixed and variable cost is illustrated in Table 1.2.

Table 1.1 Per cent variable costs of four-star hotel revenue

	Rooms	Food	Beverage
Direct costs	Nil	32%	32%
Miscellaneous costs	4%	8%	2%
Labour costs	16%	35%	16%
Contribution	80%	25%	50%

Table 1.2 Ratio of fixed to variable cost in the hotel industry

	Rooms	Food	Beverage
Contribution	80%	25%	50%
Fixed costs	High	Low	Low
Variable costs	Low	High	Low
Marginal revenue (i.e. discount)	Yes	No	Maybe

Service operations achieve profitability on the basis of relatively low materials costs and relatively high labour costs, which lead to a high contribution margin. This tends, therefore, to be sensitive to demand fluctuations, making capacity management a key feature of successful OM. According to Heskett, Sasser and Schlesinger (1997), profit in the most successful 'service breakthrough' firms derives from achieving effective market segmentation based on high-volume sales; understanding these segments' needs, values and behaviour; selecting profitable segments; articulating the service concept's benefits; deploying resources efficiently; and creating barriers to entry. A second key factor is having a high level of repeat custom. Apart from this being a form on entry barrier, repeat customers have lower acquisition costs and a closer match between expectation and perception,[4] and make more efficient use of the system.

Manufacturing operations, on the other hand, have relatively high materials cost and high labour costs and hence low margins. In most cases, materials consumption should not be sensitive to demand, as both components and end products have a shelf life. So manufacturing profit derives from the control of materials through all stages of manufacture (storage, production, assembly, etc.) and from the control of labour costs. In the hospitality industry, in the last 10 years, there has been a shift from control towards planning, due to the availability of convenience foods and stable prices, better scheduling and use of peripheral staff and introduction of integrated inventory to POS systems (consistent with the Theory of Lean Manufacturing).

Retail operations cost structure has relatively high materials cost and low labour cost and therefore reasonable margins. These too are insensitive to demand fluctuations due to the shelf life of stock. Hence, retail operations managers make profit through stock control and sales and revenue management (such as direct selling, sales scripts, table-top promotions and merchandizing).

Importance of differences to hospitality industry context

Some argue that hospitality has some distinctive features. For instance, Bowen and Ford (2004) conducted an extensive review of literature to see if there was evidence indicating there are differences in the management of hospitality organizations and manufacturing organizations from the perspective of organizing,

[4] For a discussion of this, see Chapter 13.

staffing and commanding. Their results indicated that there are a number of differences between managing a manufacturing firm and a hospitality firm:

- Tasks have to be designed to fit with the degree of interaction with the customer.
- The 'servicescape' is important.
- Operations must be designed to cope with high degrees of uncertainty.
- Employees must be recruited with the right 'service attitude'.
- Internal marketing may be significant.
- Employees may suffer from boundary-role stress (role conflict, role ambiguity, etc.).
- Customers become 'partial employees'.
- Employee empowerment, especially of front-line staff, may be important.

Bowen and Ford (2004) argue on this case, based on asking hotel executives and managers what they thought. Since most managers think that their industry is unique in some way or the other, often because they have no direct experience of any other industry, this may have biased their conclusions.

Reviews of operations management research in hospitality

Although the hospitality research literature is now quite substantial and growing rapidly, a relatively small proportion of this literature focuses on the area of OM. For instance, in a review of the research, Teare (1996) provides an overview of 'hospitality operations management' articles published in selected journals from 1989 to 1994, but in his summary of the main themes and subthemes (sic), hospitality operations is not referred to at all. Ingram (1996) in a similar review of 820 postgraduate research projects in the hospitality and tourism field comments that in the hospitality area 'most relate to the leisure and hotel sectors while food and catering entries show a marketing or science focus and rarely relate to operational or service issues'. Moreover, as the review of OM theory has demonstrated, there has been very little research designed to test OM laws and propositions.

Jones and Lockwood (1998) specifically explore the nature of hospitality OM research by reviewing 143 articles from 1970 up to 1997. They divide this literature into five areas, gradually shifting from a macro-perspective of hospitality operations down to a micro-perspective of hospitality operations.

They start by considering the industry as a whole, go on to consider research into chain and unit operations, then consider operating systems in accommodation and food and beverage and conclude with a review of the operational interface between providers and customers (the so-called service encounter). They draw three conclusions from this analysis. First, 'there is no lack of terminology, but various definitions, few taxonomies and alternative typologies. This can result in researchers using the same term to describe different phenomena'. Second, a high proportion of the research is 'conceptual in nature'. Third, much of the research is 'phenomenological'. They state: 'it is certainly the case that very little hospitality operations management research is related to the generic discipline of operations management or based on operations research methodologies'.

Drawing on this work, two further analyses of the literature have been published. Lockwood and Ingram (1999) reviewed research in hotel OM, whilst Jones (1999) considered catering OM. Lockwood and Ingram (1999) consider 141 articles by subdividing them into the topics of strategy and environment, property and asset management, human resources, customers and marketing, profitability and yield management, productivity and performance, service and quality and operating systems. Jones (1999) reviews 63 articles by categorizing them into six main areas – classification, systems design and technology, 'operations management', catering managers, menu planning and analysis and chain development and growth.

Since these reviews of the research literature, the situation with regard to OM research in hospitality has worsened rather than improved, with even less output between 2000 and 2005 than in the preceding five years. In a review of hospitality research, Jones (2006) cites only 65 hospitality articles from this millennium, which represented only one-third of the total output he identified in the field. O'Connor and Murphy (2004) reviewed research on information technology in the hospitality industry. Their perspective on its quality mirrors the comments of Jones and Lockwood (1998) made six years earlier. O'Connor and Murphy (2004: 481) state: 'too much of this research (in I.T.) is descriptive … [and] needs more originality in both the topics addressed and the research methods used'.

Summary and conclusion

This chapter has identified and discussed three main issues. First, OM theory has been identified, along with the extent to which this theory has been researched in the hospitality industry.

It is concluded that there has been very little explicit investigation of the propositions and 'laws' that underpin hospitality operations. This might be because the theory itself is relatively new, so there has not been enough time for it to be researched, or because hospitality operations are in some way distinctive or different to other types of operation.

The notion of distinctiveness was therefore the second issues discussed. It was identified that operations have been postulated to vary according to whether they were manufacturing or service; materials or customer processing; or retail, service or manufacturing cost based. It is proposed that in the hospitality industry, it is important to distinguish between MPOs, which are typically back-of-house and CPOs, which are front-of house. The cost structure also has important implications for managing operations.

Finally, there was a discussion of reviews of hospitality research in order to identify the scale and scope of OM research to date. This identified that certain topics, notably quality management and yield (or revenue) management, had received a great deal of attention, but that other topics had rarely been researched.

This book seeks to address these issues by exploring all the topics related to OM. In doing so, each subsequent chapter will discuss both theory and industry practice, explore the nature of the challenges facing management and identify any research contribution that might help managers. Each of the reviews of hospitality OM research discussed above has been unique in terms of their analytical framework. In this book, hospitality operations research is analysed by specifically adopting the generic POM framework, that is the issues of process design and layout, capacity and production planning, materials and inventory control, supply chain management, productivity and workforce management, quality management and innovation. This approach is adopted for two reasons. First, it identifies the scope of hospitality research and therefore helps to identify the future research agenda. Second, it emphasizes the need for future OM research to test the theories and 'laws' stated earlier.

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