

THE OPPORTUNITY FOR THE INTRODUCTION OF PREDICTION MODELS IN HOTEL MANAGEMENT

CASE STUDY HOTEL DEVA ***, DEVA, ROMANIA

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Abstract: *In modern hotel management, the need for prediction is acute. Hotel managers must make managerial performance projections for at least one year, based on the results of the previous year.*

Based on the performance indicators of hotel management, we have sought to create a prediction model that will guide management decisions for the period following the completed cycle.

Keywords: *hotel management, revenue management, performance indicators, predictive models in hotel management*

JEL Classification: L21, L83

1. Introduction

In today's large hospitality industry, a special place is occupied by hotel activity, which most supports and reflects the volume of the tourist activity, although certain categories of visitors (tourists) do not always resort to hotel accommodation.

Since the 1950s, hotel activity has become an important element of economic growth and societal development. Influenced by the economic development of a certain region, the beneficiaries of these services have primarily been businessmen and people on holidays.

On the one hand, the hotel industry's position and role are influenced by the economic development of the areas in which they operate; on the other hand, the industry influences the level of development of an area. Because the hotel industry mainly offers accommodation services, its role, together with the transport sector and other tourist services, is to ensure the appropriate infrastructure for tourism development. Accommodation infrastructure is defined by all relevant organisations as having the objective of satisfying the rest and food needs of visitors.

In order to organise and manage hotel business, the management of the organisation must take into account the following characteristics of the services they provide:

- Perishability of services: unoccupied or unsold accommodation cannot be stored and offered for sale in another period of time;
- Limited service offering: accommodation capacity cannot be modified according to market trends in the short term;
- Location of the accommodation unit: plays an important role in ensuring profitable occupancy;
- High operating costs: lead to the accumulation of high fixed costs that require a certain level of occupation to reach the critical point;
- Seasonal demand: imposes long-term managerial strategies to ensure as few variations as possible.

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In general, in the hotel industry, investors seek a quick return on invested capital, but these features make the hospitality industry the traits of being cyclical, highly capital-intensive and highly competitive. Thus, long-term investments are made in tangible assets that serve a hotel business with a relatively short life cycle. Worldwide, the life cycle of a hotel is not more than 30-40 years, and the business cycle is appreciated at 10 years. Generally, what determines this cyclicity is the economic factors of the area in which the hotel is located.

In this sense, that changes in the economic profile of an area act as a factor of influence on the hotel market after only 3-6 months is appreciated; however, each hotel's business will be affected differently and will have its own business cycle according to the plans and strategies of the management team.

The investments involved in the hotel industry are tremendous. The hotel industry is a major contributor of the capital required for the building(s), equipment and facilities. Together with wear, interest, rents and insurance, these expenditures turn into fixed costs. How profitable a hotel will be remains to be seen. However, all of these new units are financially supported by companies operating in other fields.

Investors in small and medium-sized hotel businesses hope that they will attract customers from the large hotel chains; if they are not immediately profitable, they do not consider it a problem. However, the period of time until the investments will become profitable can be quite long compared to a hotel's life expectancy, and the market is extremely competitive. At the end of each business cycle, some organisations, especially those that have not adapted to change, will exit the market.

The Romanian market is in a growing phase of economic advancement. Therefore, the accommodation business can be considered attractive to those who have the opportunity to enter this industry because the barriers to entry are high and protect those who are active in the market.

In this context, hotel management deals with all of the activities regarding the organisation, control and coordination, as well as with the planning of all of the hotel's activities for the efficient provision of services for clients. Hotel management is a discipline in which decisions are made for a future time period based on data collected in a past time period. It is a field in which management decisions are based more on the experience of decision-making factors, combined with results obtained in the past and conditioned by expectations for the future.

2. Research methodology

Within this academic paper, we propose an applied scientific study of practical nature, aiming to contribute to the application of hospitality management by offering new methodical solutions for maximising profit. Specifically, we seek to obtain a mathematical prediction formula applicable to hospitality management that contains all the performance indicators in the field. Thus, a general mathematical equation model, applicable to hospitality management, will be created whereby the required value of one or more performance indicators will be calculated in order for an objective (e.g. BEP) to be achieved.

3. Literature review

Income optimisation in the hospitality industry is the main objective of the research, and the subject proposed in this paper was first addressed by Philips (2005).

For Romania, a first step taken by the authors of the present paper, in the sense of a direct and specific approach of the proposed research topic, was to publish two specialised papers entitled *The Influence of Hotel Performance Indicators on Management Decision Making* and *Introducing a Predictive Model in Hotel Management*.³

³ Papers published in the *In Extenso* Magazine, edited by the University "1 December 1918" from Alba Iulia, on the occasion of the participation in the last two editions (2018 and 2019) of the student scientific session organised by the Faculty of Economic Sciences of the university; works were awarded with third place and first place, respectively.

The concept of revenue management is relatively new, which is why we find it rarely addressed in the foreign literature and much less in Romanian literature. Instead, we find another approach, namely yield management (Y.M.), which is close as a sphere of action, but not equal to revenue management.

In this sense, the Romanian authors Gabriela Stănciulescu and Olimpia State define *yield management* as “a conception, a way of approaching the maximisation of the profit based on the careful monitoring of prices and tariffs evolution and the way they are set, considering the actual sales and availability of the company”(Stanciulescu, G., State O.,2013).

The components of revenue management, namely the pricing of hospitality industry branches, the approach and importance, are extremely explicitly detailed by the authors of *Revenue Management for Hospitality and Tourism*.

Also, in the specialised literature, we have identified the primary indicators of hotel activity that are presented in this paper and that are in close connection with the subject addressed, respectively: Average Daily Rate – ADR, referred to as Real Average Rate of rooms; Revenue Per Available Room – Rev PAR; Occupation Degree – GO; Cost Per Available Room – CCD; Cost Per Room Sold – CCV; and Break Even Point – BEP.

4. The concept of revenue management – features and role

One of the most important components of hotel management is revenue management, which brings together all of the components for setting ideal fares for a certain period of time or at a specific point in time. Correct decisions in revenue management will decisively influence the final results of the managed objective.

“By applying Y.M. is aimed to determine the highest value of the tariff that can be charged within the limits of the available costs and capacities and, at the same time, to guarantee that all those customers who want to benefit of a certain product or service and are willing to pay the tariff can do it.” (Stanciulescu, G., State O.,2013).

Practically, Y.M. assures:

- Maximisation of the average profit for a product available based on the customers' expectations regarding the price and establishing the highest value that customers are willing to pay;
- The decrease of the demand seasonality, by transferring its surplus from the peak period to other time intervals.

Y.M. is based on the analysis and interpretation of the demand curve, which represents an expression of the relationship between price and demand. If, here, it is observed that yield management is, in fact, price optimisation, then revenue management is the global strategy based on analysis and projections that can be adopted by the tourism company, resulting in profit maximisation.

“Revenue Management is an art of predicting real customer demand over time, to determine the optimal price and availability of a product. Or, in simple terms, we can say to sell the right product, to the right customer, at the right time at the right price, thus maximising total revenue.” (Stanciulescu, G., State O.,2013).

A presentation similar to the international concept of revenue management, belongs to a professional in the field who works in the UK, and according to whom: "Revenue management is a technique used to optimize the revenues and benefits of a fixed but perishable inventory, such as rooms, conferences rooms, places in a restaurant or places in an airplane. The real challenge is to sell this 'space' to the right customer, at the right price and at the right time. We all know that a hotel room for example, if you didn't sell it today, you can't sell it tomorrow for today” (Gherghel O., 2013).

The concept started in the 1980s with the airline B.O.A.C. (today British Airways), which offered discount 'Early Bird' rates to generate demand and sell what they called “empty seats”

(Poelt, S., 2011). Robert Crandall, former president of American Airlines, continued to develop this experiment with demand forecasting, inventory control and overbookings. Due to a recession and the deregulation of airlines, low-cost airlines were born (Lee, A. O., 1990). Revenue management systems targeted the surplus of vacant seats with competitive prices to obtain a share of the market share of low-cost companies. Following this experiment, American Airlines revenues increased by 14.5% and profit by 47.8% in the following year.

These results have not gone unnoticed by managers in other industries. Robert Crandall met with Bill Marriott from Marriott International, and this is how this concept of 'revenue management' came to be used in hotels (Hayes, D. K., Miller, A. A., 2011).

Revenue management works if:

- A fixed amount of resources are available for sale;
- Sales resources are very perishable;
- Customers will pay different prices for using the same resources.

This model fits perfectly in the hotel industry because of its fixed amount of rental accommodation spaces, which are perishable and, due to the variety of customer segments, tourists will pay different rates for services.

If the fixed costs are high, then revenue management part becomes very relevant because once costs are covered, the additional revenue directly contributes to overall profit creation.

The effective differentiation of the market segments for a tourism business is vital in order to be successful with the application of revenue management. Most hotels have peak periods and periods when sales are not at the desired level, particularly hotels located in tourist destinations.

Customers are prepared to pay more for rooms with a great view, which are larger, non-trivial or even unique. In addition to the normal demand, other opportunities can be identified to generate an increase in revenue, such as organizing exhibitions, fairs, festivals or shows that take place in the hotel or in the destination where it is located, in addition to group bookings or higher capitalisation of local attractions. These all provide additional revenue management opportunities.

Closely related to the application of revenue management is the person designated for its implementation, the Revenue Manager (RM). The RM has the power to set, at any time, the optimal selling price of a room to reach the targets set in the management plan and can be the key decision-maker in reaching the Break Even Point (BEP)⁴ in key negotiation situations. The RM is directly subordinate to the General Manager (GM) and is in charge of the reservation department and the marketing department (in terms of tariffs). In the offers conceived by the marketing department or in other negotiations of the sales or reception department, the RM sets the tariffs, which can only be modified by the GM.

Thus, revenue management decisions are made by considering hotel performance indicators, results obtained and costs during a past time period .

5. Performance indicators in hotel management

Modern hotel management is based on well-defined performance indicators, which can create an overview of the financial results and which can determine future action models to reach clearly set objectives.

By calculating hotel performance indicators and room costs, an optimal management model can be created, which when transposed into practice will ensure the expected results.

In order to create the context in which predictions can be made regarding managerial performance in the field of tourism, in general, and in the hotel industry, in particular, the indicators specific to the volume of hotel activity are presented first. Most important, the following are considered:

1. TVC – Total income from accommodation

⁴ Break Even Point is the point on the balance sheet of a hotel where the expenses are completely covered by the revenue, in a given period of time (one year in general).

2. **TCC – Total accommodation expenses**

3. **TCV – Total rooms sold**

4. **TCD – Total rooms available**

5. **ADR – Average Daily Rate** is the income obtained on a room sold within a fixed period of time (generally one year) of the past. The calculation method of this indicator is as follows: $ADR = TVC/TCV$ within the set period.

6. **Rev PAR – Revenue Per Available Room** is the average income obtained on an available room (in the tourist circuit) in a fixed period of time (one year). $Rev PAR = TVC / TCD$ within the set period.

7. **GO – Occupancy** represents the ratio expressed as a percentage of the available rooms and the rooms sold within a set period of time.

$$GO = TCV / TCD \times 100$$

For the highest accuracy of GO calculation, rooms unavailable for certain periods are subtracted from the total number of rooms. GO is expressed in two forms, namely the Room Occupancy Rate or the Occupancy Rate. Due to the fact that, in the present, rare cases exist where accommodation is shared, for example: two individual tourists are accommodated in the same room, and because the units prefer to accommodate a single guest in the room, we will not use GO relative to the number of beds, an approach that is being used more by country level statistics (Lupu, N., 2010).

8. **Cost per room available (CCD)** represents the average cost of an available room (in the tourist circuit) per night during a set period of time. CCD is calculated by dividing the total hotel expenses (strictly the accommodation activity) by the total number of rooms in the tourist circuit in a period of time (one year in general). The calculation method is as follows:

$$CCD = \text{Total expenses accommodation activity (TCC)} / \text{total rooms available (TCD)}$$

9. **Cost per sold room (CCV)** represents the average cost of a sold room per night over a set period of time.

$$CCV = \text{Total expenses accommodation activity (TCC)} / \text{total rooms sold (TCV)}$$

10. **Break Even Point (BEP)** is the point in the balance sheet of a hotel in which expenses are completely covered by revenue in a given period of time (generally, one year).

Of course, other indicators are used in the analysis of the activity of a hotel, such as *the attendance rate, the rate of the hotel fix or the double occupancy rate* (Lupu, N., 2010), but these have not been analysed in this paper.

The decision-making process for setting tariffs. In a hotel, the fares are set starting from CCV, the cost per sold room, and CCD, the cost per available room. A period is taken as a reference model, usually the previous year, for which these two values can be calculated. These values are somewhat relative, being directly influenced by the level of occupancy. GO from the base year. If the GO was low, the CCV and the CCD were certainly higher, and vice versa. Depending on the occupancy level, GO of the previous period, estimates of income growth are determined. These can be of several kinds, depending on the management policy adopted, namely:

First situation – Investments were made in rooms

Generally, rooms are renovated at a minimum of five and a maximum of 10 years. These investments do not only aim to generate a higher price but are also made to increase the accommodation fare. If it was invested for this reason, it is known that the next year will have a higher tariff. Thus, the occupancy level can be negatively influenced.

Second situation – No investments were made in the rooms

It is clear that it will not be possible to go with a higher tariff except in special cases (for example, the Mamaia resort, where fares increase steadily from year to year). In this case, a higher GO will be needed to increase revenue.

Third situation – Major events

Depending on the major events in the life of the community where the hotel is located, special fares can be set. Thus, if there are scheduled events (symposiums, festivals, etc.) that can fully occupy the accommodation capacity of the locality, decisions will be taken to increase the price during the event.

Fourth situation – Seasonality

Hotels located in tourist resorts and even in urban centers can be victims of seasonality. Thus, in full season and, respectively, in tourist season, the fares will be set higher than in the off-season.

Fifth situation – Competition

Regardless of the above criteria, competition is an extremely important factor in setting tariffs. Using modern systems such as Channel Manager, competitive rates are consulted daily, depending on which tariff of the hotel in question is positioned.

The Revenue Manager is the one who must at all times set the optimum selling fare for the room. A correct decision is based on the principle that the hotel room is the most perishable commodity sold on the market. In contrast, at the supermarket, a tomato that remains unsold today may still be sold tomorrow.

For hotels, a room not sold today is already making a loss, because tomorrow it cannot be sold for the night just passed. The loss is equal to the cost per available room – CCD, under the conditions of occupancy equal to last year. Obviously, if this year's GO is higher, the loss on that night will be lower and vice versa; nevertheless, there will be a loss.

The ideal of any hotel owner is 100% occupancy, a situation very difficult to achieve over extended periods of time. The bottom line is that, given the failure to achieve a 100% GO, losses will exist!

However, these can be covered by the Average Daily Rate (ADR), an indicator that will have to take on the task of covering all the losses of the empty rooms at least one night. In this way, it is noted that the Revenue Manager must be extremely smart at obtaining at the end of the year an ADR high enough to cover or exceed BEP and, of course, to cover losses during periods of low occupancy.

For these reasons, the RM's decisions must be pragmatic and effective. He is the one who decides that at one point (one day), due to the extremely low GO, the room will be sold just below its cost – CCV, only to avoid losing the cost of the available room – CCD. Or, it can be sold at an extremely high fare to recover the loss from the low GO period.

Many hotel managers are convinced that if rooms are available, accommodation fares are too high. While a fair consideration, hotel managers should avoid falling into the trap of regularly selling at low rates, because they may face the paradoxical situation of having a high degree of occupation with GO close to 100% and, yet, failing to reach BEP. This result is due to the fact that with the increase of GO, the CCV and CCD increase relentlessly.

Here are additional reasons why the Revenue Manager's mission is one of the most difficult in the decision-making process in hotel management.

6. The influence of ADR, Rev PAR and GO indicators on revenue management decisions

The indicators ADR, Rev PAR and GO have a decisive influence on revenue management decisions. Based on these indicators, in coordination with CCV and CCD, optimal tariff setting decisions can be made.

However, these indicators are interconnected and interdependent. Changing one modifies the others. Thus, we have situations in which some indicators are very efficient, but they are eliminated by the other poor performers. Examples of possible situations:

- a) High ADR and low GO generate high CCD and the possibility of BEP failure.

b) High Rev PAR, low ADR and high GO generate high CCD and CCV and no BEP (small hotel case).

c) Small Rev PAR, low ADR, high GO and unpaid BEP (big hotels).

d) High Rev PAR, high ADR, high GO and unmet BEP – yes, this can happen, due to the increases in GO of CCV and CCD (small hotels where rooms are sold at high prices but not high enough).

e) Small Rev PAR, high ADR, low GO and no BEP.

Through these few examples, we have tried to emphasise the burden on the Revenue Manager's shoulders whose decisions determine whether the hotel will reach, exceed or undermine the BEP, and the final financial results of the hotel (speaking only of accommodation).

Excluding the atypical moments (festivals, symposiums, etc. that occupy much of the accommodation capacity of the area in which the hotel is located), the Revenue Manager must make punctual decisions or, for longer periods of time, consider the performance indicators from the previous year. Several types of decision strategies are established at the beginning of the year and which form an integral part of the management plan established by the General Manager and / or the Board of Directors, respectively:

- Strategy based on GO growth and decrease of ADR

In this strategy, BEP will be achieved and overcome by increasing GO, which from the RM's point of view can be achieved by reducing ADR. If the marketing programs are effective, a decrease in ADR may not be necessary as the increase of GO is sufficient. Alternatively, if investments have been made in the rooms, ADR can be maintained at least at the level of the previous year, following the increase of GO to cover the investments and reach or exceed the BEP.

- Strategy based on ADR growth

If the previous year produced a satisfactory GO, revenues could be increased by increasing tariffs, resulting in a higher ADR at the end of the year and GO at a similar level to the one from the previous year. If both are on the plus side, growth will be higher. If investments were made, ADR growth will be normal and is likely to be doubled by GO growth.

- Growth strategy based on Rev PAR

Less commonly used and with many variables, this strategy may result in higher ADR and lower GO or lower ADR and higher GO at the end of the period. This approach is quite risky and requires increased RM skills and frequent evaluation of financial results.

- Strategy based on ADR and GO growth

This strategy is ideal and can be the result of multiple factors: investments in rooms, increased tourist circulation in the area, efficiency of marketing programs, a high number of scheduled events, major corporate contracts, etc.

For a useful example of the influence of hotel performance indicators in the activity of a hotel chain, we present Unita Turism Holding SA, currently the second-largest hotel chain in Romania. Unita Turism operates the Deva Hotel, which is the subject of the case study addressed in this paper. The reference period is 2008-2016, using data that was provided to us by the company.

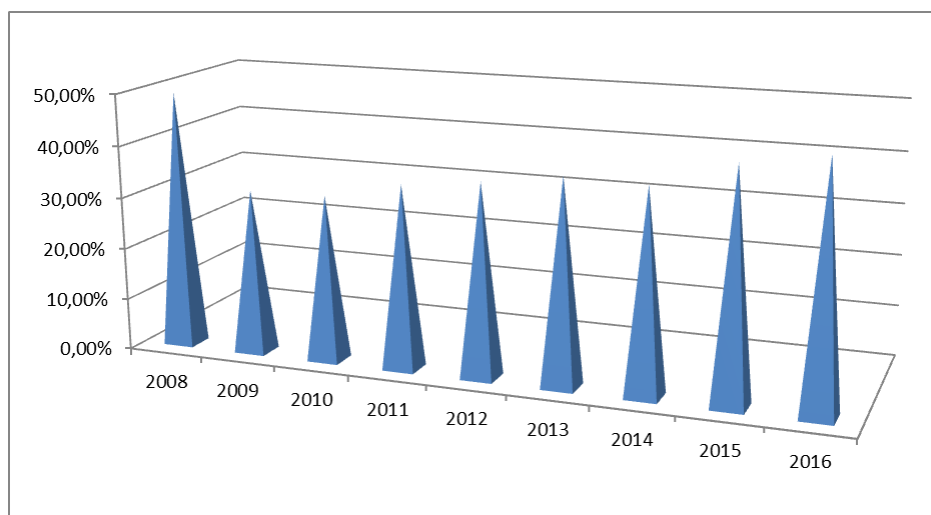


Chart no. 1 - Evolution of GO in the period 2008-2016

Source: internal documents U.T.H.

As can be seen, the economic crisis decisively influenced the occupancy rate with a collapse in 2009 and then a modest annual return. It took more than seven years to reach the 2008 level again.

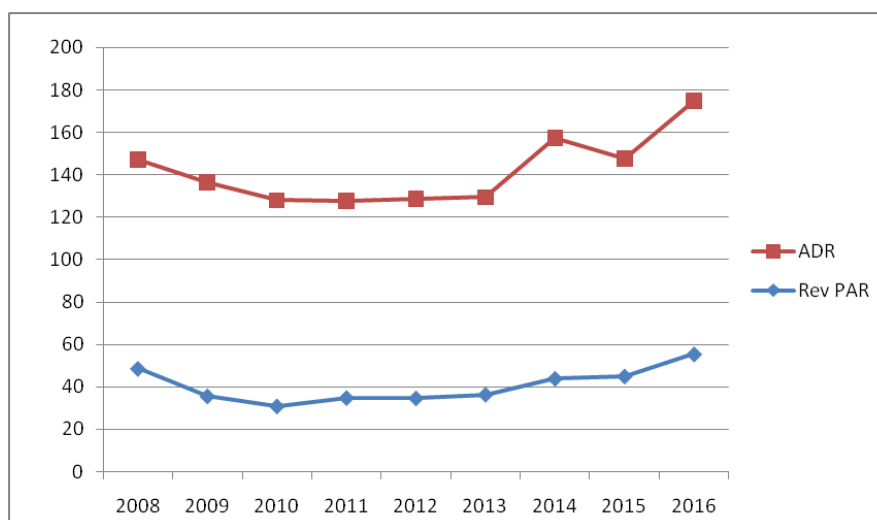


Chart no. 2 - Evolution of Revenue per available room (RevPAR) and Average Sales Rate (ADR) 2008-2016

Source: UTH internal documents

A similar evolution, produced by the economic crisis, reached the indicators RevPAR and ADR, which are interconnected with GO, as noted earlier.

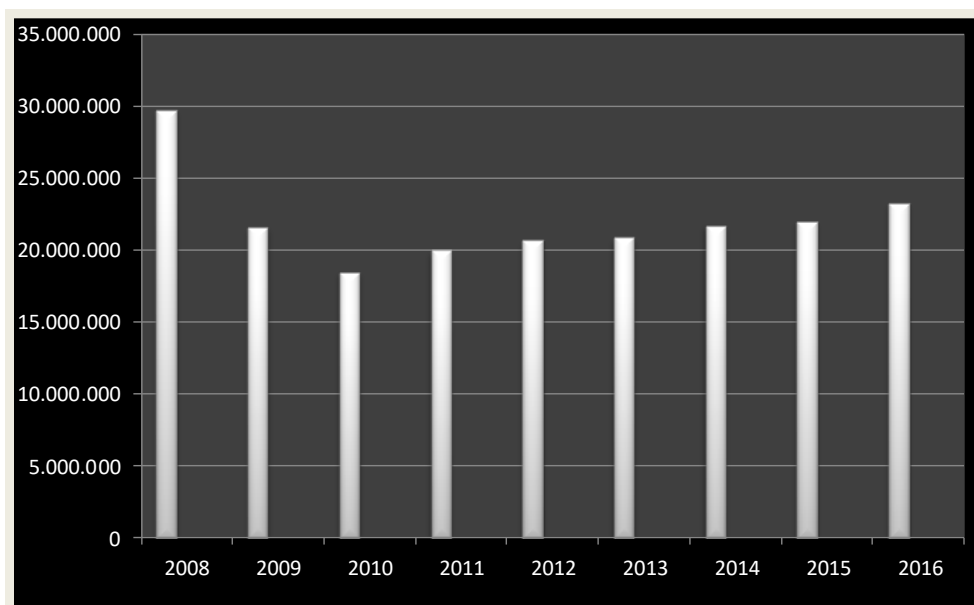


Chart no. 3 - Revenues between 2008-2016

Source: UTH internal documents

As can be observed, the interconnection of performance indicators is also reflected in the changes in revenues.

In conclusion, hotel performance indicators decide the financial results. They are interconnected, influence each other and are particularly important in revenue management decisions, which, in turn, determine the financial results of a hotel.

7. Predictive models in hotel management

The perfect decision in revenue management is the one that identifies the exact tariff at a certain moment or for a period of time to reach the proposed objective. As noted, the decision is somewhat relative and is based, without exception, on the performance indicators.

In the following, we will try to introduce prediction models, which will help the RM in making both short- and long-term decisions.

This approach to hotel management has innovative characteristics, which is why the specialised literature is quite poor both domestically and internationally.

In the following, we seek to obtain a mathematical prediction formula applicable in hospitality management that contains all of the performance indicators in the field. Obviously, it will be a pseudo-equation, given that performance indicators are variable and interconnected so that each influences the others. A pseudo-transcendental equation with few constant factors will be obtained.

However, by stabilizing $n-1$ variables, an unknown will be nominated whose value will be calculated by the proposed formula, offering a prediction of management decisions over a set period of time.

Specifically, with a number of " n " performance indicators and an " x " objective to be achieved, the value of the " a " indicator ($a \in \{n\}$) will be calculated – considering that the rest of the " $n- a$ " indicators will be constant – as necessary for " x " to be reached.

A general mathematical equation model applicable to hospitality management will be created whereby the required value of one or more performance indicators will be calculated in order for an objective (e.g. BEP) to be achieved.

Cyclical prediction formulas

The decision-making process in hotel management is laborious, requiring rigorous databases to be effective. In the decision-making process of hotel management, the only concrete data are the results of the previous financial year from which all the necessary data for a projection / prediction for the following year can be extracted, namely the value of the BEP indicator.

The premise of efficient management is at minimum the achievement of BEP. To achieve the BEP, the final results of the previous financial year can be schematically included in a mathematical formula.

Based on this formula, which has multiple variables, and by assigning more constants, prediction models can be created to ensure the performance of the hotel management.

Thus, starting from the fact that $BEP = \text{total expenditure} / \text{total income}$, we can conclude that BEP is reached when total expenditure = total income ($TCC = TVC$).

Now, we will use elementary mathematics to generate a larger equation, starting from the premise that:

$$TVC = ADR \times TCV$$

and

$$TCC = CCV \times TCV$$

results:

$$ADR \times TCV = CCV \times TCV.$$

As:

$$TCV = GO \times \frac{TCD}{100}$$

Then:

$$ADR \times GO \times \frac{TCD}{100} = CCV \times TCV.$$

However,

$$TCD = \frac{TVC}{Rev PAR}$$

Then:

$$ADR \times GO \times \frac{TVC}{Rev PAR} = CCV \times TCV \times 100$$

Or

$$\frac{ADR \times GO \times TVC}{Rev PAR} = CCV \times TCV \times 100$$

Therefore, the linear equation results:

$$ADR \times GO \times TVC = Rev PAR \times CCV \times TCV \times 100.$$

Thus, we have obtained an equation that brings together nearly all performance indicators in the hotel. Maybe it is improper to say equation, because all of the elements are variable, which is why the term prediction model is preferred.

Thus, based on this model that brings together the performance indicators, one can make predictions or decisions for a future reference period by setting constants and generating values for the remaining variable.

For example, it is established that for the next period the expenditures, ADR and Rev PAR will remain unchanged with the objective of obtaining a certain TVC. And, from the equation one obtains the necessary value of GO in order to reach the proposed objective. In the same way, the constants and the variable can be changed by obtaining a cyclic model that will generate the required value of the chosen variable.

This method will result in a calculation formula for each performance indicator taken into account:

$$GO = \frac{Rev\ PAR \times CCV \times TVC \times 100}{ADR \times TVC}$$

$$ADR = \frac{Rev\ PAR \times CCV \times TVC \times 100}{GO \times TVC}$$

$$RevPAR = \frac{ADR \times GO \times TVC}{CCV \times TVC \times 100}$$

As mentioned above, calculation formulas have been established for each performance indicator in hotel management. We emphasise that all these indicators are influenced by each other, so it is necessary to establish the performing indicators and keep them constant in order to obtain the necessary value the non-performing indicator.

8. Case study: Hotel Deva ***, Deva Romania



For the case study, we chose Hotel Deva ***, a hotel that is part of hotel chain Unita Turism Holding SA portfolio.

The Unita Hotel Chain - Tourism Holding (UTH) is the first domestic hotel chain to appear on the Romanian market. Josef Goschy, a German citizen who is originally from Romania, holds the majority number of shares with 99.80%.

He returned to Romania in 1990 and invested two million DEM in the insurance company Unita Asigurări through which, in 1998, he started investments in tourism.

In 2006, all of the companies acquired by Goschy merged into SC Unita - Turism Holding SA. In this way, Unita came to own at its peak in 2008 with 25 hotels and two camp sites.

Currently, UTH owns 13 classified hotels, three conservation hotels and two campsites. The hotel activity of UTH is divided into three main areas: business and transit tourism, leisure and spa.

*Short presentation of the Hotel Deva ****

Hotel Deva complex, representative image for Deva municipality, is strategically located on the main boulevard of the city and offers a double opening both to the most important administrative and financial institutions as well as to the cultural and historical area of the city.



The Hotel Deva is classified with three stars and has 122 rooms, arranged as follows:

- 58 modernized rooms, of which 25 rooms have double beds, 30 rooms have two beds and three triple rooms have a double bed and a sofa bed; equipped with air conditioning, internet, TV, cable TV, telephone, minibar, shower or bathtub, hairdryer.

- 31 rooms classified with the comfort level two stars, of which nine rooms have double beds, 15 rooms have two beds, four triple rooms have separate beds, two apartments and one room for persons with disabilities; equipped with TV, cable TV, telephone, minibar, shower or bathtub, hairdryer.

The hotel restaurant has the following dining areas: restaurant room with 150 seats and terrace of 16 seats; breakfast room with 40 seats and terrace 60 places and two terraces with 16, respectively 60 places at tables.

Hotel Deva *** also has the following conference rooms: Room 1 and Room 2, each with a maximum capacity of 50 seats in theatre arrangement, located at the mezzanine level. The surface area of each room is 60 sqm. The rooms have modular chairs, ventilation system, and there is also the possibility of arranging the U-shape room for up to 25 people.

The conference room facilities include: video projector, flipchart, projection screen, internet access, notebook.

*Volume of tourist activity of Hotel Deva *** in 2018*

From the financial data provided by the company for the year 2018, the values of the indicators specific to the activity of the Deva hotel are as follows:

Total income from accommodation – TVC = 1,072,234 RON

Total accommodation expenses – TCC = 1,236,031 RON

Occupancy rate – GO = 27.13%

Average sale price per room – ADR = 129.40 RON

Total rooms available – TCD = 33,945

Total rooms sold – TCV = 9,208

Revenue per available room - Rev PAR = 31.58 RON

Expenses per room sold – CCV = 134.23 RON

As can be seen, the year 2018 was not the happiest financial year for the Hotel Deva because the hotel was at a loss, with expenses higher than the revenues. These results reflect not only from the difference between TVC and TCC, but also from ADR and CCV.

Next, we will see, based on the established formulas, what revenue management decisions must be taken in 2019 in order to achieve Break Even Point (BEP).

Predictions of the values of the analysed indicators for 2019

1 Occupancy degree

We will first calculate what degree of occupancy (GO) will be required in 2019 for BEP to be achieved.

$$GO = \frac{\text{Rev PAR} \times \text{CCV} \times \text{TCV} \times 100}{\text{ADR} \times \text{TVC}}$$

$$GO = \frac{31,58 \times 134,23 \times 9208 \times 100}{129,40 \times 1.072.234}$$

$$GO = \frac{3.903.255.914,7}{138.747.079,6}$$

As a result, **GO = 28,13%**

Surprisingly, an increase of exactly 1% of the occupancy rate (GO), while keeping the rest of the factors constant, will ensure the achievement of BEP in 2019.

2. Average room sale fare - ADR

If GO cannot be changed, we must determine at what average fare it will be appropriate to rent the hotel room in 2019.

$$\text{ADR} = \frac{\text{Rev PAR} \times \text{CCV} \times \text{TVC} \times 100}{\text{GO} \times \text{TVC}}$$

$$\text{ADR} = \frac{31,58 \times 134,23 \times 9208 \times 100}{27,13 \times 1.072.234}$$

$$\text{ADR} = \frac{3.903.255.914,70}{29.089.708,42}$$

Calculated value: **ADR = 134,18 RON**

In case of constant maintenance of GO and other indicators, in 2019 an increase of the average room sale fare (ADR) from 129.40 RON to 134.18 RON will be needed to reach BEP.

3. Income per available room - Rev PAR

We turn to the hypothesis that the degree of occupancy GO and ADR remain unchanged. Let's see how RevPAR will have to evolve.

$$\text{RevPAR} = \frac{\text{ADR} \times \text{GO} \times \text{TVC}}{\text{CCV} \times \text{TVC} \times 100}$$

$$\text{Rev PAR} = \frac{129,40 \times 27,13 \times 1.072.234}{134,23 \times 9208 \times 100}$$

$$\text{Rev PAR} = \frac{3.764.208.269,50}{123.598.984}$$

Results the value: **RevPAR = 30,45 RON**

As can be seen, paradoxically, in order to reach BEP, in 2019 Rev PAR should fall. From 31.58 RON in 2018 to 30.45 RON in 2019. It may be a paradox, but mathematics never lies. And, if we analyse logically, given that the GO and ADR remain fixed compared to the previous year, Rev PAR, in the condition of keeping the same number of rooms in the tourist circuit, cannot vary.

But, in the analysed context from the Deva Hotel, where there was a loss in the previous year, the equation shows that a smaller Rev PAR is required to be able to reach the BEP, provided that the same values of the expenses and the other performance indicators are maintained.

It is both paradoxical and perhaps incredible, but mathematically a smaller RevPAR is required. This result can only be achieved by removing a certain number of rooms from the tourist circuit. In conjunction with the influence of GO and ADR, this approach will produce the desired result and is necessary because of the expenses on the rooms sold.

Of course, the possibility exists of drastically reducing expenses on rooms sold in order to avoid removing rooms from the tourist circuit.

The case study represents a hotel that was at loss. Obviously, in the case of a hotel that has profit, profit maximisation is desired. Using the formulas presented above, in the chapter on income, it will be multiplied by the desired percentage to obtain the income factor.

9. Conclusions

As can be seen, the introduction of prediction models in hotel management, in general and in revenue management, in particular, makes it easier for the manager to determine future strategies.

In the above equations, we have introduced only three performance indicators, but prediction models can be created for other indicators as well; we intend to do so in future specialised research.

It cannot be stated that without these formulas, revenue management decisions cannot be taken; they can, but in an empirical way.

In the model we have proposed, decisions can be made with mathematical precision by identifying the indicator that needs to be modified in order to improve financial results. A system of equations can also be developed so that at least two indicators are established at the same time.

The applicability of the results of this paper can be realised immediately. For dissemination, a web-based or mobile application can be created, which will be offered to revenue managers.

In this particular case, strictly referring to Hotel Deva ***, our suggestion is to try to increase the occupancy rate – GO, even by lowering the average room sale rate – ADR. Calculating margin, in which the decrease of ADR will not affect revenues, can be achieved by increasing the GO; in fact, this approach represents one of the revenue management strategies described above.

Expenditures must be reduced, despite rising utility prices; this reduction can be accomplished through a better human resources policy and by combining some services offered.

Likewise, a better revenue management policy will allow the hotel to stop its refusals of accommodation of some groups, which are not discounted, despite the low occupancy.

And, on the same note, during periods of low tourist influx – i.e. November-December and January-February, respectively – massive reductions in room rates can be made to ensure improved occupancy levels.

Similarly, a better marketing policy will produce better employment.

Undoubtedly, the present work can be perfected, and we intend to extend it through research that will contain all three typologies: fundamental, empirical and applicative.

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