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# An Analysis of the Tourist Mobility in the Island of Lanzarote: Car Rental Versus More Sustainable Transportation Alternatives

José María Martín Martín <sup>1,\*</sup>, Jose Manuel Guaita Martínez <sup>2</sup>, Valentín Molina Moreno <sup>3</sup>  
and Antonio Sartal Rodríguez <sup>4</sup>

<sup>1</sup> Department of Business, International University of La Rioja, Avenida de la Paz, 137, 26004 Logrono, Spain

<sup>2</sup> Faculty of Business, Valencian International University, Carrer del Pintor Sorolla, 21, 46002 Valencia, Spain; josemanuel.guaita@campusviu.es

<sup>3</sup> Faculty of Economics and Business, Department of Management-1, University of Granada, Campus de Cartuja, 18071 Granada, Spain; vmolina2@ugr.es

<sup>4</sup> Department of Business Organization and Marketing, University of Vigo, Estrada San Cosme, 2, 36310 Pontevedra, Spain; antoniosartal@uvigo.es

\* Correspondence: josemaria.martin@unir.net; Tel.: +34-958-241-000

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**Abstract:** Studies have shown that certain modes of tourist development jeopardize the environment, as in the case of mass tourism, especially in areas that require special protection. The goal of this study is to apply a proposal for studying sustainability of tourist mobility to a protected space, the island of Lanzarote, which has been declared a Biosphere Reserve by UNESCO. This paper seeks to figure out the mobility patterns of tourists, the criterion used to select a mode of transportation, the attitude of tourists towards the sustainability of transport, and its environmental implications by analyzing secondary sources and interviewing tourists. The results show that the tourism model of the island is based on scattered natural resources that tourists want to enjoy in a tailor-made visit, which makes it hard to give up individual transportation. The only environmentally sustainable alternative is opting for electric vehicles with charging stations in the aforementioned tourist spots.

**Keywords:** mobility; sustainable development; environmental sustainability

## 1. Introduction

Specific human actions can have a negative impact on natural resources in protected areas if they do not adopt behavior in accordance with principles of sustainability [1]. The management and administration of these areas thus hold a fundamental role in preserving these resources. Tourism produces a set of interferences on the environments where it is developed. These interferences are derived from the number of arrivals, a factor that can also intensify the effects linked to seasonality [2]. The type of impacts derived from tourism and the way that the population perceives them should be under continuous examination [3]. The concept of tourism is intrinsically associated with mobility, since it appears as a temporary displacement from one's usual place of residence [4]. Tourism includes the activities that people undertake during their trips and their stays in places different from their usual environment for recreation, business, and other purposes. Currently, tourism is the largest industry in the world and one of the most rapidly growing ones on an international scale [5]. This causes problems, especially in its impact on the environment. In both developed and less-economically developed nations, public sector attention has increasingly focused on the perceived economic benefits of tourism, which has progressively been adopted as a vehicle for the regeneration of rural areas suffering economic decline or deprivation [6].

Tourism can have economic, sociocultural, and environmental repercussions for the surrounding environment, and these can be both positive and negative. They can be positive because tourism generally means an increase in the income of the area that receives tourists, and social relationships between residents and visitors are established during tourists' stay at the tourism destination. Further, planning can make it possible for tourism to contribute to sustainable development and can serve as a stimulus for conservation and protection of natural systems, as well as for educating the population to avoid destroying these systems [7]. Negative impact occurs when tourism is developed in an unorganized, uncontrolled way, causing irreversible damage and threats to the environment, which ironically can destroy the resources that constituted the main attraction of the tourist destination. This may be due to changes that transform the environment irreversibly, such as excessive urban growth, the creation of artificial spaces and infrastructure not integrated into this environment, the generation of waste, the erosion and degradation of the surroundings, the deterioration of flora and fauna, and other issues.

The concept of sustainable tourism comes from another broader notion, sustainable development, which involves satisfying the needs of the present without compromising the possibilities of future generations [8]. The evolution of the relationships between tourism and development has taken place in various declarations and documents sponsored by international organizations; among these, the World Tourism Organization. There has been a gradual transition from the dominance of sociocultural and economic aspects of tourism to the omnipresent paradigm of sustainability [9], which recognizes the potential of the tourist sector as a driver of economic and social development, while maintaining a balance between social, economic, and ecological interests. The WTO itself indicates that sustainable tourism attends to the needs of current tourists and the receiving regions, while also protecting and fostering opportunities for the future [10]. Further, these documents conceive of transportation as a key environmental sector, along with water, energy, and waste [11]. It seems obvious that new, innovative, interdisciplinary structures are needed for sustainable tourism services [1].

To be sustainable, tourism and the mobility it involves should integrate resources, be participatory and planned, be open to nearby geographical areas, be organized to eliminate the effect of seasonality, be oriented towards the long term, and be viable economically, socially, and environmentally [12]. Policy makers and tourism developers must understand visitors' mobility behavior and how they consume space and tourism resources in order to set up sustainable cultural tourism destinations [13]. With this considered, we conclude that there are limits to visitors' use of tourist spaces [14,15] and that it is necessary to perform studies that consider the individual characteristics of each scenario so that tourism does not become a destabilizing factor in the areas that receive tourists.

The aim of this paper is focused on analyzing the mobility of tourists in an environmentally sensitive destination characterized by scattered tourist spots. By doing so, we intend to determine which modes of transportation are used by tourists, their restrictions, why they are selected, and what effects these mobility patterns have on the environmental and economic sustainability of the destination. Lanzarote has been chosen due to its environmental value, but also due to the fact that because it is an island, the modes of transportation are influenced (in fact, it is impossible for tourists to get there with their own vehicle), and because the tourists spots are scattered. This paper seeks to offer useful information to design public policies relative to tourist mobility with the aim of reaching more sustainable models. We intend to provide academic literature with information on tourist mobility in islands, especially in environmentally sensitive destinations, as well as to offer a guide of the possible improvements, and a framework of analysis that is applicable to other fields. Studies on tourist mobility in islands based on direct surveys are scarce in the academic literature, let alone those concerning protected areas, which is why this study offers unique and new information that should be completed with similar studies in similar destinations.

## 2. Tourist Mobility Impacts on the Environment

The management of tourist mobility on destinations environmentally sensitive proves of great importance, given that the impacts generated by visitors are dependent upon it [16,17]. The intensity of said impacts will vary depending on the attitude, motivation, and behavior of tourists. Previous studies indicate that these three factors are key when investigating eco-tourism [18–20]. In this paper, the mobility patterns of the tourists visiting the island (behavior) are analyzed while considering their motives to choose a mode of transportation and their attitude towards sustainability. According to Ma et al., the motivations of the tourists in their visit influence their behaviors while they are at the destination [21], as well as a responsible attitude towards the environment [22,23].

The spreading of mass tourism has been a factor influencing the mobility patterns of tourists, since it is associated with the increase in the number of private vehicles [24]. In coastal destinations, like the one this paper takes as the case study, resorts have expanded at the same time as the tourist activity [24], which also widened the gap between them. In coastal destinations or islands, tourist activity represents a large part of the revenue, hence the high pressure on the development of resorts and transportation infrastructure [25]. Moreover, the pressure on coastal areas is intensified if we take into consideration that they are usually more populous than interior areas, which increases the necessity for transportation infrastructure and generate a larger number of journeys [26]. The effects of tourist mobility are more intense in destinations suffering from high seasonality levels, given that in those destinations the concentration of tourists at certain times of the year pressures the destination even more. This is proven by the deterioration of dirt roads, interferences with the flora and fauna, the crowding of transportation infrastructure, increasing emissions, and the inconveniences endured by the residents [2,3,6,27,28].

The studies focused on tourist mobility built around rental vehicles are very scarce. The only existing studies are focused on the economic impact of tourism, including the car rental industry as part of this impact [29]. There are also studies related to the degree of satisfaction of the tourist with the services they hire [30], and to the measurement of the quality of the service [31]. Other studies analyze the tourist mobility across the board, but they do not do so specifically when it comes to the mobility associated with car rentals. Using a set of various indicators can be very useful to measure achievements in development and sustainability [32–36].

One of the most relevant aspects within the impacts associated with transportation in tourist destinations is related to greenhouse gas emissions. It is estimated that the tourism industry is directly responsible for 5% of the total volume of CO<sub>2</sub> emissions. Furthermore, 75% of that percentage is attributed to mobility [37]. What is more, whereas global emissions are decreasing, those associated with the tourism industry grow more and more [38,39]. Therefore, it is urgent to know and control the mobility patterns that explain the increase in the volume of emissions [40]. This paper moves in that direction, seeking to assess the tourist mobility patterns and the reasons why the visitors choose car rentals. Sustainable mobility in the tourism industry does not only include changes in the transportation models, but also a reduction of the number of journeys, which would result in the development of new forms of tourism [41]. Some studies even introduce tourism models pointing at the type of tourism that should be developed to comply with the commitments related to matters of greenhouse gas emissions [42].

This study is focused on matters highlighted by the academic literature, such as mobility patterns in environmentally sensitive destinations, the motivations behind the selection of a mode of transportation, or even the limitations of more sustainable alternatives. In tourism research, it is necessary to count more specific studies that describe the behavior of tourists instead of general approximations [43]. Following this idea, this paper has selected an environment that meets several desirable requisites: it involves an island, which influences mobility; it is an environmentally sensitive destination and tourist spots are scattered throughout the area, with most of them being located in enclaves far from population centers and resorts.

### 3. Materials and Methods

Given its importance for the tourist sector and the economy in general, this study focuses on firms in the car rental sector in Lanzarote. More specifically, it focuses on this sector's target audience—tourists who use rental vehicles.

Diagnosis of the situation shows a scenario of massive use of private vehicles and only slight use of public transportation. Thus, we wish to evaluate the intermodal transportation and accessibility of transportation in the area, focusing our study on specific analysis of the rental vehicle sector on Lanzarote. Our analysis is based on data compiled from a survey that was developed and carried out specifically for this study as an opportunity to obtain information relevant to the study's goals. The data were collected at different points on the island to guarantee maximum heterogeneity of the sample. We obtained first-hand information about the guidelines describing the use of this service.

The survey was performed during 1–30 November 2015, in collaboration with Lanzarote's Car Rental Association on a representative sample of 400 tourists who used rental vehicles. Therefore, the final number of surveys was 400. Selecting the time frame was dependent upon the cooperation of the association. Given the low level of tourism seasonality of the Canary Islands [27], there are no big differences in the tourist arrivals throughout the year. The association allowed the interviewers to interview tourists in the premises of their partners (car rental companies) and they also shared the necessary information to estimate the representative sample and the main surveying points. To perform the survey, we administered the questionnaire to tourists who had finished using the rental car service, including both Spanish and foreign tourists. The surveys were carried out on-site by professional interviewers in eight different places of delivery of rented cars dispersed throughout the island in the municipalities of Teguiise, Arrecife, Puerto del Carmen, and Playa Blanca, the main access points for tourists. To reach a sufficient level of representativeness, we considered the number of annual users of Rent a Car services, and based on this information, estimated the necessary sample. We determined the sample size according to the following conditions: (1) We took as the parameter of interest the population proportion (number of users of the Car Rental service); (2) the population proportion considered was 0.5, the least favorable that one might find ( $p = 50$ ); (3) we established the maximum allowable error as 0.03 (+/− 3.0%); (4) we assigned a confidence level of 0.95. By creating the formula, we obtain the following model for selection of the sample size used in the fieldwork:

$$n = \frac{\sum_h W_h^2 \frac{N_h}{N_h - 1} \frac{P_h Q_h}{w_h}}{\frac{e^2}{k^2} + \frac{1}{N^2} \sum_h \frac{N_h^2}{N_h - 1} P_h Q_h}$$

where:

$k$ , is the value of the confidence level calculated using normal distribution.

$e$ , is the maximum allowable error, interpreted as the difference between the population parameter and the estimator of this parameter:  $|\theta - \hat{\theta}|$ .

$h$ , indicates the stratum at which we are operating (determined by taking into account the first stratum and weighting the other strata according to size).

$W_h$  are the weightings of each stratum, with the strata considered in this case to be uniform.

$N_h$ , is the population size of each stratum.

$N = \sum_h N_H$ , is the population size.

$P_h$ , is the population proportion, where  $Q_h = 1 - P_h$

The four premises stated above influence the model and the formula used to calculate “ $n$ ”, the number of surveys needed to ensure that the data and the results of the research are statistically representative [44]. If we consider the user's country of origin, the greatest percentage of respondents is composed of Spaniards (55%), although English (17%), German (16%), and French (9%) tourists are also represented. Among Spaniards, the greatest proportion are from Madrid, the Canary Islands,

and Catalonia, although the origin of the users is quite varied. We find that the most common kind of group to visit Lanzarote are couples (61.36%), followed at a considerably lower rate by groups of friends (17.05%) and families (13.64%). Although independent users are in the minority, they do constitute 7.95%

Given that the aim of the study is descriptive, the analysis focuses on analyzing descriptively the data gathered by the survey, so that we can know in an intuitive manner the mobility patterns of the tourists, the way in which they organize their visit, and the criteria that the tourists take into consideration when choosing a mode of transportation. However, t-test and one-way analysis of variance (ANOVA) have also been used to analyze whether the answers of the tourists were influenced by personal motives, such as nationality, gender, age, or level of education. The sets of questions that comprise the questionnaire are as follows: characteristics of the tourist, spots visited on the island, mode of transportation used to arrive at each tourist spot, criteria taken into consideration when selecting a mode of transportation, assessment of the overall private vehicle rental experience. The questionnaire is designed by keeping in mind the basic goal of knowing the mobility patterns of the visitors as well as the factors that influence choosing one or another mode of transportation. To design the questionnaire, we have made a bibliographic review on tourist mobility. The work of Ekiz and Bavik [31] has been of great help since it reviews the assessment methodologies on quality service of car rental.

#### 4. An Application: The Case of the Island of Lanzarote

Lanzarote is an island in the archipelago of the Canary Islands (Spain). It has considerable natural, social, scientific, and tourism importance. The location of the Canary Islands is shown in Figure 1. The island of Lanzarote hosted 2.93 million tourists in 2017, a figure that shows growth in relation to the 2.13 million tourists that arrived in 2013 [45]. The accommodation offering of the island rose to 71,830 beds, out of which 40,342 are part of hotels. The total number of accommodation facilities in the island is 291, out of which 75 are hotels [45]. When not controlled, traditional tourist development of this kind of area, with its special attraction and natural beauty, is particularly damaging to the environment [1,9]. In developing this study, we propose that tourist management on the island of Lanzarote is not being performed using the criteria of sustainability [46]. Based on this premise, we design and apply a questionnaire to identify the priority elements of mobility for tourists who arrive on the island [46]. Successful tourism development involves balancing relationships among tourists, residents, places, and the organizations and businesses that provide tourism services [47].



**Figure 1.** Location of the Canary Islands, Spain. Source: Developed by the authors.

Lanzarote is a small island with a low population and low population density, although we can observe from Table 1 that its population has undergone intense growth—over 50%—in only a decade. Since the 1970s, Lanzarote’s tourist development has spread out gradually from the capital, Arrecife,

to the southern towns, which have more beaches. This has led to greater pressure on the system of roads from both residents and tourists. An important factor that influences this development and must be taken into account is that over 40% of the island's surface has been declared a protected area (Table 2).

**Table 1.** Population and population density according to the Town Register by years.

Year	Inhabitants (No.)	Population Density (Inhabitants Per km <sup>2</sup> )	Year	Inhabitants (No.)	Population Density (Inhabitants Per km <sup>2</sup> )
2016	141,437	167	2010	116,782	138
2015	141,938	168	2009	114,715	136
2014	139,506	165	2008	109,942	130
2013	132,366	156	2007	103,044	122
2012	127,457	151	2006	96,310	114
2011	123,039	145	2005	90,375	107

Source: Canary Islands Institute of Statistics (ISTAC) [45]. Developed by the authors.

**Table 2.** Surface area of protected natural areas according to protection categories (in hectares).

Surface	Hectares	Percentage of the Total Surface of the Island of Lanzarote
Declared "National park"	5107.00	6.04%
Declared "Natural park"	19,270.40	22.78%
Declared "Integral natural reserve"	165.20	0.20%
Declared "Natural monument"	5211.90	6.16%
Declared "Protected countryside"	5676.50	6.71%
Declared "Place of scientific interest"	199.50	0.24%
Total Protected	35,029.20	41.41%
Total of the Island of Lanzarote	84,594.00	100.00%

Source: Canary Islands Institute of Statistics (ISTAC) [45]. Developed by the authors.

The location of protected spaces in Lanzarote is shown in Figure 2. In recent years, the improvement in accessibility and infrastructure and the increase in tourist activity and land mobility due to the economic evolution of Lanzarote have made this island a unique space in Spain on which to perform our research analysis. One of the main natural treasures is the National Park of Timanfaya, the only area on the island in this protection category. Its property structure is primarily public. Of the 5107 hectares that make up the surface of the National Park of Timanfaya, 95.90% are public property and 4.10% private property [45]. This area has experienced increased tourism and tourist fame in recent decades (Figure 3). There has been an increase in the number of visitors, namely, if we compare the number of tourist arrivals in 2015 with 1996, they have doubled. However, we can observe increasing and decreasing cycles in the number of arrivals, associated with reasons outside the sphere of the destination.

The problems with the current model of land mobility in Lanzarote stem from the accumulation and interrelation of many conflicts [49], among which are: strong growth in tourist demand; imbalance in the connection, use, and integration of the means of transportation; increase in the number and distance of trips made in motor vehicles; high accident rate; growth in greenhouse gas [50]; strong geographical and seasonal concentration of tourist activity; and occupation of the area for infrastructure and vehicle parking. Given all of these changes in an environment with the natural wealth of Lanzarote, defining transportation systems that respect the environment should be a priority. For example, the decreasing number of users of intercity transportation (Figure 4) leads us to think that the trips are usually made in less sustainable ways, particularly by car [50].



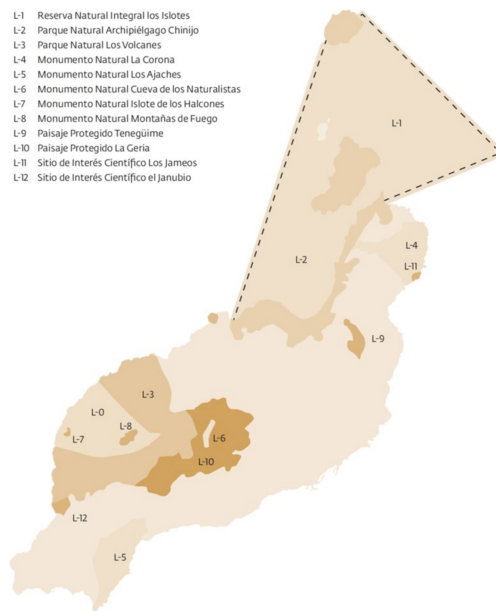


Figure 2. Location of the protected enclaves in Lanzarote. Source: Alvarez, 2014 [48].

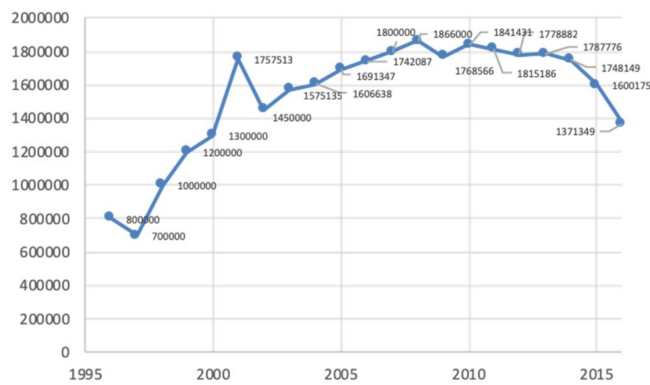


Figure 3. Number of visitors per year to the National Park of Timanfaya. Source: Canary Islands Institute of Statistics (ISTAC) [45]. Developed by the authors.

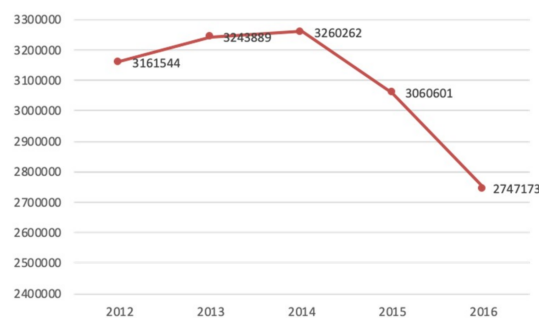


Figure 4. Evolution of intercity transport in Lanzarote. Number of bus users. Source: Canary Islands Institute of Statistics (ISTAC) [45]. Developed by the authors.

Lanzarote provides the perfect case for studying and analyzing the impact of tourists' use of vehicles, since the number of vehicles in the island's fleet is higher than the average in Spain (Table 3). The annual licensing figures show the important of mobility based on car rentals in the island.

**Table 3.** Relationship between population and fleet of vehicles (vehicles per 1000 inhabitants).

Year	Vehicles Per 1000 Inhab. in Lanzarote	Vehicles Per 1000 Inhab. in Spain
2016	849	673
2015	847	684
2014	868	685
2013	864	661
2012	842	636
2011	826	616
2010	825	594

Source: Canary Institute of Statistics (ISTAC) [45] and National Institute of Statistics (NIS) [51]. Developed by the authors.

The public transportation available for travelers on the island is strongly supported by the rental car sector, which becomes the most significant and specialized tourism-related sector. The advantage of rental cars stems from the fact that they guarantee the tourist's autonomy, enabling access to different geographical points on the island. Currently, the rental sector for transportation in Lanzarote provides an excellent price-quality ratio, making it one of the most abundant sectors throughout tourism development (Table 4). The sector generates significant activity, both its own and activity derived from the use of rental vehicles. The increase in individual trips and outings has stimulated rental car services (Table 5), which although they suffered the effects of the global economic crisis, have improved thanks to the systems of electronic reservations and the Internet.

**Table 4.** Number of firms and fleet of rental vehicles with active registration for the year 2016.

	Lanzarote	Spain
Number of Car Rental firms	25	1768
Number of Car Rental firms per 1000 inhabs.	0.18	0.04
Total fleet of rental vehicles	10,245	275,000
Rental vehicles per 1000 inhabitants	72	6

Source: Canary Island Institute of Statistics (ISTAC) [45].

**Table 5.** Registrations of vehicles for rent without driver in Lanzarote.

Year	Registrations (No.)
2016	1413
2015	2919
2014	6148
2013	5817
2012	3989
2011	3612
2010	3435

Source: Canary Island Institute of Statistics (ISTAC) [45].

Road transportation, which is included in this sector, can encounter problems of sustainability in the medium and long term. An effort must therefore be made to regulate transportation in a way that is environmentally sustainable (this is necessary to guarantee the future of tourism on the island), as well as the economic implications of tourism. As will be explained in what follows, a model must be advanced that encourages the rational use of public and private transportation and mobility that respects the environment.

## 5. Results

From the sample surveyed, we find that of the users of rental cars enter and leave the island from Lanzarote Airport (97%). This has clear repercussions for planning the pick-up and drop-off points for the vehicles. However, transportation service to the hotel, which is provided in many



cases, also influences the pick-up point of the vehicle. As for the itinerary of the visit, users stress the following as the main locations of overnight stays: Costa Teguisse (37.50%), Puerto del Carmen (30.68%), and Playa Blanca (18.18%). The itinerary is determined by considering the most-visited tourist locations on the islands. The users visited primarily Los Jameos del Agua, La Cueva de los Verdes, Las Montañas del Fuego, Playa Blanca, the Cactus Garden, Yaiza, Mirador del Río, among other popular destinations (Table 6). The data shows the distribution of the tourists' trips, which begin and end at the airport, hence the importance of rental vehicles in organizing the visit. The locations of the main tourist spots in Lanzarote are shown in Figure 5.

**Table 6.** Points of interest visited by tourists on their trips.

Touristic Location	%
Puerto Calero	7.95%
Castillo de San José	9.09%
Caleta de Famara	10.23%
Tinajo-La Santa	10.23%
Isla de la Graciosa	10.23%
Bodegas de Vino	12.60%
Haría	13.64%
Isla de Fuerteventura	13.64%
Mercadillo de la Villa	17.05%
Monumento Campesino	18.18%
Salinas de Janubio	21.69%
Fundación Cesar Manrique	21.69%
Playas de Papagayo	27.27%
La Geria	30.68%
El Golfo	35.23%
Mirador del Río	45.45%
Yaiza	46.69%
El Jardín de Cactus	51.14%
Playa Blanca	53.41%
Las Montañas de Fuego	64.77%
La Cueva de los Verdes	73.86%
Los Jameos del Agua	80.68%

Source: Direct survey. Developed by the authors.



**Figure 5.** Main tourist spots in Lanzarote. Source: Lanzarotetours.com [52].

To analyze intermodal transportation in tourist displacement on the island, we considered the set of means of transportation used on the route. Among users of rental cars, the complementary means of transport most used was the inter-city bus, although the rate of use was only 13.64%.

This means of transportation is followed by complementary use of taxi (7.95%), city bus (6.82%), and boat (6.82%). Hotel transportation and bicycle also appear, but in very low percentages (2.27% and 2.27%, respectively). The low rate of intermodal transportation registered nowadays among users of rental vehicles may be due to lack of information or lack of need.

It is worth stressing that 81.88% of those surveyed did not know about the availability of public transportation before arriving on the island, a factor that could limit the possibilities for setting up an intermodal route. Within the group of rental vehicle users, the motives given for the decision to use rental vehicle services are related to tourists' ability to tailor their visits and to be independent—first, for the possibility of making a tour of the island (93.18%), and second just to be able to take a drive (37.50%). Considering the survey sample as a whole, 78.41% of the respondents indicate that they did not use the public transportation available on the island, and only 11.36% considered it useful and comfortable. Still, a good percentage of those who used public transportation felt that it did not fit their needs (5.68%) or had difficulty accessing it (3.41%). The last element in our analysis of means of transportation used on a tourist visit to Lanzarote was the mode of access to the main tourist resources on the island (Table 7). We would like to stress the predominant use of rental vehicles, especially in natural spaces, tourist centers, points of entrance and exit, and lodging. The complementary means of transportation most used are the tourist bus in cities and taxis to access lodgings.

**Table 7.** Means of transportation used to access tourist attractions.

Transportation System	Cities	Beaches	Natural Spaces	Tourist Centres	Points of Entrance and Exit	Lodging
Public bus	12.79%	7.23%	-	2.38%	-	1.16%
Taxi	1.16%	-	-	1.19%	1.15%	5.81%
Rental vehicle	86.05%	90.36%	100.00%	95.24%	96.55%	91.86%
Bicycle	-	2.41%	-	-	-	-
Tourist transportation	-	-	-	1.19%	-	1.16%
Other	-	-	-	-	2.30%	-

Source: Direct survey. Developed by the authors.

Only 9% of those surveyed indicated specific problems parking. Users reported that connecting with intermodal transportation created difficulties in accessing public transportation and tourist transportation. Thus, the percentages of those who did not use public transportation are very high (55.68%), and the percentages for those who did not use tourist transportation are even higher (92.05%). The users of public transportation did not mention difficulty in accessing public transportation, as they did when mentioning access to tourist transportation. The last block of survey questions focused on the rental vehicle user's satisfaction with the rental vehicle service for tourists (Table 8). The assessment that the tourists perform about car rental services is expressed on a scale from 1 to 10, in which 1 is the most negative assessment and 10 is the most positive one. The aspects that received the highest point values were those related to the vehicle used, accessibility, parking, and heavy road traffic. We should point out that these issues exceed the average point value of 8, and that none of the concepts analyzed is under the value 7, indicating that the experience was positive. The concepts that received the lowest evaluation were related to quality of infrastructure and intermodal transportation.

We have used t-test and one-way analyses of variance (ANOVA) to analyze whether the tourist assessment about the rent-a-car services shows statistically significant differences depending on nationality, gender, age, and level of education (Table 9). The same analyses were used to determine whether there are any differences in the importance that tourists give to sustainability when choosing a mode of transportation. They have also been used to find out if there are any differences in the criteria used to choose a mode of transportation in relation to the different segments. With respect to the assessment of car rental services, the most positive opinions correspond either with foreign tourists, tourists below 35 years of age, or tourists educated to a primary school level. We have found statistically significant differences in these three cases, unlike the differences found in terms of gender.

**Table 8.** Degree of satisfaction with rental vehicle services.

Item	Satisfaction
Price/quality ratio of the service	7.66
Parking problems	8.78
Accessability problems	8.63
Heavy traffic	8.31
Intermodal transportation alternatives	7.36
Quality of roadway infrastructures	7.37
Information on points of interest	7.40
Information on routes and roads	7.41
Prior information	7.75
Reservation process	7.23
Attention to public	7.95
Vehicle used	8.11

Source: Direct survey. Developed by the authors.

**Table 9.** Assessment of the car rental service in terms of the characteristics of the tourist.

Assessment of the Car Rental Service	N	Mean	Standard Deviation	Test Statistic	p-Value
Origin					
National tourists	220	7.62	0.54	t-test	0.000 *
Foreign tourists	180	8.11	0.41	4.11	
Gender					
Male	301	7.89	0.61	t-test	0.541
Female	99	7.11	1.21	3.12	
Age					
<35 years	121	8.44	0.347	ANOVA	0.000 *
36–50 years	219	8.01	0.541	4.211	
>50 years	60	7.54	0.412		
Level of Education					
Primary studies	68	8.10	0.642	ANOVA	0.000 *
Secondary studies	124	8.01	0.415	3.221	
Higher studies	208	7.12	0.402		

Source: Direct survey. Developed by the authors. \*  $p < 0.05$ .

The tourists were asked to assess the importance of certain factors when they had to select a mode of transportation (Table 10). This assessment is measured on a scale from 1 to 5, where 5 implies a great importance in the process and 1 implies minimal importance. In regard to the criteria used by the tourists to select a mode of transportation during their visit, the most highly valued is “the capacity to access tourist spots”. The second criterion in terms of importance is “freedom to arrange the visit”, whereas the third one is “cost of transport”. The two less important elements are “environmental sustainability” and “professional driver familiar with the area”. The answers show significant differences between Spanish and foreign tourists when assessing how important it is the freedom to arrange the visit, as well as in the presence of a professional driver or the importance of sustainability, to which foreign tourists are more sensitive.

Regarding the assessment of sustainability as an element of importance when choosing a mode of transportation, foreign tourists hold it in higher esteem than Spanish ones do, being this a statistically significant difference (Table 11). It is also more important for women, young people and those who pursued higher studies. Statistically significant differences have also been found in these three cases.

**Table 10.** Assessment of the different elements intervening in the selection of a mode of transportation.

	N	Mean	Standard Deviation	Test Statistic	p-Value
Freedom to arrange the visit					
National tourists	220	3.81	0.49	t-test	0.000 *
Foreign tourists	180	4.52	0.41	3.98	
Average cost of transportation					
National tourists	220	3.42	0.814	t-test	0.451
Foreign tourists	180	3.31	1.27	0.711	
Environmental sustainability					
National tourists	220	2.84	0.45	t-test	0.000 *
Foreign tourists	180	3.11	0.55	4.015	
Capacity to access tourist spots					
National tourists	220	4.88	0.911	t-test	0.0671
Foreign tourists	180	4.74	0.971	0.842	
Professional driver familiar with the area					
National tourists	220	2.47	0.841	t-test	0.000 *
Foreign tourists	180	3.01	0.661		

Source: Direct survey. Developed by the authors. \*  $p < 0.05$ .

**Table 11.** Assessment of the importance of sustainability when choosing a mode of transportation according to the characteristics of the tourist.

Environmental Sustainability	N	Mean	Standard Deviation	Test Statistic	p-Value
Origin					
National tourists	220	2.84	0.45	t-test	0.000 *
Foreign tourists	180	3.11	0.55	4.015	
Gender					
Male	301	3.34	0.41	t-test	0.000 *
Female	99	2.74	0.35	2.128	
Age					
<35 years	121	3.41	0.44	ANOVA	0.000 *
36–50 years	219	3.11	0.45	3.121	
>50 years	60	2.64	0.47		
Level of education					
Primary studies	68	2.67	0.32	ANOVA	0.000 *
Secondary studies	124	2.89	0.47	3.451	
Higher studies	208	3.29	0.55		

Source: Direct survey. Developed by the authors. \*  $p < 0.05$ .

Now that we have analyzed all of the data, we can consider the current situation and future challenges in Lanzarote. In this context, one of the problems comes from the insufficient infrastructure for public transportation, which influences trips. The fleet of vehicles is large, and the use of private vehicles predominates over public transportation. The local population is highly mobile, in part because of the average distance between workers' places of residence and the tourist centers (Table 12). It is thus essential to rationalize mobility and increase the use of public transportation. This table shows the geographical dispersion of the tourist spots in Lanzarote. In it we can appreciate the distance between population centers and the different tourist spots. This influences the tourist mobility and forces the visitors to use a flexible mode of transportation. Moreover, the distance between population centers and tourist spots makes it necessary for a large number of the population to count with a mode of transportation for their commute to work.

This causes serious problems, which are especially significant on an island that boasts the title of Biosphere Reserve, particularly for the value of its landscapes [7]. In fact, the island's current system of mobility takes up an increasing amount of the territory, with new roads and the expansion of existing ones generating pollution and leading to accidents. Therefore, this is an unsustainable model that should opt for a rethinking of mobility with action taken in infrastructure, means of transportation, and regulation of the territory. It is necessary to decrease the impact on the landscape

caused by transportation infrastructure, which is precisely the main island's export product, since its sustainability is influenced, in part, by the growth of transportation and the infrastructure that supports it.

**Table 12.** Distances in kilometres between the main population centres in Lanzarote.

From	To	Via	Distance (km.)
Arrecife	Playa Honda	LZ-2	3.40
Arrecife	Pto. Del Carmen	LZ-40-2	10.20
Arrecife	San Bartolomé	LZ-20	6.20
Arrecife	Tinajo	LZ-20	17.10
Arrecife	Haría	LZ-1-10	25.70
Arrecife	Teguise	LZ-1-10	9.25
Playa Honda	Yaiza	LZ-2	17.50
Playa Honda	Tinajo	LZ-2	16.80
Playa Honda	Teguise	LZ-2-3-1-10	15.11
Playa Honda	Costa Teguise	LZ-2-3	8.90
Playa Honda	Tahiche	LZ-2-3-1	9.70
Playa Honda	Pto. Del Carmen	LZ-40-2	8.60
Playa Honda	Playa Blanca	LZ-2	33.30
Playa Honda	Pto. Calero	LZ-2	14.00
Tinajo	San Bartolomé	LZ-20	10.90
Tinajo	Yaiza	LZ-67	16.40
Pto. Del Carmen	Haría	LZ-40-2-3-1-10	39.80

Source: Direct survey. Developed by the authors.

To achieve more sustainable mobility, there should be more means of transportation and intermodal transportation, including the introduction of more ecological vehicles, consciousness-raising campaigns, and demystification of private transportation and possession of high-end vehicles as social status items [53]. Lanzarote's character as an island makes private rental transport a necessity that encourages the geographical distribution of the benefits of tourist activity and satisfies the needs and expectations of tourists' visits, granting tourists a degree of flexibility. Further, the geographical dispersal of tourist attractions and lodging requires quick flexible use of transportation that can respond to the tourist's needs. Given the small amount space, rental vehicle firms in Lanzarote should be given incentives to renew their car fleets with ecological vehicles and to improve intermodal transportation by imitating other European models implemented in small spaces, such as the natural environment of the ski station Zermatt (Switzerland), in which this kind of instrument has been organized, prohibiting the use of the conventional automobile and permitting only electric car and train [54].

## 6. Conclusions and Discussion

Tourist trips often take place in areas with unique environmental and social characteristics that make these places particularly sensitive to degradation and requiring support for modes of transportation with a lower environmental impact. Managing mobility can prevent the degradation of the environment through the use of strategies such as the improvement of public transportation, commitment to ecological transportation, management of parking lots, distribution of transportation guides, etc. The availability of different transportation alternatives in tourist areas improves accessibility for visitors, as well as for tourist industry employees. Thus, managing mobility also benefits tourism, because among other things, it generates savings, reduces traffic jams, and improves habitability and conditions of access. Our research shows that in small protected spaces like the island of Lanzarote, rental vehicle transportation has been a good instrument for the tourist until now, although it creates environmental problems. The tourism developed on the island is based on numerous tourist spots scattered throughout the island, some of them in environmentally protected areas. This poses a challenge in the planning of public transport. According to the data provided by

the survey, tourists highly value the capacity of the mode of transportation to access tourist spots and the freedom to arrange their visit. Other modes of transportation with lower environmental impact than cars will hardly meet these criteria.

The assessment of sustainability is higher amongst young people, tourists with higher levels of education, and foreign tourists. The demand of sustainable transportation on the part of the tourists will probably increase in the future. Public authorities should plan sustainable alternatives for the future to meet the necessities of tourism and work around the particular characteristics of the island. Electric car rentals are possibly a good option, given that they meet the requirements of tourists and have a low environmental impact. In this sense, and considering the distances between tourist spots and resorts, there should be a large investment in charge stations. Rental vehicles should not necessarily be replaced but should be complemented by other means of transportation with less environmental impact. The results of our study show the importance of and need for planning and management of mobility in protected natural spaces in the presence of mass tourism.

We propose that public transportation be stimulated and improved for residents in order to gain energy efficiency and coherence in trips. These measures will have a clear effect on the congested roadways and on accessibility. We also propose rationalizing the use of private transportation based on better planning at the levels of territory, labour, etc. Finally, the island should commit itself to sustainable intermodal transportation appropriate to the economic and functional needs of its residents. As for specific proposals for tourists, the island should make a direct and decisive commitment to ecological vehicles. It can do this by promoting these vehicles, expanding the points for recharging them, and creating parking lots in centres of tourist interest. For intermodal transportation, Lanzarote should foster connections to ecological vehicles inside the points of tourist interest and to bicycle routes, pedestrian zones, and individual electric vehicles. These measures are complemented by a commitment to improving the roadway infrastructure and providing appropriate information for users, which will help both residents and visitors.

This paper shows that the challenges posed by mobility on this island are a complex matter. The number of private vehicles should be reduced in environmentally sensitive spaces, but due to the widespread location of tourist locations, it is hard to achieve. However, a combination of private and collective transportation based on electric vehicles could help to reduce the number of vehicles on the island, while still allowing the tourists to visit the most sensitive spots. Moreover, this would also meet the demands of some tourists who require a professional driver that knows the area, especially in remote areas. The key to doing so is to plan a possible combination of elements with enough frequency that they are able to adjust to the necessities of the tourists. Likewise, it is important to collaborate with the hotel industry to provide them with information about transportation possibilities, as well as to be able to coordinate the transportation necessities of the tourists in order to share it with other facilities and optimize collective modes of transportation. Car rental companies should work jointly with the public administration sector, with the aim of designing the future of intermodal transport and planning the implantation of charging stations for electric vehicles. The results of the survey show that tourists nowadays, and increasingly in the future, will demand more sustainable modes of transportation. Therefore, it is the responsibility of public administrations to offer viable solutions in this regard. Local- and worker-oriented transportation cannot be set apart or cast into oblivion when designing the island's transportation network. The geographical dispersion of the tourist spots also affects these collectives, whom must be offered viable solutions so that they can also have access to sustainable modes of transportation.

This research has proven that in order to analyze tourist mobility, we must perform a comprehensive analysis of the destination as well as the elements influencing tourist mobility, the most widespread modes of transportation, and the assessment of the tourists in regard to the elements they consider most important when choosing a mode of transportation. This research should be developed in the future by applying the same model of analysis in islands with similar characteristics in order to complete the data obtained in this study.



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