

IMPACT OF BUSINESS INTELLIGENCE AND ANALYTICS ON DECISION- MAKING IN ONLINE RESERVATION SYSTEMS WITHIN THE HOSPITALITY SECTOR

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Abstract

This study investigates the impact of business intelligence and analytics (BIA) on decision-making in online reservation systems within the hospitality sector. This study presents a comprehensive review of ten research papers in the field of BIA within the hospitality sector. The findings indicate that organizations effectively leveraging BIA experience enhanced decision-making, improved operational efficiency, revenue growth, and customer satisfaction. Integration of BIA leads to improved customer experiences through personalization and recommendation systems. Adopting BIA tools results in significant operational efficiency gains by addressing issues in real-time. Effective utilization of BIA positively impacts revenue growth through optimized pricing strategies and demand forecasting. Despite implementation challenges, this study highlights the practical significance and benefits of BIA in online reservation systems, while providing recommendations for organizations. Future research directions include exploring artificial intelligence, examining ethical considerations, conducting industry-specific analyses, and assessing long-term impacts of BIA implementation in the hospitality sector.

Keywords: business intelligence; analytics; online reservation systems; artificial intelligence; machine learning; strategy; optimization.

1. Introduction

The hospitality sector encompasses a wide range of businesses and services, including hotels, restaurants, resorts, car rental services, tourism, and more. The global economy is greatly impacted by a thriving and ever-expanding industry known for its dynamism. This sector's growth stems from the rising demand for travel,

tourism, and leisure activities, while its trajectory is significantly shaped by evolving consumer preferences and advancements in technology [1]. Hospitality businesses focus on providing exceptional customer experiences, creating memorable moments, and delivering high-quality services. They strive to meet and exceed the expectations of guests while ensuring operational efficiency and profitability. Successful organizations within the sector understand the importance of adapting to changing trends and embracing innovation to remain competitive in a crowded marketplace [2]. Over the years, the hospitality sector has experienced notable transformations. Technological advancements have revolutionized various aspects of the industry, from online reservation systems and mobile applications to personalized marketing and guest engagement. Digital platforms and social media have empowered consumers to share their experiences, shaping the reputation and success of hospitality businesses. As the hospitality sector continues to evolve, organizations are increasingly turning to data-driven decision-making to gain a competitive advantage. Business intelligence and analytics (BIA) have emerged as powerful tools that enable hospitality businesses to extract valuable insights from vast amounts of data [3]. By leveraging data, organizations can optimize revenue management, customize guest experiences, streamline operational processes, and make informed decisions to foster growth and ensure long-term sustainability.

In the ever-evolving landscape of the hospitality sector, decision-making plays a crucial role in shaping the success and competitiveness of businesses. In the past five years, the advent of business intelligence and analytics has brought about a transformative impact on the decision-making processes within the industry. The ability to gather, analyze, and interpret vast amounts of data has empowered hospitality organizations to make informed and strategic choices, leading to enhanced operational efficiency, improved guest experiences, and ultimately, increased profitability [4].

Before the introduction of the internet, reservation systems suffered from this analogous era, the process had various barriers like the need for a physical presence to complete a transaction, constrained service client base and the long customer wait time, that could stretch to the length of a train almost. In addition, data was often stored in silos across different departments and systems, making it difficult to access and integrate for analysis. This led to incomplete or inconsistent data that was difficult to reconcile, limiting the insights that organizations could glean from their data. Overall, the lack of robust data analysis tools and the limitations of manual data processing meant that organizations often struggled to fully understand and utilize their data, and were therefore at a disadvantage in terms of making data-driven decisions.

Aside from the fact that there was clearly a lack of robust data analysis tools, we cannot ignore the continuous increase of data into large dataset or what we may term "Big data". In the early 2000s, the term "big data" surfaced and gained recognition [5] to describe the large and complex datasets that were being generated by organizations and the internet. The exponential growth in data was driven by several factors, including the increasing digitization of information, the proliferation of sensors and devices that collect data [6], and the growth of social media and other online platforms. For example, data from online customer interactions, social media, mobile devices, and web analytics can all be collected, integrated, and analyzed to generate valuable insights. As organizations began to grapple with these massive datasets, they realized that traditional data processing tools and methods were no longer sufficient. They actively pursued inventive technologies and methodologies capable of accommodating the data's vastness, speed, and diversity. Business Intelligence and analytics tools provide businesses with the ability to create dashboards, reports, and visualizations that highlight key performance indicators, making it easier for managers to make informed decisions if executed properly.

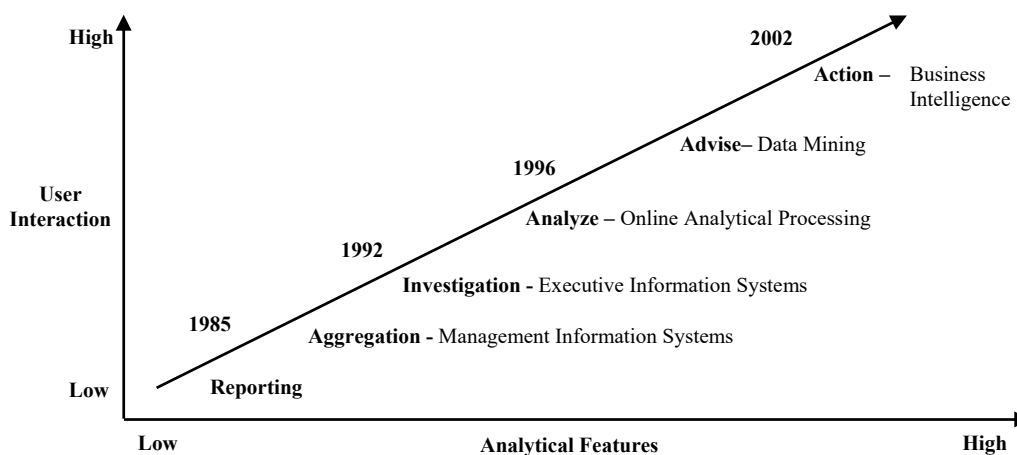


Figure 1: Evolution from static reports to Business Intelligence. Source: [7]

Nonetheless, there remains a necessity for extensive research to understand the full extent of how Business Intelligence and analytics influence decision-making within the hospitality sector. Existing research has delved into the influence of BIA on decision-making in various contexts, yet there is a dearth of studies specifically examining their impact on online reservation systems. Moreover, given the rapid advancements in technology and the constantly evolving business landscape, there is a need for continuous research to identify the latest trends, best practices, and difficulties related to the utilization of BIA in online reservation systems.

2. Review of Related Literatures

This review section provides an in-depth exploration of the key concepts related to business intelligence, analytics, and decision-making in the hospitality sector. Although the primary focus of the review is to incorporate empirical research, it will also encompass prescriptive and conceptual contributions, ensuring a comprehensive analysis [8]. It examines the role of data-driven decision-making in improving demand forecasting, pricing optimization, customer segmentation and personalization, and recommendation. We intend to analyze a collection of ten interconnected academic papers, providing details on the article's title, authors, the problem under investigation, the methodology employed to address the problem, the achieved outcomes, and the identified research gap.

Title: Online reservation systems in e-Business: Analyzing decision making in e-Tourism [9].

Authors: C. Halkiopoulou, H. Antonopoulou, D. Papadopoulou, I. Giannoukou, and E. Gkintoni

Objective: The objective of this paper is to analyze the decision-making process in e-tourism, specifically in online reservation systems, and to identify the factors that influence consumers' choices when making online reservations.

Methodology: The methodology used in this paper is a qualitative approach that utilizes a case study method. The authors selected three online reservation systems from different industries in Greece and collected data through in-depth interviews with the systems' managers and users. The data was analyzed using content analysis, which involved identifying themes and patterns within the data.

Results: The study found that consumers' decision-making process in online reservation systems is influenced by several factors, including the system's usability, trustworthiness, perceived value, and convenience. The study also identified the importance of information quality and the use of technology in improving the overall user experience.

Gaps: Although the study provides valuable insights into the decision-making process in online reservation systems, the sample size is relatively small and limited to only three systems in Greece. The study also focuses exclusively on the consumer's perspective and does not consider the systems' business and operational aspects. Additionally, the study's findings may not be generalizable to other contexts or industries.

Title: A predictive investigation of first-time customer retention in online reservation services [10].

Authors: Y.-C. Chou and H. H.-C. Chuang

Objectives: This paper aims to forecast the loyalty of new customers in online reservation services and ascertain the pivotal factors that impact customer retention.

Methodology: The methodology used in this paper is a quantitative approach that involves data mining and predictive modeling. The authors collected customer data from an online reservation service in Taiwan and applied logistic regression analysis to identify the factors that influence customer retention. The authors also used a decision tree algorithm to develop a predictive model to forecast customer retention rates.

Results: The study found that customer retention in online reservation services is influenced by several factors, including the customer's past booking behavior, the number of bookings made, the number of days between bookings, and the type of booking. The study also found that the predictive model developed using the decision tree algorithm was effective in predicting customer retention rates.

Gaps: The study provides valuable insights into predicting new customer loyalty in online reservation services, but the sample size is relatively small and limited to only one online reservation service in Taiwan. The study also focuses exclusively on first-time customers and does not consider the retention of repeat customers. Additionally, the study's findings may not be generalizable to other contexts or industries. The study could also benefit from using more sophisticated data mining techniques to explore the relationships between customer behavior and retention.

Title: Clustering helps to improve price prediction in online booking systems [11].

Authors: L. H. Trang, T. D. Huy, and A. N. Le

Objectives: The objective of this paper is to enhance price forecasting accuracy in online booking systems by using clustering techniques to segment customers based on their preferences and behavior.

Methodology: The methodology used in this paper is a data-driven approach that involves clustering techniques and machine learning algorithms. The authors collected customer data from an online booking system in Vietnam and applied K-means clustering to group customers into different segments based on their booking

pattern. The authors then used a Random Forest algorithm to predict prices for each customer segment and compared the results with a baseline model that did not use clustering.

Results: The study found that clustering techniques improved price prediction accuracy in online booking systems. The authors identified three distinct customer segments based on their booking behavior and preferences, and the Random Forest algorithm was able to predict prices for each segment more accurately than the baseline model. The study also found that incorporating clustering into the prediction model reduced the overall prediction error.

Gaps: Although the study provides valuable insights into improving price prediction accuracy in online booking systems, the sample size is relatively small and limited to only one online booking system in Vietnam. The study also does not explore the generalizability of the clustering approach to other online booking systems or industries. Additionally, the study's findings may be limited by the specific clustering and machine learning algorithms used. The study could benefit from exploring other clustering and machine learning techniques to improve price prediction accuracy further.

Title: Application of online booking data to hotel revenue management [12].

Authors: T. Saito, A. Takahashi, N. Koide, and Y. Ichifuji

Objectives: The objectives of this paper are to investigate the usefulness of online reservation data for hotel revenue management and to propose a new method for revenue management based on online booking data.

Methodology: The study used a quantitative research approach, analyzing data from an online reservation system used by a Japanese hotel. The data included the number of reservations, room types, rates, dates, and other relevant information. The authors used statistical analysis techniques, such as regression analysis and cluster analysis, to analyze the data and develop a revenue management model.

Results: The study found that online reservation data can be useful for revenue management in hotels. By analyzing the data, the authors were able to identify patterns and trends in customer behavior, such as which room types and rates were most popular during certain periods. They also developed a revenue management model that took into account the seasonality of demand and the characteristics of different customer segments. The model was able to accurately predict demand and optimize room pricing, resulting in increased revenue for the hotel.

Gaps: One potential gap in this study is the limited scope of the data analysis. The study only analyzed data from one hotel, which may limit the generalizability of the findings. Additionally, the study did not consider external factors that may affect hotel revenue, such as competition from other hotels or changes in the local economy. Future research could expand the scope of the analysis to include a larger sample of hotels and incorporate additional variables that may impact revenue management.

Title: Understanding customer's online booking intentions using hotel big data analysis [13].

Authors: Š. Chalupa and M. Petříček

Objectives: The objective of this paper is to understand the customers' online booking intentions using hotel big data analysis. The study aims to explore the correlation between customer characteristics, online behavior, and hotel attributes on customers' booking decisions.

Methodology: The study collected data from a hotel reservation website, which included customer profiles, hotel characteristics, and booking details. The authors used logistic regression analysis to examine the relationships between customer characteristics, online behavior, and hotel attributes on customers' booking decisions. They also conducted a factor analysis to identify the underlying elements that shape customers' intentions to book online.

Results: The study found that several customer characteristics, such as age, gender, and nationality, significantly influenced customers' online booking intentions. Additionally, hotel attributes, such as hotel ratings and the number of hotel reviews, also had a significant impact on customers' booking decisions. The authors identified five underlying factors that influenced customers' online booking intentions: price, hotel ratings, hotel location, hotel amenities, and hotel reputation.

Gaps: One potential gap in this paper is the lack of information about the specific hotel reservation website used for data collection. The study also focused on a limited set of customer characteristics, online behaviors, and hotel attributes, which may not fully capture the complex

Title: Analyzing online customer experience in hotel sector using dynamic topic modelling and net promoter score [14].

Authors: V.-H. Nguyen and T. Ho

Objectives: The objective of this paper is to analyze the online customer experience in the hotel sector using dynamic topic modeling and Net Promoter Score (NPS). The study aims to identify the key factors that influence customers' satisfaction and loyalty towards hotels by analyzing customer reviews on online platforms.

Methodology: The study collected customer reviews from a popular hotel booking website and used dynamic topic modeling to identify the topics that customers commonly mentioned in their reviews. The authors then

calculated the Net Promoter Score (NPS) to measure customers' overall fulfillment and retention. They also conducted regression analysis to examine the relationships between the identified topics and NPS.

Results: The study identified several key factors that influenced customers' satisfaction and loyalty towards hotels, including room cleanliness, staff service, room amenities, and hotel location. The authors also found that customers' satisfaction with these factors had a significant positive impact on their likelihood to recommend the hotel to others, as measured by the NPS.

Gaps: One potential gap in this paper is the reliance on customer reviews from a single hotel booking website, which may not be representative of the entire hotel sector. Additionally, the study only focused on a limited set of factors that influence customers' satisfaction and loyalty, and did not explore other potential factors such as price, food, or entertainment. Finally, the study did not examine the impact of external factors, such as macroeconomic conditions or industry trends, on customers' satisfaction and loyalty towards hotels.

Title: Factors Influencing Hotels' Online Prices [15].

Authors: S. Moro, P. Rita, and C. Oliveira

Objectives: The objective of this paper is to explore the factors that influence hotels' online prices. The study aims to provide insights into the pricing strategies adopted by hotels in the online marketplace and to identify the key determinants of hotel prices.

Methodology: The study collected data on hotel prices from a popular online booking website and used multiple regression analysis to explore the correlation between hotel prices and various elements such as hotel size, location, star rating, and customer ratings. The authors also conducted a content analysis of hotel websites to gather information on other potential factors that may influence hotel prices, such as hotel amenities and services.

Results: The study found that several factors influenced hotel prices in the online marketplace, including hotel size, location, star rating, and customer ratings. The authors also identified several other factors that were associated with higher hotel prices, such as the availability of spa and wellness services, the presence of a restaurant or bar, and the inclusion of breakfast in the room rate. The study also found that hotel prices were higher during peak travel seasons and weekends.

Gaps: One potential gap in this paper is the limited scope of the study, which only examines hotels' online prices on a single booking website. The results may not be representative of the entire hotel sector or of other online booking platforms. Additionally, the study did not examine the impact of external factors, such as macroeconomic conditions or industry trends, on hotel prices. Finally, the study did not fully explore the pricing strategies adopted by hotels in the online marketplace, such as dynamic pricing or revenue management techniques.

Title: Big Data in Hotel Revenue Management: Exploring Cancellation Drivers to Gain Insights into Booking Cancellation Behavior [16].

Authors: N. Antonio, A. de Almeida, and L. Nunes

Objectives: The objective of this paper is to explore the drivers of booking cancellations in the hotel industry using big data analytics. The authors aim to identify patterns and trends in customer behavior that can help hotels improve their revenue management strategies.

Methodology: The study is based on a dataset of over 22,000 hotel bookings from a Portuguese hotel chain. The authors used statistical analysis techniques such as regression analysis and cluster analysis to identify the factors that influence booking cancellations. They also used machine learning algorithms such as decision trees and neural networks to build predictive models of cancellation behavior.

Results: The authors identified several factors that significantly influence booking cancellations, including the length of the stay, the type of room booked, the time of the year, and the channel through which the booking was made. They also found that different customer segments exhibit different cancellation behavior patterns. By analyzing these patterns, the authors were able to develop predictive models that can help hotels anticipate cancellations and adjust their revenue management strategies accordingly.

Gaps: One potential gap in this paper is that the study is based on data from a single hotel chain in Portugal, which may limit the generalizability of the findings to other contexts. Additionally, the study focuses primarily on identifying the drivers of booking cancellations, but does not provide specific recommendations for how hotels can use this information to improve their revenue management strategies.

Title: Online hotel demand model and own-price elasticities: An empirical application in a mature resort destination [17].

Authors: A. Vives, M. Jacob, and E. Aguiló

Objectives: The objective of this paper is to develop an online hotel demand model that incorporates sentiment analysis and to estimate own-price elasticities for hotels in a mature resort destination. The authors aim to demonstrate the usefulness of sentiment analysis in improving demand forecasting and pricing strategies in the tourism industry.

Methodology: The authors collected data on daily hotel room rates, occupancy rates, and other relevant factors for 134 hotels in a mature resort destination in Spain. The data was obtained from an online travel agency (OTA) for the period of 2014-2015. Overall, the methodology used in this research is empirical in nature and involves collecting and analyzing data on hotel room rates and occupancy rates to estimate the own-price elasticity of demand. The authors used a fixed-effects regression model to estimate the coefficients of the model and validate their findings.

Results: The authors found that sentiment analysis can significantly improve the accuracy of demand forecasting models in the tourism industry. They also found that own-price elasticities vary depending on the type of hotel, with luxury hotels having more elastic demand compared to budget hotels. The authors suggest that these findings can inform pricing strategies for hotels in the destination.

Gaps: One potential gap in this paper is that it only focuses on one mature resort destination in Spain, which may limit the generalizability of the findings to other destinations.

Title: A Novel Cancellation Protection Service in Online Reservation System [18].

Authors: Z. Sadreddini

Objectives: The objective of this paper is to propose a novel cancellation protection service for online hotel reservation systems using sentiment analysis. The author aims to show how sentiment analysis can be used to develop a more effective and personalized cancellation protection service that takes into account customers' attitudes and emotions towards cancellations.

Methodology: The author used a dataset of online hotel reservations from a popular hotel booking website. They first conducted sentiment analysis on the reviews and comments related to cancellations to determine the overall sentiment and emotional tone. They then used this information to develop a cancellation protection service that is personalized based on the customer's sentiment towards cancellations.

Results: The author found that the proposed cancellation protection service that incorporates sentiment analysis can improve customer satisfaction and loyalty by providing a more personalized experience. The service allows customers to select different levels of protection based on their emotional attachment to the trip and the likelihood of cancellation.

Gaps: One potential gap in this paper is that it only focuses on the proposed cancellation protection service without addressing the limitations and challenges of implementing sentiment analysis in online hotel reservation systems. Additionally, the paper does not provide a thorough analysis of the effectiveness of the proposed service compared to existing cancellation protection services in the industry. Finally, the study only focuses on one hotel booking website, which may limit the generalizability of the findings.

3. Methodology

The researchers conducted an extensive review of the existing literature, aiming to identify pertinent studies published over the past five years. They utilized academic databases as well as industry-specific sources to gather a wide range of studies, ensuring diversity in their sources. The academic databases explored for this study includes; IEEE Xplore, Google Scholar and Scopus, while the industry-specific sources include; DataProt, and TechCrunch. The researchers conducted a study on the application of BIA in decision making within the hospitality sector. They selected studies based on their relevance to the research objective and focused on empirical evidence, case studies, and theoretical frameworks. Non-English studies were excluded unless translated versions were available. The research is descriptive in nature, and the extracted data will be analyzed using qualitative analysis techniques to identify specific areas where business intelligence and analytics have made significant contributions to decision-making in the hospitality industry.

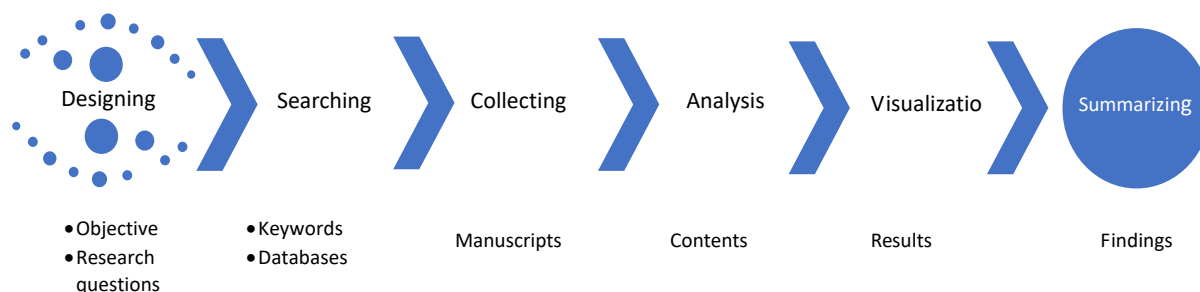


Figure 1: The research design followed in the study. Source: [19]

3.1. Business Intelligence and analytics (BIA) tools analysis

This analysis was carried out by the researchers based off estimates from DataProt and TechCrunch as it aims to explore and evaluate some popular BI and analytics tools utilized in the hospitality sector.

1. *Tableau*: It enables hospitality businesses to create interactive dashboards, reports, and charts to analyze key performance indicators (KPIs) such as occupancy rates, revenue, customer satisfaction, and marketing campaign effectiveness [20]. Tableau offers extensive connectivity options, allowing integration with various data sources, including property management systems (PMS) and customer relationship management (CRM) platforms [21].
2. *Microsoft Power BI*: With its intuitive drag-and-drop interface and seamless integration with Microsoft products, Power BI enables users to build interactive reports, real-time dashboards, and data-driven alerts [22].
3. *QlikView*: It allows hospitality businesses to consolidate data from multiple sources, including financial systems, guest surveys, and online reviews, providing a holistic view of operations [20]. Its responsive design allows for mobile access, making it convenient for hotel managers to monitor KPIs on the go.
4. *IBM Cognos Analytics*: Is an enterprise-grade BI platform that provides comprehensive reporting, dashboarding, and data exploration capabilities. It offers advanced analytics, including predictive modeling and scenario analysis, enabling hospitality organizations to forecast demand, optimize pricing strategies, and improve resource allocation [22]. Cognos Analytics also supports collaboration, allowing teams to share insights, annotations, and reports, fostering a data-driven culture across the organization.
5. *SAS Visual Analytics*: It leverages in-memory processing and advanced statistical techniques to handle large datasets and deliver interactive visualizations [21]. In the hospitality sector, SAS Visual Analytics can be utilized to analyze customer preferences, perform market segmentation, and personalize marketing campaigns. Its self-service capabilities enable business users to explore data independently, reducing the reliance on IT teams [22].

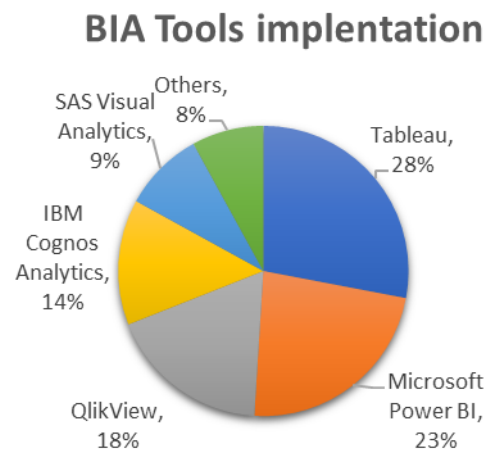


Figure 2: Estimated BIA tools implementation percentage. Source: [23]

3.2. Tangible Benefits

The incorporation of business intelligence and analytics has unquestionably brought advantages to this industry. We will now delve into the concrete perks that businesses have acquired by utilizing data-driven decision-making in revenue management, customer relationship management, marketing strategies and operational planning.

3.2.1. Revenue management

1. *Optimized Pricing Strategies*: Data-driven decision-making enables businesses to analyze market trends, customer behavior, and demand patterns to set optimal pricing strategies as exploited by Airbnb price prediction [24]. By understanding pricing elasticity and demand fluctuations, businesses can implement dynamic pricing models to maximize revenue and profitability.
2. *Demand Forecasting*: With access to historical and real-time data, businesses can leverage predictive analytics to forecast future demand accurately. This helps in determining inventory levels, staffing requirements, and allocating resources effectively, leading to reduced costs and enhanced operational efficiency [24].
3. *Improved Revenue Allocation*: Data-driven insights allow businesses to allocate resources and inventory strategically. By identifying high-demand periods, businesses can allocate rooms, tables, or

resources to maximize revenue potential and minimize the risk of hotel overbooking or underutilization [15].

4. *Competitive Advantage*: Utilizing data-driven decision-making gives businesses a competitive edge. By monitoring market trends, benchmarking against competitors, and identifying emerging opportunities, businesses can make informed decisions, adapt quickly to market changes, and stay ahead of the competition across travel agencies [25].

3.2.2. Customer Relationship Management (CRM)

1. *Personalized Customer Experiences*: Business intelligence and analytics enable businesses to gather and analyze vast amounts of customer data. By understanding individual preferences, behaviors, and needs, businesses can personalize guest experiences, tailor marketing campaigns, and offer targeted promotions, resulting in increased customer satisfaction and loyalty [26].
2. *Improved Guest Service*: Data-driven decision-making helps businesses gain insights into customer feedback and sentiment analysis. By monitoring customer reviews, feedback surveys, and social media interactions, businesses can identify areas for improvement, address guest concerns promptly, and deliver exceptional service, fostering positive guest experiences.

3.2.3. Marketing strategies

1. *Targeted and Personalized Campaigns*: Business intelligence and analytics enable businesses to gather and analyze customer data, including demographics, preferences, and behaviors [15]. Through the utilization of this data, enterprises can develop precise marketing campaigns and deliver tailored messages to distinct customer segments, leading to increased engagement, conversion rates, and customer satisfaction.
2. *Optimized Marketing and Sales Efforts*: Business intelligence enables businesses to measure and analyze the effectiveness of marketing and sales campaigns [24]. By monitoring essential metrics like conversion rates and customer acquisition, and return on investment (ROI), businesses can refine their strategies, allocate resources efficiently, and optimize marketing spend.
3. *Real-Time Monitoring and Adaptation*: This enables businesses to monitor campaign effectiveness, make adjustments on the fly, and respond quickly to market changes, optimizing marketing strategies and maximizing results [26].
4. *Improved Customer Segmentation*: Data analytics allows businesses to segment their customer base effectively. By identifying different customer segments based on demographics, behavior, and preferences, businesses can tailor their marketing messages, offers, and promotions to specific target groups, increasing the relevance and effectiveness of their marketing efforts [26].

3.2.4. Operational planning

1. *Optimized Staffing and Labor Management*: By leveraging data analytics, businesses can determine staffing requirements based on demand patterns, seasonality, and historical occupancy rates [27]. This enables efficient staff scheduling, reducing labor costs, minimizing overstaffing or understaffing issues, and ensuring excellent service delivery.
2. *Improved Inventory Management*: Data-driven decision-making assists businesses in managing inventory more effectively. By analyzing purchasing patterns, consumption rates, and historical data, businesses can optimize inventory levels, reduce waste, and avoid stockouts, leading to cost savings and improved operational performance [24].
3. *Proactive Maintenance and Asset Management*: By utilizing data analytics, businesses can implement predictive maintenance strategies. Analyzing equipment performance data and maintenance history helps identify potential failures, schedule maintenance proactively, and reduce downtime, ensuring operational continuity and cost savings.

4. Challenges and Opportunities

4.1. Challenges

The associated challenges are listed below:

1. *Data Integration and Quality*: Implementing business intelligence and analytics requires integrating data from various sources, such as property management systems, customer databases, and online booking platforms [15]. Ensuring data accuracy, consistency, and cleanliness poses a challenge.
2. *Skill Set and Expertise*: Organizations need skilled professionals with expertise in data analysis, statistical modeling, and business intelligence tools. Developing a team or partnering with experts can address this challenge and enable businesses to extract meaningful insights from the available data.

3. *Data Security and Privacy*: Handling sensitive customer and business data requires strict security measures and compliance with data protection regulations [28]. Implementing appropriate data security protocols and ensuring privacy safeguards are crucial in maintaining customer trust.
4. *Change Management*: Implementing business intelligence and analytics initiatives may require organizational and cultural changes. It's important to address resistance to change, promote data-driven decision-making as a cultural norm, and provide training and support to employees.
5. *Technology Infrastructure*: Businesses need robust technology infrastructure to store, process, and analyze large volumes of data in a timely manner. Ensuring scalability, data accessibility, and infrastructure upgrades are essential for successful implementation.

4.2. Opportunities

The associated challenges are listed below:

1. *Improved decision-making*: Leveraging business intelligence and analytics to gain insights and make data-driven decisions, leading to enhanced efficiency and competitiveness in the hospitality sector.
2. *Personalized customer experiences*: Utilizing analytics to understand customer preferences and behavior, enabling personalized offers, recommendations, and tailored experiences.
3. *Forecasting and demand optimization*: Applying advanced analytics to predict demand patterns, optimize pricing, and maximize revenue for hotels and other hospitality businesses.
4. *Operational efficiency*: Streamlining processes, optimizing inventory management, and reducing costs through data-driven insights and automation.
5. *Competitive advantage*: By effectively utilizing business intelligence and analytics, hospitality businesses can gain a competitive edge by identifying market trends, understanding customer needs, and adapting their strategies accordingly.

These challenges and opportunities highlight the importance of leveraging business intelligence and analytics to drive decision-making and innovation in the online reservation systems within the hospitality sector.

5. Results and Discussion

The findings of this study revealed several key results regarding the impact of BIA on decision-making in online reservation systems.

1. *Enhanced Decision-Making*: The analysis of the collected data demonstrated that organizations that effectively leverage business intelligence and analytics in their online reservation systems experienced improved decision-making processes. By utilizing data-driven insights, such as customer behavior patterns, demand forecasting, and pricing optimization, these organizations were able to make informed decisions that positively impacted their operational efficiency, revenue generation, and customer satisfaction [29].
2. *Improved Customer Experiences*: The study found that organizations that integrated business intelligence and analytics in their online reservation systems were able to enhance customer experiences. Personalization strategies based on customer segmentation and recommendation systems driven by analytics helped tailor offerings to individual preferences, resulting in increased customer satisfaction, loyalty, and higher conversion rates.
3. *Operational Efficiency Gains*: The findings indicated that businesses that adopted business intelligence and analytics tools in their online reservation systems experienced significant operational efficiency gains. Through real-time monitoring and reporting capabilities, organizations could identify and address issues promptly, optimize resource allocation, streamline processes, and improve overall efficiency.
4. *Revenue Growth*: The analysis revealed that effective utilization of business intelligence and analytics positively impacted revenue growth in online reservation systems. By optimizing pricing strategies, implementing revenue management techniques, and leveraging data-driven insights for demand forecasting, organizations were able to maximize revenue generation and achieve better financial outcomes.

Although there exist various challenges in implementation of BIA in the hospitality sector this study explores the practical significance of the results of the benefits in the various areas of the hospitality businesses and provides insights into the mechanisms through which BIA impact decision-making in online reservation systems. Additionally, any limitations or constraints of the study have been acknowledged and discussed.

6. Conclusion

In conclusion, this study highlights the powerful impact of business intelligence and analytics on decision-making in online reservation systems. The results demonstrate that organizations that effectively leverage data-driven insights are able to make informed decisions, enhance customer experiences, improve operational

efficiency, and drive revenue growth. By adopting appropriate business intelligence tools, integrating data from multiple sources, and employing advanced analytics techniques, organizations can unlock the full potential of their online reservation systems.

7. Recommendations

Based on the findings, several recommendations can be made for organizations seeking to leverage business intelligence and analytics in their online reservation systems:

1. *Invest in robust business intelligence tools*: Organizations should invest in reliable and scalable business intelligence tools that enable data integration, analysis, and visualization to derive actionable insights.
2. *Develop a data-driven culture*: Organizations should foster a data-driven culture that emphasizes the importance of data quality, data governance, and decision-making based on data-driven insights.
3. *Prioritize customer-centric approaches*: Organizations should prioritize personalization strategies and recommendation systems to enhance customer experiences, improve conversion rates, and foster customer loyalty.
4. *Continuously monitor and optimize*: Regular monitoring and optimization of key performance indicators, such as booking rates, website traffic, and customer feedback, can help organizations identify areas for improvement and make data-driven adjustments.

8. Suggestion for Future Research

While this study provides significant insights into the impact of BIA in hospitality sector, there are several areas for further research:

1. *The role of artificial intelligence and machine learning*: Future research can explore the integration of artificial intelligence and machine learning algorithms in online reservation systems to further enhance decision-making, personalization, and operational efficiency.
2. *Ethical considerations*: Future studies can investigate the ethical implications of utilizing customer data in hospitality sector and explore frameworks for responsible data usage and privacy protection.
3. *Industry-specific analysis*: Further research can delve into industry-specific analyses to understand the nuances and challenges faced by different sectors in leveraging business intelligence and analytics in their online reservation systems.
4. *Long-term impact assessment*: Future studies can assess the long-term impact of implementing business intelligence and analytics in hospitality sector.

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Conflict of interest

The authors have no conflicts of interest to declare.

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