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# Beyond Chartering: Adapting the Offer to Customer Behavior for a Sustainable Yachting Industry

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**Abstract:** The significant and ongoing growth of the yacht charter sector plays a crucial role in the tourism industry as a whole, especially in nautical tourism. This study provides a detailed analysis of the yacht charter market, focusing on the opportunities for and challenges in its sustainable growth, with a specific emphasis on Andalusia, Spain. The main objective is to align the yacht charter offer with customer preferences, enabling yacht owners or companies to make more informed decisions and contributing to the sustainability of the sector and the region. Using machine learning techniques, researchers have analyzed extensive datasets to identify patterns in customer behavior and yacht characteristics. Industry companies and yacht owners can use the results of this research to develop more effective marketing strategies, improve customer experience, and efficiently manage their fleets, thus directly contributing to the socio-economic and environmental sustainability of mooring locations. Furthermore, this research enhances the understanding of yachting tourism, laying the groundwork for future research and developments in the industry.

**Keywords:** yacht charter; sharing economy; nautical tourism; clustering; random forest

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## 1. Introduction

In general, technological advances have generated an unprecedented increase in the emergence of digital business models based on online platforms where the specific concept of sharing economy has gained strong potential and positioning [1]. The sharing economy, also known as the collaborative economy or peer-to-peer (p2p) economy, acts as a disruptive force and a crucial ally in the transformation of the tourism and hospitality sector [2–4], offering tourists alternatives to traditional tourism services. Online channels have contributed to the consumption of tourist products or services experiencing exceptional growth, with products being more accessible, with an extensive set of information useful for the consumer in their selection, planning, purchasing, and use of a tourism product [5]. Increasingly, consumers participate in the collaborative economy managed by tourist operators or agents but also exchange, sell, or rent their resources with others [6]. The behaviors and motivations of tourists facilitate consumption and can contribute to making tourism companies and destinations more sustainable.

To enhance visitor experiences, tourist destinations must provide a diverse range of services, particularly those related to aquatic recreation and boat rentals. In recent years, the market for yacht charters has experienced substantial growth, serving a critical role in fostering social interaction through navigation and highlighting their significance in coastal tourism. Frequently perceived as a premium offering, this segment constitutes the highest spending category within the tourism sector in certain locales. Yacht charters are essential for sustaining tourist activity, augmenting the average expenditure per visitor, and enhancing the overall reputation of destination areas [7].

In the context of the tourism industry, where online platforms have become indispensable for booking accommodations, similar online channels for intermediating tourist services have supported and simplified the expansion of tourist boat rentals, providing consumers with a broader selection of products characterized by diverse services that can complicate their selection process compared to other tourist offerings. Unlike the established categorization system in hotels, yacht charters encompass a multitude of services, transforming them into distinct products that may appeal to different consumer segments based on their preferences [8,9]. Consequently, the decision-making process for consumers is more complex. Additionally, the destination, port, or marina where the boat is moored can significantly influence the success of the boat rental or yacht charter business as it may align or diverge from consumer preferences. A comprehensive understanding of consumer behavior within different destinations is thus crucial for yacht charter companies to tailor their offerings and contribute to the sustainable development of nautical tourism, facilitate socio-economic territorial development, and mitigate coastal damage.

Despite the direct impact and growing importance of yachting in the tourism sector, scientific research in this area remains limited [10]. The main purpose of this study is to contribute to the existing knowledge on yacht charters by systematically examining and characterizing yacht charter products. In doing so, we aim to enable yacht owners to strategically position their offerings in various markets, thus adjusting to consumer preferences and demands. To achieve the general purpose, the following objectives need to be achieved in this research:

1. Identify the different yacht charter product groups, allowing for a better understanding of product characteristics and behaviors;
2. Analyze supply and demand dynamics, uncovering the geographic preferences of yacht charter consumers;
3. Determine critical factors that influence the classification of yacht charter products, providing yacht owners with valuable predictive tools to adapt their offerings to specific markets.

This study focuses on the Andalusia region of Spain, which boasts a prime geographical location in southern Spain. With 910 km of coastline, 45 marinas, and an exceptional climate, it is an ideal destination for nautical tourism. In 2023, over 19.5 million tourists visited this coastline, reflecting a year-on-year increase of 10.4% (Institute of Statistics and Cartography of Andalusia) [11]. The yachting sector presents numerous new opportunities and developments that Andalusia has embraced to continue providing high-value tourist services.

Currently, large amounts of data acquired from digital devices generate a data analysis problem when extracting the information of interest from the acquired samples. In these cases, proper grouping of the data is necessary to obtain relevant and accurate information to demonstrate the physical phenomenon to be treated [12]. A quantitative methodology with machine learning techniques has been used to achieve this study proposal. Machine learning combines science, statistics, and computational coding to detect patterns in large amounts of data to perform diagnostics, estimations, and predictions, identify features, and provide detailed information, among other tasks [12,13]. Machine learning therefore offers a variety of potential benefits, including the opportunity to apply more robust methods for the generalization of scientific discovery obtaining predictive analytics from data to provide more information and aid decision making. According to Andrade [14], segmentation is very useful for real-time business decision making, avoiding customer loss, and tracking market trends. Therefore, a clustering methodology using machine learning will be used to identify groups of yacht products with similarities, deepen their quantitative and qualitative characteristics, identify consumer preferences, and, last but not least, determine the weight factors in the set of characteristics that determine the classification of a boat in a particular cluster.

Significant results were found that contribute to a better understanding of the behavior of recreational vessels to increase the sustainability (social, economic, and environmental) of the nautical charter sector and the destinations in which it operates. The research comprised five steps: (i) conducting a literature review; (ii) collecting a dataset; (iii) using machine learning techniques to group, explore, and identify patterns of product and consumer preferences; (iv) conducting an evaluation of predictor variables; and (v) drawing conclusions.

## 2. Theoretical Framework

### *2.1. Yacht Charter Business*

The lack of a clear agreed-upon definition of nautical tourism creates misperceptions between terms such as coastal tourism, maritime tourism, and nautical tourism [15,16]. Be that as it may, we can define nautical tourism as a variant of tourism in which the sea is the most important element, and the presence of marinas is a differential element that satisfies the complex and growing demand of the nautical tourist [17,18]. It is hard to separate it from leisure activities that are carried out on the sea or on the coast, with the role of yacht charter being prominent with a direct impact on future trends in nautical tourism [19]. In this context, nautical tourism has surged in popularity, particularly along its coasts, with yacht charter emerging as an attractive, high-return option for tourists seeking exclusive experiences. Key motivations include the appeal of scenic beaches and the desire for a relaxing, unique experience on board [20]. The growth in this sector emphasizes the need for sustainable management strategies that align with the 2030 Agenda for Sustainable Development. Significant considerations include ensuring that increased yacht rental activity does not negatively impact the environment or local communities. Sustainability is now a central theme in nautical tourism, with businesses like Sunreef Yachts leading the way in incorporating eco-friendly innovations [4]. This highlights the broader importance of balancing tourism development with environmental consciousness, a growing expectation among both businesses and tourists. As the yachting sector continues to grow, it becomes imperative to address not only the economic opportunities but also the environmental impact. Yachting, particularly luxury yachts, has long been associated with negative environmental effects, including high $CO_2$ emissions, marine pollution, and damage to fragile coastal ecosystems [21].

On the economic side, the overall size of yacht charter or yacht owner service (i.e., repairs and maintenance) businesses was estimated to be USD 9.39 billion in 2023, and it is expected to register a compound annual growth rate of 5.1% from 2024 to 2030 [19]. Nautical tourists sailing in Spain are predominantly European, over 45–55 years old. They travel with family or friends, mainly motivated by exploration and relaxation. They are passionate about the sea and nautical activities and tend to have medium–high purchasing power [22]. Specifically, in Andalusia, nautical charters have experienced an upturn in popularity among domestic tourists, especially during the pandemic period, where the intimate nature of the experience has fostered a new appreciation for sailing. Foreign tourism also remains strong, with British, French, and German visitors leading the way, and Polish sailors represent an emerging market. New boaters are observed, characterized by a younger demographic and a higher inclination to rent than own boats [23]. The duration of rentals usually ranges from 1 to 7 days, with average stays of between 3 days and 2 months. It should be noted that 43% of these travelers participate in shore excursions during their nautical trips. Some limited studies focused on the influence of this activity or on the economy of countries in which a high number of yachts are chartered per year (i.e., Spain and Greece) [7,24–26].

Therefore, the literature shows an unexplored area in terms of offering complex nautical tourism products and managing and promoting nautical tourism destinations from a network perspective or from the recognition of factors that affect consumer preferences that it is especially important for managers [21]. According to Luna-Cortés [10], the interest in academic research on nautical research is relatively recent, with the largest number of articles having been published since 2021, showing a growing trend. Likewise, it is necessary to increase research in this domain to promote knowledge of a sector whose growth trend will have a significant impact on the economic, social, and environmental sustainability of tourism, with strong implications for the managers in this peculiar industry [27].

### 2.2. The Yacht Charter in the Sharing Economy

At present, there exists no universally accepted definition of the sharing or collaborative economy, a situation that parallels the context of nautical tourism [15]. For the purposes of this discussion, we will adopt the 2016 definition provided by the European Commission, which characterizes the sharing economy as "commercial models where activities are facilitated by collaborative platforms that create an open market for the temporary use of goods or services, often provided by individuals" [28].

The collaborative economy, driven by digital platforms and innovation, is transforming the entrepreneurial business model, offering new opportunities and lifestyles while challenging traditional norms [29]. This transformation also attracts companies because of its potential to generate economic benefits for all stakeholders involved [30]. As a result, businesses are increasingly interested in the collaborative economy's ability to not only innovate but also create economic opportunities across various sectors. The primary sectors of the sharing economy in Europe are predominantly centered around transportation and apartment rentals. Notably, the transportation sector has emerged as the most significant contributor to revenue generation within this market [31–33]. This sector connects drivers and passengers to reduce travel costs [34–37]. Car sharing involves access to cars from private organizations' fleets and P2P car sharing, with sustainable environmental solutions [38]. Meanwhile, the peer-to-peer accommodation sector represents the largest segment in terms of total transaction value. This sector provides access to a range of rental options, including vacation rentals, home exchanges, and rental platforms [39,40].

The growth and importance of the collaborative economy are highlighted by several factors, benefiting both consumers and companies. Among the most significant are the generation of income for local communities where shared services are offered, greater access to tourism and accommodation services, the promotion of sustainable tourism, and fostering cooperative relationships [39,41–44].

Recently, the collaborative economy has gained popularity in the nautical sector, driven by platforms and business models that allow boat owners to share their assets with users. This trend has opened new business opportunities but also presents challenges such as safety, sustainability, trust, and regulation [45–48]. The tourism industry, particularly yacht charters, has seen rapid development facilitated by the large availability of yachts through online platforms, which is transforming the sector [21]. This business model is a boost for nautical products, which have a shorter life cycle than other tourist products or services (for example, accommodation) [5]. Charter operators are therefore concerned with achieving the maximum possible use of boats, linked to achieving a rental or turnover ratio that generates income.

In this sense, digital platforms like Click&Boat have significantly expanded access to yacht rentals, increasing the fleet and offering various boat types to cater to different budget levels. It is a leading digital business platform that connects boat owners with users, operating in over 50 countries, including Spain, which is one of its main markets. Click&Boat has consolidated its presence through acquisitions, such as that of Nautal in 2020, offering rentals in numerous Andalusian marinas, an important coastline region in Spain. Andalusia, with its favorable climate and extensive coastline, is one of the top destinations for nautical tourism. It has been growing uninterruptedly for years in coastal tourism, receiving 19.5 million coastal tourists in 2023 [11], more than half of the total of tourists in this region (30 million).

For all of these reasons, focusing this study on the analysis of the products hosted on these lead market platforms and coastal tourism regions provides an ideal context to take the pulse of the behavior of the yacht-sharing economy. In this way, characterization of the products offered, consumer preferences, and the most relevant characteristics or services will be provided to help operators or owners make a profitable decision in the management of their vessels. Likewise, as indicated in previous sections, this will result in the sustainability and adequate development of the coastal destinations in which these products or services are offered.

Despite the growing importance of digital platforms in tourism, most research has focused on hotel reservations, leaving sectors like yacht rentals underexplored [49]. This gap in the research justifies the need for further studies on how digital business models operate in the yacht charter market, focusing on product characterization, consumer behavior, and market dynamics.

## 3. Materials and Methods

### 3.1. Data Collection

The data source used for this analysis is the Click&Boat website [50]. Automated web scraping using the R language with RSelenium was employed to extract data from this website. A filter was applied specifically to the Andalusian provinces, which helped create a structured dataset for later analysis. Selenium1.7.9 is an open-source software tool used for automated web navigation and scraping. It enables users to interact with web pages by locating specific data elements and extracting their attributes or text [51,52]. This approach allows for the systematic collection of relevant information, improving the robustness of the research results. The resulting dataset contains information on 365 nautical products available in March 2023 and includes 11 attributes: province, location, boat, captain, license, fuel, passengers, deposit, price, beds, and users. Additionally, we introduce a binary variable, "Rented" (yes/no), which indicates whether the boat was ever chartered based on the presence of a value in the user variable.

Among the main characteristics of this offer of nautical products, Málaga, Cádiz, and Huelva account for 89%. Launches and sailboats are the types of vessels with the greatest offers (66.58% and 23.29%, respectively). The key features of the charter offer include skipper services (67.67%), no license requirements (63.84%), and no fuel supply (73.15%). Regarding capacity, the average number of passengers does not exceed eight, with most of the offers being concentrated on boats with a capacity of more than nine passengers. In economic terms, approximately 45% of charter services do not require a deposit, and daily pricing is contingent upon the type of vessel. Additionally, an analysis of the data suggests that the most cost-effective options are jet skis and select sailboats, whose average prices are close to that of launches, compared to yachts as the most expensive option (see Table 1).

**Table 1.** The characteristics of the yacht charter boats offered.

| Characteristics | Frequency | Percent (%) |
|---|---|---|
| *Province* | | |
| Malaga | 192 | 52.6 |
| Cadiz | 79 | 21.6 |
| Huelva | 54 | 14.8 |
| Almeria | 33 | 9 |
| Granada | 5 | 1.4 |
| Seville | 2 | 0.6 |
| *Boat* | | |
| Launch | 243 | 66.6 |
| Sailboat | 85 | 23.3 |
| Yacht | 18 | 4.9 |
| Catamaran | 10 | 2.7 |
| Pneumatic | 7 | 1.9 |
| Waterscooter | 2 | 0.6 |
| *Skipper* | | |
| Yes | 247 | 67.7 |
| No | 118 | 32.3 |
| *License* | | |
| Yes | 132 | 36.2 |
| No | 233 | 63.8 |
| *Fuel* | | |
| Yes | 98 | 26.9 |
| No | 267 | 73.1 |

**Table 1.** *Cont.*

| Characteristics | Frequency | Percent (%) |
|---|---|---|
| *Passengers* | | |
| Between 1 and 3 | 4 | 1.1 |
| Between 4 and 6 | 121 | 33.2 |
| Between 7 and 9 | 94 | 25.7 |
| More than 9 | 146 | 40 |
| *Deposit* (€) | | |
| Between 0 and 500 | 326 | 89.3 |
| Between 501 and 1000 | 18 | 4.9 |
| Between 1001 and 1500 | 12 | 3.3 |
| Between 1501 and 2000 | 6 | 1.7 |
| More than 2000 | 3 | 0.8 |
| *Beds* | | |
| Between 0 and 3 | 265 | 72.6 |
| Between 4 and 7 | 64 | 17.5 |
| Between 8 and 12 | 36 | 9.9 |
| *Price* (€) | | |
| Between 0 and 500 | 193 | 52.9 |
| Between 501 and 1000 | 112 | 30.7 |
| Between 1001 and 1500 | 26 | 7.1 |
| Between 1501 and 2500 | 23 | 6.3 |
| More than 2500 | 11 | 3 |

### *3.2. Yacht Charter: Clustering and Significant Predictors*

Machine learning (ML) has emerged as a powerful and essential technique for effectively harnessing the vast potential of data. By analyzing complex datasets and identifying patterns, ML empowers businesses to innovate their products and services, enhance operational efficiency, and adopt more sustainable practices. This transformative technology not only drives better decision making but also fosters a culture of continuous improvement and adaptation in an ever-evolving market landscape [53]. In this context, ML techniques such as clustering and Random Forest were employed to provide reliable data on yacht charter behavior (Figure 1). Clustering is an unsupervised machine learning technique used to group data objects based on shared characteristics [54–56]. It identifies clusters that exhibit high intra-class similarity and low inter-class similarity, grouping items that are close to each other while keeping them distinct from other clusters [57]. This method has been widely applied in various fields, such as pattern recognition, customer segmentation, similarity searches, and product trend analysis [58,59]. Analyzing these clusters can uncover valuable patterns, help identify anomalies, and facilitate predictions [60,61]. By analyzing each cluster, we can extract useful patterns. To group the boat rental offers effectively, we utilized clustering techniques with an R language package. The scripts for this analysis were developed in the R programming language within the RStudio environment to achieve the objectives of this study [62,63]. Additionally, we employed the tidy verse and cluster libraries for data cleaning, estimation, and graphical representation [64,65].

This study classifies the behavior of boat rental offerings, presenting visually appealing groupings to predict user preferences for nautical options based on an analyzed dataset. By providing a thorough examination of the collected data, we aim to enhance understanding of rental behavior and the likelihood of boats being rented [27]. In addition, in this study, a supervised learning method based on the construction of multiple decision trees, the Random Forest algorithm, was employed for assessing the contribution of each variable to the classification process; variable importance was calculated using the impurity reduction method, based on Gini index, a common criterion in decision tree construction that measures how homogeneous the classes are within a node [66]. A higher importance score indicates that the variable significantly contributes to improving classification by reducing node impurity [67]. This approach illustrates the frequency with which a variable effectively partitions the dataset and accurately distinguishes between the classes. This information is critical for interpreting the results and conducting a deeper analysis of the key factors driving the classification.

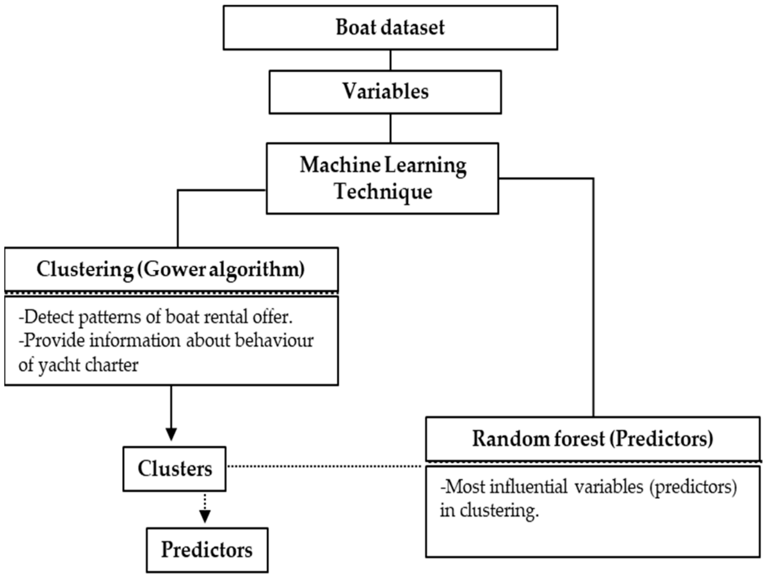


**Figure 1.** Methodology process.

Clustering mixed-type data play a crucial role in fields like knowledge discovery and machine learning [68], but traditional algorithms are not easily applicable to such datasets. Our boat rental dataset includes both numerical (e.g., passenger capacity and price) and categorical attributes (e.g., boat type and skipper availability), making standard clustering methods such as k-means or hierarchical clustering unsuitable. Therefore, Gower's distance metric was employed during the clustering process, which allows for a weight to be given to each variable as a combination of the absolute distance and 0–1 distance, ensuring an accurate representation of the dataset's diversity [69]. This approach calculates a composite distance (d(i, j)) between individuals that incorporate their mixed attributes. Gower's distance computes similarity as a combination of scaled differences for numerical variables and binary indicators for categorical variables. This approach ensured that the clustering process considered the dataset's full complexity without distorting relationships between data points. The resulting distance matrix served as the input for subsequent clustering.

The Partitioning Around Medoids (PAM) algorithm was selected as the clustering technique due to its robustness and suitability for mixed-type data. PAM groups data points around the most centrally located object of the cluster (medoid) with a minimum sum of distances to other points rather than using the mean point as the center of a cluster as in the k-means method. The medoids are iteratively optimized to minimize the total distance within each cluster while maximizing the dissimilarity between clusters.

Once the optimal number of clusters is established, such as the k value, the first medoid is identified as the data point that exhibits the smallest distance to all other data points, thereby positioning it at the centroid of the dataset. Subsequent medoids are added iteratively, each minimizing the total distance to the nearest medoid for all points. During this process, candidate medoids are swapped if replacing one with another reduces the total within-cluster distance, ensuring that the optimal configuration is achieved [70]. All combinations in the dataset are tested, resulting in one solution.

To determine the optimal number of clusters, the silhouette width method was applied, as it is best used with the PAM method. This technique evaluates the compactness and separation of clusters by comparing the average distance of data points within a cluster to the nearest neighboring cluster. The k value that corresponds to the largest silhouette width indicates the optimal quantity of clusters for the given dataset. Figure 2 shows that segmenting the dataset into two groups maximizes the similarity within the clusters and the dissimilarity between clusters. However, using k = 2 produces useful results. Cluster plots help visualize the clusters formed by a k-medoids machine learning algorithm, which effectively represents the dataset by capturing distinct groupings of yacht charter products.

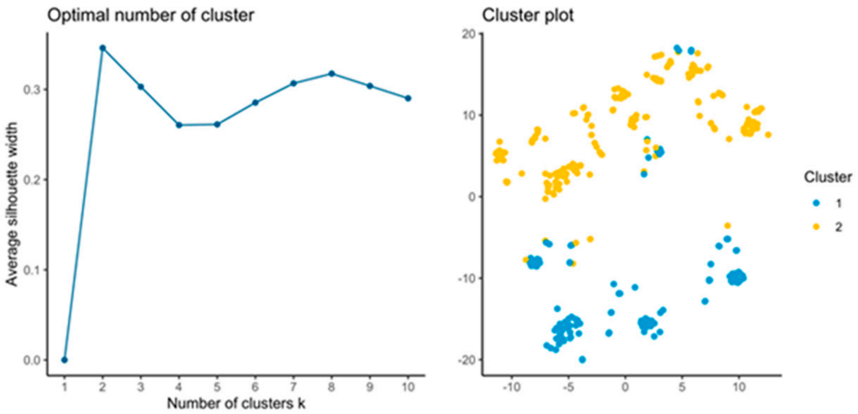


**Figure 2.** Optimal number of clusters by using silhouette width and cluster plot.

Although the clusters are generally well defined, Figure 2 illustrates some data points near the boundaries of the clusters that are less clearly assigned to one group. These ambiguous cases occur due to overlapping characteristics between the two clusters. For example, observations in transition zones often arise when boats are offered with optional upgrades, such as skipper availability or fuel inclusion. This can blur the distinction between basic and premium categories.

## 4. Results and Discussion

This section outlines the main findings of our research, in line with the objectives set. It is structured in three subsections, each of which develops a specific objective and provides data, an analysis, and supporting arguments to understand the results. We consider that this organization allows for a better understanding of the phenomenon studied and the achievement of the main proposal, enriching the research field of yachting.

### *4.1. Yacht Charter Clusters*

After applying a machine learning algorithm to cluster our boat dataset, we identified two distinct clusters comprising 157 and 209 objects, respectively. This section presents an analysis of the characteristics of these clusters to refine our understanding of the types of boats offered in each cluster and provides insights into yacht charters with the ultimate goal of improving boat marketing success.

To begin, Table 2 displays the proportion of boats that have been chartered versus those that have not, categorized by cluster, with Cluster 1 boats being the most likely to be chartered despite the highest supply being concentrated in Cluster 2. For this, exploring the vessels grouped by cluster can help identify patterns related to consumer preferences and help us understand how the characteristics of each cluster influence the chartering rate.

**Table 2.** Proportion of boats that have been chartered by cluster (%).

| | Cluster 1 (157 Boats) | Cluster 2 (209 Boats) |
|---|---|---|
| Yes | 68.15% | 54.32% |
| No | 31.85% | 45.67% |

Subsequently, Figure 3 plots the variables by cluster to identify differences, allowing us to identify variables and establish patterns in the boats offered across the two clusters.

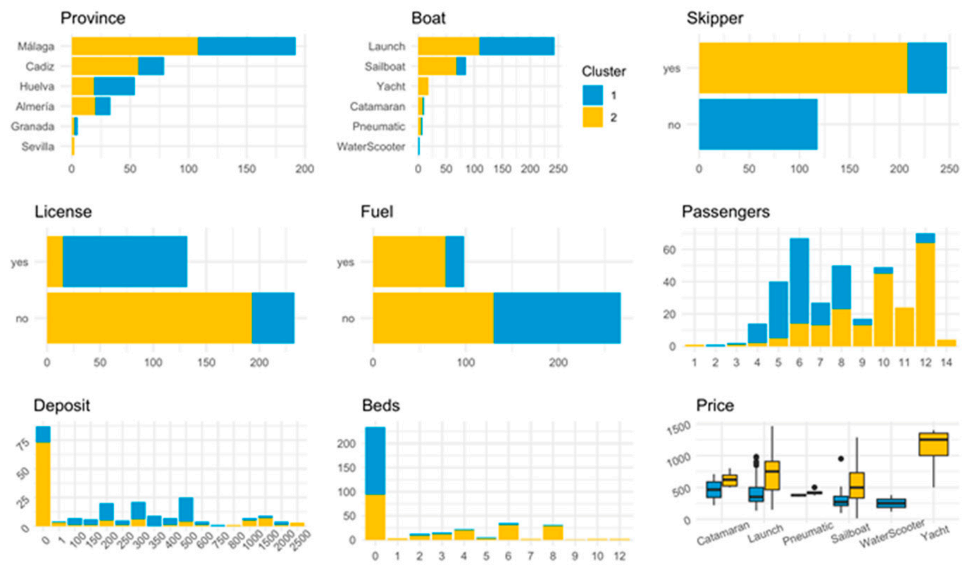


**Figure 3.** Descriptions of the clusters' compositions.

On the one hand, Cluster 1 exhibits a less diverse fleet composition, with launches constituting the majority (85.35%). Sailboats (10.83%) and other vessel types (3.81%) represent smaller proportions. Services and amenities are tailored towards bareboat charters intended for licensed boaters, typically accommodating 4–6 passengers (64%). These charters commonly exclude bedding (89.17%) and fuel (87.26%). The fleet is characterized by lower daily rates, often contingent upon a security deposit. The charter rate within this cluster amounts to 68.15%. On the other hand, Cluster 2 demonstrates a lower charter rate compared to Cluster 1 (54.32%). The fleet within this cluster is characterized by more sophisticated vessels, including total yachts collected, sailboats (32,69%), catamarans, and launches with skippers (56%). These boats often accommodate a larger number of passengers and are more frequently equipped with onboard amenities such as beds. Consequently, the rental rates for these vessels tend to be higher and do not typically require a deposit. Fuel inclusion may also be optional.

Table 3 summarizes the key findings from the comparative analysis of the two clusters, revealing the existence of two differentiated market segments with varying needs and expectations, probably influenced by destination. Companies operating in this sector need to tailor their strategies to each segment to enhance their profitability and competitiveness. In addition, it is essential to be aware of market trends and external factors that may influence the evolution of both segments.

**Table 3.** Principal characteristics of clusters.

| Characteristic | Cluster 1: Bareboat Vessels | Cluster 2: Skippered Vessels |
|---|---|---|
| Boat type | Predominance of launch | Yachts, sailboats, catamarans, and skippered launches |
| Services | Bareboat charter<br>Reduced capacity<br>No additional amenities | Skippered charter<br>Larger capacity<br>On-board amenities |
| Price | Lower | Higher |
| Target customer | Boating license holders<br>Individuals seeking simple and affordable boats | Customers with higher purchasing power<br>Individuals seeking luxurious and personalized boating experiences |

### 4.2. An Analysis of Supply and Demand in the Yacht Charter Market

The identification of patterns in the boat rental market allows for a more accurate analysis of the supply and demand of complementary services. This analysis will enable the establishment of a tailored offer that meets the specific needs of tourists in the different maritime points of the Andalusian region, allowing boat owners or yachting operators to make strategic decisions to align their offers with consumer preferences and destination needs, thereby directly influencing the social, economic, and environment aspects of the mooring locations. For this reason, to prevent generalized diagnoses and achieve a positive impact on yacht charters, a detailed location-based analysis is necessary. To accomplish this, we quantify and compare the percentage of available boats (total supply) to the rate of boats ever rented, specifically by cluster and location (Table 4). We calculate the percentage of vessels chartered in each location by utilizing the previously defined "Rented" variable and the established clustering segmentation. Moreover, the application of machine learning techniques to predict the most suitable boat type based on location is a significant contribution of this study. Finally, the collected data can contribute to the sustainable development of the industry.

**Table 4.** Distribution of boats offered and chartered by cluster and location.

| Province | Location | Bareboat | Skippered | Bareboat | Skippered |
|---|---|---|---|---|---|
| | | % Offered | | % Chartered | |
| Almeria | Adra | - | 100 | - | 0 |
| | Aguilas | - | 100 | - | 0 |
| | Almería | 33.33 | 66.67 | 0 | 100 |
| | Almerimar | 33.33 | 66.67 | 0 | 0 |
| | Carboneras | 50 | 50 | 0 | 100 |
| | Garrucha | 40 | 60 | 55.56 | 44.44 |
| | Mojacar | 100 | - | 100 | - |
| | San Juan de los Terreros | 50 | 50 | 50 | 50 |
| Cadiz | Algeciras | - | 100 | - | 0 |
| | Cadiz | 17.65 | 82.35 | 23.08 | 76.92 |
| | Chiclana de la Frontera | - | 100 | - | 100 |
| | Chipiona | - | 100 | - | 100 |
| | El Puerto de Santa María | 44.83 | 55.17 | 52.63 | 47.37 |
| | Gibraltar | - | 100 | - | 100 |
| | Línea de la Concepción | - | 100 | - | 100 |
| | Rota | - | 100 | - | 100 |
| | San Roque | 66.67 | 33.33 | 100 | 0 |
| | Sotogrande | 23.53 | 76.47 | 25 | 75 |
| Granada | Almuñecar | 75 | 25 | 66.67 | 33.33 |
| | Costa Tropical | - | 100% | - | 100 |
| Huelva | Ayamonte | 50 | 50 | 75 | 25 |
| | El Portil | - | 100 | - | 100 |
| | El Rompido | 56.52 | 43.48 | 73.33 | 26.67 |
| | Huelva | - | 100 | - | 100 |
| | Isla Canela | 100 | - | 0 | - |
| | Isla Cristina | 66.67 | 33.33 | 100 | 0 |
| | La Antilla | 100 | - | 100 | - |
| | Lepe | 100 | - | 100 | - |
| | Mazagon | - | 100 | - | 0 |
| | Punta Umbria | 75 | 25 | 66.67 | 33.33 |
| | Sanlucar de Guadiana | 100 | - | 0 | - |

**Table 4.** *Cont.*

| Province | Location | Bareboat | Skippered | Bareboat | Skippered |
|---|---|---|---|---|---|
| | | % Offered | | % Chartered | |
| Malaga | Benalmadena | 75 | 25 | 72 | 28 |
| | Caleta de Velez | - | 100 | - | 100 |
| | Estepona | - | 100 | - | 100 |
| | Fuengirola | 44 | 56 | 47.06 | 52.94 |
| | Malaga | 44 | 56 | 45 | 55 |
| | Marbella | 30.12 | 69.88 | 34.04 | 65.96 |
| | Nerja | 87.50 | 12.50 | 80 | 20 |
| | Puerto Banus | - | 100 | - | 100 |
| | Torre del Mar | - | 100 | - | 0 |
| Sevilla | Sevilla | - | 100 | - | 0 |

By comparing the proportion of available boats to charter rates, segmented by cluster and location, we identified imbalances in certain destinations, attributable to various factors:

- Increased interest in bareboat yacht charters.
  Boat rentals categorized in Cluster 1 are more popular in marinas located in Garrucha, El Puerto de Santa María, San Roque, Ayamonte, El Rompido, Isla Cristina, Punta Umbría, Benalmádena, and Nerja. These locations show a higher likelihood of demand for boats in this cluster.
- Increased interest in skippered yacht charters.
  Locations such as Almeria, Carboneras, Cadiz, Sotogrande, Fuengirola, Málaga, and Marbella exhibit a stronger preference for renting boats classified under Cluster 2.
- Limited interest in cluster products.

Some marinas provide boats from both clusters; however, for one of these clusters, the chance of rental is either very low or nonexistent. This is particularly evident in the marinas of Almeria and Carboneras, where boats from bareboat yacht charters have never been chartered. Conversely, all charter transactions in these locations have involved boats from skippered yachts. The opposite phenomenon occurs in the marinas of San Roque, Isla Cristina, Mazagon, and Torre del Mar, where minimal interest has been shown for boats from skippered yacht charters in that specific area. The boats available in Almerimar are not performing well in the market, such as those in Isla Canela or Sanlúcar de Guadiana.

The distribution of boat clusters varies by province, with a higher concentration of skippered yacht charters being observed in Cadiz and Malaga. This could be due to the purchasing power of tourists in those areas. However, Malaga offers a more diverse range of options compared to Cadiz, with an acceptable demand for both products. On the other hand, Huelva and Almeria have a stronger presence of bareboat vessels. Despite this, boat rentals with a skipper are more popular in Almeria. Similarly, Huelva, like Malaga, also shows a high preference for rentals in both categories.

### *4.3. Predictors Determination*

At last, to delve further into the aforementioned subsections and effectively achieve the last objective and the overall aim of this research, we decided to determine the relative importance or weight of the variables constituting the obtained clusters.

This knowledge is crucial for ship owners as it enables them to identify the most significant factors influencing the categorization of their vessels into specific clusters. Such insights play a pivotal role in making well-informed decisions that enhance the success of their products. In this sense, Figure 4 presents the significance of predictors based on the Random Forest model. As illustrated, the "Captain" variable emerges as the most influential predictor, followed by "License" and "Passengers". Within the framework of the model, these variables exert a more substantial impact than others in predicting the cluster affiliation of an offered boat.

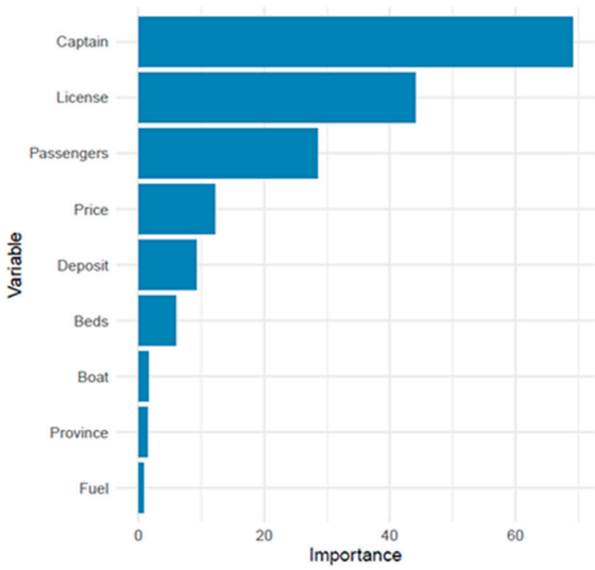


**Figure 4.** Random Forest results. Importance of predictors.

In more detail, the hierarchy of the influence of variables on group membership revealed by the Random Forest model offers some key results and implications. In this regard, the captain is the most prominent predictor, which would underscore the critical role of the captain's experience and qualifications in differentiating between boat categories or charter segments. Boat specifications, including variables such as "License" and "Passengers", also demonstrate substantial predictive power, suggesting a direct relationship with vessel size, type, and intended use. Financial attributes such as "Price" and "Deposit" show moderate influence, while vessel amenities such as "Beds" and "typology of boat" have a more marginal impact on group differentiation. Geographical location and operational factors, represented by "Province" and "Fuel", respectively, exert minimal influence on group membership compared to other predictors.

## 5. Conclusions

Yacht chartering has become an essential aspect of coastal tourism, contributing to economic growth and offering significant benefits while enhancing the overall tourist experience. Tourists appreciate water resources and activities related to marine leisure. Yacht charters offer a nautical experience that anyone can enjoy, regardless of their financial means, challenging the notion that such experiences are only for the wealthy. In this way, yacht chartering is established as a valuable asset for local tourism. Moreover, digital business models, propelled by platforms that facilitate the collaborative economy, have significantly enhanced access to chartering for consumers and boat owners seeking to generate returns on their investments. This evolution has increased the availability of boats for charter, subsequently creating challenges in aligning consumer needs and preferences with the existing supply of boats and their respective locations. Nonetheless, research efforts by the academic community concerning the behavior of this sector remain limited and relatively recent. Consequently, it is of substantial interest and relevance to provide a thorough characterization of the yachting product and the dynamics of the market. This study contributes to improving understanding and filling the gaps that exist in this sector due to a lack of previous studies, especially empirical ones.

A structural analysis of yacht charter product offerings has revealed significant insights by distinguishing between two distinct categories. The first category comprises simpler boats, while the second encompasses more comprehensive and sophisticated vessels. Cluster 1 focuses on bareboat charters that target a specific market segment of licensed boaters seeking smaller vessels with a capacity of four to six passengers. This segment is characterized by a notable sensitivity to price and does not include additional amenities such as bedding or fuel. Conversely, Cluster 2 comprises a premium fleet, which includes yachts, sailboats, catamarans, and launches with the provision of skippers. This service offering is differentiated by its larger passenger capacity and the inclusion of onboard amenities. Despite the elevated rental rates associated with this cluster, it presents a lower charter rate when compared to Cluster 1. Furthermore, the practice of requiring deposits is less common, and the inclusion of fuel may be optional.

Spain holds the fifth position among the top ten countries with the highest number of boats available on Click&Boat, a boat rental platform that highlights a rising trend in bookings by Spanish users. The platform continues to expand its offerings to cater to the diverse plans and budgets of boaters. This growing supply, particularly along the Andalusian coast, is expected to significantly contribute to Andalusia's economy and tourism development. Notably, locations in the province of Málaga stand out for hosting the largest share of the community's boat rental offerings.

When analyzing the aggregated data for Andalusia, it becomes apparent that there is a slight inclination towards skippered vessels in terms of availability. Conversely, the charter rates for bareboat groups are higher within the region. This trend is particularly notable in the Cadiz province, where the demand for bareboat vessels surpasses supply. To rectify this disparity, it would be prudent to enhance the availability of more affordable boats equipped with basic features, thereby aligning with the profile of vessels categorized within the bareboat cluster to better satisfy the needs of tourists.

In conclusion, it has been shown that the destination is a crucial factor to consider before mooring a boat. Furthermore, relevant variables (captain, license, and passengers) must be taken into account to determine which category a product fits into. These findings provide important information for stakeholders in the nautical sector and contribute significantly to this field of study. In particular, boat rental companies can use this information to improve their services by tailoring marketing strategies, optimizing pricing, or enhancing inventory management. Thus, complementarily, the sustainability of the destination will positively benefit everyone involved.

Data-driven boat rental management presents a solution for enhancing promotional strategy design; however, our case study revealed some limitations. These limitations are primarily related to the specific context we examined. Moreover, the absence of prior empirical studies limits our result comparisons. Nonetheless, this also provides an opportunity for future research to expand on these findings. On the other hand, during the analysis period, vessel registration may be influenced by product seasonality.

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