CHAPTER 2

Hospitality systems

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Introduction

One of the earliest contributions to the research literature on hospitality systems was that made by Livingstone and Chang (1978). They collected a series of papers which reported on systems analysis and design applied to foodservice operations at that particular time. Despite being 30 years old, and with much of the specific content now out-of-date, the topics covered in this text remain highly relevant today. They include computer-assisted production planning (Bresnahan 1978), design of centralized production facilities (Livingston 1978), human engineering in foodservice system design (Symington 1978), management information systems for foodservice operations (Gibbons 1978), and the design and operation of a quality assurance program (Schwartz 1978).

When applied to hospitality, 'systems' can have two meanings. First, 'systems' can be explained in terms of how one thinks about and conducts research in hospitality, i.e. through reference to so-called systems theory and analysis. Secondly, 'systems' can be considered as the actual operations themselves – their infrastructure, their layout and organization and their different types. Clearly both of these meanings can be linked – as is done by Ball (1992), when fast food technology and systems of operation are examined. But this linking need not necessarily be done. Systems theory and analysis can be applied to any industry, not just hospitality, and hospitality operations can be classified and analysed without any reference to systems thinking.

In this chapter, systems theory will be briefly explained and research conducted from the above-mentioned perspective will be identified. The chapter will then proceed to discuss the different types of operation and processes found in the hospitality industry. It concludes with a brief review of some of the major systems to be found in hospitality, not discussed elsewhere in this text – focusing on foodservice systems and the physical infrastructure of operations.

Systems theory

As Johns and Jones (1999) explain, in the hospitality industry, the language of systems is ubiquitous – management information systems, property management systems, service delivery systems, central reservation systems, or food production systems are some examples.[1] Mostly these are 'hard' systems, based on technology. But just as important are non-technological systems, sometimes called 'soft' systems, such as employee recruitment policies, selection procedures, customer service training or mystery shopper programmes. The combination of these two is called a socio-technical system, comprising both the physical infrastructure (hard systems) and human activities (soft systems), that enables a hospitality operation to deliver goods and services to customers. Technology can influence individual and group behaviour and the broader social relationships (Kast and Rozenzweig 1970), and foodservice operations can be regarded as socio-technical systems in which technological and social factors are integrated (Collison and Johnson 1980).

There is an important difference between hard and soft systems. Because the former comprise physical artefacts (i.e. equipment, machinery, technology) they behave in predictable ways according to scientific laws. Hence a hard system can be modelled as having precise outcomes which can be quantified precisely and be analysed mathematically. It is what is called 'deterministic'. For instance, it is possible to calculate precisely how long it will take for a deep fat fryer to cook different portion sizes of French fries. Soft systems, on the other hand, involve humans and technology, and human beings do not conform to scientific laws in terms of their behaviour. Hence it is not so easy to calculate precisely how long it will take different workers to prepare a portion of French fries – it will depend on their ability, their skill, their motivation and the context in which they are doing it. This is one reason why many processes have been automated and are computer controlled. They are more reliable as a result.

Although the term 'system' is used widely, it is also misused and hence misunderstood (Kirk 1995). It is often used to 'describe an assembly of parts … [or] package of components which can be purchased "off-the-shelf" with little thought of the way in which they are going to be used'. Kirk goes on to argue that such systems come as ready-made solutions to problems which often fail in practice because of the fact they are not properly designed for the environment in which they are placed. Hence the right way to think of a system is as a set

[1] It could be argued that all the remaining chapters in this book are about systems, such as those on the 'servicescape', the 'service encounter' and so on. But it should be noted that few of the authors of these chapters adopt a systems perspective on these topics.

of components and the relations between them, usually configured to produce a desired set of outputs, operating in the context of its environment.

Key aspects of systems

Ball et al. (2004) identify five key aspects of systems theory:

1. the general systems view,
2. systems hierarchy,
3. systems interactions,
4. simultaneous multiple containment (SMC),
5. cohesion and dispersion.

General systems view

The standard systems model shows the relationship between inputs, transformational inputs, processes, outputs and feedback – as illustrated in Figure 2.1. Inputs, or resources, are typically divided into materials, energy and information, whilst outputs are the same, although often described, especially in man-made systems, as product (inputs transformed in the desired way), waste (inputs transformed as a by-product) and residue (unused inputs). The conversion of inputs into outputs is achieved by some kind of transformation process that typically requires 'transformational inputs' such as a physical

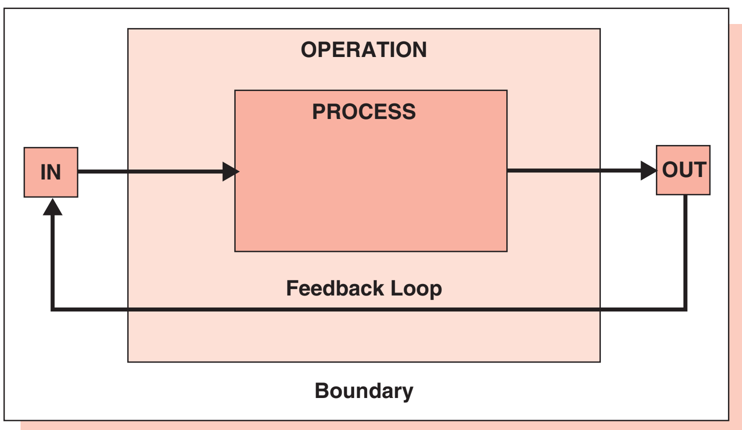

Figure 2.1
The basic systems model.

infrastructure, order, structure and capacity. These largely remain unchanged by the process, although over time machinery wears out, buildings need refurbishment and so on. In order to ensure output conforms to established requirements, it has to be monitored. If there is a deviation from expectation, there is a feedback loop so that the inputs or processes may be adjusted. Finally, this input–process–output activity is situated in a systems environment, i.e. all those things with which the system interacts. This introduces the idea of a systems 'boundary'. The boundary delineates what is 'in' the system and what is 'outside'. Sometimes the boundary is quite clear, but rather fuzzy at other times.

Systems hierarchy

Very few systems operate in isolation from other systems. Many systems are made up of sub-systems and are themselves sub-systems of a larger system. This concept of hierarchy is commonly applied in the hospitality industry to the way in which operations are organized. For example, a restaurant chain (the principal system) is usually made up of a head office and individual restaurants (the first-level sub-system). Each restaurant is organized into departments such as foodservice, bars and food production (second-level sub-system).[2]

Systems interaction

This concept of a hierarchy implicitly means that systems must interact with each other. The outputs of one system may form all, or part, of the inputs of another system. Some processes combine to deliver an accommodation experience to a hotel guest (front office, housekeeping and laundry), whilst others combine to create the foodservice experience for the diner in a restaurant (food preparation, food production, holding/transportation/regeneration, dining and bars). All of these are supported by other systems with which they interact (procurement, stores, maintenance and environmental/waste).

The existence of boundaries, hierarchy and interaction creates a challenge for the operations manager. Boundaries help to clarify where one system ends and another begins, and

[2] Another good example is in Chapter 13 where it is explained that quality inspection is part of quality control, and quality control can be part of the quality assurance system.

often where one manager's responsibility starts and ends. But hierarchy and interaction require a great deal of communication and coordination between systems, something that 'boundaries' can hinder or prevent. Sometimes these boundaries are physical, such as the distance between the hotels in a chain or the wall between the kitchen and the restaurant. But sometimes they are organizational and derive solely from the way work and responsibility have been allocated to managers or employees. One of the earliest research studies in hospitality (Whyte 1948) identified the existence of 'boundary conflict' between waiters and chefs in the restaurant industry. Historically, the industry has been quite good at recognizing the problems of physical boundaries and has removed them. One of the unique (at that time) and innovative things about McDonald's was the removal of the traditional barrier between the kitchen and the restaurant. Understanding this helps to explain why there has often been resistance to innovations that cross traditional boundaries, such as business process engineering or total quality management (TQM).

Simultaneous multiple containment

SMC is the idea that systems may exist as sub-systems of more than just one system. Thus, a hotel may be a part of a hotel chain, a member of a trade association, have a team playing in a local sports league and contribute greatly to employment in the city by operating in that labour market. Ball et al. (2004) suggest two implications of SMC. First, the complexity of the system is increased, so that understanding system behaviour and managing its performance becomes more difficult. Secondly, there can be tension between the outputs desired by the different systems. They give the example of a hotel chain in the UK which was interested in why some of its hotels were more able to implement its new 'green' policy[3] than others. The chain found that successful hotels were located in cities (i.e. another 'system') which had already established their own green policies, facilitated separate waste collections and educated the public and hence employees in best practice.

Cohesion and dispersion

The final aspect of systems is concerned with the idea that there must be forces that bind sub-systems together, balanced

[3] See also Chapter 17.

by forces that prevent them from merging into one. Ball et al. (2004) suggest franchising is a good example of this, in that operations are 'bound together' by franchising agreements to create chains of independently owned but mutually operated businesses.

Systems principles

Having identified five major elements of systems theory, there are seven principles which govern the behaviour of systems. If systems are to be managed effectively, these seven principles need to be clearly understood (Jones and Johns 1999).

The principle of reactions

In the physical sciences, 'if a set of forces [i.e. a system] is in equilibrium and a new force is introduced then, in so far as they are able, the existing forces will rearrange themselves so as to oppose the new force' (Le Chatelier 1884). This is true of *all* systems – commercial, economic, technological or social – as well as the natural world. Reaction is typically seen in response to the introduction of a new technology or new processes, most often when employees react negatively to the innovation and change. The nature of this reaction might take a variety of forms. It may be slow (such as an increase in employee turnover after a change has been made) or fast (employees going on strike), and hence it may be chaotic and even catastrophic.

The principle of systems cohesion

Due to multiple systems containment, every system has 'dispersive' forces that seek to break it up, in order to redefine the systems boundaries. At the same time there will be 'cohesive' forces that keep the system together. For any system to continue in its current form, these cohesive and dispersive forces must be balanced. Ball et al. (2004) argue that managers spend a lot of time engaged in activities designed to create cohesion, largely because there are so many dispersive forces. Hence managers draw up plans, budgets and schedules so that colleagues work together towards the same goals; they hold meetings to ensure team members share information; they manage by walking around to observe behaviour and correct any deviance; and they interact with key opinion makers to influence their behaviour in support of the business.

The principle of connected variety

This principle states that the more stable the interaction between systems, the greater the variety and amount of interconnection between them. Recently a number of management ideas have been proposed that build on this principle. For instance, TQM requires a high degree of team work. 'Quality teams are often interdepartmental, and a quality assurance *system* (my emphasis) makes it difficult for divisions to see themselves as independent operators' (Breiter and Bloomquist 1998). Thus, TQM recognizes and values variety, and sets out to deliberately create connections to ensure stability, so as to assure the delivery of established standards.

The principle of adaptation

Since a system exists within an environment, cohesion can only be achieved if the rate of change in both the system and the environment is matched. The hospitality industry is full of examples of this principle in action. Over the years the hospitality industry has adapted to meet changing demographics and changing lifestyles of people. In the hotel industry, there has been development of the motel to match the growth in car ownership, the resort property to reflect the increase in disposable income, and more recently, the all-suite concept to reflect the increases in job mobility and family reunions.

The principle of limited variety

This principle states that the variety of systems is limited by the available space and level of differentiation possible. Hence, whilst new systems will be created to fill any gaps or niches in the systems environment, there is ultimately a limit to how many new systems can do so.

The principle of preferred patterns

This principle highlights the idea that interacting systems will adopt configurations that are locally stable, especially if there is systems variety and a high level of connectivity. This applies especially to managers' attempts to control processes. One of the key elements of TQM is the identification and standardization of processes. Horst Schulze in describing Ritz-Carlton's experience describes how key processes were selected for analysis and how each process was analysed over an 18-month period in order to systematize them. Prior to this study, these processes were all more or less effectively managed, but each hotel did so in slightly different ways influenced by employees' previous experience, working relationships, levels of skill and training and so on. Each hotel had its own preferred pattern based on 'local stability'.

The principle of cyclic progression

This principle suggests that all interconnected systems go through a cyclic progression of five stages:

1. system variety is generated,
2. dominance emerges,
3. variety is suppressed,
4. the dominant mode decays or collapses,
5. survivors emerge to regenerate variety.

Integration of principles

As well as their separate influence on systems, these seven principles may be integrated into a single 'unified systems' model (Hitchins 1992), as illustrated in Figure 2.2. Any manager should keep this model in mind when considering any problem (Johns and Jones 2000). It demonstrates that the world is both extremely complex and dynamic. It may appear to be chaotic. However, the model identifies specific relationships that place structure on this apparent chaos. Thus, the model

- identifies the extent to which the system is stable or unstable,
- helps to forecast likely events in the system environment,
- suggests appropriate plans of action that will counteract negative influences and sustain the system,
- emphasizes that change is inevitable.

To apply and use the model, the notion of hierarchy must be considered. The model should not be applied to more than one level in the hierarchy. A 'one level view' must be adopted, i.e. at an industry, firm, unit or socio-technical system level. Ball et al. (2004) give many examples of the unified systems model at work – the emergence of motels in America, the development of McDonalds, changes in foodservice management contracts and hotel management contracts, the implementation of cook-chill technology and inflight foodservice.

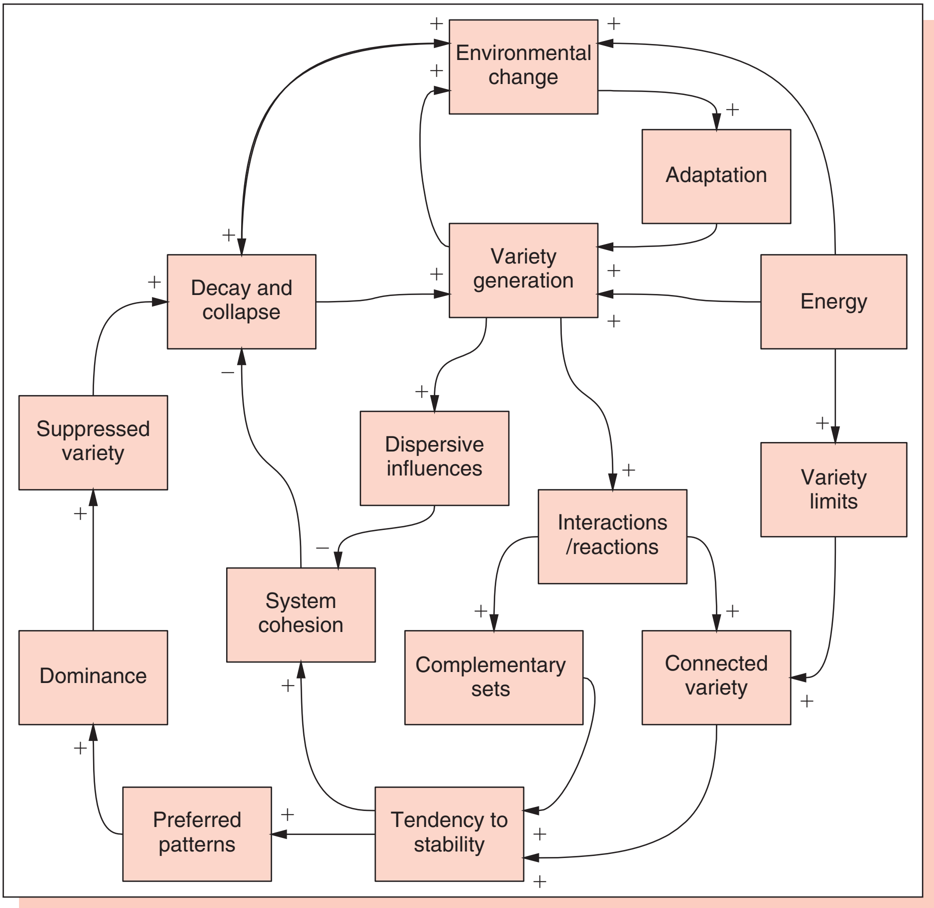

Figure 2.2
The unified systems model (*Source*: Adapted from Hitchins 1992).

Types of hospitality operation and their processes

There are alternative ways of thinking about types of operation. Johnston and Morris (1987) proposed that there are basically three types of operation: materials processing operation (MPO), customer processing operation (CPO) and information processing operation (IPO). Hayes and Wheelwright (1984), however, suggested five types – ranging from continuous through to project – based on two criteria, volume and variety.[4] Jones and Lockwood (2000) combined these two ideas to

[4] Discussed in Chapter 1.

develop their classification of operational types in the hospitality industry. They proposed that hospitality operations need to be modelled as either CPOs or MPOs. If an operation is a hybrid, i.e. it processes customers and materials, then it should be divided into its two constituent parts and each categorized accordingly. It should be noted that it is assumed that those operations where food items are mainly prepared from fresh ingredients are typically associated with table service, whereas those using convenience products are linked to cafeteria or counter-style operations. Whilst this is generally true, the industry is considerably diverse in its practice. This classification, by its very nature, simplifies this complexity. Hence the operations identified in Figure 2.3a and b are listed as either predominantly CPO or MPO or hybrid, and then hybrids are divided into their back-of-house and front-of-house systems. Their analysis is shown in Figure 2.3a and b.

Jones and Lockwood (2000) go on to suggest that this analysis of hospitality operations identifies some key aspects of the hospitality industry:

1. Hotels are generally more complex than foodservice operations, simply because other than limited service hotels, they provide both lodging and foodservice.
2. Hybrid operations are more complex to manage than non-hybrid operations.
3. Hospitality MPOs are job shops (e.g. a la carte restaurant), batch production (e.g. cook-chill) or mass production (e.g. fast food).
4. Most hospitality CPOs are service shops (e.g. table-service restaurant) or mass services (e.g. fast food).
5. There is generally a relationship between volume and variety, i.e. the greater the variety the lesser the volume produced (see Table 2.1).
6. It follows therefore that hybrid operations that are batch production MPOs are typically associated with service shop CPOs, whilst mass production matches mass service.

One of the main reasons for classifying operations in this way is to more fully and in more detail understand how each type varies from one another. A highly effective way of doing this is to compare job/service shops with mass production/service. A number of criteria can be used for identifying such differences, as illustrated in Table 2.1. This comparison brings us on to consider process choice in hospitality.

As well as classifying types of operation, some systems analysis has been made of the processes, or sub-systems, within these.

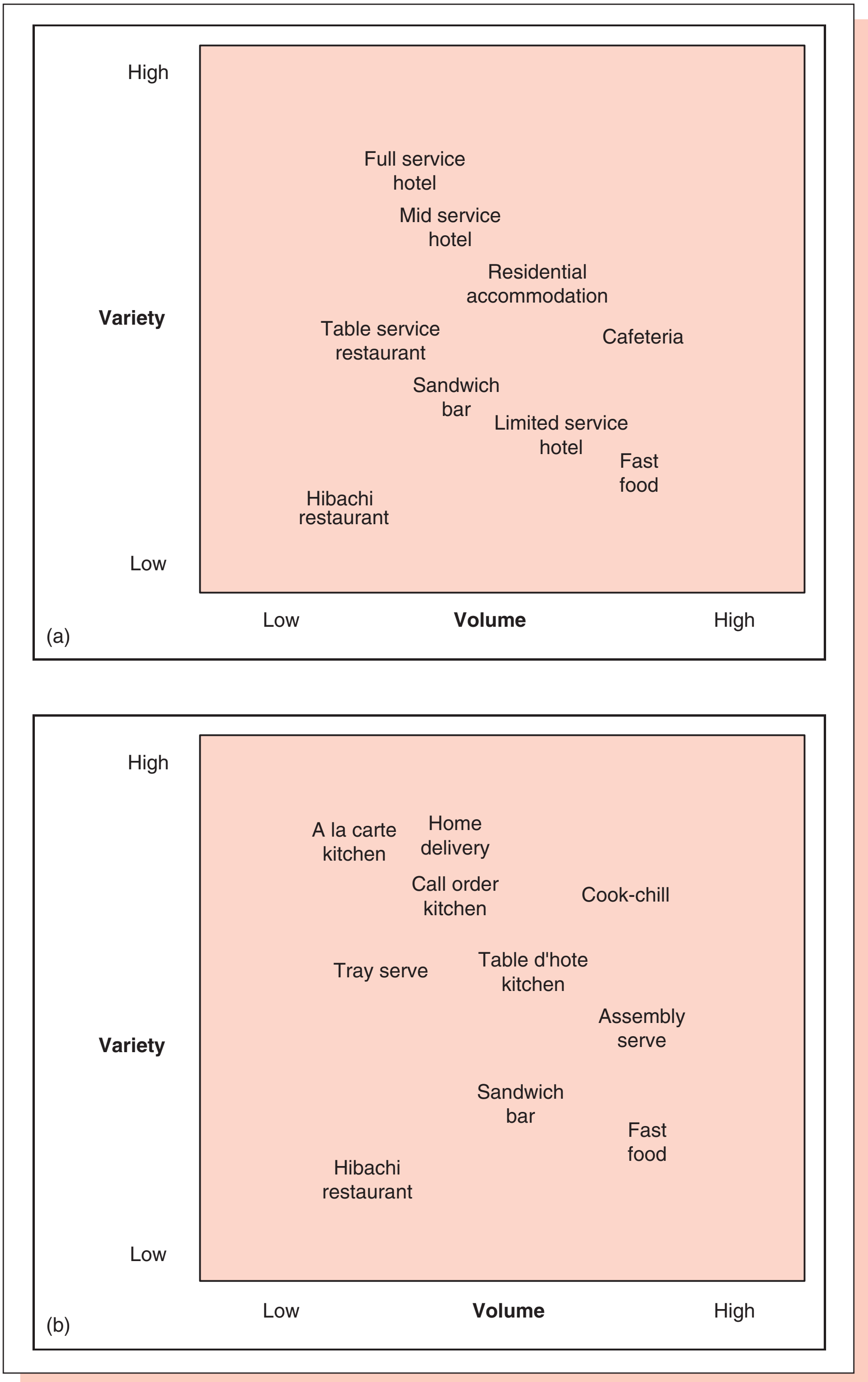

Figure 2.3
Classification of hospitality (a) customer processing operations and (b) materials processing operations (*Source*: Jones and Lockwood 2000).

Table 2.1 Differences between job shops and mass production/service

	Job/service shops	Mass production/service
Volume	Low	High
Mix of services	Diverse	Limited
Demand variation	Lumpy demand accommodated	Preferably stable demand
Pattern of process	Adaptable	Rigid
Process change	Easily accommodated	Costly
Role of equipment	Multi-use	Single use, often automated
Labour skills	Flexible, skilled workers	Generally lower skilled
Job content	Wide in scope	Narrow in scope
Work environment	Individual, craft-based	Visible, paced performance
Economies of scale	Limited	Some
Bottlenecks	Movable and frequent	Identified and predictable
Additions to capacity	May be incremental	Difficult to adjust
Tolerance for excess capacity	Adapt activity of workforce	Adjust staffing levels

Source: Adapted from Sasser et al. (1978) and Schmenner (1986).

Jones (1996) has considered both accommodation and foodservice, developing systems models for each of them. He argues that for accommodation there is a *core* system comprising four sub-systems of reservations, reception, overnight stay (housekeeping) and payment (or billing). This is illustrated in Figure 2.4. Besides these, depending on the type of market being served there are ancillary systems that may, or may not, be offered (also shown in Figure 2.4). These sub-systems include laundry, restaurants, bars, business services and leisure services. Jones (1996) identifies that a hotel is largely a CPO, especially for the core system. He then writes about six different types of accommodation operation (business hotel, resort hotel, budget hotel, guest house, hospitality and residential care and hostels).

Foodservice, on the other hand, is an MPO and a CPO. Jones (1993, 1996) and Jones and Huelin (1990) have made a number of attempts to classify foodservice operations based on an analysis of their systems design, technology and configuration.

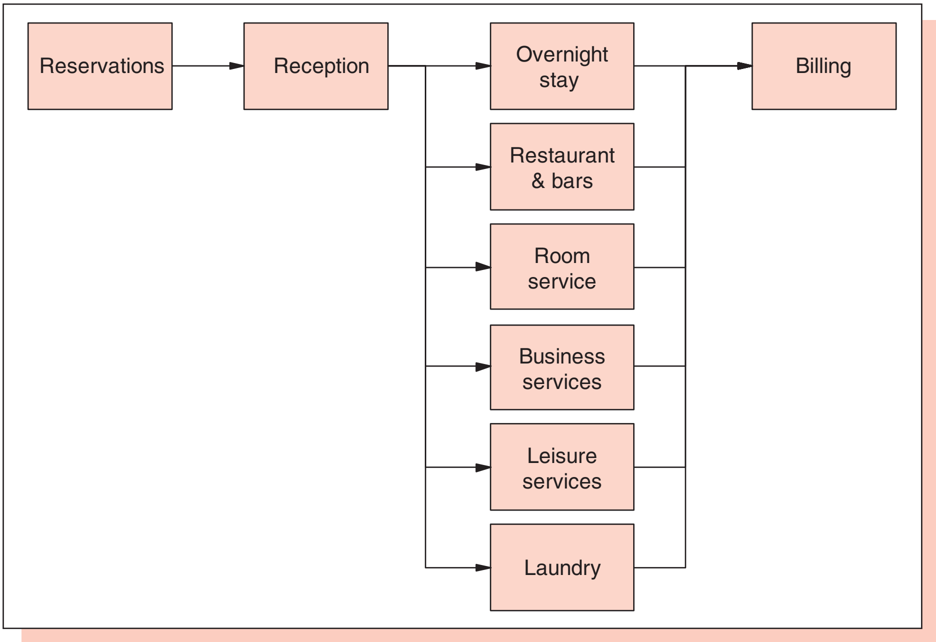

Figure 2.4
A systems model of hotel operations (*Source*: Jones 1996).

They identify 10 sub-systems of foodservice, namely storage, preparation, cooking, holding, transport, regeneration, service, dining, clearing and dishwash. Jones (1996) goes on to suggest that these have been configured in a limited number of ways, within three broad categories – food manufacturing systems, food delivery systems and integrated foodservice systems.

Configuration and layout in hospitality operations

The hospitality industry has tended to regard its processes and related technologies as unique – and in some senses they are. Few, if any, other industries prepare meals, service bedrooms, organize conferences and banquets, serve alcoholic beverages, and provide leisure facilities. Likewise the paint industry only processes paint and the car industry only makes vehicles, but they are seen as sharing some characteristics, along with many other types of manufacturing operation. For it is increasingly being recognized that concepts in relation to process choice, process configuration and process technology can be applied to *all* sectors, including the hospitality industry.

There are four basic layout types found in manufacturing and service settings (Brown et al. 2004). These are

1. fixed position,
2. process layout,
3. product layout,
4. a combination of product and process layout.

Fixed position – refers to a single, fixed position at which the product is assembled or service is processed by workers who move to that position to carry out their work. This layout is applied to products that are heavy, bulky or fragile such as in ship-building, aerospace or dentistry. In hospitality, the provision of accommodation services, i.e. hotel bedrooms, is an example of this kind of layout. Room attendants move from room to room in order to service them. This means that they have to take the technology they need to perform this task with them. The same is true of table-service restaurants – staff go to each table to perform their duties and deliver service.

Process layout – has machines or activities grouped together non-sequentially to allow a range of different products to be made. Products move to a particular location for processing according to need. Workers tend to operate within one area, but may be multi-skilled enough to work across areas. This is the typical layout associated with job shop or batch production. It allows for a wide variety of products to be made in relatively small volumes. Breakdown of one machine does not halt production. Examples of sectors that use this approach are jewellery making, hair-dressing and low-volume furniture manufacturing. Most traditional food production kitchens have a process layout. The kitchen is organized into different sections – larder, sauce, vegetables, pastry and so on – each of which can produce a wide variety of outputs. The technology in each section is carefully selected to support this activity – for instance, a large wooden chopping block in the larder, marble-topped tables in pastry and boiling pans in the vegetable section. The same is true when production is scaled up for cook-chill production, albeit that the equipment is of considerably larger capacity.

Product layout – has machinery dedicated to a particular product, usually laid out in a sequence, with distinct stages in manufacture. Workers are usually required to perform relatively simple tasks at one particular stage in the process. Whenever possible such tasks have been automated. This is the layout associated with mass production. It is used in car manufacture, chocolate production and fast food. One of the reasons that fast food was innovative was that it adopted a product layout in order to achieved high-volume, low-variety mass production style output. The technology of these operations is organized so that raw materials are processed in a highly sequential way by individual crew members. Each worker carries out one or two simple tasks such as cooking the beef pattie, toasting the bun, topping the pattie with dressing, assembling and wrapping the finished product, or serving the customer.

Process/product layout – combines elements of the process layout, such as clusters of machines, with product layout, so that each cluster is organized sequentially. Hence each cluster or cell can produce in high volumes a variety of outputs based around a single product. This, in essence, is mass customization adopted in high-tech manufacturing operations. This layout is probably only found in the flight catering sector. Large-scale food production facilities of this type may be producing up to 50,000 inflight traysets a day. They therefore have product layouts, particularly for the laying up of trays, whilst they have process layouts for the production of different types of meal item, such as starters, main meals and sandwiches.

This analysis of choice and layout identifies some interesting issues with regards to the industry. In manufacturing industry, there is a close fit between operational type and process layout. This derives from the fact that manufacturing is essentially an MPO, and service elements of a product are usually decoupled from the actual manufacture of the product. But in hospitality both customer and materials processing are closely interlinked, leading to a lack of fit between layout and process type. Fortunately (it could be argued) many of the processes in the hospitality industry are relatively simple and do not require sophisticated technology or highly skilled labour. Thus, the lack of fit between the type of process and the process layout has not become an issue. Housekeeping is a good example of this. The processes or activities undertaken to clean a guest room are basically identical and would normally lend themselves to both production-lining and even automation. If it was physically possible, one could envisage a factory in which rooms moved slowly along a production line and as they did so, a worker (or machine) polished the mirror, another vacuumed the floor, and third dusted the lampshades and so on. Of course, this cannot happen due to the size of the room and its fixed position. Hence tasks which could (should?) be dealt with on a mass production basis are actually managed as a job shop.

Systems analysis

The most frequent application of systems analysis and research into systems in hospitality is in the field of foodservice. This is due to the evolution over time of alternative ways of producing, holding and regenerating meals, such as cook-chill, cook-freeze and sous-vide. This has lead to the production of food and its service being separated in time, and often in place, something Jones (1996) refers to as 'decoupling'.[5] The theory behind these systems is essentially that of economies of scale. By decoupling the kitchen from the point of service, production facilities can be centralized, increased in size and operate in isolation from peaks and troughs in short-term demand.

Foodservice systems

A key factor in these systems is ensuring food safety and hence the process by which this is assured. Each system adopts a different 'technological' solution to this. In cook-chill systems the food is cooled to a temperature under 3ºC within 90 min of cooking and stored at a maintained temperature of 0–3ºC. This has now been further developed into short shelf-life (SSL) systems, where meals may be kept for up to 5 days, and long shelf-life (LSS) systems (Rodgers 2005), where shelf life is extended, usually by pasteurization.

Cook-freeze systems, as the name implies, take the temperature of cooked foods rapidly below freezing to −20ºC. The advantage of this approach is that the shelf life is extended to at least 3 months. Disadvantages are that the freezing process expands water molecules in the foodstuff, and when they turn to ice the cell walls break down, potentially making the food mushy. This technology has now introduced some dehydration of meals prior to freezing in order to reduce this effect. But this does require rehydration at the point the meal is being regenerated for use. Another disadvantage is the cost and environmental impact of maintaining freezer equipment.

Sous-vide is a method of cooking that is intended to maintain the integrity of ingredients by heating them for an extended period of time at relatively low temperatures. Food is cooked for a long time, sometimes well over 24 h. But unlike a slow cooker, sous-vide cooking uses airtight plastic bags placed in hot water well below boiling point, around 60ºC. The method was developed by Georges Pralus in the mid-1970s for the Restaurant Troisgros (of Pierre and Michel Troigros) in Roanne,

[5] See Chapter 1.

France. Sous-vide cooking must be performed under carefully controlled conditions to avoid botulism poisoning. To help with food safety and taste, relatively expensive water-bath machines are used to circulate precisely heated water; differences of even 1ºC can affect the finished product. A study by Church and Parsons (1993) reviewed the claims that sous-vide technology improved both shelf life and eating quality, but in doing so presented an increased public health risk. This demonstrated at that time that, although there was some theoretical foundation, in practice the claims were unsubstantiated by their study.

Foodservice systems research

As Rodgers (2004) points out 'Foodservice systems … development is supported by research in engineering (equipment), food science (safety, quality and nutrition) and operations management (system selection criteria and productivity). As a result, methods vary from microbiological and instrumental to computer modeling and case studies'. In this chapter, it is only the latter type of research that is of relevance. Such research can be done at the macro level, across sectors or at the unit level.

At the sectoral level, Nettles and Gregoire (1996) undertook research into foodservice directors' satisfaction with conventional or cook-chill systems and to determine whether ratings differed based on the type of system. They found that the degree of satisfaction with certain issues differed based on the type of foodservice system the director had selected. Another study by Mibey and Williams (2002) of the foodservice departments in 93 hospitals throughout New South Wales in Australia (covering 51% of hospital beds in the state) compared results with those from similar surveys conducted in 1986 and 1993. Over the previous 8 years there had been a significant increase in the proportion of hospitals using cook-chill foodservice production systems, from 18% in 1993 to 42% in 2001. Hospitals with cook-chill systems had better staff ratios than those with cook-fresh systems (8.3 vs. 6.4 beds/full-time equivalent staff), but there was no significant difference in the ratio of meals served per full-time equivalent (FTE). There was no difference between public and private hospitals in terms of ratios of beds or meals to foodservice staff. Managers using cook-chill systems reported significantly lower levels of satisfaction with the foodservice system compared to those using cook-fresh. A more recent study by Engelund et al. (2007) discusses the change in technology and logistics used in the Danish hospital foodservice during the years 1995–2003.

On the other hand, a number of unit-level studies have also been undertaken. Hartwell and Edwards (2003) investigated a hospital foodservice system that enables patients to see and smell the food on offer and interact with the staff serving the meals. This was done to establish if it resulted in better patient nutritional intake and increased meal satisfaction. Their study showed that nutritional intake was not dependent on the catering systems, but patient satisfaction was improved with the trolley system, where 93% of patients were satisfied compared to 76% with the plate system. This research suggests that nutritionally, the method of meal delivery is immaterial but patients do prefer choice at the point of consumption. Another study by Edwards and Hartwell (2006) investigated the new *Steamplicity* concept, recently introduced into UK hospitals. This system seeks to address some of the current hospital foodservice concerns through the application of a static, extended choice menu, revised patient ordering procedures, new cooking processes and individual patient food heated/cooked at ward level. The aim of their study was to compare a cook-chill foodservice operation against *Steamplicity*. Specifically, the goals were to measure food intake and wastage at ward level, stakeholders' (i.e. patients, staff, etc.) satisfaction with both systems, and patients' acceptability of the food provided. They found that patients preferred the *Steamplicity* system overall and in particular in terms of food choice, ordering, delivery and food quality. Wastage was considerably less with the *Steamplicity* system, although care must be taken to ensure that poor operating procedures do not negate this advantage.

One interesting aspect of both these studies is that their research methodology was experimental. Systems theory lends itself to this methodological approach, which is perhaps used less frequently than it could be in the hospitality operations field. An even smaller scale study also demonstrates this approach. Cocci et al. (2005) adopted a between-groups experimental design to collect data for their study of ergonomically designed worktables, and their contribution to improving the productivity of workers in a foodservice establishment. Their results provided strong support for the statement that ergonomic design contributes to an improvement of about 35% in productivity in a simple, repetitive task environment.

Facilities management in hospitality operations

As well as foodservice systems, another major operational system is the building in which the operation is situated. The management of buildings and their engineering systems is commonly known as 'facilities management'. This has become a discrete and huge body of complex knowledge and the subject of textbooks in its own right.[6] De Bruijn et al. (2001) explore how facilities management should be defined and scoped as an academic discipline by comparing it with hospitality management. But facilities management is relatively rarely mentioned in the operations management field and even more rarely researched. This is because it is a highly technical area, relying less on management expertise and more on engineering knowledge and skills.

Facilities typically have systems designed to

- deliver power and water,
- maintain a comfortable temperature,
- provide adequate lighting,
- remove waste,
- ensure personal safety,
- assist movement within the property,
- ensure the correct functioning of equipment.

Ball et al. (2004) state that the engineering function has four main purposes. The first of these is to ensure these systems operate when they are required. In situations where inputs such as energy and water are from an external provider, operators may need backup systems to ensure they are able to continue operating should external supply be interrupted. The second purpose is to ensure that these systems work properly. A systems failure has the potential to be catastrophic, for instance an electrical fault may cause a fire, a burst pipe result in flooding and so on. Third, the systems must work efficiently. Poorly controlled systems and poorly maintained equipment may result in higher than necessary energy costs. Finally, it is increasingly the case that energy consumption is an environmental issue and systems need to be designed and managed in such a way that their impact is minimized.[7]

In facilities management there are three main 'inputs' which connect the hospitality operation with the environment. These are one or more sources of power, such as electricity, gas or

[6] See, for instance, Stipanuk, D. M. (2002) *Hospitality Facilities Management and Design*, Educational Institute: Lansing, MI or Borsenik, F. D. and Stutts, A. T. (1997) *The Management of Maintenance and Engineering Systems in the Hospitality Industry*, Wiley: New York.
[7] See also Chapter 17.

solar; a water supply; and a drainage system. These external systems are connected to the facility through several technological systems that are often inter-related. These typically include a heating system, ventilation system, lighting and electrical service system, wastewater system, building transportation system and fire safety system.

From an operations' management perspective, other key activities that may need to be managed are the renovation or refurbishment of a property. Hassanien (2007) researched the practice and perception of architects, interior designers and building contractors who make up the external parties involved in the hotel renovation process. In his study, conducted in Egypt, lack of money and limitations by owners were perceived by external companies to be the main obstacles to renovation in all hotel categories.

Summary and conclusions

Discourse about systems in hospitality refers to, and uses, the concept in different ways. Systems theory is a school of thought with its own specific approach to researching the world. But systems thinking is not very theoretical – it is highly applied. In particular, it can be used for analysing hospitality operational activities, i.e. systems analysis, and solving operational problems. Systems thinking can also be used to describe the nature of hospitality operations. Systems exist everywhere in the hospitality industry, can be applied to a vast number of phenomena and can also be considered as the actual operations themselves. What one defines as a system depends on where one defines the system boundaries. This depends in turn on what one wants to study, and why. The notion of systems has a number of valuable implications. Understanding systems and effectively applying them in practice in hospitality can, for instance, facilitate better management. In his book *The Spirit to Serve* (Marriott and Brown 1997), J.W. Marriott Jr., Chief Executive of one of the world's largest and most successful hospitality companies, has written a chapter called 'The devil is in the details, success is in the systems'. In this he writes, 'systems help to bring order to the natural messiness of human enterprise … Efficient systems and clear rules help everyone to deliver a consistent product and service'. He continues, 'systems have been deeply ingrained for so long in our corporate culture that I'm always a little surprised when I come across companies that aren't as devoted to them as we are'.

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