

Virtual Reality as a Strategic Tool: Adoption Patterns and Distribution Channels in Croatian Hotels

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Abstract. *Hotel industry is one of the first to adopt virtual reality into websites to enhance customer experience, gain competitive advantage and strengthen their position relative to online travel agencies by increasing the share of direct bookings. The purpose of this research is to provide an overview of how Croatian hotels are utilizing VR on their websites. Based on sample of 201 hotels, the study examined hotel features to gain deeper insights into adoption patterns. Chi-square analysis was used to assess the relationships between hotel characteristics and VR usage. Findings confirm significant relationship between the direct booking ratio and VR implementations.*

Keywords. hotel industry, booking strategies, VR in hotels, ICT, data visualization, Chi square, hotel business strategy

1 Introduction

In recent years, the hospitality industry has undergone rapid digital transformation, driven by the increasing demand for personalized, immersive, and interactive online experiences (Collins, 2023). Among emerging technologies, virtual reality (VR) has gained significant attention as a tool for enhancing customer engagement and influencing booking behavior (Fransisco, 2024).

VR offers potential guests an experience which mimics experience in the hotel that can influence perception, trust, and purchase intention by allowing users to explore hotel environments virtually, through realistic, three-dimensional simulations (Israel et al., 2019). The competitive nature of the hotel industry forces hotels to adopt innovative technologies, especially in destinations such as Croatia where tourism is a major economic sector (Slivar et al., 2016). While many global hotel brands have already embraced VR, little is known about its adoption in regional markets or how implementation varies across different types of hotels (Lodhi et al., 2024). Moreover, limited empirical research has examined how VR

usage relates to booking strategies, especially direct bookings, which are increasingly prioritized by hotels aiming to reduce commission costs and improve customer relationships (Zeqiri, 2025).

The purpose of this paper is to provide a comprehensive overview of the use of VR in Croatian hotel websites. The study examines 201 hotels across Croatia analyzing various hotel features such as rating, location, ownership, and size with the purpose to explore potential correlations between these characteristics and the adoption of VR technology on their websites.

To the authors' knowledge, this is the first investigation of its kind, offering a foundation for future research that could be extended to other countries and regions for comparative analysis.

The research employs descriptive statistics, and Chi-square analysis to examine the dataset and extract meaningful insights. Additionally, the study investigates the relationship between hotel distribution channel strategies with the focus on the dominant distribution channel and direct booking ratio and VR usage. The findings of this study not only contribute to academic knowledge but also provide practical implications for hotel management, serving as a basis for developing effective strategies to leverage VR technology in enhancing direct bookings and competitive positioning.

The paper is organized as follows: After the Introduction section where papers objectives and context were described, the Methodology section is presented. Methodology section describes research instrument, research sample and the methods used for achieving the research goal. Furthermore, the Result section provide a statistical investigation output which were explained in the Discussion section. Lastly, the Conclusion section presents main contributions, further investigations and limitations of the research.

2 Literature Review

2.1 Virtual reality

The concept and significance of virtual reality (VR) have been widely discussed since the early 1990s, when the most used definition was first developed. Steuer (1992) defines VR as an environment that induces telepresence through stimulation, where vividness and interactivity enhance the observer's sense of presence. More recent definitions describe VR as the navigation and interaction within a computer-generated, three-dimensional environment, designed to simulate real-time sensory experiences (Yung & Khoo-Lattimore, 2019). A key feature of VR is its ability to allow users to interact with and navigate the virtual space, enhancing immersion (Kim et al., 2025).

The reason of VR technology's prevalence is because it engages users cognitively, sparking their interest and providing useful knowledge that can aid in selling products and services (De Gauquier et al., 2019). The immersive nature of VR often leads to stronger emotional responses, as users feel more involved in the experience (Riva et al., 2007). Additionally, VR enhances sensory experiences, particularly through movement and immersion, which contribute to more engaging bodily sensations. These deeper experiences tend to result in positive attitudes and behaviors toward the content (Gibson, 2017).

2.2 Virtual reality in hotel industry

In the hotel industry, travellers often rely heavily on visual content and online reviews on their websites (Fidzani & Read, 2014). Images of rooms and key services and amenities play a critical role in shaping perceptions and influencing booking decisions (Bogicevic et al., 2017). Consequently, how hotels visually communicate their brand identity, style, and service offerings has become a vital source of competitive advantage (Chung, 2017). Therefore, VR has emerged as a powerful marketing tool that allows potential guests to engage experiences of hotel environments before making a reservation (Mc Lean et al., 2022). Besides, a significant challenge for the hotel industry is its reliance on Online Travel Agencies (OTAs), which charge high commissions, reduce brand visibility, and weaken direct customer relationships and loyalty (Ćurlin, 2022). This dependence forces hotels to compete digitally while maintaining profitability and brand strength. At the same time, the intangible and perishable nature of hospitality services, such as product that cannot be evaluated before consumption, makes effective online presentation crucial (Kandampully & Solnet, 2024). The rise of e-commerce has expanded these opportunities, yet consumer expectations have evolved, demanding personalized, multichannel digital experiences (Ntumba et al., 2023). Users now expect not only platforms that offer more than just basic information

and simple applications, but sophisticated, consumer-centred applications across multiple channels and technology platforms (Lam & Law, 2019).

VR has been increasingly incorporated into the marketing strategies of many hotels, leading to its growing popularity within the hospitality and tourism sectors (Guerra et al., 2015). Marriott International was among the first hotel chains to adopt VR for marketing purposes, successfully integrating it into their product development and brand promotion efforts (Mandelbaum, 2018). Recent studies have identified key VR applications in hospitality and tourism, including promotion and advertising, planning, management, entertainment, education, accessibility, and heritage conservation (Siddiqui et al., 2022). VR is widely recognized as a major technological advancement influencing the travel and tourism industry (Tussyadiah et al., 2018). Numerous leading travel companies, such as Virgin, Disney, Emirates, and hotel brands like Marriott and Hyatt Regency, have implemented VR to allow customers to "experience before they buy" offering significant advantages by engaging consumers prior to their actual visit. In the hotel industry, VR has emerged as a powerful tool for enhancing customer engagement by offering immersive and interactive visual experiences. VR enables precise control over key visual elements such as lighting, object placement, and spatial layout, allowing hotels to create realistic and emotionally compelling environments (Soranzo & Wilson, 2014). Unlike traditional 2D or 3D platforms that limit user interaction to basic clicks or rotations (Choi & Taylor, 2014), VR immerses users in hotel spaces through multisensory experiences, including spatial navigation and sound (De Gauquier et al., 2018). This heightened sense of presence helps potential guests explore rooms, lobbies, or amenities virtually, encouraging emotional connection and stronger purchase intent (Brakus et al., 2009). In particular, 360° immersive VR (IVR) has become widely used in hotel marketing strategies, offering panoramic, photo- and video-based virtual tours of hotel interiors and surroundings. These tours provide credible and detailed representations of real-world environments, improving perceived authenticity and engagement (Wu & Lai, 2022). Consequently, 360° videos are now a key promotional asset for hotels aiming to differentiate themselves and attract bookings in an increasingly competitive digital marketplace.

Scholars have explored the potential of VR in hotel industry and hospitality for nearly thirty years. First researches were focused on highlighting VR's ability to present visually rich destination landscapes and support sustainable tourism. For instance, Cheong (1995) did a conceptual study on how far VR technology can actually deliver as a tool to increase destinations appeal, and Hobson & Williams (1995) highlighted VR as the most important technology breakthrough for hotel and hospitality industry in late 20-th century. Following research demonstrated VR's positive influence on destination image, branding,

advertising effectiveness, and visit intention (Berger et al., 2006; Giordimaina, 2008). Early empirical studies employed VR to simulate tourism settings and examine consumer responses, such as reactions to crowding and emotional responses to multistage waiting in virtual environments (Hwang et al., 2012; Kim & Kim, 2016). As VR technology advanced, researches it also used in combination with eye-tracking to study consumer attention and brand perception in hotels (Bigne et al., 2016). Moreover, VR has been shown to enhance servicescape design and support more immersive decision-making processes by offering experiential and realistic information (Han et al., 2018). With the commercialization of VR devices like Oculus, attention shifted toward user acceptance and the technology's influence on behavioral intentions, including purchase and recommendation (Griffin et al., 2017). While many studies affirm VR's ability to foster a sense of presence and increase travel intentions, relatively few have examined the mechanisms by which technical and sensory features shape user experiences (Kim et al., 2020). Recent reviews have identified significant gaps, particularly the need for more theory-driven investigations into usability, psychological outcomes, and the experiential qualities of VR travel (Shukla et al., 2024, Lampropoulos et al., 2024).

3 Methodology

Descriptive statistical analysis was employed to provide deeper insight into the data structure. Furthermore, Chi-square analysis was conducted to examine the statistical relationships between variables. The aim of this paper is to investigate how many Croatian hotels have adopted VR technologies on their websites, the distribution of adoption across different hotel types, and whether there is a significant relationship between hotel features and the VR adoption rate. Additionally, the study explores the relationship between preferred distribution channels, direct booking ratios, and VR implementation to determine whether hotel booking strategies are associated with the adoption of VR technologies on hotel websites.

The study was conducted on a sample of 201 hotels in Croatia, utilizing data on VR usage on hotel websites, hotel features, and booking strategies. Data collection was carried out in two stages: first, through a questionnaire administered to hotel employees, followed by an in-depth analysis of hotel websites. The data used in this paper were collected as part of a doctoral dissertation (Ćurlin, 2022).

Table 1 presents the research instrument, including all data utilized in this study. The variables listed in the table were coded and referenced using these codes throughout the paper. Additionally, the modalities of each variable are also provided. The variable code VR indicates whether a hotel's website includes virtual

reality content, where a value of 0 denotes the absence of VR and 1 indicates the presence of VR. Following hotel features were analysed: hotel rating, measured on a scale from two to five stars; hotel location, where inland hotels are coded as 0 and seaside hotels as 1; and ownership, with domestically owned hotels coded as 1 and foreign-owned hotels as 2. The variable size refers to hotel size, categorized into four groups ranging from the largest (more than 250 rooms) to the smallest (fewer than 10 rooms). Regarding distribution channels, the variable code channel represents the preferred booking channel, categorized into direct bookings, online travel agencies, foreign agencies, and domestic agencies. Finally, the direct variable refers to the direct booking ratio, expressed in percentages and grouped into ten categories.

Table 1. Research instrument

Variable code	Variable description	Modalities
VR	VR present on hotel website	0-no 1-yes
	<i>Hotel features</i>	
RATING	Number of stars	1-2*, 2-3*, 3-4*, 4-5*
LOCATION	Hotel location	0-land 1-sea
OWNERSHIP	Hotel ownership	1-domestic 2-foreign
SIZE	Total number of rooms	1->250, 2-100-250, 3-51-100, 4-11-50, 5-<10
	<i>Distribution channels</i>	
CHANNEL	Preferred distribution channel	1- direct 2-OTA 3-foreign agencies 4-local agencies
DIRECT	Direct booking ratio (%)	1-0-10, 2-11-20, 3-21-30, 4-31-40, 5-41-50, 6-51-60, 7-61-70, 8-71-80, 9-81-90, 10-98-100

Source: Authors work (2025)

The research sample included 201 Croatian hotels, along with the variables described in the previous section. Fig. 1 presents data on the presence of VR technology on hotel websites within the sample. Out of the total 201 hotels, 135 (67.16%) do not include VR on their websites, while 66 hotels (32.84%) have implemented VR technologies.

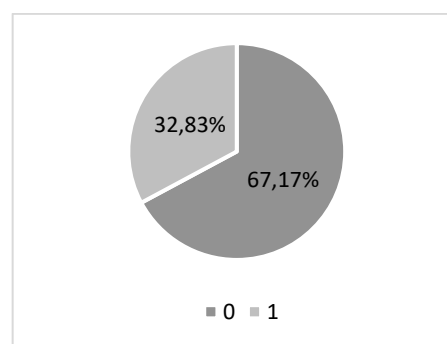


Figure 1. VR usage in Croatian hotels website;
Source: Authors work (2025)

Table 2 provides an overview of the hotel features included in this study. Variable frequencies, structure, and cumulative distributions are presented. The largest group of hotels is categorized as four-star, comprising 55.33% of the sample (a total of 109 hotels). The second most represented category is three-star hotels, accounting for 23.35%, followed by five-star hotels at 17.77%. Only seven two-star hotels are included in the study. Most hotels are located by the seaside, totaling 73.60%, which aligns with the overall structure of the Croatian hotel population. The remaining 26.40% of hotels are located inland. Most hotels in the sample are domestically owned, with 66.50% owned by domestic individuals or groups, while 33.50% are foreign-owned. Regarding hotel size, 48.76% of the sample comprises large hotels with more than 250 rooms, 45.27% have between 100 and 250 rooms, and only 5.96% have fewer than 100 rooms.

Table 2. Hotel features

Rating	Frequency	Structure (%)	Cumulative (%)
1	7	3,553	3,553
2	46	23,350	26,904
3	109	55,330	82,234
4	35	17,766	100,000
Location	Frequency	Structure (%)	Cumulative (%)
0	52	26,396	26,396
1	145	73,604	100,000
Ownership	Frequency	Structure (%)	Cumulative (%)
0	131	66,497	66,497
1	66	33,503	100,000
Size	Frequency	Structure (%)	Cumulative (%)
1	98	48,756	48,756
2	91	45,274	94,030
3	5	2,488	96,517
4	7	3,483	100
Total	201	100	

Source: Authors work (2025)

Table 4 presents the structure of hotel distribution channels. Most hotels in the sample identified online travel agencies as their dominant distribution channel, accounting for 93 hotels or 46.27%. Direct booking was the primary distribution channel for 27.86% of the hotels, while a slightly smaller proportion, 24.38%, reported foreign agencies as their main channel. Only 1.49% of the hotels included in the study listed local agencies as their dominant distribution channel. The direct booking ratio refers to reservations made through a hotel's official website, by phone, email, or on-site. Within the sample, 45 hotels (22.39%) reported that direct bookings formed between 21–30% of their total reservations. Moreover, 39 hotels (19.40%) had a direct booking share between 11–20%, and 32 hotels (15.92%) reported between 31–40%. Collectively, 57.51% of the hotels surveyed had direct booking rates ranging from 11% to 40%. Furthermore, 9.45% of hotels reported 61–70% of their bookings coming through direct channels, and a total of 32 hotels (8.96% each) had either 0–10% or 41–50% direct reservations. Another 14 hotels (6.97%) fell within the 51–60% range. Only 8 hotels (3.98%) reported direct

bookings in the ranges of 71–80% and 81–90%, respectively. Notably, none of the hotels in the sample reported more than 90% of bookings via direct channels.

Table 3. Hotel distribution channel structure

Channel	Frequency	Structure (%)	Cumulative (%)
1	56	27,861	27,861
2	93	46,269	74,129
3	49	24,378	98,507
4	3	1,493	100
Direct	Frequency	Structure (%)	Cumulative (%)
1	18	8,955	8,955
2	39	19,403	28,358
3	45	22,388	50,746
4	32	15,920	66,667
5	18	8,955	75,622
6	14	6,965	82,587
7	19	9,453	92,040
8	8	3,980	96,020
9	8	3,980	100
Total	201	100	-

Source: Authors work (2025)

4 Results

The following section presents a descriptive analysis alongside the results of a Chi-square test. This analysis aims to investigate the relationships between VR utilization in Croatian hotels and various hotel characteristics, as well as the distribution channel structure, with the objective of uncovering new insights on the topic.

4.1 Descriptive statistics results

Table 4 presents the results of the descriptive statistics for the use of VR on hotel websites, hotel feature variables (rating, location, ownership, and size), and distribution channel structure variables (dominant distribution channel and direct booking ratio). Descriptive statistics reported include the mean, median, mode, standard deviation, variance, skewness, kurtosis, and their respective standard errors. The results suggest an adequate dispersion of the data, with standard deviation values ranging from 0.473 to 2.16, indicating the representativeness of the sample. The mean and median values suggest that most hotels in the sample do not include VR on their websites, are large, domestically owned, located on the seaside, and categorized with four stars. The results also indicate that online travel agencies (OTAs) are the dominant distribution channel, and that the average direct booking ratio for Croatian hotels falls between 32% and 40%.

4.2 Chi-square analysis results

Finally, the results of the Chi-square analysis are presented. The Chi-square test is a nonparametric statistical method commonly employed in research

involving nominal variables (Adhikari et al., 2023). This analysis not only assesses the significance of differences between variables but also identifies the specific categories contributing to these differences (Beillouin et al., 2021). In this study, the Chi-square test is utilized to examine the relationships between VR usage on hotel websites, hotel characteristics, and distribution channels.

Table 5 presents the results of the Chi-square analysis examining the relationship between VR usage on Croatian hotel websites and various hotel features. The analysis reveals a statistically significant association between the rating variable and VR usage at the 10% significance level, with a Chi-square value of 6.270. Cramér's V coefficient of 0.560 supports a strong relationship between these variables. Additionally, a statistically significant relationship was found between ownership and VR usage at the 5% significance level, with a Chi-square value of 4.700 and a Cramér's V coefficient of 0.154, suggesting a weak association. In contrast, no statistically significant relationship was identified between location and VR usage, as evidenced by a Chi-square value of 1.370 and a Cramér's V coefficient indicating no meaningful association. Similarly, the analysis did not reveal a statistically significant relationship between hotel size (measured by number of rooms) and VR usage, with a Chi-square value of 3.110. However, the corresponding Cramér's V value of 0.126 suggests a potential weak relationship, which may warrant further investigation in future research.

5 Discussion

The following section summarizes the key findings presented in this paper. Table 6 provides an overview of the Chi-square analysis results related to VR usage on hotel websites, hotel features (including rating, location, ownership, and size), and hotel distribution channel strategy (including dominant distribution channel and direct booking ratio). The analysis confirmed statistically significant relationships between hotel rating and ownership with VR usage in the hotel features category. Regarding hotel rating, the findings suggest that higher-category hotels are more likely to implement VR on their websites. For hotel ownership, when normalized values are considered, it can be concluded that foreign-owned hotels are more likely to adopt VR technologies, implying that domestic hotel owners should consider adopting modern technological solutions to remain competitive. The variables *location* and *hotel size* did not show statistically significant associations with VR usage, suggesting that the adoption of VR is not dependent on whether the hotel is located inland or on the seaside, nor on the number of rooms. However, further investigation into hotel size is warranted, as the Cramér's V coefficient indicates a potential weak relationship between hotel size and VR adoption.

Table 4. Descriptive analysis results

Variable	N	Mean	Median	Mode	Standard deviation	Variance	Skewness	Std. error skewness	Kurtosis	Std. error kurtosis
VR	201	0,34	0	0.00	0,473	0,224	0,704	0,173	-1,52	0,345
Rating	201	2,86	3	3.00	0,735	0,540	-0,309	0,172	-0,0507	0,341
Location	201	0,73	1	1.00	0,444	0,197	-1,05	0,172	-0,903	0,341
Ownership	201	1,25	1	1.00	0,433	0,188	1,17	0,172	-0,635	0,341
Size	201	1,61	2	1.00	0,707	0,500	1,33	0,172	2,40	0,341
Channel	201	2,00	2	2.00	0,765	0,585	0,21	0,172	-0,737	0,341
Direct	201	3,99	3	3.00	2,16	4,680	0,67	0,172	-0,456	0,341

Source: Authors work (2025)

Table 5. The Chi square analysis results for VR and hotel features

Variable	Modality	VR		n	Pearson Chi-square	df	p-value	Phi-coefficient	Cramer's V
		0	1						
rating	1	3,08%	4,48%	197	6,270	3	0,089	/	0,560
	2	24,62%	20,90%						
	3	54,62%	56,72%						
	4	17,69%	16,42%						
location	0	29,23%	22,39%	197	1,370	1	0,241	0,0835	0,083
	1	70,77%	77,61%						
ownership	0	79,23%	64,18%	197	4,700	1	0,03	0,154	0,154
	1	20,77%	35,82%						
size	1	53,85%	40,30%	197	3,110	3	0,375	/	0,126
	2	42,31%	49,25%						
	3	2,31%	2,99%						
	4	1,54%	5,97%						

Source: Authors work (2025)

Regarding the distribution channel strategy and VR usage on Croatian hotel websites, the statistical analysis confirmed a significant relationship between the direct booking ratio and the presence of VR, representing one of the most important contributions of this study. The visual representation of variable structure indicates that hotels which have implemented VR on their websites tend to have a higher proportion of direct bookings compared to those that have not. This insight may be valuable for both future research and hotel managers aiming to increase their share of direct bookings. The visual data also showed that hotels with VR tend to prefer online travel agencies (OTAs), direct bookings, and foreign agencies as their primary distribution channels. However, the dominant distribution channel variable did not show a statistically significant relationship with VR usage. Nonetheless, the Cramér's V coefficient suggests a possible weak association, indicating that further research in this area may be warranted.

Table 6. Summary results of the Chi square analysis

Variable	VR in hotel websites
<i>hotel features</i>	
rating	10%
location	Ø
size	Ø
ownership	5%
<i>distribution channel</i>	
channel	Ø
direct	5%

Source: Authors work

6 Conclusion

Virtual reality technologies have become omnipresent across various industries, significantly enhancing business operations and marketing strategies. The hotel industry, as a leader in adopting advanced technologies, continuously seeks novel approaches to gain competitive advantage. One of the key interests in hotel industry is to increase their direct booking in order to be less dependable of the online travel agencies. Consequently, many hotel strategies prioritize strengthening direct distribution channels due to the high commission fees associated with OTAs. Previous research has established links between website quality and direct bookings; however, most studies focus on website functionality and utility. Recently, hotels have begun incorporating VR on their websites to offer potential guests an immersive preview of the hotel experience.

This paper aimed to explore the adoption of VR technologies on Croatian hotel websites, with particular emphasis on the relationship between VR

usage and hotel characteristics. Chi-square analysis was employed to investigate potential associations between specific hotel features and VR presence on websites, as well as to examine the connection between hotel distribution channel strategies and VR adoption.

The paper makes several valuable contributions to both academia and hotel management. Firstly, it provides a comprehensive overview of VR implementation in Croatian hotels, representing the first study of its kind to the authors' knowledge, thus laying the groundwork for future research. Nearly one-third of the sampled hotels have implemented VR on their websites, a substantial adoption rate with room for growth. Hotels rated four stars, located on the seaside, domestically owned, and with hundred or more rooms showed the highest VR adoption. However, only hotel rating and ownership demonstrated statistically significant associations with VR usage. Higher-rated hotels and foreign-owned properties were more likely to adopt VR, suggesting that better-resourced or internationally affiliated establishments invest more in advanced digital technologies.

The most significant finding is the statistically significant relationship between VR adoption and direct booking ratio. Hotels utilizing VR tended to achieve higher direct booking levels, indicating that VR serves not only as a marketing enhancement but also as a strategic asset to reduce reliance on third-party booking platforms. Although the dominant distribution channel did not show a statistically significant link to VR adoption, observed weak associations warrant further investigation. Visual analysis confirmed that hotels with VR on their websites enjoy higher direct reservation ratios, a critical advantage for hoteliers aiming to increase direct bookings and reduce OTA dependency. Thus, VR integration on hotel websites emerges as a strategic tool for boosting direct booking performance.

These findings enrich the growing literature on digital innovation in hospitality and offer practical implications for hotel managers. By adopting VR, particularly domestically owned and mid-tier hotels can strengthen their competitive position, enhance user engagement, and potentially increase direct sales. Future research should explore the impact of hotel size on VR adoption and conduct longitudinal studies to assess whether VR continues to influence booking behavior over time. Additionally, further investigation is needed to examine other hotel features and distribution channels, ideally using larger and more diverse samples across regions and market segments to improve representativeness. Moreover, a promising direction for further research is also the potential of augmented reality (AR), which may offer more accessible and interactive experiences for users and could complement or even enhance the role of VR in hotel marketing and customer engagement.

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