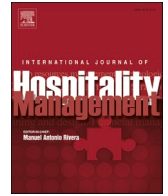




Contents lists available at ScienceDirect

International Journal of Hospitality Management

journal homepage: www.elsevier.com/locate/ijhm

The wheel of dynamic pricing: Towards open pricing and one to one pricing in hotel revenue management

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ARTICLE INFO

Keywords:

Open pricing
One to one pricing
Dynamic pricing
Hotel revenue management
Big data
Conceptual framework of pricing in hospitality

ABSTRACT

Dynamic pricing is at the core of hotel revenue management (RM). Big data technologies have facilitated information processing and enriched dynamic pricing techniques. One of the challenges in the sector relates to price personalization, i.e., how prices can be adjusted at the customer level. Using a qualitative approach, the study analyzes how dynamic pricing is currently implemented in hotel RM. By doing so, this research shows empirical evidence of the use of recent concepts in the industry like “open pricing” and identifies the opportunities and challenges of a customer-centric approach to pricing. From a theoretical perspective, the study may guide future research on pricing in hotel RM. Finally, this work also presents actionable insights for practitioners.

1. Introduction

The emergence of big data has reshaped information processing systems across industries. One of the most affected is certainly the hospitality industry (Talón-Ballestero, González-Serrano, Soguero-Ruiz, Muñoz-Romero and Rojo-Álvarez, 2018). Data is one of the most valuable assets in this industry. Big data technologies have transformed hotel information processing systems and offer great opportunities for revenue management (RM) (Erdem and Jiang, 2016). Pricing is a key strategic pillar of RM. In hotel RM, pricing allows practitioners to cater to different customer segments that may vary in the benefits they look for (e.g. tourists vs business travelers), their information search involvement (Lee, Bai and Murphy, 2012), and even their willingness to pay (Dolnicar, 2002). Big data technologies can therefore facilitate price discrimination at the customer level by integrating customer knowledge into pricing techniques through automation (Mariani et al., 2018).

The use of data to inform pricing has transformed revenue management systems (RMS), thus attracting the attention of both scholars and practitioners (e.g., Abrate and Viglia, 2016). More available data, coupled with information processing technologies, allows more dynamic pricing techniques, opening up new avenues for price optimization that point towards a more customer-oriented pricing (Noone, Enz and Glassmire, 2017; Vives, Jacob and Payeras, 2018). Reflecting this landscape, new approaches and terminology have emerged in the hospitality industry that academics have not adopted yet. For instance, the

term “open pricing” (OP) has become commonly accepted among industry practitioners (e.g., “Open Pricing, Hotel Revenue Strategy, Duetto, 2020) while it still lacks an academic definition. *One-to-one* or *customised pricing* are two additional examples (González-Serrano and Talón-Ballestero, 2020).

These terms reflect a shift in the industry towards price personalization. Price personalization can lead to better demand adjustments based on customers’ willingness to pay (value-based pricing approach). Literature on hotel RM suggests that pricing will be more effective when applied at customer level (e.g., Denizci Guillet and Shi, 2019). These works build up on the lifetime-value (LTV) approach to pricing, in which the rate customer pays matches his or her lifetime value to the firm (Noone et al., 2003). In light of these arguments, price personalization should be driven by both customers’ willingness to pay (value-based pricing) and the value of the customer or LTV. In this sense, recent works have shown the benefits of the joint adoption of customer relationship management and RM for price personalization (e.g., Peco-Torres, Polo-Peña, Frías-Jamilena, 2021). Despite its clear benefits, the application of personalized pricing in the industry is still scant. Given this mismatch between theoretical developments and practical application, we can see an emerging need for a comprehensive study that brings together practitioners’ views and academic theory (Vives et al., 2018).

This study therefore responds to recent calls for further research on dynamic pricing (e.g. Altin, Schwartz, and Uysal, 2017). Vives et al. (2018) provide insights on the topic, with a specific focus on the main

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<https://doi.org/10.1016/j.ijhm.2022.103184>

Received 13 July 2021; Received in revised form 21 November 2021; Accepted 9 February 2022

Available online 16 February 2022

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price optimization and customer segmentation techniques. However, the study consists of a critical literature review, thus overlooking the practitioners' views. Gaining insights from the industry is crucial to develop an up-to-date understanding of the recent developments of dynamic pricing. In light of these arguments, the objective of this article is twofold. First, the article reviews the main literature on dynamic pricing and aims to provide a clear and straightforward understanding of the evolution of these techniques in the hotel industry. Second, the article examines how these techniques are currently implemented by industry practitioners.

To this end, we present a review of the literature that follows a four-phase chronological structure. We also summarize this review visually in a conceptual model. By conducting a focus group analysis, the work then reveals the views of both international hotel chain managers and RMS suppliers. The findings provide a comprehensive understanding of recent conceptualizations used in the industry and shed light on the contemporary issues in hotel pricing.

2. Theoretical background

According to the organizational information processing theory (Daft and Lengel, 1986), information is one of the most important organizational resources. This theory assumes that organizations can reduce context-specific uncertainty through information processing. Information processing mechanism designs are effective, and associated with high performance levels, if they are capable of handling the amount and type of information that is required in a given problem context (Daft and Lengel, 1986, Huber 1990). The emergence of big data has challenged the way information is processed in organizations. Organizations now use information processing technologies that can reduce uncertainty by exploiting big data (Chen, Chiang and Storey, 2012). Big data tools are characterized, among other things, by the volume, variety and velocity of data that they can handle (Chen et al., 2012).

Organizations in the hospitality industry have witnessed an increase of information processing needs over time. The internal information typically handled by RMSs has become not sufficient to inform pricing decisions (Buhalis and Leung, 2018). The availability of context-specific information like competitors' prices, contextual and reputational factors (Abrate and Viglia, 2016; Masiero, Pan and Heo, 2016; Noone, 2016) has resulted in organizations currently managing a large and varied amount of data in real time (Wang, Heo, Schwartz, Legohérel and Specklin, 2015). The optimal use of big data for dynamic pricing purposes ultimately leads to enhanced RM performance (Buhalis and Leung, 2018). The next section presents the evolution of dynamic pricing in hotel RM.

2.1. Evolution of dynamic pricing in hotel RM

While there is not a well-accepted definition, scholars agree that dynamic pricing refers to the continuous adjustment of prices, according to demand, being the differences in price not related to the company's costs (McGuire, 2015). This practice allows companies to extract a greater customer surplus than the one resulting from the application of linear or single prices (Talón, González and Segovia, 2011). The availability of data has transformed dynamic pricing techniques, which have evolved from the narrow view of capacity control-based yield management with short-term approach, to the more encompassing and customer-centric view and a long-term approach (Altin et al., 2017; Vives et al., 2018).

The present study proposes a synthesis of the evolution of dynamic pricing that revolves around four dimensions. These dimensions are necessary to build a RMS from zero. Data, and optimization methods are the two dimensions that represent RM inputs (Baker, Eziz, and Harrington, 2019; Vives et al., 2018). The proposed model includes information processing systems as another dimension since the sophistication of the RMS also depends on the rigor of the information analysis (Xu,

Zhang, Baker, Harrington, and Marlowe, 2019). Finally, we include key performance indicators (KPIs) as the fourth dimension since these are the RM outputs that capture system performance (Baker et al., 2019). The synthesis comprises four historical phases. All the phases share a tactical nature based on capacity and price, except for the last one which has a more strategic nature based on customer value. These phases may not coincide in time across countries and/or businesses in the industry.

2.2. First phase of dynamic pricing in hospitality RM

In the early stages of hotel pricing, the information available for practitioners is limited to the internal property management system and the central reservation systems (Anderson and Xie, 2010). Prices are set according to historical demand, current demand and basic environmental aspects (e.g. hotel location). Spreadsheets and traditional RMS are the main information processing tool. In this phase, different tariff levels are set to accommodate demand from different customer segments (Talluri and van Ryzin, 2004). Physical (room type or room location) and non-physical (advance purchase, non-refundable) rate fences were set to avoid cannibalizing demand, i.e. customers who are willing to pay more are not tempted by low tariffs (Hanks, Cross and Noland, 1992). These traditional RM systems optimize availability capacity and length of stay inventory controls based on the assumption of independent demand (Noone, 2016). The bid price approach to inventory allocation is the most frequently used (IDeaS, 2005). This approach takes the value of the marginal unit of capacity to determine the lowest acceptable price (bid price) for the next booking. Only if the proposed price equals or exceeds the bid price, the booking is accepted (Noone, 2016). In this stage, the main KPI used is the revenue per available room (RevPAR). Other metrics, like the total revenue per available room (TrevPAR) and the gross operating profit per available room (GOPPAR), also become popular. Unlike RevPAR, that focuses on guestroom revenue, these metrics consider all sources of revenue within the hotel (TrevPAR) and the operative profit (GOPPAR). However, they are not commonly used by managers due to their complex calculation (Schwartz et al., 2017).

2.3. Second phase of dynamic pricing in hospitality RM

In this phase, rate shopping automates the collection of competitor price data from multiple distribution channels and its real time integration into RMSs (Noone, Canina and Enz, 2013), which results in a more effective dynamic pricing (Cross, Higbie and Cross, 2009). The rise of online travel agents (OTAs) brings a high volatility rate, that is mitigated with the introduction of parity policies (Demireiftci et al., 2010). Among these, the application of the best available rate (BAR) becomes the norm in the hotel market. Rates and discounts are established in advance, with a predetermined number of BARs for the year ahead that vary with demand. Later on, hotels start using the so-called "floating BAR" that consists of applying different BARs during the customer's length of stay (Talón et al., 2011). The sector clearly moves from inventory allocation to more dynamic price optimization methods that account for price elasticity of demand and competitors' price to determine the optimal tariff (Cross et al., 2009; Noone, 2016). It is also possible to analyze the hotel performance versus its competitive set through benchmarking tools such as STR reports (Haynes, 2016; González-Serrano and Talón-Ballestero, 2020). The main KPIs facilitated by STR and used in this stage are the market penetration index (MPI), that shows the behavior of the hotel with respect to the occupation within its competitive set; the average rate index (ARI), that indicates the performance with respect to average daily rate (ADR) by comparing it with the average prices of the competitors; and the revenue generation index (RGI), that is the combination of both indexes (MPI x ARI) and shows the performance of the hotel with respect to its competitive set (Talón-Ballestero and González-Serrano, 2011).

2.4. Third phase of dynamic pricing in hotel RM

2.4.1. "open pricing"

A greater volume of information enriches demand forecasting and pricing in this stage (e.g., online reputation, macro-economic data, industry data, customer data). Powerful cloud-based RMS are developed using big data technologies, which facilitates real-time decision-making (Applegate et al., 2015). Online reviews become more relevant for hotel choice (Anderson, 2012; Nieto-García, Muñoz-Gallego and González-Benito, 2017; Noone and McGuire, 2014). Therefore, online reputation insights (e.g. Reviewpro) now enrich RMS, contributing to its sophistication (Xu et al., 2019).

At this stage, the use of cross-elasticity price optimization results in each customer segment paying the highest price they are willing to pay (Duetto, 2019; Xu et al., 2019). Inventory allocation methods and price optimization methods are combined together into a single optimization method that is based on customer choice (Xu et al., 2019). The resulting optimization method (i.e. customer value-based optimization) takes customer perceived value of the service as the base price. New KPIs are considered to optimize performance. For instance, the net revenue per available room (NetREVPPAR), which accounts for the distribution costs and is easier to calculate than GOPPAR. Concerning online reputation, the quality penetration index (QPI) allows hotels to gain knowledge about their competitive positioning (Global Review Index my property / Average Global Index Total Market). In addition, pricing becomes more flexible by suppressing traditional price ranges. The industry starts referring to this approach as "agile pricing" or "open pricing". RM is still price centric; however, customization of offerings and discounts replaces conventional pricing. According to Baker et al. (2019), this stage represents a first step towards personalized pricing or "one to one pricing".

2.5. Fourth phase of dynamic pricing in hotel RM

2.5.1. "one to one pricing"

Academics agree that the future development of dynamic pricing will become more strategic than in previous phases (Viglia and Abrate, 2019). Customer value and customer life cycle will gain greater relevance (Noone et al., 2017). The synthesis of RM and customer relationship management will be synergistic and focus more on long-term customer value than on one-off benefits (Denizci Guillet and Shi, 2019; Peco-Torres et al., 2021; Noone, Kimes and Renaghan, 2003; Wang and Bowie, 2009). This integration will facilitate personalized offers (*attribute based pricing*) (Vinod, 2019; IDEaS, 2020) or personalized prices (one to one pricing) through the identification of customers (González-Serrano and Talón-Ballestero, 2020).

Smart data technologies and artificial intelligence will help processing all available customer information such as customer repurchase rate, reference prices and patronage behavior. This phase requires a deeper understanding of the customers' booking behavior (Cross, 2016), reference price (Choi and Mattila, 2017), and service perceptions (Cheng and Monroe, 2013). More importantly, price customization will require knowing the value of the customer to the firm and adapting prices accordingly (customer value-based and lifetime value (LTV)). New customer centric KPIs will be increasingly used, like the Total Hotel RM (THRM) that considers the management of all sources of customer revenue in a hotel, such as hotel restaurant, bar, spa, etc. Other KPIs, like the revenue per available customer (RevPAC) and the gross operating profit per available customer (GopPAC) will consider, in addition to demand, the customer lifetime value (Shoemaker, 2003). By integrating customer lifetime value into pricing, businesses will have an encompassing measure of the value of the expected customer future transactions. This enriched approach entails a move towards perfect price discrimination (Wang et al., 2015).

Due to the recent developments of strategic dynamic pricing in the hotel industry, the academic field is witnessing a scarcity of works on the

latest concepts. While some studies have investigated the use of big data for RM purposes (e.g. Buhalis and Leung, 2018), the topics of price optimization and, specifically, "open pricing" have received scant attention. More importantly, price optimization has been approached from a theoretical standpoint (Vives et al., 2018), thus overlooking the practitioners' view. Therefore, the present work aims to extend our understanding of "open pricing" and explore the applicability of "one to one pricing". The study methodology and subsequent analysis allow gaining empirical evidence to back up these concepts. Fig. 1 presents an integrated visual summary of the four phases explained above.

3. Methodology

The study adopts a qualitative approach. Since the study aims to gather professionals' perceptions, qualitative methods are suitable to elicit a more in-depth and honest response. The study follows Baker (2006) recommendations for carrying out a qualitative study in the sense of transparency, systematization and rigor of the process, member checking and careful consideration to ethical issues, confidentiality, superficial analysis and interpretation of results. Specifically, the study is designed to understand how RMS users (international hotel chain managers) interact with the system and their views on the recent developments of "open pricing". To enrich users' perceptions, the study also includes the point of view of RMS providers.

3.1. Data collection

Data is collected through focus group interviews. Focus group is a well know approach in tourism related literature, especially in those studies addressed to experts (e.g., García-Muiña, Fuentes-Moraleda, Vacas-Guerrero and Rienda-Gómez, 2019; Segovia-Pérez, Figueroa-Domecq, Fuentes-Moraleda and Muñoz-Mazón, 2019). The focus group includes twelve experts involved in RM implementation in the hospitality industry. This number fits with the ideal focus group size (between four and twelve) suggested by Krueger and Casey (2000). The focus group follows a structured way with one of the researchers acting as the moderator and leading the topics under discussion and the group dynamic (Morgan, 1996). The empirical context for data collection is the international hospitality industry represented by international hotel chains and RMS providers. Data is collected in Spanish and translated to English by a professional service. Next, back translation of each of the captions and themes in the study is conducted in order to confirm the equivalence of the translated items (Brislin, Lonner and Berry, 1986).

To ensure heterogeneity and diversity among participants, the study uses deliberate sampling. Deliberate sampling consists of selecting participants based upon a relevant characteristic (Patton, 1990). In this study, participants must have in-depth expertise and extensive professional experience in RM. The sample includes three managers of leading international RM system providers, eight senior RM directors working for dominant international hotel chains, and the country manager of a leading hospitality data provider. We present the detailed profile of participants in Table 1.

3.2. Thematic analysis

The empirical analysis relies on thematic analysis (Braun and Clarke, 2006; Morgan, 1996). Thematic analysis allows researchers to identify, organize, analyze and propose patterns of the relationship between themes (Braun and Clarke, 2006; DeSantis, Ugarriza, 2000). We adopt a semantic approach, therefore, the themes are identified within the explicit meanings of the data, and the researcher strictly focuses on what a participant has said or what has been written. The analytic process progresses from description, showing patterns in semantic content, to interpretation (Patton, 1990). The researchers analyzed the interview transcripts in order to identify emerging themes and sub-themes (Prayag and Ryan, 2011). The analysis was conducted manually, which enables

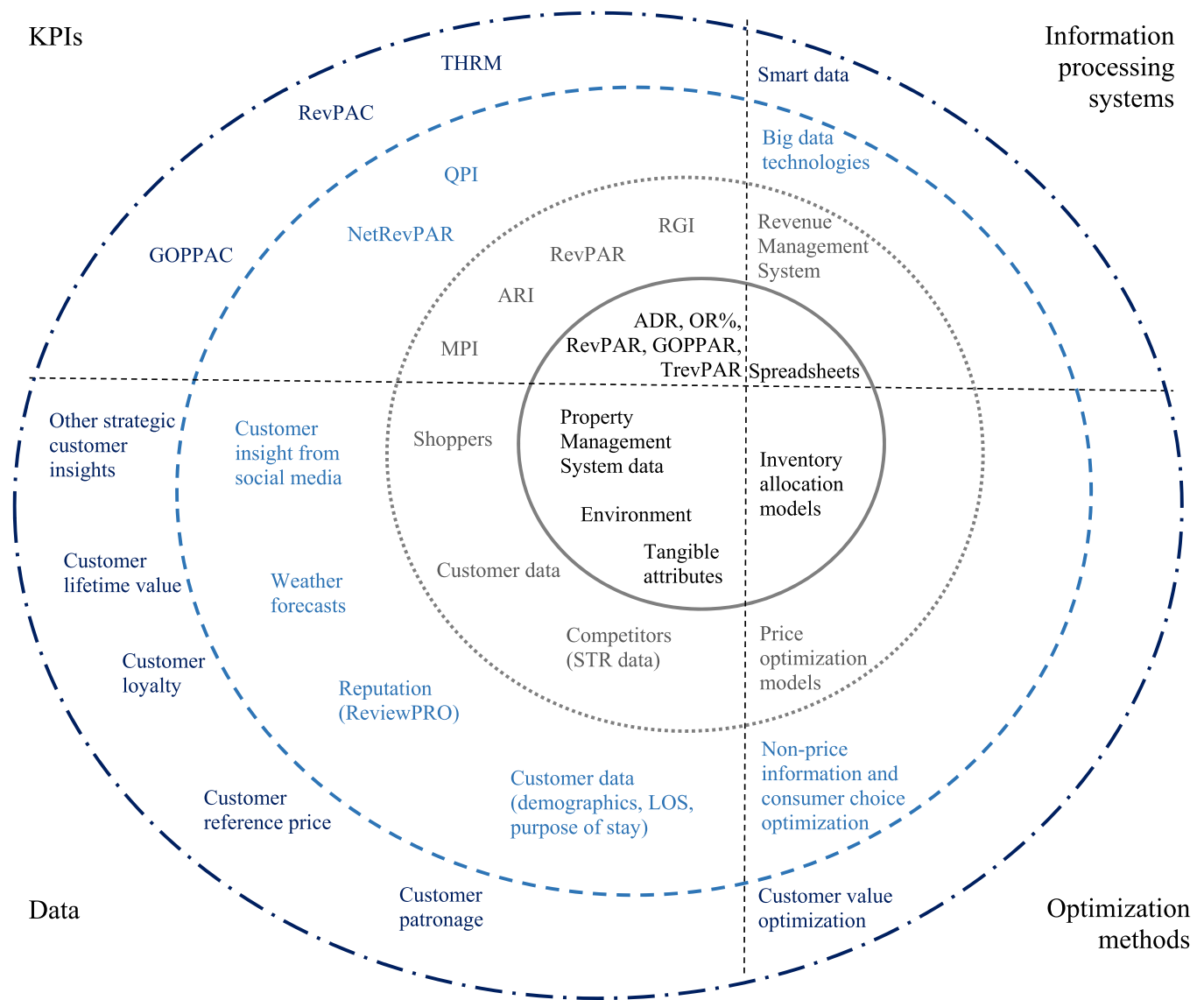


Fig. 1. Conceptual model of pricing in hotel RM.

an in-depth understanding of the phenomenon (Cheng and Wong, 2015). The coding scheme was unrestricted and was not content-specific (Miles, Huberman, Huberman and Huberman, 1994). Table 2 provides illustrative examples of how the coding was conducted. To ensure the reliability and validity of the findings, the study relies on continuous analysis to confirm that the themes did originate from the research data (Guba and Lincoln, 1989). Table 3.

4. Results

By following the six phases of thematic analysis proposed by Braun and Clarke (2006), the researchers identified six themes. Fig. 2 illustrates these themes that are discussed further in the following subsections.

4.1. Open pricing concept

Participants stress the relevance of OP and their insights contribute to the development of the following conceptualization. OP consists of “a sophisticated discrimination technique in which there are no rate ranges and price recommendations are offered in real time”. The optimization is only based on price and occurs individually per night. This has made it

possible not to close rates with restrictions on OTAs and has improved hotel positioning on them. In addition, there are no minimum stay restrictions, since OP optimizes the days individually, so there is always availability and demand is controlled just with the price. Discounts are flexible depending on occupancy.

Compared to other optimization approaches, OP allows prices to match the last room value (LRV), that is the maximum price associated with the last available room. Instead, the bid price approach considers a predetermined BAR that exceeds the LVR.

Despite some studies portraying that OP adopts a customer-centric perspective (Baker et al., 2019), our results point out that practitioners still indicate that optimization is mainly linked to revenues. However, OP entails a tighter adaptation to demand since there are infinite price options and it allows managers to change the application of supplements between room types without closing any availability.

Finally, OP can be successfully applied to business clients via dynamic discounts. The specific products or services subject to OP will depend on the company’s marketing strategy.

4.2. Open Pricing impact

The experts agree on the positive impact of OP on revenue, especially

Table 1
Profile of participants.

Participant	Professional role	Company	Years of experience
P1	Manager	RMS provider (1)	+ 20
P2	Manager	RMS provider (2)	+ 20
P3	Manager	RMS provider (3)	+ 20
P4	Chief Commercial and RM officer	International hotel chain	+ 20
P5	RM officer	International hotel chain	+ 10
P6	RM officer	International accommodation provider	+ 15
P7	Regional commercial and RM director	International hotel chain	+ 10
P8	Regional commercial and RM director	International hotel chain	+ 10
P9	Senior director of RM	International hotel chain	+ 20
P10	Development and Planning Senior Director of RM	International hotel chain	+ 15
P11	Director of RM	International hotel chain	+ 20
P12	STR Country Manager	STR	+ 15

Table 2
Illustrative coding example.

Themes	Subthemes	Illustrative coding examples
Open pricing (OP) concept	To close availability and channels	"[...] With open pricing (OP), minimum stay restrictions do not exist, since OP only optimizes the days individually, so there is always availability unless the hotel is physically full, and demand is managed only with price [...]"
OP data	Data collection	"[...] There is a lot of confusion in the market because it seems that all RMS incorporate a lot of data sources to their algorithms, when in reality it is not like that, they simply incorporate widgets to visualize that data [...]"
Future	Smart data	"[...] not all data is actionable, it has to be segmented, it has to be polished and the revenue managers are at that point where they will be able to have that actionable data, that Smart Data. [...]"
One to one pricing	Customer value	"[...] One to One pricing not only implies knowing the customer's willingness to pay in real time but also knowing the value that the customer has for the company [...]"

on RevPAR. One possible explanation is the removal of price ranges, which results in a higher number of customers who can find the price that they are willing to pay. Many authors have already shown the significant role of dynamic pricing strategy in increasing hotels profit and customer value (e.g., Abrate, Nicolau and Viglia, 2019; Anderson and Xie, 2016). The experts also point out that the application of dynamic pricing to corporate accounts benefits both clients and hotels.

4.3. Open Pricing data

The most recent RMSs rely on big data technology which aids in the integration of a high volume of structured and unstructured information in real time for the purpose of demand forecasting (Haynes, 2016; Mariani, Baggio, Fuchs and Höepken, 2018). This information includes historical and current reservation data, competitors' real time rates (from rate shopping) and historical rates (STR), and online reputation data. Some RMS also include flight information, aggregated future demand, group rates, weather information, and web shopping regrets and

Table 3
Open Pricing Concept analysis.

OP CONCEPT	No rate ranges & real time price recommendations	"[...] OP means being able to set the price in real time for your product without limitations. In our industry, this was not done until recently, mainly because we did not have the technology to allow it and the barrier was mainly the hotel management systems, which often had to have a pre-established price scale and you moved prices from one to another. Intuitively it doesn't make sense, and also you are potentially not capturing opportunities by not having the price that a customer is willing to pay, so the OP is to be able to set your prices without limitations. [...]"
	Price based optimization & hotel position on OTAs improved	"[...] However, with OP, the restriction of one specific night at a promotional rate does not close the possibility of booking the rest of the stay. Instead, the discount is reduced up to a minimum for the night of the restriction. In other words, the optimization is only based on price and occurs individually per night. This has made it possible not to close rates with restrictions on OTAs and has improved hotel positioning on them. [...]"
	No fences: no minimum stay restrictions & demand is controlled just with the price	"[...] With OP, what does not exist are minimum stay restrictions, since it only optimizes the days individually, so there is always availability (unless the hotel is physically full) and demand is controlled only with the price [...]"
	Dynamic pricing across tariffs (business, loyalty programs), discounts and distribution channels.	"[...] once you adopt OP, the type of product that you want to apply dynamic pricing depends on the hotel marketing strategy. There are hotels that only apply dynamic pricing to BAR and some specific discounts, others exploit dynamic pricing further, by applying it to room types, business clients and even loyalty programs [...]"
	Infinite price options	"[...] With OP, the pre-payment discount rate would be available and the discount is flexible depending on occupancy. For instance, 12% discount if occupancy is 80%, 8% if occupancy is 90% and no discount when there is full occupancy. This way, room-rate availability is not as restricted as before [...]"
	Changing the application of supplements between room types without closing any availability	"[...] What we did was to offer OP to B2B by introducing the Open Corporate Rate. From then on, we do not go for as many dynamic rates as before with businesses (i.e., dynamic corporate rate). Instead, we offer a dynamic rate discount range of 8-25%, and the RMS optimizes that specific discount [...]"
		"[...] These RMSs offer the hotel continuous price recommendations; for example, Duetto optimizes the price at least three times a day but comes with the possibility of optimization as and whenever required [...]"
		"[...] With a bid price approach, a reservation is accepted provided that the price is higher than the lowest class price which is pre-set in advance. With OP, the price is extremely flexible and adapted to demand [...]"
		"[...] RMS usually focuses on the type of room with the highest capacity, the double room usually, but what about the suite, what about the junior suite?, the demand for these kind of room may be different from double room. These rooms can also be used and don't always have to come with a fixed supplement based on the double, so this concept also has to be applied to the total flexibility in room types [...]"

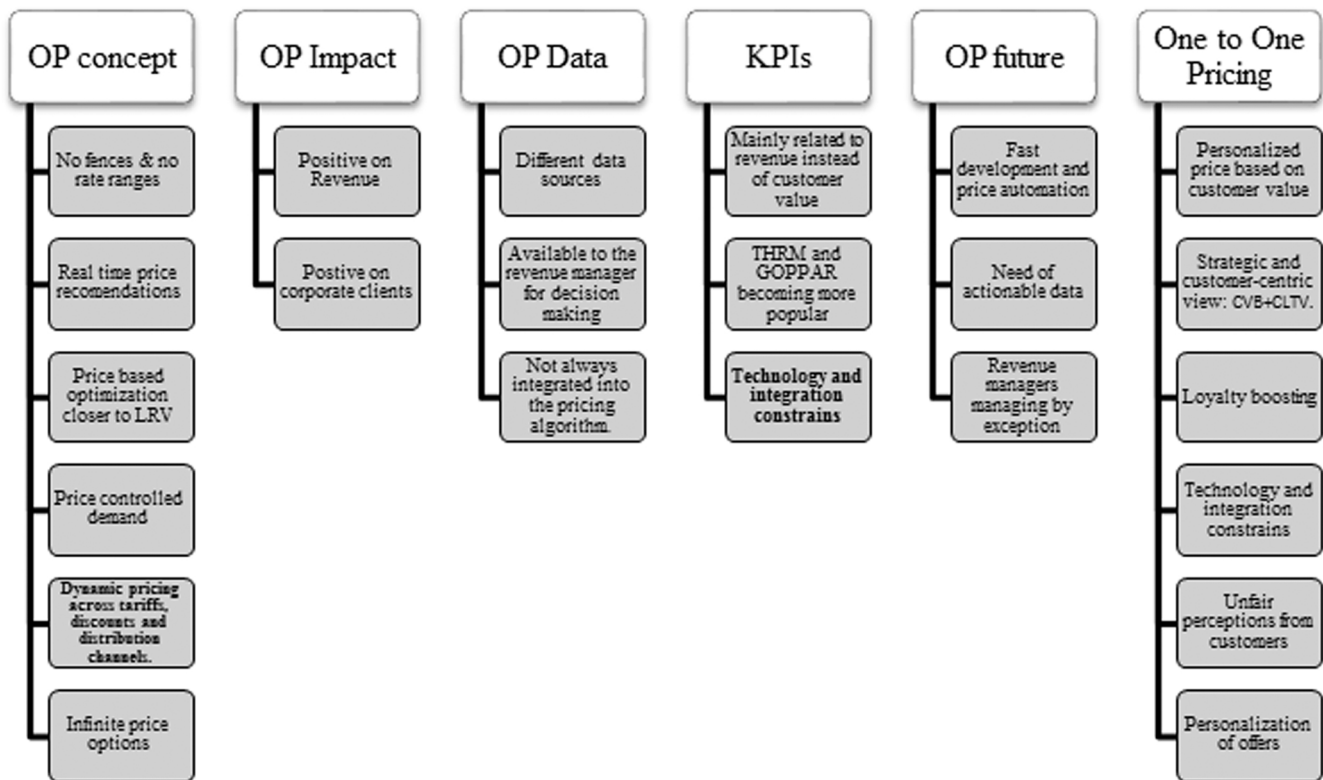


Fig. 2. Key themes.

denials (Cetin et al., 2016). According to the experts, this second set of data is often available to the revenue manager for decision making rather than integrated into the pricing algorithm (i.e. the revenue manager asks the RMS to enter the following rule into the system: if flight occupancy is 80%, the price increases by 2%). There can be two reasons for this lack of integration: one is that it is costlier for RMS and the other is that there is certain information, that due to different changes in demand and company strategy, hotels prefer to handle directly.

4.4. KPIs

The experts state that the most common KPIs for practitioners mainly relate to revenue instead of customer value. They agree that THRM is becoming more popular in the industry but there are doubts as to the degree of actual application. The same can be said of the gross operating profit per available room (GOPPAR). This is often related to (1) the constraints of technology or (2) the perceptions that it is not relevant for the hotel strategy.

4.5. Open Pricing future

Although OP is still in its early stages, the experts predict a fast development linked to the advance of technology (e.g., artificial intelligence). The full integration of available data into pricing algorithms is essential to optimize the OP performance. RMS have to be able to provide actionable data and thus avoid the accumulation of unmanaged information, which is one of the biggest problems nowadays. RMS will benefit from task automation, allowing revenue managers to focus on strategic decision making and “managing by exception” (Duetto, 2019).

4.6. One to one pricing

The development of OP is moving towards the concept of one to one pricing. Conceptually, one to one pricing integrates each individual

customer’s buying pattern and preferences into pricing. By doing so, hotels can offer a personalized price based on how valuable the customer is for the business. Therefore, one to one pricing involves a more strategic and customer-centric view than OP. From the customer perspective, prices resulting from one to one pricing are closer to their individual willingness to pay (customer value-based). From the business perspective, one to one pricing accounts for the customer lifetime value, which promotes long-lasting relationships with the customer. Optimizing RM according to the customer lifetime value instead of revenue triggers a more strategic and long-run approach to pricing that can boost customer loyalty.

Technology issues like data constraints and lack of integration, coupled with the unfair perceptions held by customers are the key factors preventing the full application of personalized pricing. Unfair perceptions could be mitigated by the application of personalized pricing via loyalty programs. This way, prices would not be disclosed publicly but each customer would get their personalized price. Another viable alternative could be the personalization of offers, that is, a personalized experience (e.g., choosing the amenities in the room), instead of prices what has come to be known by the industry as *attribute based pricing ABP* (Vinod, 2019; IDeas, 2020).

5. Discussion

Our findings reveal an ongoing transformation of traditional dynamic pricing that is aid by the availability of big data and sophisticated information processing tools. Industry practitioners agree that these tools (i.e. RMSs) allow a more customer-centric dynamic pricing or “open pricing”. Building up on practitioners’ views, this study delineates the concept of OP: open pricing can be defined as a “dynamic pricing approach that consists of a sophisticated discrimination of prices based on the demand fluctuation, supported by big data-led RMSs, which occurs in real-time without pre-set price ranges and fences”. In addition, our findings identify the main benefits of OP. These benefits relate to the application of dynamic, demand-based discounts and supplements that

eliminate the use of fixed percentages over/under the BAR. To the best of our knowledge, this is the first study that reveals the specific features of open pricing, thus addressing a key research avenue identified in previous studies on dynamic pricing (e.g., Baker, 2019).

According to the experts, implementing an OP strategy does boost revenues. This finding reflects that effective information processing is associated with high performance levels as the information processing theory suggests (Daft and Lengel, 1986). This idea is also in line with empirical evidence gathered in previous works (Abrate et al., 2019). OP is certainly more dynamic compared to other pricing approaches, which explains its greater efficiency for revenue maximization. Compared to traditional RMS, OP-based RMS excel at data gathering and integration. It is important to note that despite being available to revenue managers for decision-making, some of these data do not feed pricing algorithms yet. Instead, revenue managers adopt this information to set ad-hoc pricing rules. While big data-driven RMS have the technical capability of setting prices autonomously, the reality is that managers still supervise every stage of the pricing process (Egan and Haynes, 2019). This is partly due to a lack of trust in big data-driven RMSs, resulting in managers putting their personal insights upfront in the decision-making process. Therefore, our findings suggest that customer-centric pricing strategies are still scant in the industry. Table 4, Table 5.

Finally, this study unveils that one to one pricing has a clear focus on customer knowledge. As a customer-centric approach, it entails both tactic and strategic advantages. First, from a tactical perspective, it offers a better adjustment of prices to the individual customer's willingness to pay (customer value-based). Second, it accounts for the customer lifetime value from the business perspective (strategic). Despite these advantages, its implementation is still at its infancy in the hotel industry. Practitioners indicate several factors that explain this. On the one hand, many agree on the technological barriers (e.g., customer identification at booking). On the other hand, industry practitioners report customers' fairness concerns. Specifically, they state that customers may hold unfair perceptions related to price differences. When these differences benefit the business, fairness issues arise (Choi and Mattila, 2009; Xia, Monroe and Cox, 2004). To tackle this, hotel managers use personalization of offerings or *attribute based pricing* (e.g. favorite amenities, personalized experience) instead of price personalization. Loyalty programs may become an effective vehicle for the implementation of one to one pricing (Koo, Yu and Han, 2020). Table 6, Table 7, Table 8.

6. Conclusion

6.1. Theoretical contributions

The use of big data technologies has been shown to improve information processing in the hotel industry. In line with the information processing theory (Daft and Lengel, 1986), the findings suggest that more efficient information processing leads to enhanced revenue management performance. RM systems supported by big data have facilitated the application of "open pricing". The present work provides the first academic definition of this concept. The paper defines open pricing as a "dynamic pricing approach that enables a sophisticated discrimination of prices, supported by big data-led RMS, which occurs in

real-time without pre-set price ranges and fences". The main advantage of OP is a greater adaptation of prices to both demand and last room value. Compared to traditional price discrimination, we observe five major differences:

- (1) Real time price setting, that is, rate ranges are not set in advance but determined dynamically without fences.
- (2) Prices are closer to the last room value and more aligned to customer's willingness to pay (value-based pricing) since OP integrates customer information.
- (3) Optimization takes place individually per day and room type without fences. Restrictions to OTAs are released and hotel positioning on OTAs improves.
- (4) Increased dynamism (i.e., infinite price points) that does not only refer to price but also to discounts, supplements and fees.
- (5) Dynamic pricing across tariffs (e.g., BAR, business rates, loyalty programs) and distribution channels.

In addition, building up on information processing theory and literature on dynamic pricing, the study offers a summary of RM-related terms that nurture the academic field. By integrating the four key elements of dynamic pricing (KPIs, forecast insights, IT systems and optimization methods) into a single conceptual model, this work sets the basis for future theoretical developments. Specifically, this model facilitates a synthetic visual representation of the evolution of dynamic pricing. The study clearly reveals a tendency towards one to one pricing, thus delineating the forthcoming stage of dynamic pricing in the hotel industry.

Finally, despite numerous studies on hotel RM, academics have recently highlighted the need for further empirical research investigating how RMS users interact with these systems (e.g., Baker, 2019). Our study addresses this issue by bridging the gap between practitioners' views and the development of dynamic pricing models in the literature. More specifically, our findings provide a deeper understanding of the features that RMS users most value as well as those that they feel are still missing. Therefore, this work represents a first step towards the collaboration of the hotel sector and RMS developers with academics in order to understand the requirements and needs of the sector.

6.2. Practical implications

From a practical perspective, the study facilitates the understanding of new trends in pricing and identifies key challenges for revenue managers and industry operators. RMS providers are leading the era of OP (e.g., Duetto, 2019). Our findings will benefit those interested in either implementing or improving OP techniques in their businesses, an investment that will boost revenues. Some challenges remain open for practitioners. Data access, integration, automation in price decision processes and customer culture are some of them. RMS providers should refine their solutions in order to provide actionable data and avoid the accumulation of unmanaged information. In line with this, integrating new technologies like artificial intelligence into RMS will be crucial.

More automated RMSs will allow revenue managers to focus on

Table 4
Open Pricing impact analysis.

OP IMPACT	Positive impact on RevPAR and other figures	"[...] we have also found that hotels that move from a fixed rate structure to an OP generate more RevPAR than before [...]" "[...] after three years using OP, the company had an increase of 8.5% in (RevPAR), a 4.9% in (ADR) and a 3.4% growth in occupancy [...]"
	Positive impact on corporate clients	"[...] applying OP to corporate clients in our chain was one of the greatest successes in our marketing strategy [...]" "[...] usually, the corporate segment has fixed negotiated rates attached to it which are not yieldable, and which generally have a fixed discount on the BAR (Best Available Rate). The systems that offer open dynamic prices give the possibility of introducing a discount range in the corporate rates, which in the case of ..., for example, for a fixed discount of 10%, the range with OP can currently fluctuate from 8-25% depending on demand. In other words, the OP enables price dynamism in corporate rates. Companies also benefit from these agreements. In fact, all corporate accounts in this chain have introduced dynamic pricing are very satisfied with the outcome[...]"

Table 5
Open Pricing data.

OP DATA	Different data sources available to the revenue manager for decision making	<i>"[...] our RMS integrates property management data (historical and forecasted), competitors' prices, online reputation and market demand in the algorithm. There is a lot of confusion in the industry because lots of data sources feed the RMS. However, the reality proves this is wrong. RMS provides a tool to visualize all these data but the algorithm does not necessarily include all of them [...]"</i>
	Not always integrated into the pricing algorithm	<i>"[...] the RMS we use for demand forecasting incorporates hotel data from historic records and "on the books" data. Hotel web traffic data is only considered to a limited degree. Other information like incoming flights is considered just for reporting purposes [...]"</i>

Table 6
KPIs.

KPIs	THRM and GOPPAR becoming more popular	<i>"[...]THRM is becoming more popular in the industry. We can see a clear tendency towards the use of GOPPAR given that food and beverages' revenues come with a different margin compared to rooms. TREVPAR presents some limitations. For example, the homogenization of ratios in restaurants and those related to spa, golf and other facilities. [...]"</i>
	Mainly related to revenue instead of customer value	<i>"[...] The most frequently used KPIs are ADR, OCC, REVPAR, Room nights, GOPPAR, NETRevPAR, TREVPAR (total revenue per available room) or THRM [...]. In restaurants, we also have Revpash (revenue per available Seat Hour). For conferences, Revm2 or REVPAAM (revenue Per Available Square Meter). Regarding the competitive set, we have MPI, ARI, RGI and BQI" [...]"</i>
	Technology and integration constraints	<i>"[...] we are working on the technology surrounding our RMS with the purpose of optimizing prices according to the total profit across segments, we see that is the way to go. The main constraints are the technology and corresponding integrations to make the system works [...]"</i>

strategic decision making and “managing by exception”, while ensuring that the right data are powering the right system (Millauer and Vellekoop, 2019). As the industry slowly recovers from the impact of COVID19, the automation of RMS based on artificial intelligence will be more important in order to better respond to uncertain and volatile environments (González-Serrano, Talón-Ballestero, Muñoz-Romero, Soguero-Ruiz, Rojo-Álvarez, 2021). An effective alignment of prices to customers’ valuations will be key for the future performance and sustainability of the sector.

6.3. Limitations and future research

The study is not without limitations. First, it is important to note that the proposed stages of dynamic pricing may not coincide in time across countries and/or business in the industry. Therefore, the findings should be regarded with caution when extrapolating any conclusion to different geographical areas or different industries (e.g. airlines, peer-based services). Second, the findings come from a single focus group study. Focus groups are an efficient way of gaining rich insights on a certain topic but might lead to biased responses (Maxwell, 1992). Future research might

Table 7
Open Pricing future.

OP FUTURE	Fast development and price automation	<i>"[...] so where I think we are going is towards that world where there has to be an integration of the data by the pricing decision making processes. Technology is fundamental to be that facilitator since it is not sensible to use an Excel spreadsheet when there are so many sources of information that can be explored in an efficient way. And this will take us to a new era of price automation where some hotel chains, hotels or systems are already doing it with less or more success [...]"</i>
	Need of actionable data	<i>"[...] not all data is actionable, it has to be segmented, it has to be polished and the revenue managers are at that point where they will be able to have that actionable data, that Smart Data. [...]"</i>
	Revenue managers managing by exception	<i>"[...] technology will help revenue managers to automate complicated and repetitive tasks to focus on managing by exception, or focusing less on pulling pricing levers and more on building strategies to capitalize on their most compressed days [...]"</i>

complement these results by running in-depth interviews with key informants.

Another future research avenue regards to testing the implementation of OP quantitatively. An investigation of the impact of OP on revenues would enrich these results. Another avenue for further research relates to the advance of optimization models that account for customers perceptions of the value of the service. Similarly, future developments of one to one pricing could explore the operationalization of customer lifetime value pricing, as well as the integration of this approach into a long-term dynamic pricing strategy. Finally, since the data collection for the study took place in 2019, right before the COVID pandemic, it would be interesting to extend the present study by retrieving more recent data to explore the effectiveness of RMSs when demand is constrained by external factors.

CRedit authorship contribution statement

Pilar Talón-Ballestero: Conceptualization, Formal analysis, Investigation, Resources, Project administration, Supervision, Validation, Visualization, Writing – review & editing, Data curation. **Marta Nieto-García:** Conceptualization, Formal analysis, Investigation, Resources, Software, Supervision, Validation, Visualization, Writing – review & editing. **Lydia González-Serrano:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Supervision, Validation, Visualization, Writing – review & editing.

Appendix

Focus Group Questions

1. How is RM changing with Big Data technology?
2. What does Open Pricing really consist of? what impact does it have on RM if a company implements it? how can the OP be implemented in a company? what requirements are necessary? what limitations does it have? is this technology accessible to all hotels?
3. Is it true that Open Pricing does not close channels for sale?
4. What is the difference between bid price and open price?
5. What performance KPIS do hotels manage?
6. Why is Total Revenue Management not yet used in the hotel industry, and do you see it being used in the future?
7. With regard to data, what data do these systems handle, apart from the historical data on occupation and real demand, pick-up,

Table 8
One to One Pricing.

ONE TO ONE PRICING	Personalized price based on customer value	<i>"[...] one to one pricing is not only about knowing consumers' willingness to pay, but also about understanding the lifetime value of that specific customer to the firm [...]"</i>
	Strategic and customer-centric view	<i>"[...] The customization we are talking about today is impossible to achieve. Now, what are the big chains doing? You are already seeing what Intercontinental is doing, it is not talking about custom pricing, but it is taking a look at it and what it is offering is room attributes, that is, you choose your custom product and, therefore, you choose this, you choose that... In the end, personalizing your product is equal to customizing pricing [...]"</i>
	Loyalty boosting	<i>"[...] To implement price personalization, a great advantage for hotel chains is that they have access to loyalty programme databases, which are loyalty programmes [...]"</i>
	Technology and integration constraints	<i>"[...] price customization is complex from two points of view. From the point of view of customer perception. and the second from what technological capacity you have to be able to customize the price and which databases you are able to reach [...]"</i> <i>"[...] To me, one of the great challenges of the coming years is the integration of systems.</i>
	Unfair perceptions from customers	<i>"[...] Price differences may cause unfair perceptions to those customers that pay a higher price [...]"</i>
	Personalization of offers	<i>"[...] to start with the first part, we are not talking internally about price personalization, instead we are talking about personalized offers [...]"</i>

ROH, competition, online reputation? Do they all track the OTAS websites and the hotel's website?

- BEONPRICE (e.g.: meteorological.
- DUETTO (flight occupancy:.
- IDEAS (

8. What is the difference between these three systems?
9. What is One to One for you and what are the implications?
10. What do you think are the reasons that make it difficult to implement this strategy in the hotel sector? (technological or customer perception) what consequences do you think this pricing strategy could have? how could these consequences be mitigated? how do you think it could be implemented without customers feeling unfairly treated when they pay higher prices than others?
11. Are there problems with integrating information into the chains? does the revenue manager currently have many technological tools for daily decision making, however, sometimes this information is not integrated and therefore unmanageable? can an excess of information and a lack of integration lead to erroneous decision making?

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