Part II

Revenue Management in Practice

6 Revenue Management for Fixing Quotas and Prices of Perishable Commodities under Uncertainty

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Learning outcomes

After reading this chapter, you should be able to:

- Understand the dynamics of a decision making model and approach for the revenue management of perishable commodities under uncertainty of demand, through fixing quotas and prices of commodities.
- Appreciate the superiority of the proposed approach by comparing the respective revenues generated through the new quotas and prices using the proposed yield maximisation model, with that of the old practised prices and quotas.
- Understand the applicability of the model, which offers theoretical and real-time facilitation in hospitality management, through the case study of a hotel.

Introduction and literature

Revenue management (RM) refers to the strategy and tactics used by a number of industries to manage the allocation of their capacity over time to different willingness to pay end-users in order to maximise revenue (Burgess & Bryant, 2001; Phillips, 2005; Sanchez & Satir, 2005). According to Sanchez and Satir (2005), it is a holistic and systematic approach to maximise revenue through varying the rates offered to the end-users in light of forecasted demand and supply patterns. Shy (2008) defines RM as the utilisation of profit-maximising pricing techniques.

From several studies (e.g., Kimes, 2000; Phillips, 2005; Sanchez & Satir, 2005; Wang & Bowie, 2009), it emerges that RM is applicable when:

1 The provider is offering a fixed quantity of perishable capacity;

2 The receivers (or the end-users) book capacity prior to using the commodity;

3 The provider manages a set of price modules; and

4 The provider can change the choice of price modules over time.

The various approaches of RM are geared towards allocating the right percentage of capacity to the right end-user at the right time for the right price. Hence, market segmentation, timing (demand and supply management) and pricing are the three cornerstones of RM. Its successful implementation should benefit all the stakeholders. The provider of the service benefits in terms of increased yield and thus higher revenues, whereas the end-user has the option of taking advantage of reduced prices at non-peak times for the same service quality (Sanchez & Satir, 2005; Palmer & McMahon-Beattie, 2008).

Many industries have been reaping the benefits by employing the concepts of revenue management in their businesses (Wang & Bowie, 2009). In particular, the capacity- constrained service industry has been a popular area of research for many researchers for the last two decades. Predominantly researchers have applied revenue management in capacity-constrained service industries. For Example, Orkin (1988), Kimes (1989a), Brotherton and Mooney (1992), Weatherford and Kimes (2001), Burgess and Bryant (2001), Sezen (2004), Harewood (2006) have used the concepts of revenue management in the hospitality sector; Kimes (1989b) in healthcare; Goulding and Leask (1997) and Heo and Lee (2009) in theme parks; Hoseason and Johns (1998) in cruise lines; Hwang and Wen (2009), Noone and Mattila (2009), Guadix, Cortés, Onieva and Muñuzuri (2010), Padhi and Aggarwal (2011) in the hotel industry; Kasilingam (1997), Kuyumcu and Garcia-Diaz (2000), Gorin and Belobaba (2004), Luo and Peng (2007), Lindenmeier and Tscheulin (2008) in the airline industry; Bharill and Rangaraj (2008) in railways; and Tsai and Hung (2009) in Internet retailing. Although there is extensive literature available on applications of RM practices in various service industries, the literature is, however, scant in the field of RM under uncertainty for fixing of quota and price of hotel commodities (perishable commodities), where it is difficult to handle RM under stochastic market conditions, i.e., under uncertain customer demand, customer preferences, and commodity price. For example, the hotel industry faces problems while allocating different types of rooms – Standard, Deluxe, Junior Suite, Suite — to customers under various schemes, such as complimentary, honeymoon, season, summit, where hotel managements only have past information of the customers demand and market condition. Thus RM under uncertainty is an important field of investigation (Hwang & Wen, 2009; Morales & Wang, 2010; Padhi & Aggarwal, 2011), and many RM researchers have developed probability models or forecasting methods to reduce the level of uncertainty.

However, researchers have paid little attention towards competitive RM of the hotel industry under price uncertainty. Most researches in the past have assumed the hotel to be a price maker rather than a price taker under competition. Moreover, the hotel industry as an emerging business provides a typical pattern of competitive and dynamic pricing (Madanoglu & Brezina, 2008). The problem of RM in the hotel industry is complicated and challenging, not only because of a variety of commodity offerings, but also because of revenue uncertainty and complex cost structures (Padhi & Aggarwal, 2011).

For these reasons, this chapter aims to present a practical and flexible approach to optimise the competitive RM of the hotel industry under price uncertainty. The integrated real options approach developed by Tsai and Hung (2009) has been modified for the RM problem of Internet auctions to implement it in the RM of hotels. Since it is difficult to access the real option values of hotel rooms (commodities) and categorise them to poor, normal, and high prices commodities, the profit of each commodity was forecast, based on past trends using artificial neural network (ANN) methodology, and categorised accordingly. The analytic hierarchy process (AHP) methodology was adopted to assign quotas of each commodity (as a long-term goal), and the maximum expected profit (risk adjusted) of each commodity was used as a short-term goal to reap the multifaceted revenue performance under low risk and high expected profit setups (Reynolds & Braithwaite, 1997). Finally goal programming was used to fix the optimal quota and price of each commodity under each category for various schemes under uncertainty.

Dynamic revenue management framework with forecasted values

This chapter develops a forecasting approach to solve the dynamic pricing under uncertainty RM problem for a hotel. In each period, the hotel selects the optimal commodity mix with a fixed budget. For each commodity, the firm must fix prices (p) and number of bookings (x) having probability of cancellation of bookings (α) (Harewood, 2006; Morales & Wang, 2010). It can increase the quota of a commodity (such as high profit commodity, +1), keep it as it is (such as normal profit commodity, 0), or decrease the quota (such as for low profit commodity, -1). The hotels display the price of different rooms under different schemes. For setting up the price and number of rooms under different schemes, hotel management looks for the past trend of occupancy of rooms (demand), operating cost and service complexity associated with it and calculates the profit obtained under each category of commodities. The ANN based forecasting can help them to a better understanding and proper evaluation of the prices and quotas. In order to