Sustainability, insularity, Pareto and the paradox of Schrödinger

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Abstract

The evolution of transport systems in recent decades arising from fast and cheap access to the fossil energy has resulted in the expansion of public mass transport and therefore the colonization of territories that otherwise would be unthinkable. The phenomenon of tourism developed in Northern France and Southern England by Thomas Cook in the second half of the 20th century joined with the new means of transport, provided the possibility to move enormous amounts of people from one territory to another, colonizing it and extending its capacities. If we put together this with the expansion of sun and beach tourism in island territories around the 60s we can have an explosive combination. Most of the islands with large rates of tourism, as is the case with the Canary Islands, have been developed under the umbrella of a high floating tourist population that is able to support, through the development of the tourist industry, a huge, disproportionate and growing local population. This economic system has its basis in the maintenance of the current conditions of air transport prices, responsible for the tourism industry. In the current world energy crisis concert in which we operate with a continuous increase in fuel prices, and being that air transport is the most fossil dependent system by consumption and distance, the future of these destinations becomes uncertain, and local populations in the majority of cases has spent by far the load capacity of the territory and therefore could be pushed to a process of emigration. Thus, a study of the current situation of islands transport, its foreseeable evolution and possible competitors is essential, in order to develop a sustainable tourism model and thus calibrate future capabilities of the sector and an absolutely dependent economy of it. It is in my opinion the paradigm of a transport system in which society, economy,

and territory depends on the confluence of all three, not only represents the basis of the sustainability, but in this case ends up with an imperative need for subsistence.

Keywords: air transport system, mass tourism, energy cost, load capacity, islands transport, tourist industry.

1   Introduction

The Canary Islands are in the outermost region of the European Union. It is made up of seven major islands: El Hierro, La Gomera, La Palma and Tenerife, Fuerteventura, Gran Canaria and Lanzarote. The archipelago is located at the northwest coast of Africa, between the coordinates 27°37′ and 29°25′ of North latitude and 13°20′ and 18°10′ West longitude, the distance to the African continent is just 95 km at the closest point (figure 1).

These islands, of volcanic origin, are part of the natural region of Macaronesia. Its climate is subtropical, though modified by the height and the north side or South, Canary has four National Parks and several islands are of UNESCO biosphere reserves. They are visited each year by more than 12 million tourists.
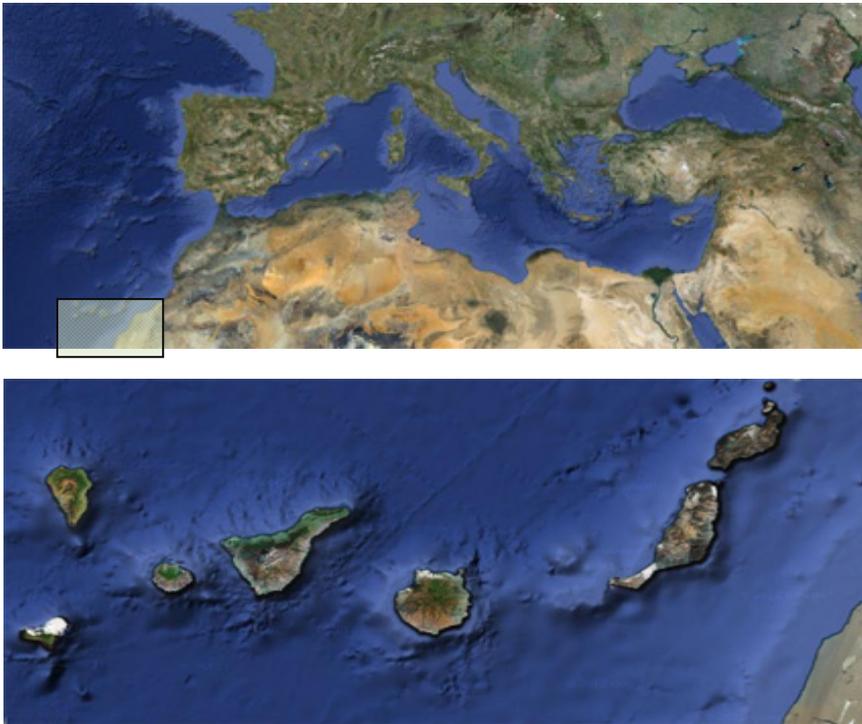

Figure 1:   Geographical location, Canary Islands [2].

The natural Islands population is 2.126.769 inhabitants, in a surface of 7,447 km^2 which gives a population density of 286 people per square kilometer, one of the highest densities in Europe, the floating tourist population is 12,354,212 tourists/year, approximately 1,029,517 tourists/month. One hundred percent of tourism reaches the islands using the aircraft as a means of transport, therefore taking into account that transport and connections are the cornerstones of any tourist destination, in the insular case turns into a fundamental value and especially when the economy of the Islands depends mainly from this sector.

2   The outlook of island air transport

Tourism is the first industry in the archipelago with a weight of 30% of the GDP (gross domestic product) of the Canary Islands economy, without quantifying the indirect income that this sector moves, and is also responsible for the 32% of the direct employment. The following graph quantified by issuing origin countries the number of passengers who arrived to the Islands in the years 2011 and 2012 [1] (table 1).

Table 1:   Passengers from abroad according to country of origin in the autonomous community of the Canary Islands. Data IDEA Canary Island Government [1].

YEAR	JANUARY–DECEMBER			
	2011	2012	Difference	Percentage
GERMANY	2,720,153	2,642,638	-77,515	-2.85%
AUSTRIA	107,005	110,064	3,059	2.86%
BELGIUM	354,655	354,625	-30	-0.01%
DENMARK	321,315	321,956	641	0.20%
RUSSIA	69,129	90,470	21,341	30.87%
FINLAND	267,251	263,595	-3,656	-1.37%
FRANCE	197,140	208,065	10,925	5.54%
UNITED KINGDOM	3,625,810	3,511,210	-114,600	-3.16%
HOLAND	410,254	423,420	13,166	3.21%
IRELAND	405,201	378,260	-26,941	-6.65%
ITALY	298,086	237,527	-60,559	-20.32%
NORWAY	437,404	458,877	21,473	4.91%
CZECH REPUBLIC	36,133	30,968	-5,165	-14.29%
POLAND	147,380	151,817	4,437	3.01%
SWEDEN	443,242	450,769	7,527	1.70%
SWITZERLAND	212,061	228,296	16,235	7.66%
PORTUGAL	63,314	53,522	-9,792	-15.47%
OTHER COUNTRIES	202,645	185,414	-17,231	-8.50%
TOTAL..................	10,318,178	10,101,493	-216,685	-2.10%

If we study in detail the recent developments in air transport we realize that it is one of the sectors that has most suffered the structural changes that are taking

place in the global economy since the crisis of the oil prices in the 2006/2008 during which the barrel became about 142$ USA.

Currently the rising prices of oil, the new Low cost companies, the investments made in the field of aviation safety from the terrorist attacks of 9/11, the use of new technologies online for purchase and consultation of air services and the global economic crisis of the past years have been all determining factors that have pushed many leading companies to processes of fusion or disappearance irrespective of its way of operate, regular, Charter or Low cost. Because of this set of events companies have focused on reducing costs while maintaining and prioritizing the maximum occupancy lines thereby reducing the number of operations and closing lines to tourist destinations among others, or changing the marketing of the product using the supplementary income, i.e., "pay-for service used" limiting hand baggage, weight, volume etc., charging on the basis of the transferred kilos what makes more expensive the flight ticket for long stay destinations (over one week) and the leisure sports requiring transfer of material as the case of the Canary Islands and in general the majority of Island Sun and beach destinations. This has forced these destinations to reduce costs to be more competitive, resulting in a loss of the quality of service that leads to a deterioration in the infrastructure which entails a gradual decrease in visitors to the destination in the short term and enter a vicious circle which again ends in loss of passengers and flights reduced, the curve of the process follows the pattern of the Gauss campaign with a peak and a quick and pronounced decline.

In the five large airports of the Island operate the major European airlines in a total of 47 with 166 air connections throughout the year due to the fantastic weather conditions and the climate which allows no seasonality tourism [3], table 2.
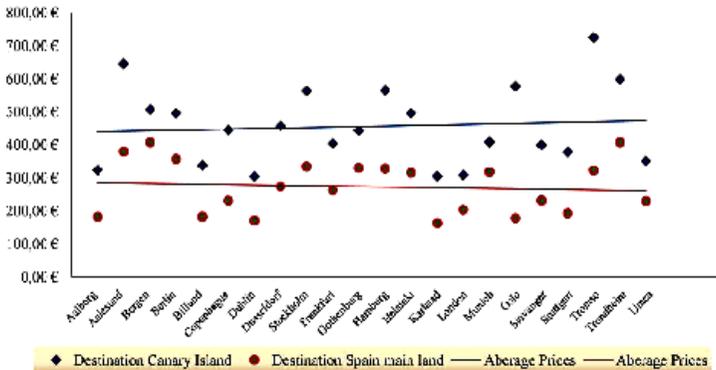

Figure 2:   Average price per destination.

If we look at table 1, the main markets are in the United Kingdom, Germany, Benelux, Norway and Sweden, with average price to the Islands in air transport as indicated in figure 2. By the costs per route per distance travelled is extracted an arithmetic mean of cost per passenger every 100 km. of distance that is around the figure of 11,96 €/100 km for the Canary Islands and 12,70€/100 km for destination Spain (mainland) as competitor.

As we see in figure 2, the average lines of travel costs have a different of 40% between the Canary Islands and its competitors, and those lines will not remain parallel as the fuel prices go up, the distance between them would increase

Table 2:   Air connections and companies by Islands [3].

AIRLINE		CONNECTION WITH						
Name	Nacionality	Gran Canaria	Tenerife	Lanzarote	Fuerteventura	La Palma	La Gomera	El Hierro
AIR BERLIN	Germany	Yes	Yes	Yes	Yes	Yes	No	No
CONDOR	Germany	Yes	Yes	Yes	Yes	Yes	No	No
EXCEL AIRWAYS GERMANY	Germany	Yes	Yes	No	Yes	No	No	No
FLYNIKI	Germany	Yes	Yes	Yes	Yes	Yes	No	No
HAMBURG INTERNATIONAL	Germany	Yes	Yes	Yes	Yes	Yes	No	No
TUI FLY	Germany	Yes	Yes	Yes	Yes	No	No	No
LUFTHANSA	Germany	Yes	Yes	Yes	Yes	No	No	No
AUSTRIAN AIRLINES	Austria	Yes	Yes	Yes	Yes	No	No	No
LAUDA AIR	Austria	Yes	Yes	Yes	No	No	No	No
AIR LINE CABO VERDE	Cabo Verde	Yes	No	No	No	No	No	No
FINNAIR	Scandinavia	Yes	Yes	Yes	Yes	No	No	No
NORWEGIAN AIR	Scandinavia	Yes	Yes	Yes	No	No	No	No
NOVAIR	Scandinavia	Yes	Yes	Yes	Yes	No	No	No
STERLING AIRLINES	Scandinavia	Yes	Yes	No	No	No	No	No
AIR EUROPA	Spain	Yes	Yes	Yes	Yes	No	No	No
BINTER CANARIAS	Spain	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CLICKAIR	Spain	Yes	Yes	No	No	No	No	No
IBERIA	Spain	Yes	Yes	Yes	Yes	Yes	No	No
ISLAS AIRWAYS	Spain	Yes	Yes	Yes	Yes	Yes	No	No
SPANAIR	Spain	Yes	Yes	Yes	Yes	No	No	No
VUELING	Spain	Yes	Yes	No	No	No	No	No
IBERWORLD	Europe	Yes	Yes	Yes	Yes	No	No	No
EXCEL AIRWAYS FRANCE	France	No	No	No	No	No	No	No
OLYMPIC AIRLINES	Greece	No	No	No	No	No	No	No
EASYJET	England	Yes	Yes	Yes	Yes	No	No	No
FIRST CHOICE	England	Yes	Yes	Yes	Yes	No	No	No
FLY MONARCH	England	Yes	Yes	Yes	Yes	No	No	No
FLY THOMAS COOK	England	Yes	Yes	Yes	Yes	No	No	No
GLOBESPAN AIRWAYS	England	Yes	Yes	Yes	No	No	No	No
JET2	England	NO	Yes	Yes	No	No	No	No
THOMAS COOK AIRLINES	England	Yes	Yes	Yes	Yes	No	No	No
THOMSON FLY	England	Yes	Yes	Yes	Yes	Yes	No	No
FLIGHTLINE	England	Yes	Yes	Yes	Yes	Yes	No	No
AIR LINGUS	Ireland	Yes	Yes	Yes	No	No	No	No
EUROFLY	Italy	No	Yes	No	Yes	No	No	No
NEOS	Italy	Yes	Yes	Yes	Yes	No	No	No
FLYLAL	Lithuania	Yes	Yes	No	No	No	No	No
LUXAIR	Luxembourg	Yes	Yes	Yes	Yes	No	No	No
TOP FLY	Morocco	Yes	No	No	No	No	No	No
AIR MAURITANIE	Mauritania	Yes	No	No	No	No	No	No
SAS	Norway	Yes	Yes	No	No	No	No	No
JETAIR	Netherlands	Yes	Yes	Yes	Yes	Yes	No	No
TRANSAVIA	Netherlands	Yes	Yes	Yes	Yes	Yes	No	No
EUROATLANTIC AIRWAYS	Portugal	Yes	Yes	Yes	Yes	No	No	No
SATA	Portugal	Yes	No	No	No	No	No	No
SMART WINGS	Czech Republi	Yes	Yes	No	No	No	No	No
TRAVEL SERVICE	Czech Republi	Yes	Yes	Yes	Yes	No	No	No
EDELWEISS AIR	Switzerland	Yes	Yes	Yes	Yes	No	No	No
HELLO AG	Switzerland	Yes	No	No	Yes	No	No	No

	Gran Canaria	Tenerife	Lanzarote	Fuerteventura	La Palma	La Gomera	El Hierro
Total number of air connections by Island	45	42	34	32	11	1	1

significantly, take note that the 40% of the tour operators' income is dedicated to transport and obviously this is a very important competitiveness index.

3 The trend of energy markets

The adjustments made by the airlines which have resulted in a new business model based on maximum cost reduction and the use of the higher carrying capacity per unit of air displacement, are a direct result of the absolute industry dependence on the fuel prices, a standard plane consumes an average of 3.5 l. of kerosene per each 100 km and seat offered on long-haul routes as it is the case of the Canary Islands from markets issuers from central Europe [4] (table 4 and Figure 1).

Table 3:   Fuel consumption of aircraft per seat per 100 km.

Year	Total fuel	Factor Fuel	Operations	Fuel 100	Range
2008	1469776470	104072,748	29579	3,51846743	L
2007	1398970301	95566,2205	27035	3,53490736	L
2006	1357147242	91191,6055	25670	3,55245834	L
2005	1284300365	86342,4165	23898	3,61295575	L
2004	1124145421	76728,2614	21235	3,61329227	L
2003	967581713	67506,9752	18604	3,62862692	L
2002	904776547	64399,3598	18007	3,57635141	L
2001	944133660	66156,7757	18736	3,53099785	L
2000	974856116	68329,5932	18504	3,69269311	L
1999	901353879	62292,0686	16149	3,85733288	L

The evolution of kerosene prices in recent years in which there has been an explosion of air transport worldwide mostly thanks to the markets of emerging countries, has been linked to the prices of oil as a primary energy source, and Figure 2 shows the evolution of average kerosene prices at $/t (dollars per ton) in green, along with the number of passengers, the number of air operations and goods traffic, data obtained from the statistical bulletins of hydrocarbons and the AENA data centre. We can see haw kerosene consumption reaches its peak in 2007 slightly down the effect of the economic crisis and the increase of fuel prices, the first energy crisis of air transport in 2008 has been drawn by air carriers on the basis of increasing efficiency and optimizing the load reducing expenses, however if we look at the evolution of average crude oil barrel prices since the 1980s we see how the upward trend is continuing (figure 3).

As shown we are coming shortly again after the values of the year 2008, and the trend is to continue increasing the price, Figure 5 reflects the number of tourists received by the Islands in the period 2000-2012 and clearly during the years 2008, 2009 and 2010 can be seen a significant decrease in the number of arrivals in good part motivated by the diversion of large operators to other

competitive destinations in price per transport unit mostly of continental Spain, North Africa and Turkey, and being recover in the years 2011 and 2012 cause of the eruption of the so-called "Arab spring". Paraphrasing the late Matt Simmons, icon of the oil industry, in the escalation of prices, there are two pending to cushion the fall, one can be a soft fall; the other an abrupt and uncontrolled fall, and the abrupt fall is which is reflected in the unstoppable rise of the oil price, which is causing a damage of yet unknown proportions for the air transport sector and therefore the dependent tourism.
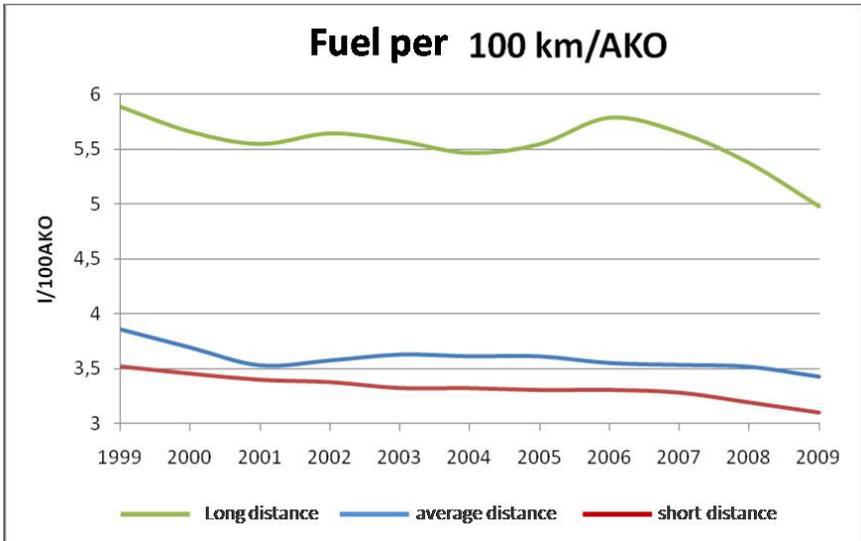
Figure 3:   Ratio of consumption of fuel per 100 km.
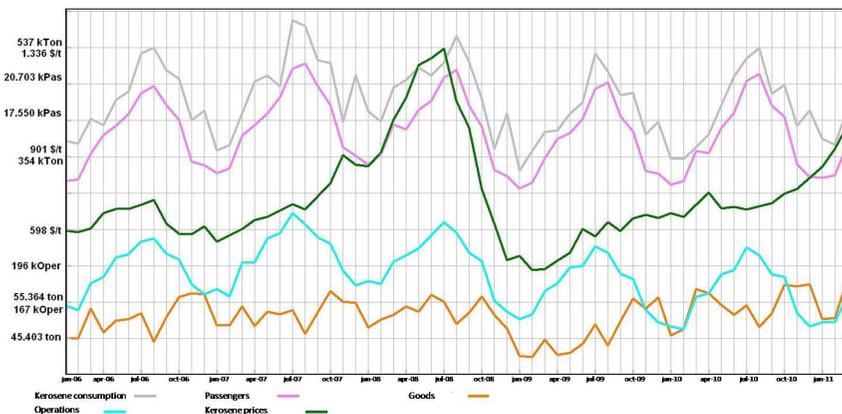
Figure 4:   Prices of kerosene, flight operations and number of passengers.
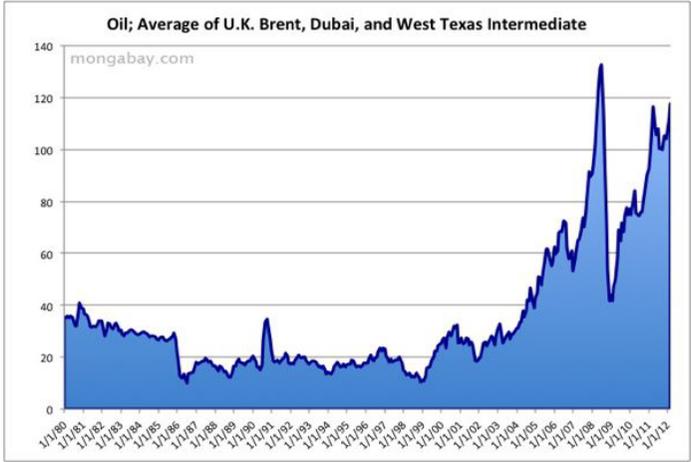
Figure 5:   Evolution of the prices of a barrel of oil.
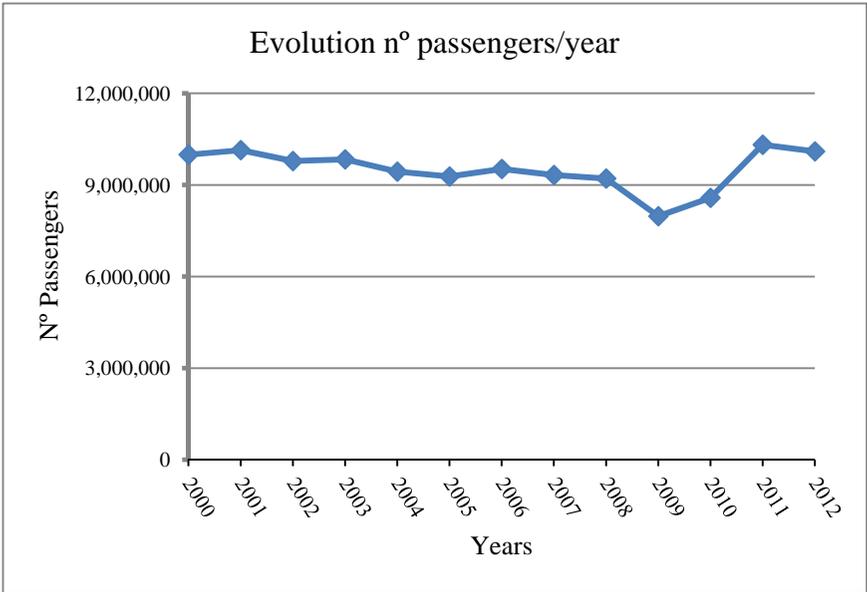
Figure 6:   Evolution of the number of passengers per year.

If the average expenditure per tourist and day is 133.42 €(4th quarter of 2011 per German tourist) , and the cost due to transportation is 39.23€ per tourist per day, we can apply the principle of the Italian Economist Wilfredo Pareto (known by the 80/20 rule) which postulates that 80% of consequences (target expenditure) depends on the 20% of the causes (air transport expenditure), if this

balance scale breaks, the destination ceases to be competitive for this mass tourism, Sun and beach, and we are heading inevitably tower it which will result in a disaster for the economy of the island's pushing the population to a mass exodus.

Let us see which are the expectations of evolution of prices of primary energy; in the following figure 4 you can see the curves of the decline of oil production according to the theory of the Hubbert peak for the major oil regions in the world until 2050. The pink layer represents the production in the area of the Middle East where would have reached its "peak" at the end of the last decade and the beginning of the present, this implies that we have a scenario of gradual reduction of the quantity of primary energy and an increase rise of the extraction of resources more and more complicated, which leads to the increase of energy prices generally, and inevitably the kerosene in particular, and this is happening already, therefore we are faced with a dizzying scenario over the next 30 years of progressive increase of the fuel prices which will affect the cost of air transport.
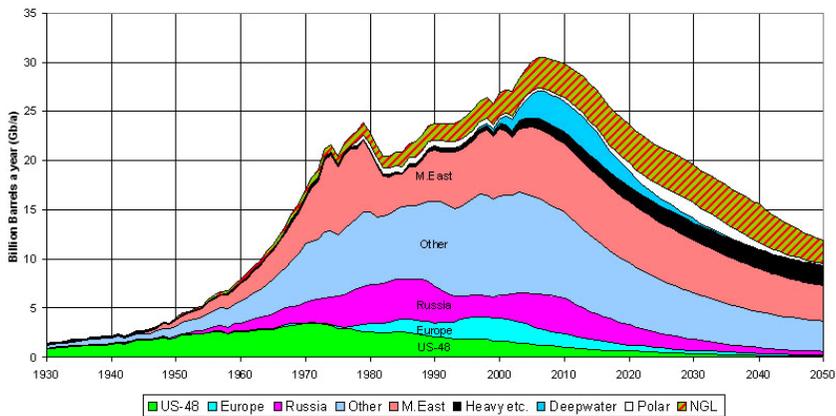

Figure 7:   The world oil reserves.

4   The current scene

Major companies and manufacturers have long working in this scenario on the basis of two lines of work, in one hand the design of aircraft operating at high altitudes which reduces consumption and significantly reduces the time travel (Stratoliner) and on the other the increase in load capacity to decrease the cost per passenger and km. (the EMIT of NASA or the new Airbus), but the question is how long will hold up our current model of air transport? For Paul Wylde, consultant of Boeing, the answer is emphatic "30 years". If the World Tourism Organization (UNWTO) presents a growing trend of the tourism sector for the next years with rates of growth around 5% annually, on which basis of transportation rests its growth?, we are faced with the paradox of Schrödinger,

which may work for quantum physics but not for real life, if we keep the cat (air transport) in the box it will not remain in two State at the same time (live and dead), we better open the box before it is too late, in the majority of directly dependent destinations on air transport haven´t even developed emergency protocols to the possibility of an excessive cost of transport.

Canary Islands Airports still intends enlargement at base to increase the amount of tracks when the number of air operations is in decline and the terminals are not adapted to accommodate the new aircraft with more carrying capacity and size, it is necessary to closely follow patterns of the Aeronautics industry and research on fuels based on biodiesel for planes, with successful initial results [5], but all these processes of transformation in an industry as powerful will require years to consolidate and the clock is ticking against us.

In destinations like the Canary Islands tourist industry must make an effort to change into a more specialized destination of greater purchasing power tourists with longer stays, leaving aside the exclusive Sun and beach model very dependent on the prices of the packages that soon will be diverting to other destinations closer to the emitting countries with similar offers, the differentiation and exclusivity is our hope of salvation.

5   Conclusion

In view of the world energy panorama is easy to imagine that the air transport costs will increase gradually in the coming years, driven by the rise in prices of primary energy, if we look at the statistics of average expenditure per tourist and day for Canary Islands provided by the ISTAC [9] we observed that they have been gradually increasing in origin, this can lead us to a misinterpretation of the results thinking on a stable and growing future, however the trend of expenditure on destination is decreasing, as well as the cost per day of overnight hotel stays, this means that the cost of the tourist package has increased in relation to the transport and decreases in others. This is no more than an attempt to keep the average final price of the package on the basis that the destination assumes the difference, the problem is that this trend is continuous and progressively increasing which implies that sooner than later the increase of costs it must have to be assumed by the tourists. If we look at the Sun and beach destinations that move the greater number of tourists with very cheap packages "all-inclusive" becomes easily concluded that as transport costs increase and therefore media packages prices rise, we will see a gradual decline of the number of tourists in destination.

Insofar as soon as an alternative energy source is not listed, air transport-dependent destinations have to make a major effort to adapt its airport facilities for aircraft of more capacity in order to reduce the cost/passenger and assumed a percentage of the loss of tourists with lower purchasing power in the coming years, on the other hand there is a second problem, in recent years the maintenance of lines and the majority of passenger air traffic has been supporting on new LC companies which usually operate on shorter radio and reduce maintenance costs by using the same aircraft model, do time, would these

companies adapt its fleet of aircraft? or eventually ends up abandoning the destinations? The future is uncertain, but the reality is that the economy of the Canary Islands as an example of sun and beach tourism, inevitably depend on the evolution of air transport in the coming years.

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