

THE ROLE OF MOBILITY IN THE SUSTAINABILITY OF ISLAND DESTINATIONS. THE CASE OF GRAN CANARIA

Author:

Julio Rodríguez Márquez

Ingeniero de Caminos, Canales y Puertos, Master en Diseño Integral de Destinos Turísticos, Profesor Asociado a la ULPGC, Departamento de Ingeniería Civil, Socio Director de Gipic S.L. y Altagracia Consultores S.L., Vicedecano de la Demarcación del Colegio de Ingenieros de Caminos, Canales y Puertos de Las Palmas.

jrodriguez@gipic.com julio.rodriguez@ulpgc.es

Universidad de Las Palmas de Gran Canaria. Programa de Doctorado de Diseño Integral e Innovación de Destinos Turísticos
Las Palmas de Gran Canaria, Spain

Abstract

A tourist destination interacts outside the territory that houses it due to mobility of persons and transport of goods, modifying its carrying capacity. There are two limits for a tourist destination: accommodation capacity and transport capacity. A paradox: the greater volume of mobility and transport, the greater the potential for development of a tourist destination, but an excess of mobility can imply its deterioration. Global Economy accepts the tourism sector as distributor of wealth and development so it has to be sustainable over time. The objective of this study is to determine the importance of mobility associated with an island tourism destination and its sustainable development. Physical indicators have been analyzed tourist destinations: material flow accounting, ecological footprint, and eco-efficiency. A new methodology is proposed. The case of Gran Canaria is studied.

Un destino turístico interactúa fuera del territorio que lo alberga debido a la movilidad de las personas y al transporte de mercancías, modificando su capacidad de carga. Hay dos límites para un destino turístico: capacidad de alojamiento y capacidad de transporte. Una paradoja: un mayor volumen de movilidad puede implicar mayor desarrollo de un destino turístico, pero un exceso de movilidad puede suponer su deterioro. La Economía global acepta al sector turístico como distribuidor de riqueza y desarrollo, pero debe ser sostenible. El objetivo de este estudio es determinar la importancia de la movilidad asociada a un destino turístico insular y a su desarrollo sostenible. Indicadores físicos han sido analizado en destinos turísticos: contabilidad de flujo de material, huella ecológica y ecoeficiencia. Se propone una nueva metodología a desarrollar. Se analiza el caso de Gran Canaria.

Keywords

Island tourist destination, sustainability, mobility, carrying capacity, material flow accounting, ecological footprint, eco-efficiency

Destino turístico insular, sostenibilidad, movilidad, capacidad de carga, contabilidad de flujo de materiales, huella de carga, eco-eficiencia

1 INTRODUCTION

1.1 The dimension of Tourism and its Sustainability

Tourism represents 9% of the world's G.D.P., is responsible for 1 in every 11 jobs with 1,035 million international tourists and 5,000 - 6,000 million domestic tourists. Trend is an annual increase of 3.3% up to 2030, year in which 1,800 million international tourists will be reached. In response to the reception of the tourists, the emerging destinations will have stronger trend, 4,4% annual, while wealthy economies destinations will grow at 2,2% annual (UNWTO Tourism Highlights Edition 2013)

United Nations (UN) has defined Tourism as a main vector for the achievement of the Millennium Development Goals (MDG), with the creation in 2004 of the Sustainable Tourism for Eradicating Poverty (ST-EP), headquartered in Viet Nam.

However, many authors question the Sustainability of an economic sector which is based on Mobility and thus, in the consumption of fossil fuels and its consequence: the emission of greenhouse gases (GHG).

Climate Change will act on tourist Destinations transforming them and, in some cases, invalidating them (case of the islands of low relief that can be inundated by the rise of the sea level). 450 ppm of CO₂ in the atmosphere is the limit to keep under 2 °C of warming that would lead to dangerous climate change (Peeters & Eijgelaard 2014)

A round scheme of the Tourism sector is:

origin market - transport - Tourist Destination - transport – origin market

This basic scheme unites the supply capacity of tourist destination with the origin markets' demand, with a limited number of people with possibility -time and money- to travel for tourism. Supply and demand are in mismatched places so transportation is essential for connecting them

The study of the Tourism sector from the supply side is based on the analysis of tourist destinations.

Tourism, as an economic sector, has to be sustainable over time to be accepted for Global Economy. That means that tourist destinations, in which the economic system of Tourism sits, should be sustainable over time.

Tourism is an activity based on the mobility, by the very definition of Tourism. To consider the Sustainability of Tourism activity, one of the main factor to be analyzed is the mobility and it can be associated to the tourist destinations.

1.2 How a territory becomes a Destination

A territory is not born being a tourist destination. A territory is transformed into a tourist destination. Initially, it is because it has some attractions, natural or man-made. Tourism activity causes this transformation with internal and structural changes in the territory, necessarily linked to mobility of persons and transport of goods.

It is a paramount to analyze migratory flows associated with the new scenarios of the tourist destination's evolution. Tourist destination itself is transformed during the process

to accommodate a flow of people, as labor, with new needs, apart from tourists' demand. One initial consequence is the increase of freight moving due to the increased population for providing service to tourists. (Dominguez Mújica, González Pérez & Parreño Castellano 2011 and Hannam, Butler & Morris Paris 2014)

As factor added to the above, during the process of transformation of the territory into tourist destination, the assistance of a labor for the execution of the tourist infrastructure will be required. Territories with tourist destinations have a superior demographic increase, in what some authors have termed "tourist-construction binomial" development model (Murray, Rullan & Blazquez 2005).

1.3 Is there a maximum capacity for tourism because of mobility?

Tourism evolution is linked to technological advances in transportation. This relationship is well studied and established the cause of tourism development in the past 100 years with the born and evolution of two modes of transportation: the automobile and the airplane.

In any scenario, there are two limiting factors in Tourist System: accommodation capacity and transport capacity, since tourists must be able to travel to a Tourist Destination and to spend the night in it. These limits can be modified by human action through the construction of new tourist beds and the implementation or expansion of major transport infrastructure.

There is no tourism without mobility of people, and in the degree of development of the sector at present, tourism hardly would hold without international trade. Depending on the dimension of the tourism sector, there will be a flow of mobility of people and transport of goods. It means that the greater mobility and transportation, in quantitative terms, the greater the capacity of the tourism system.

However, the maximum capacity of tourism has other limits. The touristic carrying capacity, whatever that be defined, will be a factor limiting sustainable tourism, provided that this is supported by sustainable tourist destinations. The limits to human action come from carrying capacity of a tourist destination, because of the natural capital.

Establishing if the natural limits to the growth of a tourist destination are in the territory in which this tourist destination is inserted, or if they are out of boundaries, is one of the main issues of this research.

There is a paradox: the greater volume of mobility and transport, the greater the power of development of a tourist destination, but an excess of mobility and transport associated with a destination can be rigged a deterioration that will alter the values attractors that was initially visited, transforming its essence and, possibly, destroying it.

It justifies the need to address the role of mobility and transport in the sustainability of a tourist destination.

In this sense, there are two aspects in the mobility associated to a tourist destination. On one hand it is the necessary connectivity between markets of origin and the destination. Secondly, mobility is located in the tourist destination itself.

Origin-destination mobility implies a constraint of the destination itself since that is necessary to the existence of paths with adequate capacity so that demand can be satisfied. Mobility in destiny is intertwined with the carrying capacity of the destination and, more specifically, with the tourism development model which is intended to apply.

2 OBJECTIVE

There are important relationships between mobility and sustainability, mobility and tourism and between sustainability and tourism. The objective of this study is to determine the importance of mobility associated with a destination in its sustainable development.

It should be applicable to any destination, but, in this case, the methodology has been applied to a single tourist destination: The Island of Gran Canaria in Canary Island, Spain

3 A FORMER APPROACH TO THE ISSUE FROM DIFFERENT SIGHTS

The consulted literature has been grouped in 5 major groups. sustainable development, tourism, mobility, tourist destinations and applied methodology.

The consulted literature allows to setting some initial findings prior to future phases of research.

3.1 Sustainable Development: An ecological sight of the Global Economy

According to the definition of the Brundtland Report (1987), a development is sustainable when it meets the needs of the present without compromising the ability of future generations to meet their own needs.

Probably, the ecological crisis will be more visible from the side of materials than from the energy (Murray et al 2005), and some authors distinguish between sustainable development and sustainable growth (Daly 1990), though it seems that there is an ecological awareness and anti-ecological behavior (Estevan 1997)

The problem of Sustainability can be on the base of disembedding or descontextualization. People who are geographically distanced from the production of ecosystem services have no incentives to reduce the impact of their consumption. (Börgeström Hansson & Wackernagel 1999 and Van den Bergh & Verbruggen 1999)

The publication of the Meadows, (Meadows, Meadows, Randers & Behrens 1972) put on the ropes to the common goal of economic growth. This report highlighted the apparent infeasibility of the permanent growth of the population and its consumption: the only continued growth could be temporarily in a physical world. However in "Beyond the limits" (Meadows, Meadows & Randers 1992) distinguish between growth and development to warn that "despite limits to growth, does not have why to have them to development".

3.2 Tourism as a tool for sustainable development.

To find these two objectives, exposed in the previous section, PNUMA (2011) established that tourism development, well planned, can improve local economy and diminish poverty, though it recognizes that tourism growth has come accompanied with great difficulties, such as GHG emissions, water consumption, etc.

Travelling and tourism are intensive activities and they employ more than 230 million people that means 8% of global labor population. Also, it is estimated that for every single

job in tourism sector, it creates 1,5 additional jobs in Tourism related economy. About transport PNUMA (2011) names three principles to green transport, 1) avoid or reduce movements integrating land and transport planning and forcing local production and local consumption; 2) improving efficiency such as public transport, non-motor modes for people and train/ship for freights and 3) technology improvements.

Negative impacts from Tourism occur when the level of visitor use is greater than the environment's ability to cope with this use within acceptable limits of change, distinguishing local impacts (depletion of natural resources as water, land degradation, pollution as air pollution and noise, solid waste, sewage. As well as physical impacts through development: construction, deforestation or physical impacts from touristic activities) and global impacts (loss of biological diversity, depletion of the ozone layer and climate change. (Camarda & Grassini 2003)).

There is a paradox between tourism as a tool for developing poor countries and as a vector for the climate change (Becken 2004). It is inevitable that both tourism and aviation will need to reduce those emissions.(Peeters & Eijgelaar 2014)

3.3 Mobility as the support of Tourism.

3.3.1 People's mobility

In 2012 world citizens move 23 billion km each year. By 2050 it is predicted that this will increase fourfold to 106 billion. (Urry 2012)

The data from ACETA (2011) shows that in 2010 aviation carried 2.400 million passenger, 40% of international touristic travels are by plane, there are almost 23.000 aircrafts, air routes reduce distances from ground in 30%, aviation occupation average is of 75%, while 50% of train and 30% of cars. The international movement of passengers is by plane, with more than 33,000 million passengers kilometer, that approximately 2/3 are related to leisure tourism and 1/3 with the business.

The transport system has provided the foundation for the development of both domestic and international tourism in its present form. Provision of transport infrastructure is a necessary precondition for the development of Tourism industry. Little attention has been given to the link between transport and Destination development. (Prideaux 2000)

For Hoyer (2010) there is no Tourism without travel. Tourist trips are a major source of environmental problems for which the concept of sustainable Tourism should be linked to the concept of sustainable mobility, implying a change in modes of transport and a reduction in the levels of Mobility.

Crespo García, (Crespo García & García Cortés 2010) reflexes about the needs of a sustainable mobility. This author analyzes with different indicators the characteristics of the urban mobility in Spain. The 39,2% of the total energy in Spain has been consumed by mobility, 68% of this in road transport.

Tourists may travel shorter distances and they may stay longer at their destinations and the higher oil prices would lead to reduced tourism demand at the global level. In 2006 oil supplies 40% of the world energy needs and 90% of transportation requirements. (Yeoman et al. 2007)

Hannam, (Hannam, Butler and Morris Paris 2014) argues that the tourism mobility approach is useful for understanding the importance of tourism research in the contemporary world. They marked the importance of automobility as the simultaneous achievement of autonomy and mobility (as the simultaneous achievement of autonomy and mobility, especially in leisure travels).

3.3.2 Freight transport. International trade

International trade allows the geographical separation between the place where carbon emissions occur and the place where income from those emissions is derived. The emissions enabled through international trade represented, in 2001, 18% of world total emissions. Find that developed economies, Asia and Fossil Fuel Exporters (FFF) contribute to 80% of the emissions enabled through international trade (Marques, Rodrigues & Domingos 2013).

Gössling, (Gössling, Garrod, Aall, Hille & Peeters 2011) shows that food production and consumption have a range of Sustainability implications and that food management could substantially reduce de GHG emissions of foodservice providers. Tourism is of relevance in food consumption because of the enormous amount of food that is prepared. According UNWTO-UNEP-WMO (2008) almost 25 billion tourist days were spent in 2005 that means 200 million meals per day. The transportation of foodstuffs can imply considerable GHG emissions.

González Hidalgo (2010) concludes that, from 1995 to 2007 food imports in Spain have grown 53% in tons emitting 2,84 Mt of CO₂ in 1997 to 4,74 Mt of CO₂ in 2007, growing 66%. This increase is because of a longer distance for the food to come to Spain (an average of 5.013 km in 2007) and the different transport modes used with more road transport (in 1995 75/24% in ship/road while 70/29,5% in 2007). Food air transport is for far the worst in pollution/ton.

3.4 Tourist Destinations

3.4.1 The evolution of Tourist Destinations

Agree with World Tourism Organization (WTO) “Tourism includes all travels which imply a stay of at least one night, but less than a year, away from home”.

Butler (1980) defines a well-known hypothetical tourist cycle of area evolution in six stages: exploration stage, involvement stage, development stage, consolidation stage, stagnation stage and decline or rejuvenation stage. Tourism has shown an unlimited potential to growth, despite economic recessions. It is taken for granted that the numbers of visitors will continue to increase.

There are few other models to explain life cycle of a tourist destination.

3.4.2 Sustainability in Tourist Destinations

Local tourism Destination was defined (WTO 2002: np) as “a physical space that includes tourism products such as support services and attractions, and tourism resources. It has

physical and administrative boundaries defining its management, and images and perception defining its market competitiveness. Local destinations incorporates several stakeholders, often including a host community, and can nest and network to form larger destinations. They are the focal point in the delivery of tourism products and the implementation of tourism policy

"Sustainable Tourism is Tourism of a type that sustains its viability in one area for an indefinite period of time" (Butler 1980 and Höyer 2010)

The UNWTO, (UNWTO-UNEP-WMO 2008) defines the carrying capacity of a Tourist Destination as "the maximum number of people who can visit a place at the same time without causing physical, economic, socio-cultural or environmental damage, as well as an unacceptable decrease in the satisfaction of visitors".

The truth is that the destination conforms as a subsystem in the common space between two more wide systems, the sectorial tourist one and the geographical one. It benefits from both and must be interpreted, planned and managed attending to its individual elements, but mainly to the interactions rising among these ones. (Barrado Timón 2004)

3.5 Applied methodology in previous researches

The sustainability of a tourist destination should be able to be measured and should be able to compare the degree of sustainability of different destinations.

It is necessary to establish the scope of study for the establishment of the sustainability of a tourist destination.

Physical indicators, within global scale, are chosen to measure the sustainability of a tourist destination, as follows:

- Materials Flow Accounting, which measures the flow of materials necessary for the maintenance of the tourist destination, distinguishing between imports and domestic production and exports.
- Ecological Footprint of a tourist destination, as well as its biocapacity and its balance sheet.
- Eco-efficiency of each destination, defined as the Tm of CO_{2-eq} emitted per unit of GDP, in the group of indicators of oil consumption and CO₂ emissions

From the local perspective, the carrying capacity of a tourist destination should be a quad perspective: economic, social, environmental, and infrastructure. In this way, the planning and management of the different activities that take place in a tourist destination have a direct impact on sustainability of the destination.

A full scan can determine an optimum size and type of tourism, defining the tourist activity in territorial planning and the relationship of tourism with local population.

3.5.1 Material Flow Account

Eurostat (2001) made a methodological guide for the Economy Wide Material Flow Accounts and in Eurostat (2009) shows a Compilation Guidelines for reporting to the 2009 Eurostat questioner.

Ginard and Murray (2012) studied the Balearic economy from the analysis of the flow of materials in accordance with the Eurostat (2001) methodology distinguishing the following indicators: domestic extraction, physical trade balance, direct material input, direct material consumption and intensive indicators ED/ha, IMP/CMD, IMP/GDP, CMD/GDP. Increase of the external dependency of the economy, i.e., the increase in GDP was based on an increase in imports. The structure of the Balearic economy encourages a PTB deficit resulting in the need to continuously increase the entrance of visitors to balance physical deficit.

3.5.2 Ecological Footprint

Wackernagel (Wackernagel, Lewan & Borgtöm Hansson 1999) defines the ecological footprint of any defined population (from a single individual to that of a whole city or a country) as the total area of biologically productive land and sea occupied to produce the resources and services consumed and to assimilate the wastes generated by the population, using prevailing technology.

According to the most recent National Accounts (Global Footprint Network 2012) for the year 2008, the total Earth's biocapacity is estimated at 12 billion gha (or 1,8 gha per person) but humanity's ecological footprint has reached 18,2 billion gha (or 2,7 gha per person). Correspondingly, the numbers of planets demanded by all humans has increased to 1,52 planet, which represents an increment of 2,5 times the demand for nature's renewable resources since 1961 (Global Footprint Network 2012)

Hunter and Shaw (2004) argues for the widespread of the ecological footprint as a key environmental indicator of sustainable tourism. "It may be that some tourism products could actually alleviate the consumption of the world's biological resources". Eco-tourism products involving long haul flights will, in net EF terms, tend to be more environmentally demanding than many mass Tourism products.

In 2007 Government of Spain through a Ministry (Ministerio de Medio Ambiente, Medio Rural y Marino) edited the Spanish Ecological Footprint Analysis (Ministerio de Medio Ambiente y Medio Rural y Marino 2007). The ecological footprint has grown from 2,197 gha/cap in 1955 to 6,395 gha/cap. The energy factor 0,422 gha/cap (19,2%) in 1955 to 4,330/cap gha (67.7%) in 2005 means that Spanish ecological footprint per capita increment has been by energy, and transport is has a main importance on it (23% in 2005).

Fernandez-Latorre (Fernandez-Latorre & Díaz del Olmo 2011) carried out an analysis of the ecological footprint and environmental partner of the Canary Islands tourist pressure. So apply the ecological footprint methodology and develop the tourist pressure index socio-environmental (prestur). The result shows a deficit of 6.27 GHa/cap that 4.41 GHa/cap correspond to the energy footprint. The Canary Islands consume 26,94 times more than the territory available. This is due to a pattern of high consumption combined with a high population density. The energy footprint of the Canary Islands is around twice higher than in Spain, due to the high-energy consumption associated with the navigation of ships and aircraft. The values of the ecological footprint of tourism do not seem despicable.

3.5.3 Oil consumption and CO₂ emissions

Eco efficiency (World Business Council for Sustainable Development 1995): Environmental damage per unit of value generation is a choice as the basis of calculation. The ratio of CO_{2-eq} (kg) to turnover (€)

Globally, tourism's emissions have been estimated at around 5% of overall CO₂ emissions, with 75% of these the result of tourist mobility and 25% due to on-site consumption, including accommodation (21%) and tourist activities (4%) (UNTWO-UNEP-WMO 2008).

Urry (2012) "oil fuels almost all movements of people and objects, and is also central in manufacturing industry in almost all agriculture and in distributing water worldwide. Or to put it in another way, there are almost no activities that presuppose movement that do not now rely upon oil; and there are almost no activities that are significant in the modern world that do not entail movement of some kind".

The International Transport Forum through "Reducing Transport Greenhouse Gas emissions. Trends and Data 2010" shows that transport sector CO₂ emissions represent 23% of overall CO₂ emissions from fossil fuel consumption. Global CO₂ emissions from transport have grown by 45% from 1990 to 2007. Road sector emissions dominate transport emissions, emissions from global aviation and international shipping account for 2,5% and 3% of total CO₂ emissions of 2007.

4 A NEW METHODOLOGY TO APPLY

Carrying capacity is a difficult consensus concept since its limits are not objectives. Here we will not discuss how to define the carrying capacity of a destination (which of course will be linked to the sizing of the tourism sector) but we will see if mobility in destination (defined by the model which is intended to implement) increases or decreases the destination carrying capacity.

Let C be the carrying capacity of a destination defined as the number of tourists that the destination can receive without compromising the future quality of the destination.

The destination can be disaggregated territorially with the carrying capacity of each of the parties. For each area "i" carrying capacity is defined as C_i so that the total capacity is the sum of the capacities of each area "i" $C = \sum C_i$

There are **several types of C_i** :

- Those linked to natural or rural areas, whether they are beaches or mountains, with a carrying capacity determined by natural resources. They should have constant value.
- Those linked to urban areas, where the capacity is determined by infrastructures and urban services (security, health...), as well as offering commercial, cultural and hospitality. This urban capacity is likely to grow artificially and whose boundary is determined by demand that has to meet and the limitation to the growth of urban land by condition to local natural resources.

The total demand for services is defined by the size of the sector, especially its accommodation part, i.e., by the number of tourists. Tourists will not eat 2 times if there

are 2 restaurants. Possibly they will eat at two different sites in two different days, which, rather than make more attractive the destination, the increase of capacity in places without accommodation (which need that mobility in destination) does not increase the total capacity of the destination. An idle capacity will be created. If idle capacity already exists and is intended to put into service to attract customers from other places, those customers will no longer consume where they were.

The dispersion of the tourist offer without accommodation (trade, catering, culture) does not increase the capacity of the destination if there is already a similar offer close to the place of overnight stay, although it may increase the appeal of the Destination.

On the other hand, mobility in destination can make a lower carrying capacity?

From the global point of view, the increase of mobility implies an increase in consumption of global resources (fossil fuels) and an increase of waste (air pollution). So, mobility has a negative impact on resource consumption and pollution.

From the local point of view, mobility in tourist destination represents a greater friction with the territory in which they are inserted, especially in transport by road, increasing congestion and safety problems. It is important the size of the tourism sector within the destination.

There are, therefore, two aspects differentiated in terms of mobility associated with a destination. First, it is the necessary connectivity between the markets of origin and destination. Second, it is the mobility in the own tourist destination. Origin and destination mobility (connectivity) implies a limitation to the growth of the tourist destination since adequate transport capacity is required so that demand can be satisfied. Mobility in destination is intertwined with the carrying capacity of the destination and, more specifically, with the tourism development model which is intended to apply.

It can be concluded that pressure on a tourist destination, whose limit should be carrying capacity, is related to the number of inhabitants, among residents and tourists, and with the activities carried out at the destination, highlighting within them as parameter to study the mobility in destination.

There seems to be a parallelism with the Law of Perfect Gases.

$$P*V = n*R*T$$

Where P is pressure, V is the volume that is occupied by the gas, n is the number of moles, R is a constant, and T is the temperature, taking into account that temperature is a measure of the kinetic energy of the gas molecules.

A similar expression can be applied for the relationship between the tourist destination, the sizing of the tourism sector and tourism model. Thus, the following formulation is created

$$C*S = f(p,M) \text{ and, probably, } C*S = p*K*M$$

Where C is the capacity of the territory, S is the surface of the analyzed territory, p is the population in the territory (resident and tourist), K is a constant associated with the tourist destination which will depend on the socio-economic characteristics and the behavior of the population, both local and tourist, and M is the mobility in the territory.

By definition, carrying capacity of a territory depends on the people who live in it and the activities carried out. So, for each specific situation, C*S is a fixed value. So, p and M are two variables related in such a way that cannot grow independently.

An additional aspect is the consideration of earth as a system with limited resources. The capacity of global mobility is limited because it depends on a finite resource that is the energy available with current techniques (fossil fuels). If we tend to the equidistribution of wealth to planetary scale with the desirable development of countries with disadvantaged economies, also there will be an equal of mobility. Each territory will have to manage their portion of associated mobility. This may mean, in tourist destinations, the need to limit mobility in destination for origin-destination mobility.

5 THE CASE OF GRAN CANARIA

The island of Gran Canaria is part of the archipelago of the Canary Islands, located in the Atlantic Ocean 100 kilometers east of the African continent and about 2000 km from the Kingdom of Spain, to which it belongs.

The population of Gran Canaria was 852.723, with an average density of 547 inhabitants per km² (INE 2103). The offer of tourist accommodation existing on the island reaches the number of 130.827 beds (ISTAC 2014). 62.857 are bed hotel beds and 67.970 are extrahotel beds. To complete the existing accommodation should be considered that there is a non-regulated tourism consisting of the new modality of tourism arising in the heat of the new technologies, and which is made up of tourists who hire residential home for short periods of time. By the very definition of non-regulated service, these beds are not registered, but estimates are that it can exist around an offer close to the 40,000 non-regulated beds in the island. So, on the island of Gran Canaria 1,000,000 people sleep daily, 850,000 are residents and 150,000 tourists.

The population of Gran Canaria is located mainly in two specific areas: the northeast corner - metropolitan area of Las Palmas and adjacent municipalities - and tourist areas in the South of the island. As a result, the coastal strip and South is that hosts most of the population; 79% of the population lives in this sector and also concentrated economic activities and major ports and airport. (Figure 1)

Because of its insularity, all “input and output” movements of people and goods are possible to be characterized, by going to the data provided by the operating companies of ports and the airport.

Figure 1. Soil building, urban and rural settlements



Source: Own elaboration (GIPIC) from data provided from PIO/GC.

5.1 Input and output of people

In the year 2012, there was passenger traffic by sea in regular lines of 908.926 passengers what had as origin/destination almost all the national territory, of which 90% are inter-island travel. Growing cruise traffic has reached 418.529 passengers in the year 2012 (UNEP & Tongji Institute 2012).

Airport traffic in 2013 rose to 5.553.158 passengers of whom 62,51% (2.992.976) were foreign, 21.50% were from the rest of Spain and 15.99% was inter-island traffic (AENA 2012).

If in the whole world there are 1,035 million international tourists and 5,000 - 6,000 million domestic tourists, the importance of Gran Canaria as a tourist destination is clear.

5.2 Input and output of goods

In 2012 8.403.038 tons of various goods entered through the main ports in Gran Canaria and 3.908.052 tons were exported. The port of Las Palmas, due to its geo-strategic importance also moves a significant volume of goods in transit (3.984.325 tons in 2012). The total of goods moved in the year 2012 exceeded the figure of 20,000,000 tons (including airport's goods).

- The above data demonstrate the model of behavior of the island of Gran Canaria in its relationship with the outside and has the next reading:
- One million people sleep in Gran Canaria, daily. 85% are residents and 15% are tourists.
- Most of the people who come to Gran Canaria from sources outside of the archipelago do so by air.
- There is an important percentage of inter-island passenger, both air and sea.
- The goods move through the ports, mostly.
- There is a significant gap between imports and exports, which are reflected in the deficit in the material flow accounting. As Gran Canaria is not specialized in the export of products with high added value, the imbalance in the flow of materials has an immediate translation into monetary measures.

The foregoing suggests that tourism sector enables the deficit of the trade balance. But it is also a cause of that deficit.

If the habits of tourists are as the place of destination inhabitants', 15% of imports are for the needs of tourists. If there were no tourists the volume of imports would descend at 1.260.455 tons shrinking trade deficit in tons from 4.494.986 tons to 3.234.531 tons, without an alternative economic sector covering the deficit.

The conclusion is that Gran Canaria is not sustainable without the mobility associated with tourism. The discussion is on the sizing and the tourism model to implement in Gran Canaria.

5.3 Internal mobility in Gran Canaria

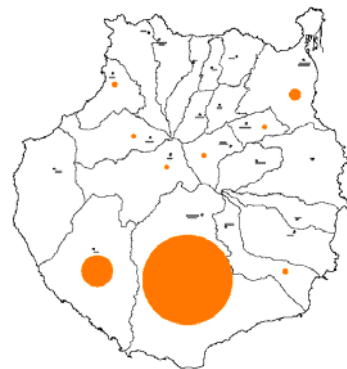
Exposed the relationship of Gran Canaria with the outside, including the mobility origin destination of tourists and imported goods to serve tourists, internal mobility should be analyzed and which part of this internal mobility is associated with tourism.

In the year 2013 Gran Canaria has 568.298 vehicles (ISTAC). The number of licenses for rental cars was just 7.873 (Ministry of transport and housing of the Cabildo of Gran Canaria). In 2014, the number of taxi licenses is 2.661, 58%, in Las Palmas while the tourist area (San Bartolomé de Tirajana and Mogan) municipalities represent 18%.

Tourism visiting Gran Canaria is 3 S tourism (sun, sand and sea), although in recent years tourist facilities have been incorporated to developing specific segments like golf, nautical tourism, etc. However, tourists that visit the island, who repeat in a high percentage, seeks the good climate fundamentally and enjoyment of natural resources, beaches mainly.

The relationship between the location of tourist beds and larger beaches exists directly in the tourism model that currently exists in Gran Canaria.(Figure 2)

Figure 2. Tourist beds distribution



Source: Own elaboration (GIPIC). Data provided by the Ministry of tourism of the Canary Islands (2013)

The tourist expenditure data indicate that the mobility of tourists in Gran Canaria is very low (Table 1)

About the preferences of tourist mobility (Survey for study of mobility of scope of Consortium of Touristic Rehabilitation in the South of Gran Canaria, year 2010):

- 2/3 prefer to stay in the zone of study (Maspalomas).
- The most common way of displacement is by foot. About 50% go walking to the beach and 65% do so to go to the malls. As an alternative to walking, the medium most used is the public bus (23%).
- The primary mode of access to the beach area is on foot with percentages ranging between 60 and 70%, followed by the private vehicle with 13%.

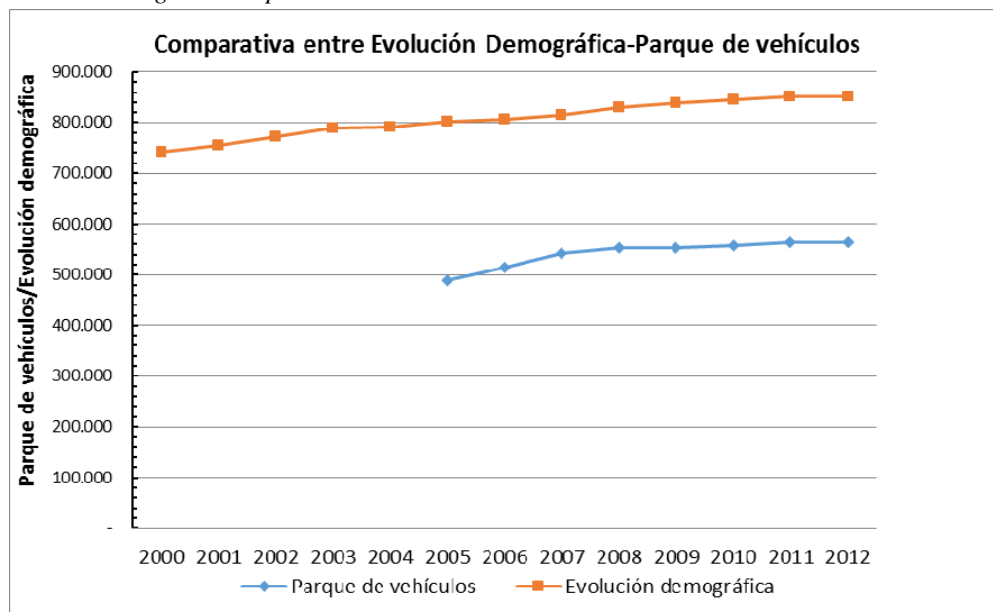
Table 1. Evolution of the average tourist expenditure

Year	2010	2011	2012	2013
In Gran Canaria	41,35	40,22	40,94	43,72
Extras accomod.	5,44	3,35	3,75	5,04
Public transport	2,67	2,35	2,05	2,47
Rent a car	1,69	1,23	1,19	1,16
Food	6,40	7,07	7,46	9,28
Restaurants	11,95	11,54	11,81	11,87
Souvenirs	6,31	7,09	7,18	8,27
Leisure	4,57	4,64	4,77	3,92
Others	2,32	2,95	2,72	1,69
TOTAL	125,00	123,78	129,92	129,47

Source: Data from Perfil del Turista 2010-2013 del Patronato de Turismo de Gran Canaria. Elaboration by (GIPIC)

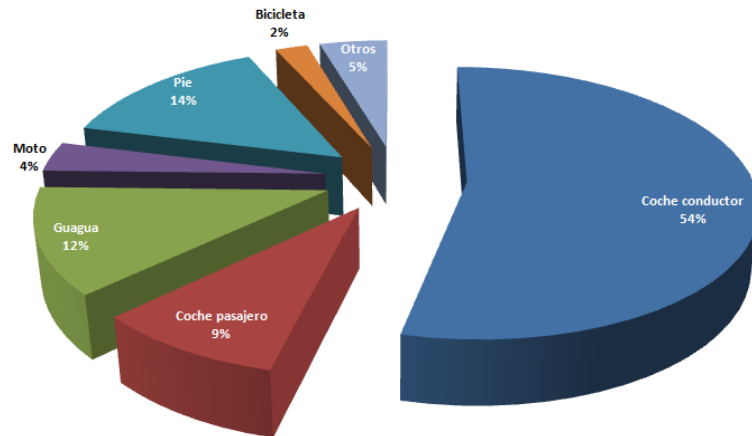
The high rate of motorization, location of activities where 40% of the population works in a different municipality than his place of residence, the high development of the road network with over 1,000 Km, with habits of mobility where the occupancy rate of vehicles is 1.19 (PMUS Las Palmas) resulting figures 3 and 4

Figure 3. Population Growth vs. N. Vehicles Growth in Gran Canaria



Source: ISTAC and own elaboration (GIPIC)

Figure 4. Cast: modal shift everyday (working + educational) in Gran Canaria

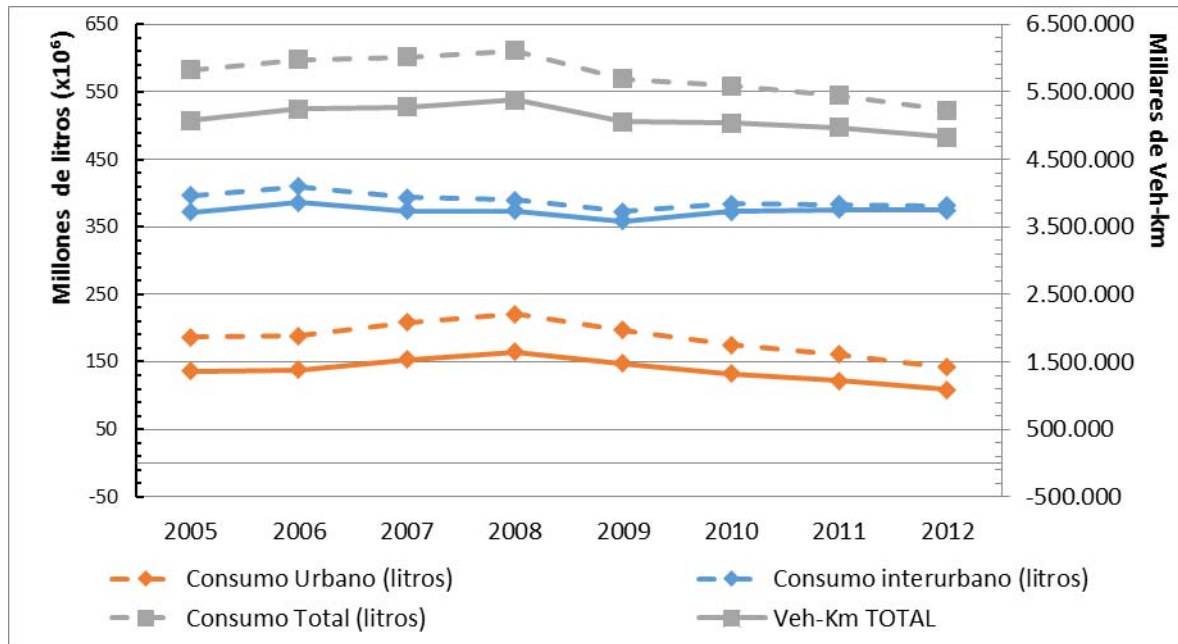


Source: Encuesta de población activa INE 2011 and own elaboration (GIPIC)

There is an increase in the number of vehicles added to population growth. The modal split shows a clear inefficient behavior where 54% of the movements are in the car with a single occupant.

A total mobility inside Gran Canaria is represented in the Figure 5:

Figure 5. Veh-km vs. oil consumed in Gran Canaria

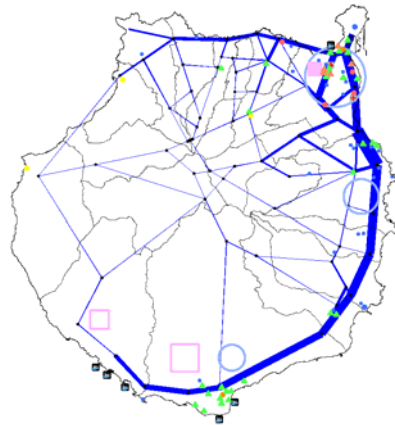


Source: IMD of Cabildo de Gran Canaria and own elaboration (GIPIC)

Despite population growth and the increase in the number of vehicles on the island on-road fuel consumption falls since 2008.

The figure 6 shows the mobility distribution in Gran Canaria

Figure 6. The internal distribution of the mobility



Source: IMD of Cabildo de Gran Canaria and own elaboration (GIPIC)

In the year 2012, the consumption of fossil fuel in Gran Canaria was, for all the activities, 1.234.104 tons. The road transportation used 421.176 ton (34,12%), which highlights the importance of internal mobility in Gran Canaria

5.4 Discussion on Gran Canaria

In this circumstance, the insular authorities promote mobility in destination. They pretend selling the image of Gran Canaria where there are other places to visit beyond the zone of accommodation. The idea is take advantage of the dual objective: to reinforce trade, culture and restaurants in other parts of the island and to increase the attractiveness of the destination.

This issue is not well studied in literature. Although, there are researches on mobility in destination: the case of the Balearic Islands where, by its proximity to the continent, tourists access to the destination taking their own car, or the case of Lanzarote, another Canarian Island, where they have prohibited the circulation of private vehicles in the National Park of Montañas del Fuego. In both cases, mobility in destination has some patterns of behavior that are radically different to the island of Gran Canaria, with few troubles because of mobility.

The question is if destination mobility affects:

- The capacity of the destination itself or
- Increases capacity.

The statement of the problem is not complete if we did not include the sizing of the tourism sector as part of the same, and the characterization of the destination as some destinations will have some resources and some behaviors different from other destinations.

The sizing of the tourism sector is directly linked with the connectivity abroad and, thus, with its associated mobility. In the case of Gran Canaria, the strong external dependence and sense importer in material flow accounting indicates the immediate export of ecological footprint of the economic model of Gran Canaria. In other words, Gran Canaria is sustainable because it is able to purchase abroad the products needed, but Gran Canaria needs the tourism sector for purchasing.

With the resident population, their consumption habits and existing resources in Gran Canaria, there is not the possibility of renouncing the tourism sector in Gran Canaria, which, in turn, has been which has led to strong growth rates in the population with the immigration of labor for the execution of infrastructure during the phase of construction and service during the exploitation phase.

Once the phase of self-sufficiency of the destination is over, the data suggest that growth in the sector is positive since the benefit generated by implying compensates the trade deficit, whenever the destination local carrying capacity is not exceeded.

In the case of Gran Canaria we have estimated that 15% of the population, who daily overnight, are tourists. Currently the number of rental cars is 1.5% of the total amount of vehicles. A successful campaign on the mobility of tourists may cause, at least, a 20% increase in the intensity of use of roads, especially among the elements attractors. Oil consumption will grow proportionally.

All the data show that tourism sector in Gran Canaria is quite developed. Gran Canaria lives because of the tourism sector, in its actual patterns. But the dimension of the sector is close to the limit of growth because of the social carrying capacity (up to 20% of local population as some authors have said), Gran Canaria has quite a big index of mobilization, in number of vehicles, in volume of movements and in percentage of energy used in transport against the whole.

So, to increase the mobility in destiny is against the sustainable development of the destination, in a global sight.

This research concludes that, in the case of Gran Canaria, it is dangerous to grow in number of hotels and in internal mobility because of the limits of the carrying capacity.

6 FINAL DISCUSSION

The idea is, if each tourist destination is sustainable, the aggregate of all the tourist destinations (which form the economic system of the supply side of Tourism) will be sustainable. Thus tourism may continue in its role of distributing wealth and developing global economic.

But, if tourism system is based on unsustainable tourist destinations then tourism system will be unsustainable as a whole and its maintenance will require the appropriation of resources from other sectors, with corrective and compensatory measures. Given the magnitude and significance of the problem, some degree of planning that would prevent divergences with the sustainability of the system (or the tourist destinations individually).

The review of the literature done in this study has shown the relationship between tourism and mobility: transport system permits the development of tourism in a territory and tourism is a main factor in transport demand. It also lets see how it is possible to measure the sustainability of mobility by physical indicators and how it has been done in several times before. Some of those researches have been on tourist destinations, other researches has been on the transport sector, with special focus in air travels, but not only.

The results are not quiet. Most of destinations are unsustainable because of tourists' consumption patterns and because of the use of oil fuel for travelling. In fact, the review of the literature has shown how Humanity's way of living is unsustainable, specially, by the carbon footprint.

As the transport contributes to this carbon footprint, as tourism is based in transport and because Tourism is not a need, the best way to make a Destination sustainable is to reduce

the volume of transport. There are various ways for doing it: limiting the tourist mobility in destination, reducing the daily mobility -of tourists at home and of destination residents-, making travels with shorter distances and, if possible, in more efficient modes of transport, reducing de km/holidays with longer stays, consuming products from destination avoiding the transport of goods, reducing the water consumption in dry destinations or traveling to them in the wet season and on...

Although the efforts of the industry in improving the efficiency with technological advances and acting on the tourist behavioral, tourism has a great challenge to survive in next decades if resources begin to scarce. As some region's economies are based on tourism sector, it could mean a deep transformation of the territory to go back to the original scenario without tourists but with an increased population in places without feed self-sufficiency.

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