CHAPTER II
THEORETICAL CONSIDERATIONS AND LITERATURE REVIEWS

To understand the conceptual and theories supporting this study, reviewing the past literatures in either books or journals to receive the basic concepts and theories is indispensable. Discussions of this chapter begin topics with operations management approaches, business management approaches, and information technology approaches.

2.1 Operations Management Approaches

2.1.1 Operations Scheduling

Scheduling is an important aspect of operations control in both manufacturing and service industries. With increased emphasis on time to market and time to volume as well as improved customer satisfaction, efficient scheduling will gain increasing emphasis in the operations function in the coming years.

2.1.2 Job Shop

Chase *et al.* (2004) explained that a job shop is a functional organisation whose departments or work centres are organised around particular processes that consist of specific types of equipment and/or operations, such as drilling and assembling in a factory, and scanning and printing in a computer laboratory. A good case of a job shop in a service environment is a hotel, which has designated areas for guest rooms, tables in restaurant and fitness training facilities. In all these cases, the good produced or the service provided is based upon an individual order for a specific customer.

Although services are typically of job-shop form, the emphasis has recently been trying to mass produce (using cells or flow shops) them so as to increase the volume

and reduce their unit cost. Some examples of the process designs selected by various organisations are listed in Table below.

Table 2.1: Common Organisational Design Forms

Organisation	Process Design Form				
	Project	Job	Cell	Flow	Process
Utility					X
Hospital		X	X		
Railroad		X			
Farm	X		X	X	X
Supermarket		X	X		
University		X	X	X	
Family	X	X		X	
Construction	X				
Hotel		X			
Church		X	X		
Charity	X				
Distributor		X	X	X	
Chemical processor				X	X
Airline		X			

Source: The Management of Operations: A Conceptual Emphasis (Meredith, 1992)

Chase *et al.* (2004) also stated the problem for the operations mangers is to decide what processing form is most appropriate for the organisation, considering long-run efficiency, effectiveness, lead time, capacity, and flexibility.

The selection task may be even more difficult of the possibility, as mentioned previously, of combining processing forms to attain efficiency in some portions of the production process and flexibility or capacity in other portions. It is clear that the trade-offs must be well understood by the manger and the expected benefits and costs well known (Chase *et al.*, 2004).

- **Job Shop Scheduling**

A schedule is a timetable for performing activities, using resources, or allocating facilities. The purpose of operations scheduling in a job shop is to disaggregate the Master Production Schedule (MPS) into time-phased weekly, daily, and/or hourly

activities – in other words, to specify in precise terms the planned workload on the production process in the very short run. Operations control focuses on job-order process and, where necessary, expediting orders and/or adjusting system capacity to make sure that the MPS is met (Nahmias, 1997).

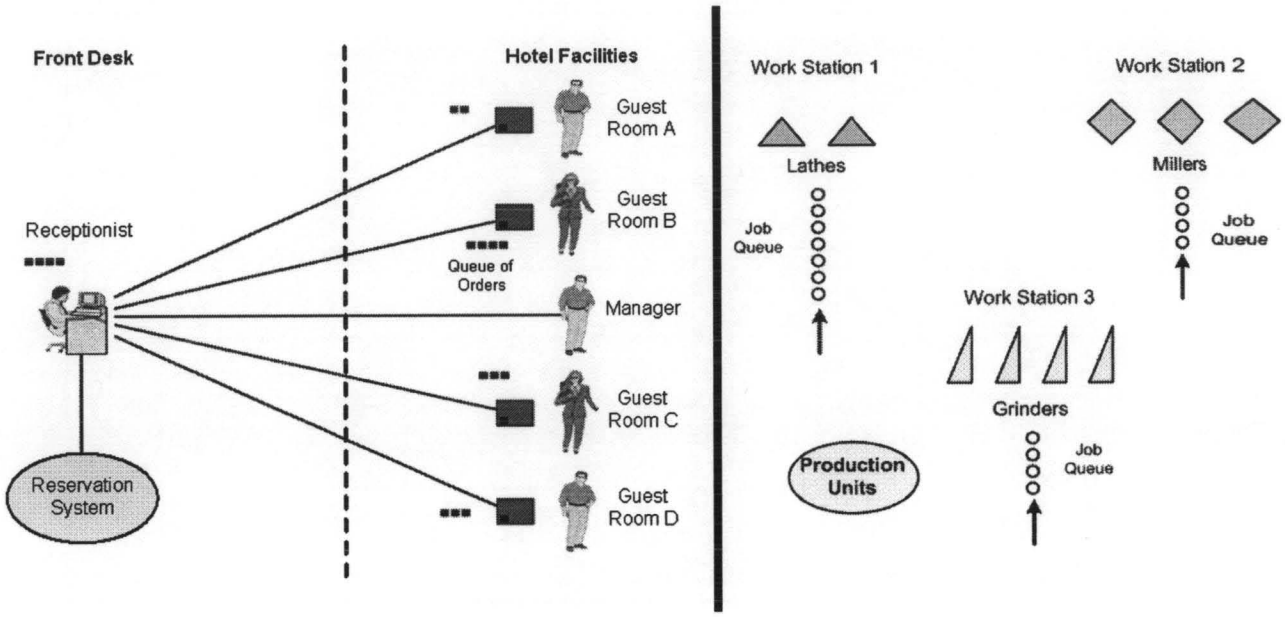

Figure 2.1: Typical Job Shop Layout in Manufacturing and Service Industries

Source: Adapted from Production and Operations Analysis (Nahmias, 1997)

In designing a scheduling and control system, provision must be made for efficient performance of the following functions (French, 1982):

- Allocating orders, equipment, and personnel to work centres or other specified locations. Essentially, this is short-run capacity planning.
- Determining the sequence of order performance; that is, establishing job priorities.
- Initiating performance of the scheduled work. This is commonly termed the dispatching of orders.
- Shop-floor control, which involves;
  - Reviewing the status and controlling the progress of orders as they are being worked on;
  - 'Expediting late and critical orders.
- Revising the schedule to reflect recent changes in order status.
- Assuring that quality control standards are being met.

- **Objectives of Job Shop Management**

One of the difficulties of scheduling is that many, often conflicting, objectives are present. The aims of different parts of the firm are not always the same.

Baker (1974) showed some of the most common objectives are:

1) Meet due dates.
2) Minimise Work-in-Process (WIP) inventory.
3) Minimise the average flow time through the system.
4) Provide for high machine/worker time utilisation (minimise machine/worker idle time).
5) Provide for accurate job status information.
6) Reduce setup times.
7) Minimise production and worker costs.

It is obviously impossible to optimise all seven objectives simultaneously. In particular, 1) and 3) are aimed primarily at providing a high level of customer service, while 2), 4), 6), and 7) are aimed primarily at providing a high level of plant efficiency. Determining the trade-off between cost and quality is one of the most important strategic issues facing a firm today.

2.1.3 Shop-Floor Control

Scheduling job priorities is just one aspect of shop-floor control (now often referred to as production activity control). The American Production and Inventory Control Society (APICS) dictionary defines a shop-floor control system as

> *"A system for utilising data from the shop floor as well as data processing files to maintain and communicate status information on shop orders and work centres."*

The major functions of shop-floor control are (Melnyk *et al.*, 1985):

1) Assigning priority to each shop order.
2) Maintaining Work-in-Process (WIP) quantity information.
3) Conveying shop-order status information to the office.

4) Providing actual output data for capacity control purposes.
5) Providing quantity by location by shop order for WIP inventory and accounting purposes.
6) Providing measures of efficiency, utilisation, and productivity of labour and machines.

The next Figure illustrates more of the details related to shop-floor control.

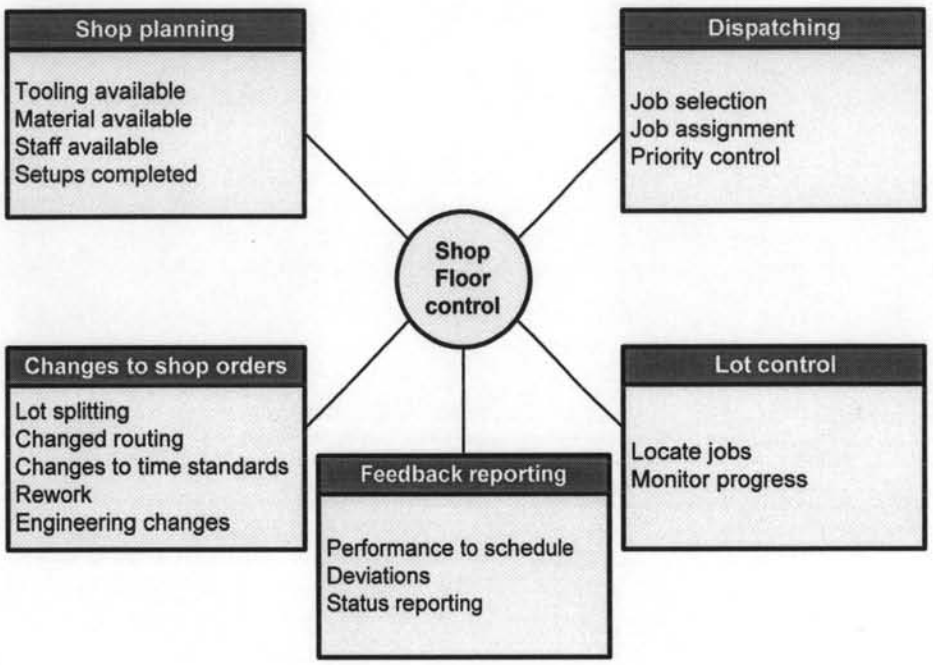

Figure 2.2: Shop-Floor Control

Source: Adapted from Shop Floor Control – Closing the Loop, (Aquilano, 1982)

- **Tools of Shop-Floor Control**

Vasilash (1995) studied that there are a variety of written forms that can help the supervisor maintain control in the job shop; these are easily generated by the appropriate software and updated frequently through a normal interaction of supervisor and software.

Dispatch List

Dispatch list (usually generated on a daily basis) tells the shop foreman what jobs need to be accomplished that day, what priority each has, and how long each will take.

Exception Reports

Exception reports provide the supervisor with the information needed to handle special cases and problems. Typically made out once or twice a week, these reports are reviewed to determine if any of the delays are serious enough to warrant revision of Master Production Schedule.

Input/output Report

Input/output report, or simply the I/O report, is used by the supervisor to monitor the relationship between the workload and the capacity of each workstation. If these relationships are significantly out of balance, then the supervisor can identify where adjustments are needed.

Status Reports

Status reports give the supervisor summarises on the performance of the operation, and usually include the number and percentage of jobs completed on time, the lateness of job not yet completed, the volume of output, so forth.

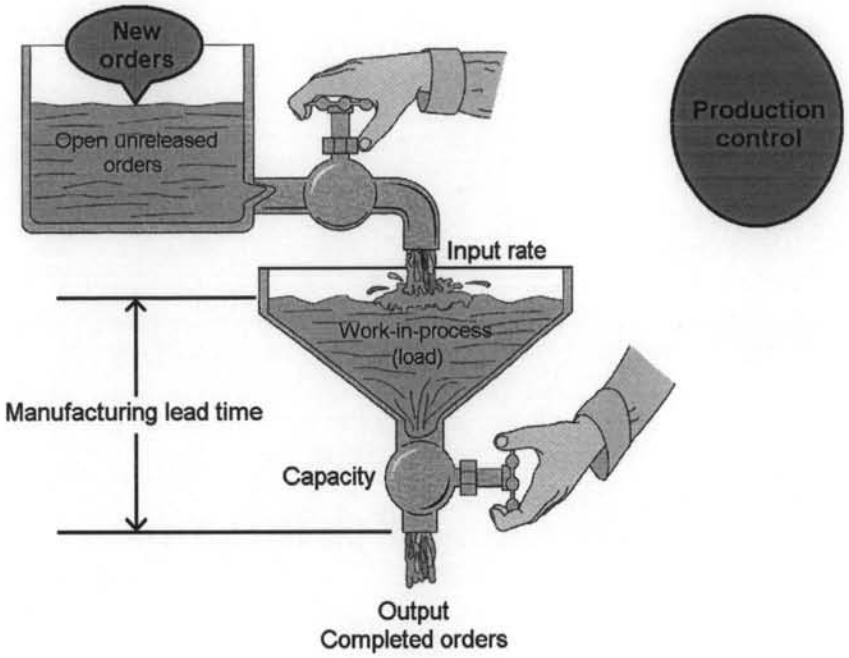

Figure 2.3: Shop Capacity Control Load Flow

Source: Training Aid – Shop Floor Control, American Production and Inventory Control Society (APICS)

2.1.4 Scheduling Services

From now, we will consider the scheduling of pure services. Much of what was said previously applies to the scheduling of services, as well as products, but here we consider some scheduling issues of particular relevance to services.

Since we have dealt primarily with situations where the jobs (recipients) where the items to be loaded, sequenced, or scheduled. However, there are many operations for which scheduling of the jobs themselves is either inappropriate or impossible, and it is necessary to concentrate instead on scheduling one or more of the input resources. Therefore, the staff, the materials, or the facilities are scheduled to correspond, as closely as possible, with the expected arrival of the jobs. Such situations are common in service systems such as libraries, supermarkets, hospitals, hotels, urban alarm services, colleges, restaurants, and airlines (Rothkopf, 1966).

In the scheduling of jobs we were primarily interested in minimising the number of late jobs, minimising the rejects, maximising the throughout, and maximising the utilisation of available resources (Conway *et al.*, 1967). In the scheduling of resources, however, there may be considerably more criteria of interest, especially when one of the resources being scheduled is staff. Staff desires in terms of shifts, are variable and not all employees are on the same schedule. In these situations there usually exist schedules that will displease everyone and schedules that will satisfy most of the staff's more important priorities – it is critical that one of the latter be chosen rather than one of the former.

2.2 Business Management Approaches

In this section, we focus on strategies; training and development, and reservation system of the ABC, a hotel case study in this research, to view its background and introduce the new system of the reservation in order to increase the sale of accommodations and tackle some of current difficulties in its system. Since ABC is not in a chain-operated hotel as the other comparative hotels in the same group; thus, this is one of weakness point of ABC to gain more sales without expanding the sale network as a chain-operated hotel.

2.2.1 Strategy

Corporate strategy can be defined as the match an organisation makes between its internal resources and skills and the opportunities and risks created by its external environment (Grant, 1991). It is what the companies do with their assets to create a profitable business. Assets in the hospitality industry include both tangible, such as buildings and facilities, and intangible, such as service, human resources, know-how and reputation. Particularly the intangible assets are important because of the service nature of the industry. It consists of experiences of these services, which are being recognised as difficult to describe, measure or standardise (Lovelock, 1991; Mills and Moberg, 1982). Nevertheless, a strategy is a comprehensive master plan stating how a company will achieve its mission and objectives (Wheelen and Hunger, 2006).

Typically, three types of strategies are considered: corporate, business, and functional. Corporate strategy's three main categories include stability, growth, and retrenchment. Business strategy is on product level, i.e. individual hotels, and has two categories, competitive and cooperative. Functional strategy, i.e. departments of the hotels, may choose different approaches such as pioneering or imitation. These three levels of strategies are set up in a hierarchical way in which functional strategies support business strategies and business strategies supports corporate strategies (Wheelen and Hunger, 2006).

2.2.2 Competitive Advantage

Many theories have tried to explain competitive advantage, which has been recognised as most important goal of a company (Porter, 1980). The reason for this strong quest of answering how to achieve competitive is because it is essential in become profitable any stay profitable in an ever changing and increasing competitive market. The increasing competition makes it hard to become profitable and even harder to stay profitable over time, which at the end the day is essential for business survival.

Two ways of gaining competitive advantage appears: cost leadership or differentiation (Porter, 1985). Despite the importance and relatively simple terms there seems to be little understanding in how to achieve competitive advantage in the hospitality industry (Yong Kim and Oh, 2004). The industry is differing from conventional manufacturing in several ways. Most importantly is the nature of the product, which despite the presence of tangible assets such as hotel buildings, is intangible. It is a service that is sold, an experience of being accommodated and catered for, and this experience is very much dependent on the service provided by a large number of people. The human factor is essential.

The little understanding in how to achieve competitive advantage can be explained by the difficulties in measuring competitive advantage, particularly within the hospitality industry.

Three approaches, which are commonly used to measure competitive advantage, are:

1) Porter's five-force approach
2) The resource-based approach
3) The relationship approach

Arguably the most important developer of competitive advantage theory is Michael Porter, and his five-force approach and value chain analysis are important contributors (Porter, 1980; 1985). Porter's five-force approach is the traditional approach, which involves threat of new entrants, threat of replacing products, bargaining power of customers, bargaining power of suppliers and rivalry amongst competitors. Intensity of these aspects varies from industries, but for a company it is important to position itself in two ways: cost leadership; or differentiation. To evaluate and classify different activities one may use the value chain (Porter, 1985).

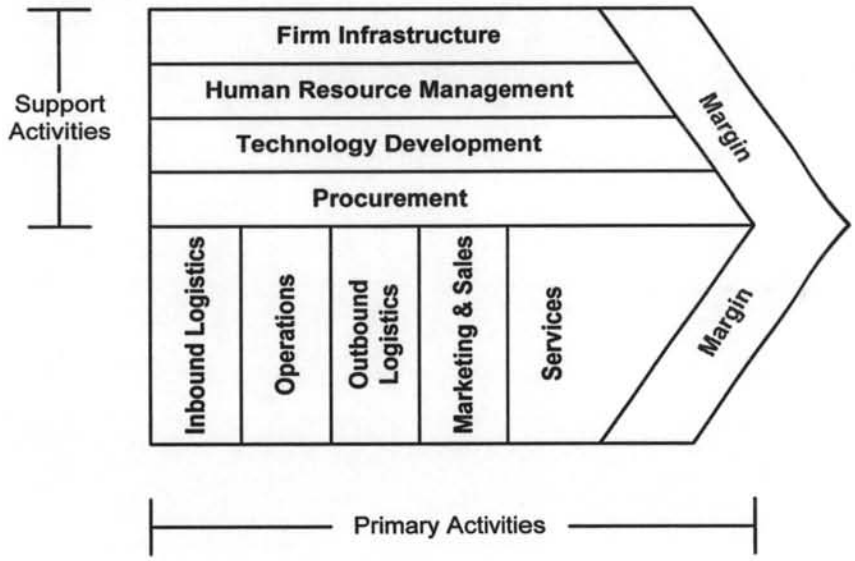

Figure 2.4: Value Chain

Source: Competitive Advantage (Porter, 1985)

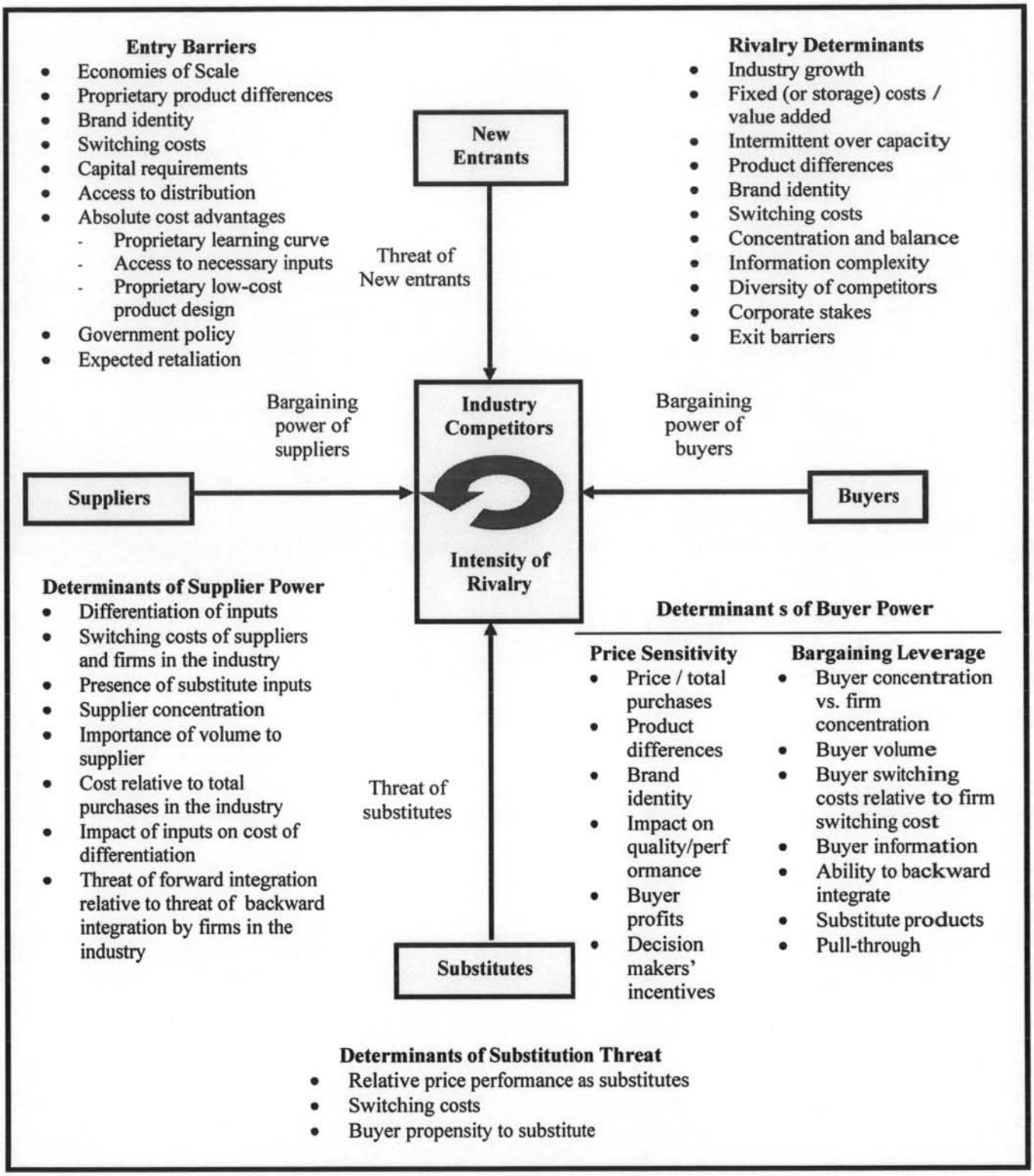

Figure 2.5: Force Driving Industry Competition

Source: Competitive Strategy – Techniques for Analysing Industries and Competitors (Porter, 1980)

There has been done a lot of research on competitive advantage in the hospitality industry over the last decade. Several are questioning the five-force approach appropriateness for the hospitality industry opting for the resource based approach (Aung and Heeler, 2001; Carmeli, 2004; Fahy, 2002; Wilk and Fensterseifer, 2003; Grant, 1991; Rangone, 1999). It has been argued that there is a lack of appropriateness in measuring hotel performance and that looking at traditional measurements such as return on investment is not sufficient. The five-force approach is mostly suitable for manufacturing industries and has been criticised for not being suitable for the hospitality industry's intangible service nature (Phillips, 1999). Due to the intangible service nature of hospitality industry a resource based approach is seen as more appropriate with its valuable, rare, imperfectly imitable or not substitutable resources/capabilities as characteristics (Barney, 1991).

With the shift towards and preference of the resource approach physical resources, human resource and organisational resources are identified as a more suitable method of measuring competitive advantage. For instance, human resource is crucial for hotels in order to establish competitive advantage as they operate in the service industry (Aung and Heeler, 2001). The hospitality industry is unique as the human factor plays and important part in the production of its products as it sells experience. Just as a smiling staff can have positive effect on a guest's experience it can negatively affect the experience if the staff act rude or with no sense of service in mind. Without high quality staff an experience may be severely damaged. Empowerment is identifies as crucial. Staffs need to be able to take quick decisions and not wait for superiors, who might be busy with other encounters, to decide. Well trained staffs are also more likely to take the right decision as they have first hand knowledge of the issues.

Hospitality products are about experiences. This intangibility makes it important for hospitality companies to focus on intangible resources (Carmeli, 2004). Planning capability, know-how, ability to learn, managerial competence and human capital were identified as essential to gain competitive advantage. The common value of all these factors is that they represent resources to the company. The resource approach say the more resources a company have the stronger position it has in regards to gaining competitive advantage. Other resources have been identified such as value

added as an important way of differentiating a hotel, thus gaining competitive advantage. This can be seen in many of the top international hotel chains, such as Four Seasons, Marriott, Hilton, Accor, InterContinental and Peninsula, which focus on high standards and customer loyalty. Furthermore, it is argued that transformation to a learning organisation is one way to gain competitive advantage (Bayraktaroglu and Kutanis, 2002). The demands from guests are continually changing and in order to keep the guests satisfied the hotels need to listen and learn from customers' feedback and be able to adapt and change in order to meet the guests' satisfaction.

A third approach, relational approach, may also be used to gain competitive advantage. Here, companies are seeking alliances in order to expand business and compete with it rivals. The alliances can be equity-based, such as joint ventures, or non-equity-based, such as franchising and licensing. Franchising is particularly seen in the fast food industry with McDonald's as the most well know, and in the hotel industry joint ventures, due to large investments needed, and management contracts, whereby hotel management companies run the operations of the buildings owned separately, are common forms of alliances. These alliances have seen a steady growth since the 1980s and are likely to continue to grow in the future (Beamish and Delios, 1997). This approach is applicable especially in very unstable markets with rapid expansion in order to get quick accesses to market with less risk.

No matter what approach is chosen it can be argued that the worst form of strategy is to choose none. Furthermore, it difficult to create competitive advantage, but it is even harder to preserve it (Passemard and Kleiner, 2000). The three approaches have similarities and all are designed to identify what makes some companies more successful than their competitors. It has been argued that the three approaches are very interlinked and complement each other. For this reason they could be looked upon in an integrated way (Yong Kim and Oh, 2004).

For the purpose of this research, competitive advantage will be looked upon from the perspective of Michael Porter's (1985) proposed strategies of how a company can develop competitive advantage which are; overall cost leadership; and differentiation.

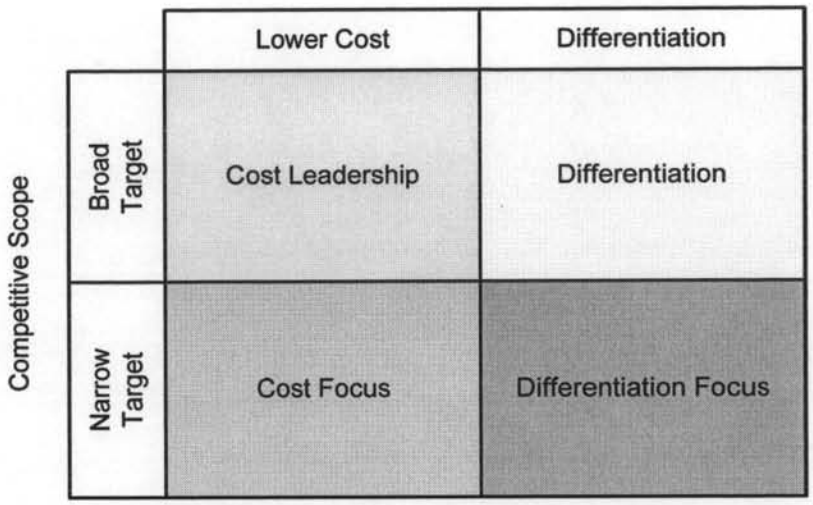

Figure 2.6: Competitive Advantage

Source: Competitive Advantage (Porter, 1985)

As mentioned a company can chose two strategies to position itself: cost leadership and differentiation. Added to this is scope in which the company is operating. Through choosing either to focus on a small market niche or a broad audience leaves the company with four possibilities of gaining competitive advantage. If the company chooses cost leadership it can either do it by attracting a broad target market or can try attracting a narrow target niche through cost focus. If the company is choosing differentiation it can either do it by attracting a broad target market or can try attracting a narrow target niche through differentiation focus. Though there are four possibilities of gaining competitive advantage the two principles of cost leadership and differentiation remain the same. Furthermore, the resource based approach will be looked upon in the context of physical resources, human resource and organisational resources.

2.2.3 Training and Development

There are various methods of developing people having widely discussed in many books and journals. Such the methods of the employee development, explained by DeCenzo and Robbins (1999) are job rotation, assistant to positions, committee assignment, lecture courses and seminars, simulations, outdoor training, on-the-job training, and off-the-job training. Furthermore, Mondy *et al.* (1999) more explained it

as coaching, mentoring, business game, role playing, job rotation, on-the-job training, off-the-job training, classroom programmes, behaviour modelling, apprenticeship training, simulator, and cyber learning. Means of Human Resource Development (HRD) depend upon the purposes, condition and resources for implementation of each company.

This section will focus on training and supervising, and also applies some criteria of investor in people standard, to explore the HRD attitude and practice of company. To understand the board view of training in organisation, the system view is discussed in the next issue.

- **System View of Training**

Tseng (1984) recommended that a training programme must be systematically designed, implemented, and evaluated and he also proposed the system view of training. His systematic approach to training can be analysed at three levels which are trainee, training department, and the organisation. The system view of training is shown below in Figure 2.7.

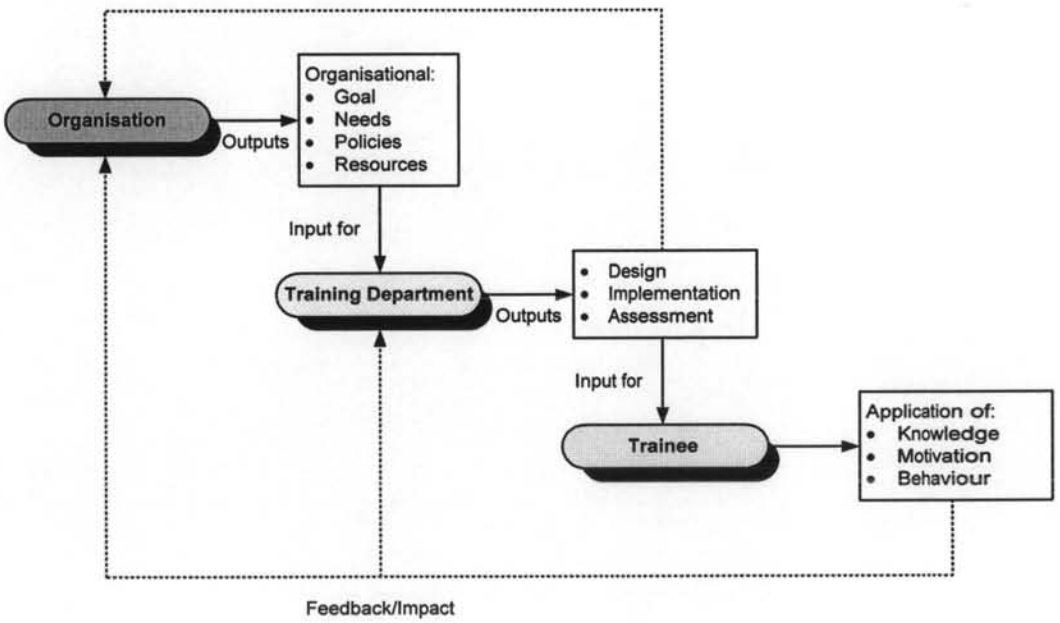

Figure 2.7: The System View of Training

Source: Training – A Tool for Human Resource Development (Tseng, 1984)

This system view of training is applied to investigate how training practices are carried out in each company. This view is executed from an organisational goal to a trainee level, this view are, therefore, selected to explain an example of the training process in organisation.

From the system view of training, Figure 2.7 can be emphasising that:

- The training department should take as its inputs not only goals and policies from the organisation, but also the feedback of trainings who go through the training programmes.
- The effectiveness of a training programme, e.g., the learning and growth of the trainees, is affected not only by the design and implementation of training programme, but also by characteristics of the trainees such as ability and motivation.
- The success of a training programme will have an impact on trainees, the training department itself, and the organisation.

When training is classified by phases, it can be divided into three phases which are derived a rationale design for a training programme from the system view of training.

Tseng (1984) also depicted a training model (see Figure 2.8) and this model emphasises:

- The importance of recognising that there are three distinctive phases in a training programme.
- The need to specify training objectives before implementing and evaluating training programme.
- The necessity of controlling learning experiences to achieve training objectives.
- The need for an evaluative component in a training programme.
- The essential steps of evaluating training programme systematically.

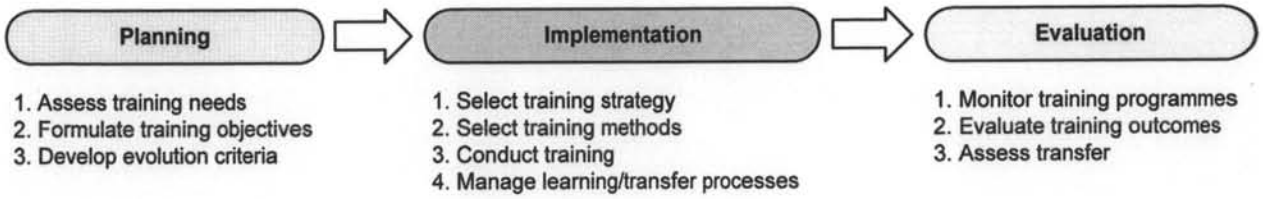

Figure 2.8: Training Model Concept

Source: Training – A Tool for Human Resource Development (Tseng, 1984)

- **Training Needs Analysis**

In analysing the training needs, Tseng (1984) explained the training needs identification in each level. The model for identifying training needs is shown in Figure 2.9.

Figure 2.9: A Model for Identifying Training Needs

Source: Training – A Tool for Human Resource Development (Tseng, 1984)

This model indicates that training needs may be derived from three sources: an analysis of organisational needs, a study of job requirements, a comparison between job requirements, and the employee's qualifications/potential.

Training needs analysis model also derived from three levels. This training needs analysis is similar with needs assessment of Goldstein (1993). He classified the

training needs in three levels from organisational analysis, task analysis, and person analysis.

Supporting in a similar views presented by Patten (1971), he has devised a threefold approach for determining development needs. It consists essentially of the following:

1) Organisational analysis – determining where within the organisation the education and training emphasis should be placed.
2) Operational analysis – determining what should be the contents of programmes in term of what an employee must do to perform a task, job or assignment in effective ways.
3) Man analysis – determining what types of behaviour change are required on the part of an employee if he/she is to perform the tasks which constitute his/her job in the organisation.

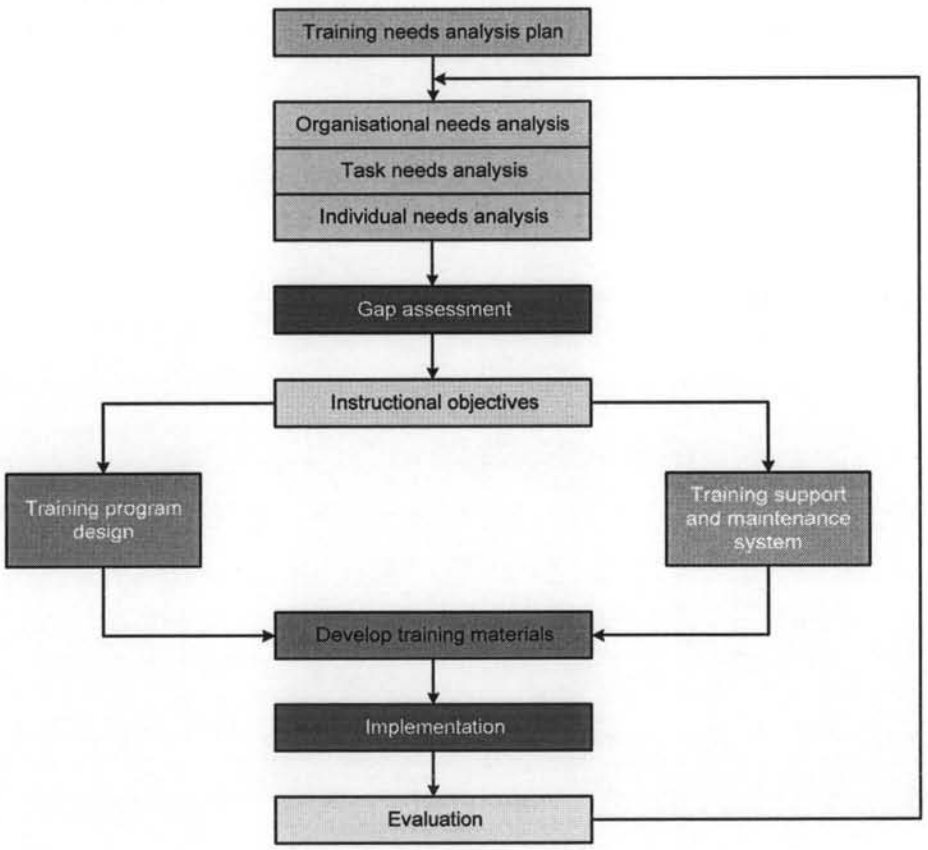

Figure 2.10: Organisational Training Model

Source: Managing Quality: An Integrative Approach (Foster, 2004)

2.2.4 Yield/Revenue Management

Yield management, also sometimes called revenue management, is the attempt to allocate the fixed capacity of a service (although the process is now being used by retailers and manufacturers, also) to match the highest revenue demand in the marketplace. It is appears that American airlines was one of the first to develop this technique but its use has spread to hotels, cruise lines, and other services who hold a fixed capacity for revenue-producing customers, jobs, items, and so on.

As described by Kimes (1989), yield management is most appropriate under the following circumstances.

1) ***Fixed Capacity***. There is only a limited, indivisible number of capacity openings available for the period. There is no flexibility in either dividing up the capacity or in finding additional capacity.
2) ***Perishable Capacity***. Once the period passes, the capacity can no longer be used for that period. There is essentially no salvage value for the capacity.
3) ***Segmentable Market***. The demand for the capacity must be segmentable into different revenue/profit classes, such as business versus pleasure, Saturday night stayover or not, deluxe and budget, and so on.
4) ***Capacity Sold in Advance***. The capacity is sold by reservation. Using yield management techniques, certain classes of capacity are held back for certain, more profitable classes of reservations or periods of the reason. If the profitable classes fail to fill by a certain time point, some of the capacity is then released for the next lowest profit class. This procedure cascades down through both reservation classes and time points as the period in question approaches.
5) ***Uncertain Demand***. Although demand for each of the reservation classes may be forecast, the actual demand experienced in each of the classes for each the time periods is uncertain.
6) ***Low Marginal Sales Cost, High Marginal Capacity Addition Cost***. The cost to add a unit of capacity is extremely high but the cost to sell (rent) a unit of it for the period in question is low.

The technique used to determine how to allocate capacity among the different classes is similar to that used for overbooking. Overbooking is an attempt to reduce costs

through better schedule management, as illustrated by Scandinavian Airlines (Alstrup *et al.*, 1989). Scandinavian Airlines (SAS) operates a fleet of DC-9 aircraft with 110 seats each. If SAS accepts reservations for only these 110 seats, "no-shows" (passengers who fail to show up for a flight) will refuse to pay for their reservations and SAS can lose from 5 to 30 per cent of the available seats. If there are 100 flights every day, these no-shows can cost the airline as much as $50 million a year. To avoid this loss, all airlines overbooking flights are accepted a fixed percentage of reservations in excess of what is actually available.

The management of SAS decided to develop an automated overbooking system to include such factors as class, destination, days before departure, current reservations, and existing cancellations. The objective of the system was to determine an optimal overbooking policy for the different classes on each flight, considering the costs of ill will, alternative flight arrangements, empty seats, and upgrading or downgrading a passenger's reserved class.

2.2.5 Overbooking in Hotel Industry

The situations in hotel and airline booking have many similarities. Overbooking is practised in both. The airline seats correspond to hotel rooms and the flights could be seen equivalent to days in the hotel situation. The major difference is that while airline reservations are for particular flight only, hotel room reservations may be made for one or more consecutive nights. This difference tends to breakdown the analogy between the two situations, and models developed for one cannot be readily used for the other.

During 1950s, there has been mention of overbooking in books on hotel management. Dukas (1957) and Lattin (1958) discussed overbooking and the reasons for its practice. As Lattin (1958) described, it is uneconomical to have one or more rooms vacant when the business is available. There is no commodity more perishable than a hotel room – if it is not sold tonight, it can never be sold. According to Dukas (1957), the answer to loss of business due to cancellations and no-shows is 'overbooking according to rather reliable estimates, previous records, and guesses – a little crystal-

ball gazing might be helpful too'. Thus, it is evident that hotel overbooking has been in practice for a long time.

However, then as now, no systematic study has been conducted nor models developed for predicting exactly how much overbooking is to be accepted. The booking levels continue to be determined through intuition and experience, and through rough estimates. A literature search has revealed no published model directed specifically to the hotel problem except one by Marvin Rothstein.

By contrast to the hotel situation, much work has been done in the airline overbooking cases. Numerous models have been developed and various techniques applied. There are discussed by Rothstein (1971). Among the models that need mention here are those by Shlifer and Vardi (1975), Taylor (1962), Thompson (1961), and Beckman (1958).

The earliest of these models is due to Beckman (1958). He considered a single class of service and his model was a highly simplified one aiming to provide a solution as to the maximum number of reservations permissible at all times irrespective of the number of days yet to transpire before departure. Moreover, it assumed that first all demands for reservations occur, then all late cancellations and no-shows occur out of the totality of reservations accepted, and finally standbys are added – a not too accurate representation of the real situation.

Once more, Beckman (1958) developed a similar model which minimises cost but is time dependent. At any time t, he calculates the expected loss (due to oversales and unsold seats) $L_n(t)$ when there are n reservations on hand. A new reservation is accepted only if

$$L_{n+1}(t) \leq L_n(t)$$

However, this model does not consider no-shows at all and hence is not realistic.

The first constrained model to appear was developed by Thompson (1961) in which the probability of denies boarding is constrained. However, costs and passenger reservation demands are omitted and only the cancellation pattern of any fixed number of reserved passengers is described. Taylor's model (1962) provides a booking level appropriate to any particular time before departure such that if that level is reached and reservations are inhibited after that time, the probability of oversales will be approximately equal to some prescribed value. This model, like Thompson's, has drawbacks in that it does not provide for situations where the books may be closed by reaching the prescribed levels and reopened due to subsequent cancellations.

The model of Shlifer and Vardi (1975) helps in determining the booking policy constrained by the limit of the loss incurred by rejecting a passenger as against the profit of carrying one. The booking level obtained for a period is independent of the levels for any other period.

A number of alternative means to overbooking have been suggested to solve the problem of loss due to cancellations and no-shows, for example by Vickrey (1972) and Simon (1972). However, there are not quantitative and have proved unacceptable to airlines and hotels.

The most famous model is the one by Marvin Rothstein (1971). The airline overbooking model of Rothstein uses a discrete time approach and views the reservation procedure as a Markovian sequential decision process. The model is an application and extension of the work of Howard (1960) and Bellman (1957). Howard considered a finite stationary Markov process to which he adds the notion of 'economic rewards' for transitions from state to state. The optimal policy is obtained using the principle of optimality of dynamic programming.

Yiu Wai Ling (1979) has developed a similar model for the airline overbooking problem using stochastic dynamic programming. Again, this is a discrete time model with the transition probability function from one stage to another following a Poisson distribution.

Thus, while a lot of literature exists for the airline overbooking situation, very little is available for the analogous situation in hotel reservation. Some analogies exist also between the hotel problem and the hospital admissions problem but the models developed for the hospital system appear inapplicable to the hotel case due mainly to the uncertainty of arrivals in the former. Rothstein (1974) was the first to consider rationalising hotel overbooking. Recognising the similarities between the airline and hotel problems, he applied the Markovian model developed by him, originally for the airlines to the hotel situation. The model is a Markovian sequential decision process whose solution is obtained using Bellman's principle of optimality of dynamic programming. This gives a recursive scheme to sequentially computing an optimal policy.

However, two major aspects make the application of the airline model to the hotel situation inaccurate. These are:

1) *Single vs. Double occupancy.* Hotel room rates depend upon the number of occupants. An airline seat can be used by exactly one person.
2) *Multiple-day stays.* Hotel reservations are made for one or more consecutive nights. A daily airline flight is analogous to a hotel in which guests stay for only one night.

In the model of Rothstein, a unique room rate based upon a weighted average of rates is used and it is assumed that a request for a multiple-day reservation is equivalent to several independent requests for single day reservations. As Rothstein admitted, this tends to make the derived reservation levels somewhat too high and suggests that further research be undertaken to include these considerations.

2.2.6 Meaning of Reservation

A reservation in the context of the front office of a hotel means the booking or reserving of a bedroom (accommodation) by a guest, and involves a particular type of guest-room being reserved for a particular person or persons, for a certain period of time. When a reservation or room booking is made at a hotel, it is expected that the hotel will honour its commitment in accepting that reservation and guarantee that a room will be available when a guest arrives (Bardi, 1996).

2.2.7 Reservations System

According to DeVeau *et al.* (1996), one of the critical financial successes of the hotel is a reservation system. The majority of requests for rooms will be processed through this system. Because of this vital function, all hotels have to have in place a system that is capable of processing the maximum number of reservation requests possible in the most efficient and effective manner. Also this must all be accomplished while providing the highest level of guest service the hotel has guarantee to give its guest.

A reservation inquiry is usually the majority activity at the pre-arrival phase and first contact a guest is going to have with a hotel, whether it is at the hotel itself or at a distant central reservation office that services the entire hotel chain. Therefore, the reservation is an excellent opportunity for the hotel put its best foot forward (Kasavana, 1993). The components of the reservation system can be considered as the following: receiving the request from guest, matching the request with accommodations the hotel has available on that particular date(s), recording the information in the hotel's reservation system, confirming the reservation with the guest directly after accepting it, updating the reservation and the status of it prior to the guest's arrival, and formulating reservation reports to be used before, during, and after the guest's stay. All of these components must be in place and working at their full potential to assure the maximisation of the hotel's room revenue. With a hotel's room revenue accounting for over 60 per cent of its total revenue; it is not very difficult to see why such significance is attached to the reservation system and why constant attention is paid to its improvement (Cross, 1997).

2.2.8 The Overview of the Reservation System

Nowadays the hotel industry is powered by sales that are derived from the use of computerised reservations systems. Means of communication with the client; room inventory data banks; systems for reservation, confirmation, deposits, and cancellations; and blocking procedures, a process of reserving a room on a specific day, are the major components of a well-organised quest reservation processing system. The hotel has to have a way to check reservation requests against a data bank of available rooms (Kasavana, 1981). To ensure the reliability of the room

reservation, the hotel establishes a deposit or guarantee system that commits the guest to the purchase of the accommodation. A cancellation process allows the guest and the hotel flexibility necessary to function in a complex society. A blocking procedure that balances future commitments with present room requirements also helps the front office manager in providing an effective room reservation processing system (Schneider and Bowen, 1995).

2.2.9 Types of Reservations

- **Advanced Reservations**

A guest usually chooses the advanced reservation option when is in transit and is calling to determine if a property has rooms available for a particular time period. The guest does not want any commitment form the hotel to secure the room reservation. The hotel will hold the reservation until a specified time (Vallen and Vallen, 1996). This type of reservation has been dropped by some lodging reservation systems in favour of confirmed reservations, which specify a certain arrival deadline with no commitment by the guest to pay if he or she does not show up.

- **Confirmed Reservations**

The confirmed reservation is comparable to a contract that becomes void at a certain hour of a certain day. The confirmed reservation allows the hotel to project the number of guests that will check in by the deadline hour. After that deadline, the hotel is free to sell that room to walk-in guests or to accept overflow guests from another property (Kasavana, 1993). The hotel usually keeps track of number of no-shows and compares them to the total number of confirmed reservations that were made; these historical records help in predicting occupancy- and revenue- accurately.

- **Guaranteed Reservations**

Guaranteed reservations enable the hotel establishments to predict revenue even more accurately. They commit the guest to pay for a room night and the hotel provide

accommodations, regardless of arrival time. If the guest does not show up (without prior cancellation), the hotel may process a credit-card voucher for payment (Rutherford, 1985). Likewise, no matter when the guest arrives on the reserved night, the hotel must have the reserved accommodation available. The guaranteed reservation requires the hotel to determine the method of guest payment. The guest may secure the method of payment with a valid credit card, an advance payment, or a preauthorised line of credit.

- **Reservation Codes**

Reservation codes or confirmation numbers are a sequential series of alphanumeric combinations that provide the guest with a reference for a confirmed or guaranteed reservation. This code indicates that accommodations have been secured for a specific date with a commitment to pay for at least the first room night (Kasavana, 1981). The code, which usually consists of several letters and digits that do not necessarily have any meaning to the guest, may identify the hotel in the chain/ referral group, the person who processed the reservation, the date of arrival, the date of departure, the type of credit card, the credit- card number, the room rate, the type of room, and/or the sequential number of the reservation. The organisation that develops the code will include information in the code that is appropriate for the efficient management of a particular reservation system.

A few things should be kept in mind when establishing a reservation code system. The amount of memory available to store the code information in a computer data bank may be limited. Therefore, a shorter code that provides less information may be necessary. The reservation code should be designed to give adequate information to the hotel property that must provide accommodation for the guest. The purpose of the code is to communicate the details of a guaranteed accommodation to the host property (Cadotte and Turgeon, 1988). The guest data have already been entered into the central computer and usually can be easily retrieved. However, there are times when these data may not be available or may be misplaced. When this happens, a reservation code allows the host property to provide appropriated accommodations. The method of paying for a guaranteed reservation is established when the reservation is made. Credit cards or previously approved direct billings are the most common

methods. Sometimes the guest will send a bank check or deliver cash to secure a reservation. A bank check is acceptable, as long as adequate time is available to process the check. The cash advance payment and bank check, however, should alert the front office manager that this guest has not established a line of credit with a credit- card organisation or with the hotel. Determining how the guest will pay the total final bill is essential. The folios of guests who pay cash in advance must be monitored.

- **Cancellations**

Cancellations due to the guest's change in plans are easily handled by a computerised reservations system. The guest calls the central reservation system or the hotel where the reservation has been made. Some lodging organisations stipulate a time period for cancelling reservations. Twenty-four, 48 or 72 hours' notice may be required for the guest to be exempt from paying the first night's room rate. Policies vary among reservation systems, based on the historical frequency of cancellations (and the subsequent effect on the profit- and- loss statement) and the public relations policy (the potential of lost repeat business) of the organisation (Bowen and Lawler, 1992).

- **Cancellation Codes**

A cancellation code is a sequential series of alphanumeric combinations that provides the guest with a reference for a cancellation of a guaranteed reservation. (Cancellation codes are also referred to as cancellation numbers.) This code verifies that the cancellation has been communicated to the hotel property and assures the guest that he or she is not liable for the cancel reservation (Williams and Hunter, 1992; Bowen and Lawler, 1992). For example, if the front office staff mistakenly processes a charge for a guaranteed reservation that had been cancelled, the guest could refute the credit-card billing with the cancellation code. A cancellation code is composed like a reservation code and consists of letters and digits that may identify the hotel property, the person who processed the cancellation, the date of arrival, the date of departure, and/ or the sequential number of the cancellation. This and other information is included to ensure efficient management of room cancellations. If the guests had

applied a cash deposit to the room, a credit balance on the guest folio would have to be processed.

- **Blocking Procedure**

After a reservation has been received, the reserved room is blocked in the room inventory. In a computerised reservation system, the room is automatically removed form the available-room data bank for the dates involved (Bardi, 1996). As a reservation request is processed, the room or rooms involved are blocked out of the available-room inventory. Another type of blocking, referred to as daily blocking, involves assigning guests to their particular rooms on a daily basis.

2.2.10 Forecasting Reservations

Forecasting or room forecasts, which involves projecting room sales for a specific period, is a natural next step after the data from the reservation process have been collected. This step includes previewing the effects of reservations on the income statement, scheduling labour, and planning for the use of facilities. In addition to presenting a practical method for preparing a rooms forecast (sometimes referred to as a "projection of room sales"), this section also indicates how such a forecast can be used as a means of communication with other departments. The three different types of forecasts are the 10-day forecast, the 3-day forecast, and the daily availability formula (Makridakis, 1990). Each of these calculations plays an important role in the day-to-day operation of the hotel.

- **Ten-Day Forecast**

The 10-day forecast is prepared for projecting the number of rooms that will be occupied over each of the next 10 days. This is accomplished by taking the number of rooms occupied last night and adding to this figure the number of reservations that have been taken for this date. Later, the estimated numbers of check-outs for the day are subtracted from this. Other factors that must be considered are the estimated number of reservations that will be received after the forecast is completed and the

numbers of walk-ins are projected for that day (Armstrong, 2001). All of the estimates that are made are based on patterns, such as those that have emerged over a period of time or those which are related to the season.

- **Three-Day Forecast**

As is the case with the 10-day forecast, the 3-day forecast is distributed for its last minute planning. This is particularly useful in the scheduling of staff. These last minute changes to the schedule can prove to be extremely beneficial to the hotel in the long run. For example, if the occupancy now appears to be higher than originally planned for the time period covered by the schedule, an addition of staff members will aid in providing better customer service, which, in turn, will result in more repeat business. On the other hand, if the occupancy now appears to be lower than forecasted, a reduction in the member of staff members will result in substantial saving over the period of a year. Moreover, the 3-day forecast will allow the management of the hotel to make adjustments to the rates, and this may result in a greater number of walk-ins accepting the accommodations offered (Armstrong, 2001).

- **Daily Availability Formula**

The daily availability formula is similar to the 10-day and 3-day forecasts mentioned earlier. The major difference between the daily availability formula and the other forecasts is the amount of information utilised in the preparation of the daily formula. In the daily availability formula, the following items of information are used in its preparation: number of no-shows, number of cancellations, number of understays, number of overstays, and the number of room out-of-order. These items are forecasted for the day in question prior to the beginning of the day's business (Makridakis, 1990).

There are a number of shortcomings in this method of preparing the daily availability formula. Missing is the consideration of the number of rooms that will be affected by such factors as were mentioned before. When these variables are taken into consideration, the formula will appear as follow (Armstrong, 2001):

	number of rooms in the hotel
Less:	number of stayovers
Less:	number of reservations
Plus:	number of no-shows
Plus:	number of cancellations
Plus:	number of understays
Less:	number of overstays
Less:	number of out-of-order rooms
Equals:	number of rooms available

2.2.11 Reservation Contact Methods

There are various methods used by guests and representatives of guests to make reservations at a hotel. Some of more common methods are telephone, mail, facsimile, and contact in person. These methods will be dealt with in this topic, as they are used by guests and their representatives to contact the hotel directly as opposed to going through the central reservation office of a hotel chain.

- **Telephone**

When a person calls the hotel's reservation office, he or she should be given the full and undivided attention of the reservationists, who represents the hotel to the guest. The impression created at this point is a lasting one and should demonstrate the hotel's concern for the guest's satisfaction (Parasuraman *et al.*, 1991).

Telephone sales of guest rooms are extremely difficult. When a guest is already at the hotel, it is difficult enough to sell the services of the hotel because of their intangible nature. Over the phone, this difficulty is multiplied. In order to sell rooms over the phone, the reservationists must verbally communicate ideas, impressions, and facts about the hotel. The best way to handle this task is to describe the room's size, location, special features, and any extra included.

- **Mail**

Fewer reservations are made today by mail than were made in the past. This situation has come about because of the ease of making reservations using the other methods (Parasuraman *et al.*, 1991). Fortunately, this is the case, because with a reservation request made by mail, there is often a problem with rooms being available on the requested dates of stay. There may also be some confusion as to what the guest wants in terms of accommodations and, in this situation; there is an inability to upsell the guest to a higher-rate room.

- **Facsimile**

With the proliferation of fax machines in businesses, there will be a growing trend to use this method of transmission to request room reservations. Some of the problems associated with mail reservation requests are still present. The fax method of communication opens up an excellent channel for reservations with international hotels. Now reservations can be made instantaneously and a reservation confirmation sent back to the caller all in a matter of a few minutes (Van Dyke, 1993).

- **In Person**

When a reservation is made in person, either by the future guest or his representative, a great many opportunities open up that did not previously exist. No longer is the reservationists faced with the dilemma of trying to explain only through verbal communication what the hotel has to offer. Now the person has an opportunity to actually see the hotel and experience its services. Whenever possible, the guest should be shown a room similar to the one he is making a reservation for. This is a perfect opportunity to make friends with the guest and to upsell him/her at the same time (Van Dyke, 1993).

2.3 Information System/Technology Approaches

This section deals with the application approach to ABC reservation system. Since the hotel has begun the business without using the database management and Internet in its reservation system. This leads to the problem of cancellation, overbooking and loss of sale opportunity.

2.3.1 Information Resource Management

Information resource management is a response to the challenge of effectively utilising information technology. The goal of information resource management is to use information technology as a tool for processing, distributing, and integrating information throughout an organisation. Management of information resources has many similarities with managing physical resources such as inventory. Inventory management involves activities such as safeguarding inventory from theft and deterioration, storing it for efficient usage, choosing suppliers, handling waste, coordinating movement, and reducing holding costs. Information resource management involves similar activities: planning databases, acquiring data, protecting data from unauthorised access, ensuring reliability, coordinating flow among information systems, and eliminating duplication.

2.3.2 Database vs. Paper-Based

The advantages of the database system over traditional, paper-based methods of record keeping will perhaps be more apparent. Some of the disadvantages are described below (Date, 1990):

- ***Compactness*** – no need for possibly voluminous paper files.
- ***Speed*** – the machine can retrieve and change data much faster than the traditional method.
- ***Currency*** – accurate, up-to-date information is available on demand at any time.
- ***Provide a User-Friendly Interface*** – provide the easy data access system for users.
- ***Centralisation*** – multi-user can used the same provided data.

2.3.3 Database Management

Data is an important resource in an organisation and must be managed, which is facts, figures, and values from which information is derived. According to Date (1990) and Elmasri and Shamkant (2000), database is a mechanised, shared, formally defined, and centrally controlled collection of the data relating to a specific organisational entity or a collection of persistent data which is used by the application system of some given enterprise. A database management system (DBMS) is a computer-based tool used to set up a database, make it available to users within an organisation, and control the integrity of the application systems for end users interactive access to data resources without having to write a programme (Date, 1990; Thalheim, 2000). Nyström and Osborn (2004) explained that a person filling the role of the database designs, defines, and creates database; provides and maintains the computer-based facilities for using the database (DBMS); assists and trains users of the DBMS and the database; and is responsible for the integrity of the database.

The methodological background and implementation of a structured modelling environment developed to meet the requirements of modelling activities to cover a wide range of issues related to model-based decision-making support with a summary of the context of modelling composed of: the role of models in decision-making support; modelling paradigms; and state-of-the-art aspects of modelling complex problems. The modelling process was characterised, and the requirement analysis for implementation of structured modelling was specified. The structure modelling technology was developed to support the implementation of the structured modelling principles for modelling complex problems (Makowski, 2005).

Linn *et al.* (2000) approached technology management to express the need to manage technology systematically from both strategic and operational perspectives and presented an object-oriented intelligent management system for technology management by using the methodology of Intelligent Engineering designed and implementation for the Intelligent Management System for Technology Management (IMS-TM) using the hierarchical model.

Web technologies, as tools, were developed by Arch-int and Batanov (2002) for developing software components as basic building elements of industrial information systems, implemented and deployed in Web-based computing environment. Respectively models, methods and techniques ensure that the objects and components to apply three-tier Web application architecture using XML document as distributed object which the proposed methodology is applied step by step to developing a part of inventory subsystem of industrial information system.

- **Development of Database Technology and Market Structure**

The features of DBMSs in today's products are a significant improvement over just a few years ago. Database management, like many other areas of computing, has undergone tremendous technological growth. To provide a context to appreciate today's DBMSs, this section reviews past changes in technology and suggests future trends. After this review, the current market for database software is presented.

- **Evolution of Database Technology**

Table 2.2 depicts a brief history of database technology through four generations of systems. The first generation supported sequential and random searching, but the user was required to write a computer programme to obtain access. For example, a programme could be written to retrieve all customer records or to just find the customer record with a specified customer number. Because first generation systems did not offer much support for relating data, they are usually regarded as file processing systems rather than DBMSs. File processing systems can manage only one entity rather than entities and relationships managed by a DBMS.

Table 2.2: Brief Evolution of Database Technology

Era	Generation	Orientation	Major Features
1960s	1st	File	File structures and proprietary programme interfaces
1970s	2nd	Network navigation	Networks and hierarchies of related records, standard programme interfaces
1980s	3rd	Relational	Nonprocedural languages, optimisation, transaction processing
1990s to 2000s	4th	Object	Multimedia, active, distributed processing, more powerful operators, data warehouse processing, XML enabled

Source: Data Management Systems – Evolution and Interoperation (Thuraisingham, 1997)

The second generation products were the first true DBMSs as they could manage multiple entity types and relationships. However, to obtain access to data, a computer programme still had to be written. Second generation systems are referred to as "navigational" because the programmer had to write code to navigate among a network of linked records. Some of the second generation products attached to a standard database definition and manipulation language developed by the Committee on Data Systems Languages (CODASYL), a standards organisation. The CODASYL standard had only limited market acceptance partly because IBM, the dominant computer company during this time, ignored the standard. IBM supported a different approach known as the hierarchical data model (Thuraisingham, 1997).

Rather than focusing on the second generation standard, research labs at IBM and academic institutions developed the foundations for a new generation of DBMSs. The most important development involved nonprocedural languages for database access. Third generation systems are known as relational DBMSs because of the foundation based on mathematical relations and associated operators. Optimisation technology was developed so that access using nonprocedural languages would be efficient. Because nonprocedural access provided such an improvement over navigational

access, third generation systems replaced the second generation. Since the technology was so different, most of the new systems were founded by start-up companies rather than by vendors of previous generation products. IBM was the major exception. It was IBM's weight that led to the adoption of SQL as a widely accepted standard (Thuraisingham, 1997).

Fourth generation, DBMSs are extending the boundaries of database technology to unconventional data, the Internet, and data warehouse processing. Fourth generation systems can store and manipulate unconventional data types such as images, videos, maps, sounds, and animations. Because these systems view any kind of data as an object to manage, fourth generation systems are sometimes called "object-oriented" or "object-relational" (Thuraisingham, 1997). In addition to the emphasis on objects, the Internet is pushing DBMSs to develop new forms of distributed processing. Most DBMSs now feature convenient ways to publish static and dynamic data on the Internet using the eXtensible Markup Language (XML) as a publishing standard.

A recent development in fourth generation DBMSs is support for data warehouse processing. A data warehouse is a database that supports mid-range and long-range decision making in organisations. The retrieval of summarised data dominate data warehouse processing, whereas a mixture of updating and retrieving data occur for databases that support the daily operations of an organisation (Ma, 2006).

The market for fourth generation systems is a battle between vendors of third generation systems who are upgrading their products against a new group of systems developed as open-source software. So far, the existing companies seem to have the upper hand.

2.3.4 Data Models

Database system technology has advanced a great benefit from the legacy system based on the network and hierarchical models to relational and object-oriented database systems depended on the client-server architecture. The data modelling has concentrated mainly in two areas from which two types of data models were developed: traditional and semantic models. Traditional models include the network,

hierarchical, and relational models. Semantic models include the entity-relationship, functional, logic-based, and object-oriented models. However, this research study merely aims on the application model of object-oriented methodology. Since its function is appropriately applied to the reservation system of ABC.

- **Object-Oriented Data Model**

Object-oriented data modelling and design is a new way of thinking about problems using models organised around the real-world concept. The objects represent a real-world entity which has particular data and procedures. Booch (1996) described object-oriented methodology as a special kind of developed software, focusing on the construction of system for which the class is the fundamental unit of architectural abstraction.

The object-oriented development methodology resolves the problem of the reservation system because (Booch, 1996):

- It is iterative and therefore adaptable to changing requirements;
- Objects are self-contained therefore changes are easier to isolate and faster to implement; and
- Objects model real-world entities, allowing requirements to become easily understood.

2.3.5 Benefits of Database Approach

This section discusses the general benefits of database approach. The benefits can be concluded as follows (Date, and Darwen, 2006):

- ***Redundancy Can be Reduced*** – in non-database systems; each application has its own private files. This fact can often lead to considerable redundancy in stored data with the resultant waste in storage space.
- ***The Data Can be Shared*** – sharing means that existing applications can share the data in the database with the newly developed applications to operate on the shared data.

- ***Standards Can be Enforced*** – standardising data representation is particularly desirable as an aid to data interchange, or migration of data between systems. Likewise, data naming and documentation standards are also very desirable as an aid to data sharing and understand ability.
- ***Security Restrictions Can be Applied*** – having complete jurisdiction over the database, the database administrator; can ensure that only means of access to the database is through the proper channels; and can define security rules to be checked whenever access is attempted to sensitive data. Different rules can be established for each type of access (i.e., retrieve, insert, and delete, etc.) to each piece of information in the database.
- ***Integrity Can be Maintained*** – the problem of integrity is the problem of ensuring that the data in the database is accurate.
- ***Conflicting Requirements Can be Balanced*** – the database administrator can structure the system to provide an overall service that is the "best for the enterprise".

2.3.6 Database Vendor Solution

Today, each of the major database vendors has a new suite of Internet-access product available to bridge their databases with the Web applications. For example Oracle's Oracle Lite 3.5 were added Java-related features including JDBC support, the ability to create triggers and procedures in Java, and the management of data through a Java-enabled browser application (Urman *et al.*, 2004).

Sybase's Adaptive Server Anywhere 6.0 provides a Java run time environment in the database server. It allows developers to store Java objects in database tables by using a Java class as a data type for a column in a table. Adaptive Server Anywhere also supports JDBC as an interface from client applications using the Sybase jConnect JDBC driver.

Microsoft's IDC/HTX, IDC (Internet Database Connector) is a component of the Microsoft Internet Information Server (IIS). IDC accepts input from a browser to execute SQL commands against an ODBC data source and return any resulting data to

browser. The format of data is defined in HTML template (htx). This solution is suitable for the organisations that are using Windows NT and ODBC-compliant database.

These solutions might be a choice of the corporations who have an existing database and have already spent a lot of money with the database engines and supporting products. It might be more economical to choose such a solution.

- **Current Market for Database Software**

According to the International Data Corporation (IDC), sales (licence and maintenance) of enterprise database software reached $13.6 billion in 2003, a 7.6 per cent increased since 2002. Enterprise DBMSs use mainframe servers running IBM's MVS operating system and mid-range servers running UNIX (LINUX, Solaris, AIX, and other variations) and Microsoft Windows Server operating systems. Sales of enterprise database software have followed economic conditions with large increases during the Internet boom years followed by slow growth during the dot-com and telecom slowdowns. For future sales, IDC projects sales of enterprise DBMSs to reach $20 billion by 2008 (Hailstone, 2007).

According to IDC, three products dominate the market for enterprise database software as shown in Table 2.3. The IDC rankings include both licence and maintenance revenues. When considering only licence costs, the Gartner Group ranks IBM with the largest market share at 35.7 per cent, followed by Oracle at 33.4 per cent, and Microsoft at 17.7 per cent. The overall market is very competitive with the major companies and smaller companies introducing many new features with each release (Urman *et al.*, 2004).

Table 2.3: 2003 Market Shares by Revenue of Enterprise Database Software

Product	Total Market Share	Comments
Oracle 9i, 10g	*39.9%*	Dominates the Unix environment; strong performance in the Windows market also
IBM DB2, Informix	*31.3%*	Dominates the MVS and AS/400 environments; acquired Informix in 2001; 25% share of the Unix market
Microsoft SQL Server	*12.1%*	Dominant share of the Windows market; no presence in other environments
Other	*16.7%*	Includes Sybase, NCR Teradata, Progress Software, MySQL, PostgreSQL, open source Ingres, Firebird, and others

Source: Oracle Database 10g PL/SQL Programming (Urman *et al.*, 2004)

Open source DBMS products have begun to challenge the commercial DBMS products at the low end of the enterprise DBMS market. Although source code for open source DBMS products is available without charge, most organisations purchase support contracts so the open source products are not free. Still, many organisations have reported cost savings using open source DBMS products, mostly for non-mission-critical systems. MySQL, first introduced in 1995, is the leader in the open source DBMS market. PostgreSQL and open source Ingres are mature open source DBMS products. Firebird is a new open source product that is gaining usage (Urman *et al.*, 2004).

In the market for desktop database software, Microsoft Access dominates at least in part because of the dominance of Microsoft Office. Desktop database software is primarily sold as part of office productivity software. With Microsoft Office holding about 90 percent of the office productivity market, Access holds a comparable share of the desktop database software market. Other significant products in the desktop database software market are Paradox, Approach, FoxPro, and FileMaker Pro (Hailstone, 2007).

Because of the potential growth of personal computing devices, most major DBMS vendors have now entered the embedded DBMS market. The embedded DBMS market is now shared by smaller software companies such as iAnywhere Solutions and Solid Information Technology along with enterprise DBMS vendors Oracle and IBM (Hailstone, 2007).

2.4 Summary of the Chapter

There are three theoretical and conceptual frameworks being applied in this study which are operations management approaches, business management approaches, and information technology approaches.

Firstly, the operations management approaches are essential especially in manufacturing and service industry. In these approaches, the shop-floor control is certainly a key factor that will be applied in this research. Its major functions control comprise of assigning priority to each shop order, maintaining Work-in-Process (WIP) quantity information, conveying shop-order status information to the office, providing actual output data for capacity control purposes, providing quantity by location by shop order for WIP inventory and accounting purposes, providing measures of efficiency, utilisation, and productivity of labour and machines, respectively.

Secondly, the business management approaches include altogether the reservation system and marketing strategy which are considered to be the primary concerns for these approaches. They contain such as yield or revenue management, overbooking theory, and meaning of reservation. It can be said that the reservation process is of vital importance for a hotel because of, for example, guests' first impression of the hotel, expansion of sale's productivity in the hotel, sharing customers with other departments as well as distribution of important management information to other departments.

As mentioned earlier in this chapter, the information shows that the reservation process is often the first contact between a guest and a hotel. In the hotel industry,

strong competition exists in the selling of accommodations. For instance, a guest who experiences problems or slow service from the reservations section will think carefully before confirming a reservation or returning to the hotel. An efficient and effective reservations system is, therefore, very important.

In addition, the reservations department not only sells accommodation but also helps to generate income for other departments of a hotel, e.g. the food and beverage department. A hotel can have a large number of guest-rooms available to let each day, but unless rooms are sold, they will not generate revenue. Hotel rooms are a saleable commodity and are strictly limited by factors of time and quantity. Therefore, if a room is not sold on a particular night, the revenue from that room is lost forever. Reservations contribute to the three main objectives of a front office department, i.e. to maximise rooms, beds/occupancy and average room rate, thereby achieving the highest possible revenue and profitability for the hotel.

Moreover, other departments often benefit from the reservation details collected by the reservations department. Such details may include an accurate estimate of the number of guests staying in the hotel, or an indication of when the hotel is expected to be full. Besides, reservation information can be used by the hotel and by individual departments to prepare sales forecasts, prepare weekly or monthly staff schedules, menus, and purchase requirements, relate sales forecasts to expenditure budgets (e.g. money available for staff wages and purchases), control costs, including materials, labour and overheads, and carry out long-term planning (e.g. renovation of rooms and expansion programmes).

Finally, the information system or technology approaches are also applied in the hotel reservation system. In this stage, the main part is to implement the database which can generate many advantages over traditional, paper-base method of record keeping. Generally, the goal of database management system is to create a database that provides an important resource for an organisation. To fulfil this broad goal, the database should serve a large community of users, support organisational policies, contain high quality data, and provide efficient access.