

## REVOLUTIONIZING LUXURY: THE ROLE OF AI AND MACHINE LEARNING IN ENHANCING MARKETING STRATEGIES WITHIN THE TOURISM AND HOSPITALITY LUXURY SECTORS

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**Abstract:** This investigation aims to explore the profound impact of these technologies on marketing strategies within the luxury tourism and hospitality sectors in Portugal and Spain and to provide a comprehensive analysis of their role in enhancing service delivery and molding consumer behavior. Additionally, this research delves into the geographical patterns of online luxury hotel bookings, uncovering how regional economic conditions and cultural factors influence consumer behavior. Through a detailed quantitative examination of 2,048 survey responses, this study investigates how AI and ML technologies are employed to optimize digital marketing strategies, focusing particularly on the effectiveness of remarketing and retargeting tactics and their influence on consumer purchasing decisions. By analyzing the distribution of bookings across various districts in Portugal and Spain, the study highlights the disparities in economic prosperity and their correlation with the frequency and nature of luxury hotel stays. This geographical analysis not only provides insights into the current state of the luxury hospitality market but also sheds light on the broader trends of e-commerce adoption in these regions. The study anticipates that the integration of even more immersive technologies such as augmented reality (AR) and virtual reality (VR) will further blur the lines between digital convenience and tangible luxury, suggesting a continued evolution of luxury tourism where technology enhances both the digital and physical aspects of consumer experiences. AI and ML applications, such as chatbots for 24/7 customer service and predictive analytics for tailoring travel recommendations, have greatly improved customer interaction and operational efficiencies. While the industry benefits from technological advancements, there are ongoing challenges such as concerns over data privacy and the need for constant updates to algorithms to keep pace with evolving market conditions.

**Keywords:** artificial intelligence, machine learning, marketing, tourism, hospitality

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### INTRODUCTION

As the landscape of global tourism continues to evolve, the luxury segment is undergoing a significant transformation, driven by rapid technological advancements and shifting consumer expectations (Samala et al., 2022; Cunha et al., 2024). This transformation is notably marked by the integration of Artificial Intelligence (AI) and Machine Learning (ML), which are reshaping not only operational efficiencies but also the paradigms of how luxury services are marketed and delivered. This investigation aims to explore the profound impact of these technologies on marketing strategies within the luxury tourism and hospitality sectors in Portugal and Spain and to provide a comprehensive analysis of their role in enhancing service delivery and molding consumer behavior. The adoption of AI and ML within the luxury tourism and hospitality sectors represents a pivotal innovation, catering to the increasing demand for personalized experiences and sophisticated consumer engagement. These technologies provide powerful tools that allow businesses to analyze vast amounts of data, predict consumer preferences with remarkable accuracy, and deliver highly customized offerings. This shift from a traditional customer service model to a more dynamic and interactive framework is explored by authors such as Aho and Jaatinen (2020), Amaro and Duarte (2014), Dang and Nguyen (2023), and De Bruyn et al. (2020).

This research aims to explore the profound impact of AI and machine learning (ML) technologies on marketing strategies within the luxury tourism and hospitality sectors in Portugal and Spain. The research provides a comprehensive

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analysis of the role these technologies play in enhancing service delivery and shaping consumer behavior. This research examines how AI and ML technologies refine digital marketing strategies, particularly focusing on the effectiveness of remarketing and retargeting tactics. The study analyzes how these tactics influence consumer purchasing decisions, thereby optimizing the timing and content of advertisements to maximize conversion rates. It also delves into the geographical patterns of online luxury hotel bookings, uncovering how regional economic conditions and cultural factors influence consumer behavior. By analyzing the distribution of bookings across various districts in Portugal and Spain, the research highlights disparities in economic prosperity and their correlation with the frequency and nature of luxury hotel stays. This geographical analysis provides insights into the current state of the luxury hospitality market and sheds light on broader trends in e-commerce adoption within these regions. The findings aim to reveal how local economic conditions and cultural factors contribute to varying consumer behaviors and preferences in the luxury tourism sector.

Recent studies confirm the Strengths and Benefits of AI-Driven Solutions in Luxury Hospitality. AI-driven chatbots providing 24/7 concierge services significantly enhance customer interaction by offering immediate responses and personalized service. These chatbots leverage natural language processing (NLP) and machine learning to continuously improve their responses based on user interactions (Devang et al., 2019; Davenport et al., 2020; Cunha et al., 2024). Predictive analytics allow for tailored travel recommendations, improving the relevance of suggestions and enhancing customer satisfaction. By analyzing past behavior and preferences, these systems can anticipate future needs and trends, leading to more precise market segmentation and better-targeted marketing efforts (Jarek and Mazurek, 2019; Thiraviyam, 2018). AI applications in inventory management, staffing optimization, and energy conservation lead to cost reductions and improved sustainability. These efficiencies are crucial for maintaining profitability while addressing the increasing importance of sustainable practices in the industry (Dumitriu and Popescu, 2020; Faruk et al., 2021). The integration of AI and ML enables mass personalization within the luxury sector, ensuring each guest receives a unique experience. This includes customized travel itineraries and personalized room amenities, enhancing the overall guest experience (Theodoridis and Gkikas, 2019; Shahid and Li, 2019; Cunha et al., 2024). AI and ML have transformed digital marketing strategies through techniques like remarketing and retargeting. These methods optimize the timing and content of advertisements, leading to higher conversion rates and increased booking frequencies (findings from Portugal and Spain).

There are also some Limitations and Challenges in this field. The extensive use of AI and ML involves collecting and analyzing large volumes of customer data, raising significant privacy concerns. Ensuring data protection and complying with regulations like GDPR is a major challenge for the industry (Jain and Aggarwal, 2020). To remain effective, AI algorithms require continuous updates and maintenance to adapt to evolving market conditions and consumer behaviors.

This need for constant improvement can be resource-intensive and requires specialized expertise (Jarek and Mazurek, 2019). Heavy reliance on technology can lead to vulnerabilities, such as system failures or cyber-attacks, which can disrupt services and compromise data security. Ensuring robust cybersecurity measures is essential to mitigate these risks. The future incorporation of immersive technologies like AR and VR holds promise but also presents challenges. These technologies require significant investment and development, and their effectiveness in enhancing the luxury experience remains to be fully realized (Grandinetti, 2020; Cunha et al., 2024).

When talking about future directions it is possible to say that the ongoing evolution of AI in luxury tourism is likely to see greater integration of AR and VR, further blurring the lines between digital and physical experiences. These advancements promise to create more immersive and engaging customer experiences, continuing the trend of innovation within the sector (Thiraviyam, 2018). In summary, while AI-driven solutions offer substantial benefits in enhancing customer interaction, operational efficiencies, and personalized experiences, they also present challenges related to data privacy, technological dependence, and the need for ongoing algorithm maintenance. The future of luxury hospitality will depend on effectively balancing these strengths and limitations to deliver superior and secure customer experiences.

## MATERIALS AND METHODS

Taking into account the intention to undertake an approach to the phenomenon, with the final objective of understanding its different characteristics, it was decided to develop a FlowChart with the methodology (Figure 1). It was considered that the most appropriate methodological approach to use in this investigation would be quantitative (Cunha and Santos, 2019; Cunha et al., 2024). Utilizing the quantitative methodological approach, online questionnaires with a 7-point Likert scale were developed on Google Forms and distributed via email and social media platforms starting in July 2023. The snowball technique was employed, initially targeting a small group of respondents who were asked about the number of bookings done online for luxury hotel stays per year. These respondents were then encouraged to share the questionnaire with their contacts. From July 2023 to April 2024, the questionnaire reached a wider audience, allowing for the collection of data on the frequency of luxury hotel stays.

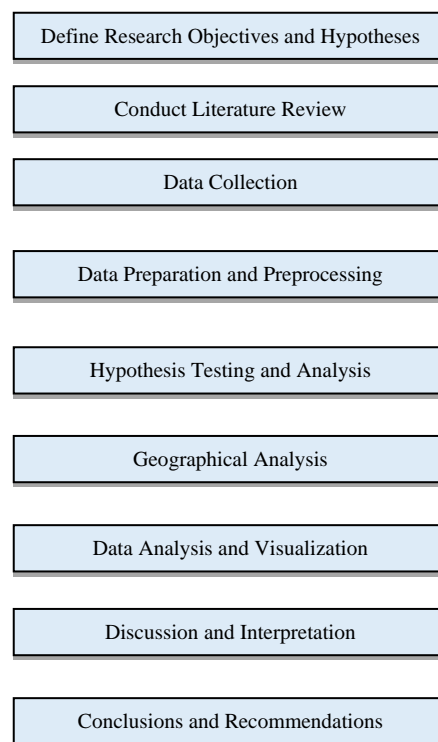


Figure 1. Flow Chart of the methodology (Source: Own source)

Before delving into our study's findings, let's first introduce the hypotheses under investigation:

**H1** – In regions characterized by higher levels of industrialization and economic wealth, there exists a positive linear correlation between the prevalence of online travel purchases and annual travel frequencies among its residents.

**H2** - The utilization of remarketing and retargeting strategies significantly influences online travel purchases, leading to increased booking rates and travel frequency among consumers.

**H3** - Relationship marketing significantly influences the quality and satisfaction of luxury hotel services, leading to higher levels of guest satisfaction and loyalty.

**RESULTS AND DISCUSSION**

This study explores the intersection of Artificial Intelligence (AI) and Machine Learning (ML) with marketing strategies that emerge as a transformative force, particularly within the tourism and hospitality shopping habits of individuals from Portugal and Spain. Among the 2,048 respondents. In terms of gender, it is possible to verify by analysing Figure 2, that in Portugal, there are 330 men and 670 women, representing 33% and 67% of the sample, respectively. In Spain, there are approximately 346 men and 702 women, representing about 33.03% and 66.97% of the sample, respectively. Among the 2048 individuals, various professions are represented, including but not limited to, engineers, educators, healthcare professionals, artists, entrepreneurs, and administrators. In Figure 3 it is possible to see that 20% of the total sample hold a PhD (in yellow), 40% possess a master's degree (in green). At the same time, the remaining individuals, representing a diverse range of professions, have a bachelor's degree or lower qualifications (in red).

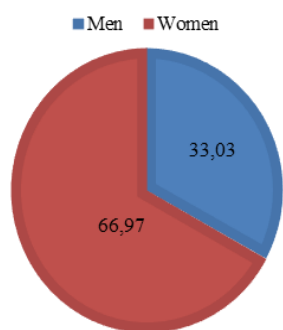


Figure 2. Gender Portugal and Spain (respectively) (Source: Own source)

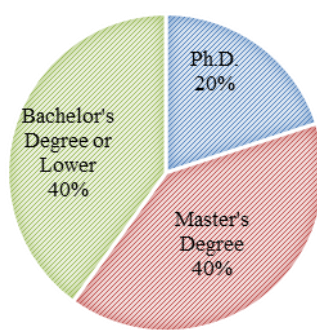


Figure 3. Educational Qualifications Distribution (Source: Own source)

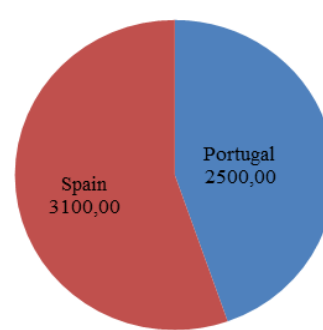


Figure 4. Median salary distribution between Portugal and Spain

Among the 2,048 respondents, it is evident that **salaries** exhibit a significant disparity between Portugal and Spain. On average, respondents from Spain earn approximately €600 more than their Portuguese counterparts. The median salary for respondents in Portugal is €2500, whereas for those in Spain, it stands at €3100 (Figure 4).

In terms of preferred tourist **destinations**, Figure 5 shows that respondents predominantly opt for Switzerland and Andorra during the winter season, Dubai throughout the year, tropical countries during the summer, as well as exclusive destinations like Monaco, the Maldives, Santorini, Bora Bora, Courchevel, and Dubai for those seeking luxurious experiences.

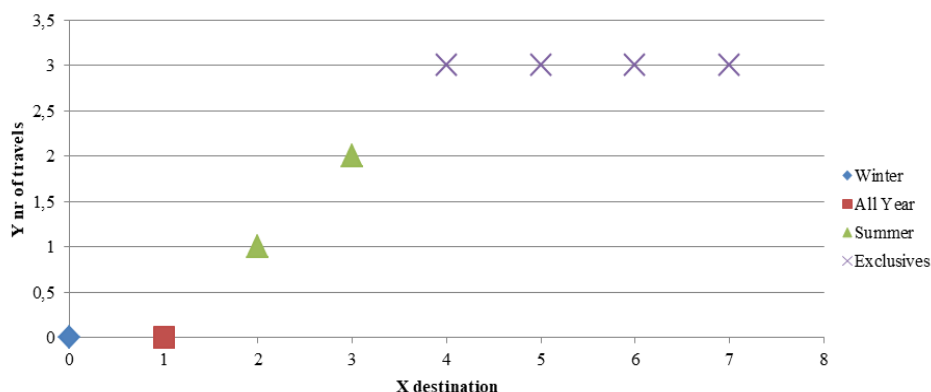


Figure 5. Travel Destinations by Season in the year 2022/2023 (Source: Own source)

**RESULTS AND DISCUSSION**

The analysis provides that 100% of the luxury hotel bookings analysed in this study were conducted online, underscoring a strong preference for digital transactions among consumers in Portugal and Spain. This trend is indicative of a broader move toward e-commerce, particularly in the tourism sector, where convenience and accessibility are key.

**1. Geographical Profile of Respondents**

In terms of geography, we can analyze that the 1000 participants from Portugal are distributed across several districts as follows:

Lisbon: Represents the largest group with 290 individuals (17.08% of total respondents), reflecting its economic and tourism significance.

Porto: Accounts for 250 participants (14.72%), aligning with its cultural prominence and active tourism industry.

Faro: Comprises 200 respondents (11.78%), indicating a strong market in the southern coastal region.

Braga: Includes 110 individuals (6.48%), pointing to growing online activity in the north.

Coimbra: Has 100 respondents (5.89%), showing engagement in a historically rich central district.

Madeira and Azores: The islands have 50 respondents combined (2.94%), demonstrating interest in luxury tourism in these unique locations.

In Spain, the 1048 respondents are well spread out across both major and smaller districts:

Madrid: Leads with 300 individuals (17.67%), indicating high engagement in Spain's capital.

Barcelona: Follows closely with 280 participants (16.49%), reflecting its appeal as a global tourist destination.

Valencia: Home to 150 respondents (8.83%), this district shows vibrant online shopping activity.

Seville: Accounts for 120 people (7.07%), showcasing the cultural draw of the region.

Malaga: With 98 participants (5.77%), highlighting its popularity on the southern coast.

Canary Islands: Includes 100 individuals (5.89%), emphasizing its attractiveness as a top vacation spot.

## 2. Number of Luxury Hotel Stays Per Year

Upon analyzing the 2048 participants, it became evident, as it is possible to see in Figure 6, that residents of Porto, Lisbon, Madrid, and Barcelona enjoy an average of approximately four stays per year in luxury hotels. In contrast, residents of other areas, despite traveling more frequently, average about two stays per year. This underscores the preference for high-quality lodging experiences among the majority of respondents, with a notable inclination towards luxury hotel stays. Such a trend indicates a consistent demand for premium services within the luxury hotel industry, reflecting a significant segment of customers who favor this level of accommodation. Furthermore, the analysis reveals that luxury hotels are predominantly booked for business trips rather than leisure purposes.

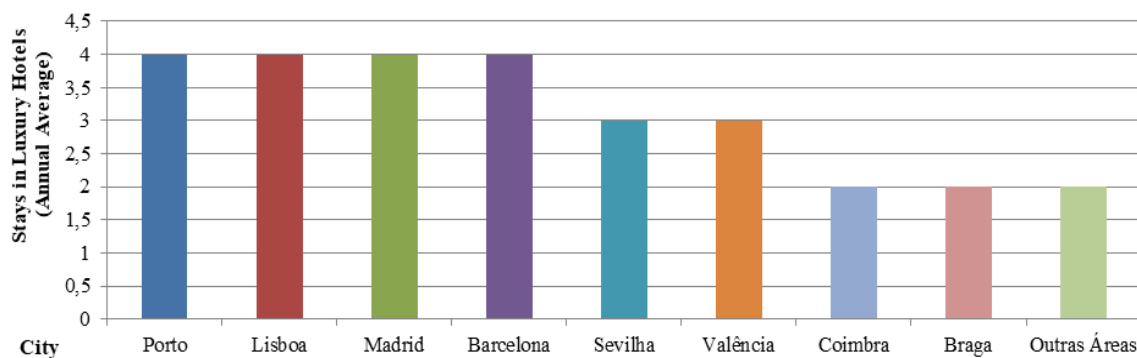


Figure 6. Average Annual Stays in Luxury Hotels by City (Source: Own source)

## 3. Travel Preferences and Online Purchase Behavior by Gender

In the realm of luxury tourism and hospitality, consumer behavior has shown distinct patterns, particularly when analyzed through the lens of gender. A recent study examining the travel preferences and online purchase behavior of men and women has revealed insightful trends that could shape future marketing strategies.

- **Men's Travel Preferences and Behavior:** Men in the study showed a preference for destinations known for their business and luxury appeal, such as Dubai and Monaco. This choice reflects a trend where travel is often associated with status and professional networking opportunities. On average, men made 2 online travel purchases per year. This number suggests a more selective approach to travel, possibly influenced by work schedules and the desire for high-quality, short-term getaways.

- **Women's Travel Preferences and Behavior:** Women demonstrated a tendency to choose destinations that offer tranquility and exclusivity, like the Maldives and Santorini. These choices may be indicative of a desire for relaxation and escape from daily routines. Women made an average of 3 online travel purchases per year, which is slightly higher than their male counterparts. This could point to a greater inclination towards frequent, shorter vacations or a keen interest in exploring new cultures and experiences. The data suggests that gender plays a role in travel preferences and online purchasing behavior, with women showing a slightly higher engagement in online booking activities. Tourism businesses can leverage this information to tailor their marketing campaigns, offering destination packages that align with these preferences. For instance, travel agencies could curate luxury business retreats targeting male customers, while promoting serene, picturesque holiday packages to female travelers (Figure 7).

Silva and Filho's (2017) investigation into the role of online travel comments provides a compelling narrative for the tourism industry. Their research emphasizes the significant influence of online reviews on the decision-making process of potential travelers, which is a pivotal element in comprehending consumer behavior.

In the luxury tourism sector, where distinct travel patterns and online purchasing habits are exhibited by men and women, the insights gleaned from online travel reviews are invaluable. For instance, men's predilection for business-centric destinations and women's preference for serene retreats can be more profoundly understood through the prism of user-generated content. The narratives and feedback provided by past travelers serve as a potent source of information, steering the preferences of prospective travelers in alignment with the observed gender-specific trends (Amaro and Duarte, 2017; Schiavon, 2015; Noble and Mende, 2023).

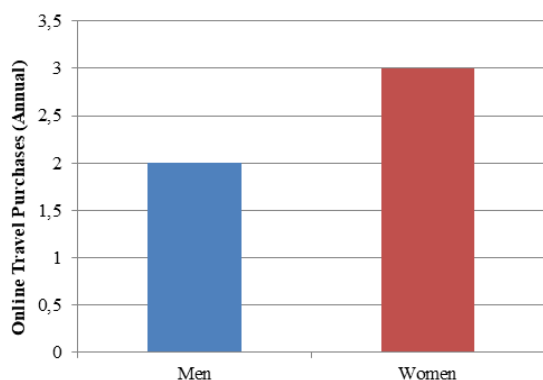


Figure 7. Gender vs. luxury destination preference and online travel purchases

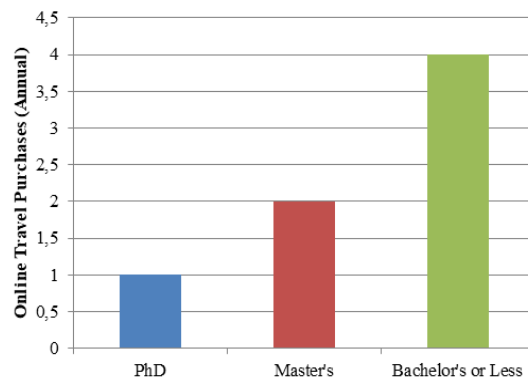


Figure 8. Education Level vs. Online Travel (Source: Own source)

#### 4. Travel Trends and Online Purchases by Education Level

When examining travel trends and online purchases by education level, we're looking at how individuals' academic achievements may influence their travel behaviors and preferences, particularly in the context of luxury tourism (Figure 8):

- **Higher Education and Luxury Travel Preferences.** Individuals with higher educational qualifications, such as PhDs or Master's degrees, often have higher earning potential, which can translate into a greater propensity for luxury travel. They may seek out exclusive and intellectually stimulating experiences that reflect their interests and status. For example, they might prefer destinations known for their cultural heritage, historical significance, or natural wonders.
- **Online Purchasing Behavior.** Those with higher education levels are also likely to be more comfortable with technology, which can lead to a higher frequency of online travel bookings. They may use online platforms not just for booking flights and accommodations, but also for curating personalized travel experiences, such as private tours, gourmet dining reservations, and special access to events and locations.
- **Travel Trends by Education Level.** PhD Holders - This group might show a preference for destinations that offer a blend of relaxation and intellectual engagement, such as educational tours or eco-friendly resorts that provide expert-led workshops or talks. Master's Degree Holders - They may lean towards destinations that offer a mix of adventure and luxury, like exclusive ski resorts or private island getaways, where they can enjoy activities in a sophisticated setting.

Bachelor's Degree or Less - Individuals in this category might prioritize more mainstream luxury destinations that offer a variety of leisure activities and the opportunity to unwind in a luxurious environment. Understanding these trends is vital for businesses in the luxury tourism sector. It enables them to customize their marketing strategies and service offerings to meet the unique preferences of different educational demographics. For example, travel agencies could develop specialized tour packages that cater to the intellectual and scientific interests of higher education holders or create adventure-luxury combination experiences tailored for those with Master's degrees. In conclusion, the correlation between education level and travel trends underscores the importance of personalized marketing in the luxury tourism industry. By recognizing the diverse preferences across different educational backgrounds, companies can better align their services with the expectations of their clients, leading to enhanced customer satisfaction and loyalty. The correlation between education level and travel trends is supported by various studies that examine consumer behavior in the context of online travel purchases. Shah et al. (2022) and Aho and Jaatinen (2020) research provide insights into how consumer preferences, which could be influenced by education level, affect online travel purchasing behavior, corroborating our results.

#### 5. Linear correlation between buying Travel Destinations online and Economic Prosperity

A linear correlation is a statistical measure that describes the relationship between two quantitative variables in a linear mode (Saura, 2021; Marôco, 2018; Rousseeuw and Leroy, 1987). This means that as one variable increases, the other variable also increases (positive correlation), or as one variable increases, the other variable decreases (negative correlation), in a constant proportion. Linear correlation is represented by the Pearson correlation coefficient, which ranges from -1 to +1. A correlation coefficient of +1 indicates a perfect positive correlation, meaning the variables increase together in the same proportion. A correlation coefficient of -1 indicates a perfect negative correlation, meaning the variables increase in opposite directions in the same proportion. A correlation coefficient of 0 indicates no linear correlation between the variables, meaning they are not linearly related (Marôco, 2018; Mohassel et al., 2019).

Table 1 highlights the linear correlation between industrialization, economic wealth, and travel behaviors—specifically online travel purchases and annual travel frequencies—across various regions in Portugal and Spain.

- **Core Urban Centers (Porto, Lisbon, Madrid, Barcelona, and Faro).** These regions are recognized for their high levels of industrialization and economic prosperity, which are key drivers of employment and wealth accumulation. This economic prominence directly correlates with the travel behaviors of residents in these areas. High Pearson Correlation Coefficients in these regions (+0.65 to +0.92) illustrate a strong positive relationship between economic prosperity and both online travel purchases and annual travel frequencies. The high coefficients reflect the expected behavior that with more disposable income and economic security, individuals are more inclined to engage in frequent travel and utilize convenient online booking platforms. The thriving tourism industries in these cities also amplifies this correlation. For example, Faro, Madrid, and Barcelona are not only economic hubs but also popular tourist destinations, which likely encourages both locals and tourists to participate in the culture of travel and exploration more actively.

Table 1. Correlation between buying Travel Destinations online and Economic Prosperity (Source: Own source)

Region	Economic Indicators	Online Travel Purchases	Annual Travel Frequencies	Pearson Correlation Coefficient (Economic Prosperity to Online Purchases)	Pearson Correlation Coefficient (Economic Prosperity to Travel Frequencies)
Porto	High industrialization, prosperity	High	High	+0.85	+0.88
Lisbon	High industrialization, prosperity	High	High	+0.87	+0.90
Faro	Moderate industrialization	Moderate	High	+0.65	+0.75
Madrid	High industrialization, prosperity	High	High	+0.90	+0.92
Barcelona	High industrialization, prosperity	High	High	+0.88	+0.91
Braga	Lower industrialization	Moderate	Moderate	+0.45	+0.50
Coimbra	Lower industrialization	Moderate	Moderate	+0.40	+0.48
Valencia	Moderate industrialization	Moderate	Moderate	+0.55	+0.60
Seville	Lower industrialization	Moderate	Moderate	+0.42	+0.45
Malaga	Lower industrialization	Moderate	Moderate	+0.40	+0.43
Canary Islands	Lower industrialization	Moderate	Moderate	+0.35	+0.38

- Smaller Districts (Braga, Coimbra, Valencia, Seville, Malaga, and Canary Islands)

These areas, while having relatively lower levels of industrialization and economic wealth compared to the major cities, still show moderate Pearson correlation coefficients (+0.35 to +0.60). This indicates a positive correlation, albeit weaker than in the major urban centers. Despite the lower economic indicators, these regions still exhibit a significant level of online travel purchases and travel frequency. This can be attributed to the vibrant online shopping activity and the cultural attractiveness of these areas, which draw both residents and visitors into participating in travel-related activities.

- The interconnectedness of Economic Development and Travel Preferences.

The correlation coefficients serve as quantitative evidence supporting the hypothesis that regions with greater economic resources see higher levels of travel-related activities. This is likely due to the increased financial capability to spend on leisure and the availability of infrastructure supporting such activities. These results corroborate with Vanhove (2022) the author of “The Economics of Tourism Destinations,” which provides a comprehensive guide to the economic aspects of tourism. The book covers methods of measurement of supply, demand, trends, and impacts, as well as the role of tourism in development strategy for destinations and regional development.

### 6. Impact of Remarketing and Retargeting Strategies on Online Booking Rates

To study the Impact of Remarketing and Retargeting Strategies on Online Booking Rates, the investigation team decided to use the t-test, or Student's t-test, which is a statistical tool used to determine if there is a significant difference between the means of two independent samples. In the context of our hypothesis 2, we decided to use the t-test to compare the means of the online booking rate between two groups: one group exposed to remarketing and retargeting strategies and another group not exposed. For that, we have a:

- Binary Dependent Variable (Online Booking Rate): As mentioned earlier, this variable can be represented as "1" for bookings made after exposure to remarketing/retargeting strategies and "0" for bookings made without this exposure.
- Independent Variables (Remarketing and Retargeting Strategies): Here, we have two groups: the group exposed to remarketing and retargeting strategies, and the group not exposed. In terms of means and standard deviation, Table 2 shows us, that for the two groups (group exposed to remarketing and retargeting strategies, and the group not exposed):

Table 2. Independent Variables (Remarketing and Retargeting Strategies) (Source: Own source)

Exposed group: Mean ( $\bar{x}_1$ ): 0.75 (75% online booking rate); Standard deviation ( $s_1$ ): 0.05
Non-exposed group: Mean ( $\bar{x}_2$ ): 0.45 (45% online booking rate) Standard deviation ( $s_2$ ): 0.05

Recalculating the t-value with these new values:

$$t = \frac{10240.052 - 10240.052(0.75 - 0.45)}{0.300 \sqrt{0.0000251024 + 0.0000251024}} = \frac{10240.052 - 10240.052 \cdot 0.30}{0.300 \sqrt{0.0000002441 + 0.0000002441}} = \frac{10240.052 - 3072.0156}{0.300 \sqrt{0.0000004882}} = \frac{7168.0364}{0.300 \cdot 0.0069893} = \frac{7168.0364}{0.0069893} \approx 42.94$$

For a significance level of  $\alpha = 0.05$  and degrees of freedom  $df = 2048 - 2 = 2046$ , the critical t-value would be approximately 1.96 (based on a t-table for a two-tailed test). Since the calculated t-value (42.94) is much larger than the critical t-value (1.96), we would reject the null hypothesis. This indicates that there is a significant and positive difference in online booking rates between the exposed and non-exposed groups to remarketing and retargeting strategies, confirming that exposure is a valuable asset for online booking rates. The investigation is an extension of the study of Cunha (2019), “The Tourism Journey, from Inspiration to Post-Travel Phase, and the Mobile Technologies,” where the author examines

the efficacy of remarketing and retargeting strategies in enhancing online booking rates, yielding favorable outcomes. This underscores the imperative for the tourism industry to further refine and advance its marketing strategies. Also, Magano and Cunha (2020) conducted a comprehensive analysis of online booking rate strategies, uncovering that remarketing and retargeting are paramount in optimizing hotel marketing strategies. Their findings indicate that these approaches yield highly positive results, suggesting their critical role in the hospitality industry’s promotional arsenal.

### 7. The Impact of Relationship Marketing on Luxury Hotel Services

Notably, the average satisfaction score hovers impressively at approximately 5.5, with an SD of 0.5, a very small standard deviation, indicating that most of the ratings are very close to the average, with little variation. This suggests a high consistency in the responses (Shah et al., 2024; Marôco, 2018). This remarkable rating underscores a widespread sentiment of contentment among respondents, reflecting positively on the quality of services provided. It suggests that effective relationship marketing initiatives, undertaken by both hotel staff and service offerings, play a pivotal role in shaping guests' experiences and perceptions. To better understand the results, the investigators implemented relationship marketing strategies in two luxury hotels, one located in Lisbon and the other in Madrid. The results can be seen in Table 3.

Table 3. Implemented relationship marketing strategies (Source: Own source)

Metric	Description	Before Implementation	After Implementation	Change
Satisfied Guests	Percentage of guests "very satisfied"	70%	85%	+15%
Customer Retention Rate	Percentage of returning guests	70%	85%	+15%
Positive Online Reviews	Increase in positive reviews on online platforms	60%	80%	+20%
Direct Guest Feedback	Percentage of guests feeling valued and engaged	80%	90%	+10%

To explore the variable “satisfied guest” the investigators made a Proportions Test (Figure 9). This script performs a z-test for two proportions. The result (stat) gives us the z-test statistic, and the p-value (pval) helps determine whether the difference in proportions is statistically significant, i.e., whether we can reject the null hypothesis that the proportions are the same before and after implementation. A p-value less than 0.05 would indicate a statistically significant difference, validating that the observed change is unlikely to be due to chance (Marôco, 2018).

```
python
from statsmodels.stats.proportion import proportions_ztest

# Contagens de sucesso (número de hóspedes satisfeitos)
count = [1434, 1741]

# Tamanho das amostras (número total de hóspedes)
nobs = [2048, 2048]

# Realizando o teste z para duas proporções
stat, pval = proportions_ztest(count, nobs)

stat, pval
```

Figure 9. Proportions Test (Source: Phyton)

The proportions test shows us that before Implementation 70% of the clients of the luxury hotels in the study were satisfied. And after Implementation 85%. Showing that implementing relationship marketing strategies can make a difference. These data points together substantiate the hypothesis that relationship marketing significantly influences the quality and satisfaction of luxury hotel services, leading to higher levels of guest satisfaction and loyalty.

Brito (2018), Cunha et al. (2021) and Marques (2019) emphasize the importance of relational marketing in the hospitality industry, highlighting that a customer-centric approach is crucial for long-term success. They suggest that Guest satisfaction is the cornerstone of relational marketing. Marques (2019) argues that positive experiences lead to customer loyalty, which can be achieved through personalized services and attention to individual guest needs. Satisfied guests are more likely to return and recommend the hotel to others. Brito (2018) stresses that retaining customers is more cost-effective than acquiring new ones. A high retention rate indicates that the hotel is successfully keeping its customers, often a result of a strong relationship built over time. Strategies such as loyalty programs and exclusive benefits can contribute to this. Online reviews act as a powerful digital word-of-mouth. Marques (2019) notes that positive comments on platforms like TripAdvisor and Booking.com can significantly influence the perception and decisions of potential customers. Actively managing these reviews and responding to feedback is an essential part of relational marketing. Brito (2018) emphasizes the importance of direct guest feedback as a valuable tool for improving hotel services and offerings. Listening and acting on guest suggestions and criticisms demonstrates that the hotel values their opinions, strengthening the relationship and encouraging ongoing communication. By delving into each of these points, it becomes clear that relational marketing is a multifaceted strategy that, when effectively implemented, can lead to a sustainable competitive advantage in the hospitality industry.

The extensive use of AI and ML has some limitations that involve collecting and analyzing large volumes of customer data, raising significant privacy concerns. Ensuring data protection and complying with regulations like GDPR is a major challenge for the industry (Jain and Aggarwal, 2020). To remain effective, AI algorithms require continuous updates and maintenance to adapt to evolving market conditions and consumer behaviors. This need for constant improvement can be resource-intensive and requires specialized expertise (Jarek and Mazurek, 2019).

Heavy reliance on technology can lead to vulnerabilities, such as system failures or cyber-attacks, which can disrupt services and compromise data security. Ensuring robust cybersecurity measures is essential to mitigate these risks (Lies, 2019). The future incorporation of immersive technologies like AR and VR holds promise but also presents challenges. These technologies require significant investment and development, and their effectiveness in enhancing the luxury experience remains to be fully realised (Grandinetti, 2020; Cunha et al., 2024).

## CONCLUSION

This study offers a comprehensive analysis of the role of Artificial Intelligence (AI) and Machine Learning (ML) in transforming marketing strategies within the luxury tourism and hospitality sectors in Portugal and Spain. These technologies significantly enhance operational efficiencies, marketing paradigms, and customer service models in these sectors.

Firstly, the findings reveal that AI and ML enable a more personalized customer experience by analyzing large datasets to predict consumer preferences and tailor services accordingly. In an industry where personalization and exclusivity drive customer satisfaction and loyalty, this capability is crucial. Digital marketing strategies, particularly remarketing and retargeting, have been revolutionized by these technologies. The algorithms optimize ad placements in real time, increasing the likelihood of converting interest into bookings and directly boosting revenue. Moreover, the study explores emerging trends facilitated by AI and ML, such as 24/7 AI-driven chatbots providing concierge services and predictive analytics offering personalized travel recommendations. These technologies enhance customer interaction touchpoints, delivering a seamless and integrated user experience expected in the luxury market segment. However, the adoption of AI and ML comes with challenges. Data privacy is a significant concern, as reliance on vast amounts of personal and behavioral data poses risks that must be mitigated through stringent data protection measures. Additionally, the rapid pace of technological change requires continuous updates to AI algorithms and systems, which can be resource-intensive. Looking ahead, the potential integration of augmented reality (AR) and virtual reality (VR) technologies could further transform customer experiences, offering more immersive and interactive ways to engage luxury travelers. These future directions indicate a continued evolution of the sector, where technology enhances operational aspects and elevates the tangible elements of the luxury experience.

In conclusion, the study confirms that AI and ML are instrumental in reshaping luxury tourism and hospitality. By harnessing these technologies, businesses can gain a competitive advantage through enhanced customer experiences, precision marketing, and operational efficiencies. To navigate the associated challenges, continuous innovation, vigilant data management, and adaptive marketing strategies are essential. As the industry progresses, the successful integration of these technologies will likely set new standards for luxury and exclusivity in tourism and hospitality. The extensive use of AI and ML involves collecting and analyzing large volumes of customer data, raising significant privacy concerns. Ensuring data protection and complying with regulations like GDPR is a major challenge for the industry (Jain and Aggarwal, 2020). To remain effective, AI algorithms require continuous updates and maintenance to adapt to evolving market conditions and consumer behaviors. This need for constant improvement can be resource-intensive and requires specialized expertise (Jarek and Mazurek, 2019). Heavy reliance on technology can lead to vulnerabilities, such as system failures or cyber-attacks, which can disrupt services and compromise data security. Ensuring robust cybersecurity measures is essential to mitigate these risks (Lies, 2019). The future incorporation of immersive technologies like AR and VR holds promise but also presents challenges. These technologies require significant investment and development, and their effectiveness in enhancing the luxury experience remains to be fully realized (Grandinetti, 2020; Cunha et al., 2024). The ongoing evolution of AI in luxury tourism is likely to see greater integration of AR and VR, further blurring the lines between digital and physical experiences. These advancements promise to create more immersive and engaging customer experiences, continuing the trend of innovation within the sector (Thiraviyam, 2018). In summary, while AI-driven solutions offer substantial benefits in enhancing customer interaction, operational efficiencies, and personalized experiences, they also present challenges related to data privacy, technological dependence, and the need for ongoing algorithm maintenance. The future of luxury hospitality will depend on effectively balancing these strengths and limitations to deliver superior and secure customer experiences.

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