Patterns of Transportation for Tourists and Residents in the Aegean Archipelago, Greece.

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ABSTRACT: The link between tourism development and accessibility is very important for island destinations, whose connectivity to the mainland depends entirely on sea and air passenger transport services. In this chapter, we analyze patterns of transportation for tourists and residents via ferry and airplane for a number of Greek Aegean islands and groups of islands. These represent distinct cases in terms of accessibility and tourism recognition: one very popular international destination (Santorini); one case of an international destination with a number of satellite islands (Rodos with Chalki, Symi and Tilos); and two less important cases in terms of international tourism (Lesvos, and Naxos with its satellites: Donoussa, Schinoussa, Herakleia and Koufonissi). The findings suggest that a number of different archipelagic clusters emerge within the Aegean Sea, determined largely by existing transport routes and tourism development trajectories.

***Keywords*:** Aegean, archipelago, airplane schedules, ferry schedules, Greece, islands, tourism, transportation,

1. INTRODUCTION

1.1 Archipelago

The word archipelago is an international geographical term that characterizes a geological formation consisting of a chain or cluster of islands. Essentially it means "first sea", from the two Greek words *archon* (leader / first) and *pelagos* (sea). Typically, archipelago is defined as either a large group of islands, or a sea containing a large number of scattered islands. Some definitions consider the distance from the mainland and suggest that the islands need to be far away from the mainland coast. Many of the world's islands are part of archipelagos (Bardolet and Sheldon, 2008). For the purpose of this chapter, an archipelago is defined as a cluster of islands in a common area of water.

1.2 Transportation for tourists and residents

Travel, and hence transportation, is an integral part of tourism. All definitions of tourism involve some aspect of travel, because all definitions of tourists include the fact that the individuals travel to a different location from the one they habitually reside on. While travel, and hence transportation, is important to varying degrees to all tourists, it is also of great importance to the destination areas themselves (Butler, 1996). The relative

accessibility or inaccessibility of a destination is normally a major factor in determining not only the number of tourists who are likely to visit the destination, but also the types of tourists, the duration of their stay, their behaviour (Butler, 1996), and as a result of these factors, their impact on the destination.

Island destinations are, by definition, pieces of land surrounded by water, and so can only be reached by boat and airplane. Their accessibility to both residents and tourists is typically more limited than mainland destinations, and this, in turn, makes them more vulnerable to changes in transportation (Papatheodorou, 2001). Such changes may occur through developments in transportation technology and physical infrastructure (including fixed links such as bridges, causeways and tunnels), political developments, and changes in economic conditions. These can occur singly or in combination, and tend to have major impacts on island tourism.

Inter-island transportation in an archipelago is much more problematic than transportation between islands and the mainland because many such archipelago islands – especially smaller ones – face problems of "multiple insularity" for movement of people, goods and other economic activities vital for the quality of life on the island and the performance of its economy (Spilanis et al., 2012). These smaller islands are almost always highly dependent on larger nearby islands, which function as local service centres.

In this chapter, we explore the link between accessibility and tourism development for island destinations and analyze patterns of transportation for tourists and residents via ferry and airplane for a number of Aegean Greek islands and groups of islands. The reason behind this choice of case studies is the exploration of internal differences inside an archipelago: as the scale changes, these differences become more apparent and yield a number of smaller archipelagoes in the end. Transportation patterns reveal a number of finer strokes in the bigger archipelago canvas.

The research methods used in this study are presented in the next section, followed by a presentation and discussion of the findings, and a conclusion.

2. METHODS AND DATA

In Greece, four insular administrative NUTS II[1] regions are found, two of which comprise the majority of the Greek Aegean archipelago (some islands lying close to continental Greece are parts of continental NUTS II level regions). Geographically, the Aegean Islands are a complex of 3,053 islands in a space defined by Crete in the South, continental Greece in the North and West, and continental Turkey in the East, with a total land area of 19,076 km^2. In the regions of the North and South Aegean, there are 53 inhabited islands (Hellenic Statistical Authority, 2013).

[1] The NUTS classification (Nomenclature of Territorial Units for Statistics) is a hierarchical system for dividing up the economic territory of the EU for the purpose of: (a) the collection, development and harmonisation of EU regional statistics, (b) socio-economic analyses of the regions (NUTS I: major socio-economic regions, NUTS II: basic regions for the application of regional policies, NUTS III: small regions for specific diagnoses) and (c) framing of EU regional policies. The NUTS classification valid from 1 January 2012 until 31 December 2014 lists 97 regions at NUTS I, 270 regions at NUTS II, and 1,294 regions at NUTS III level (Eurostat, 2014).

Historically, geographically, politically and economically, islands are very important for Greece. Their distinctive geographical features (many islands of various sizes, many at considerable distances from the Greek mainland and scattered in space) and the important but unequal tourism development, make the Aegean islands well-suited to study patterns of transportation for tourists and residents via ferry and airplane. Overall, the transportation needs of more than 200 inhabited islands are today served by a network of 24 airports and 90 seaports. Demand for transport services is highly seasonal, with the summer-time peak period, fuelled mainly by leisure tourism, being significantly higher than that for the rest of the year (Rigas et al., 2011).

In this chapter, we select four distinct cases of islands in the Aegean archipelago, differing in terms of accessibility and tourism recognition: (a) one very popular international destination, Santorini; (b) one case of an international destination with a number of satellite islands: Rodos [Rhodes] with Chalki, Symi and Tilos; and (c) two cases that are less important in terms of international tourism: Lesvos, and Naxos with its satellites: Donoussa, Schinoussa, Herakleia and Koufonissi. The selection is based on two criteria: (i) tourism development, selecting two cases with high and two cases with low development; (ii) "satellite" islands: that is, islands depending on a larger island for services and economic activity, with two cases of single islands and two cases of islands with satellites.

Until the administrative reforms of 2011, the smaller islands were separate municipalities, while in the larger ones more than one municipality was found. Since the reforms, larger and smaller islands form a single municipality, except for the satellites of Naxos, which belong to the municipality of Naxos and Lesser Cyclades. Santorini, Naxos (with its satellites) and Rodos (with its satellites) belong to the South Aegean region; while Lesvos belongs to the North Aegean region (both NUTS II level).

For the analysis of accessibility and tourism development, various secondary data sources are used: these include published official data such as population censuses and annual statistical surveys, ferry and airplane schedules, types of ferries and passengers arrivals. The data is drawn from the most recently available official statistics, obtainable from the Hellenic Statistical Authority and the Civil Aviation Authority. The calculation of tourist arrivals by air and sea was based on annual statistics data of disembarked passengers, obtained from the Civil Aviation Authority and the Hellenic Statistical Authority, with the assumption that residents (and not tourists) travel mostly during February, which is one of the months with the lowest peak seasonality of tourism activity. These figures were subtracted by the number of passengers from each month to provide an indication of the number of tourist arrivals, assuming that the number of residents traveling is roughly the same the whole year round. For matters of convenience, ferry routes to Athens stop at the port of Piraeus in the greater Athens metropolitan area, while in the case of air routes to Athens, the landing point is the Eleftherios Venizelos airport in Spata (the largest airport in Greece).

3. FINDINGS

3.1 Population

As shown in Table 1, the population of the case study islands has dropped significantly as a result of economic decline from 1951 to 1991, with 9 of the 11 islands losing population, the two exceptions being Santorini (an increase of 0.3%) and Rodos (a staggering rise of 66.6%). The mean population decline is of 27.6%, with three cases reporting over 50%: Chalki, Tilos and Donoussa. In 1991-2001, the trend was reversed and the population increased on all islands, with a mean increase of 35.1%. It continued to increase at a more modest rate (a mean of 25.7%) in the following decade (2001-11), with the exceptions of Lesvos (a decline of 4.8%) and Herakleia (a decline of 0.7%). Remarkably, on Rodos and Santorini, the population increased throughout this whole period. Overall, 54.4% of the total Aegean island population lives on Rodos, and 85% lives on Rodos and Lesvos. Population and area size are strongly correlated (Pearson's r=0.900**, p<0.01, N=11).

Table 1: Area Size, Population Change and Population Density for the Case Study Islands, 1951 - 2011

	Islands	Area size (km^2)	Population							Change of Population (%)			Population Density (inhabitants/ km^2)
			1951	1961	1971	1981	1991	2001	2011	1951-1991	1991-2001	2001-2011	2011
1	Lesvos	1,630	126,928	117,379	97,013	88,603	87,151	90,643	86,312	-31.3%	4.0%	-4.8%	52.9
2	Santorini	76	9,332	7,651	6,199	7,083	9,360	13,670	17,752	0.3%	46.0%	29.9%	234.2
3	Rodos	1,398	58,946	63,934	66,609	87.833	98,181	117,007	152,538	66.6%	19.2%	30.4%	109.1
	Chalki	28	580	523	387	334	281	313	702	-51.6%	11.4%	124.3%	25.0
	Symi	58	3,978	3,126	2,497	2,273	2,332	2,606	3,070	-41.4%	11.7%	17.8%	52.8
	Tilos	63	1,052	789	349	301	279	533	829	-73.5%	91.0%	55.5%	13.2
4	Naxos	428	18,593	16,703	14,196	14,037	14,838	18,188	18,340	-20.2%	22.6%	0.8%	42.8
	Donoussa	13	272	210	149	116	111	163	176	-59.2%	46.8%	8.0%	13.1
	Schinoussa	8	226	196	197	140	122	206	225	-46.0%	68.9%	9.2%	28.9
	Herakleia	18	189	155	129	95	115	151	150	-39.2%	31.3%	-0.7%	8.5
	Koufonissi	6	300	300	251	237	275	366	412	-8.3%	33.1%	12.6%	72.3

Source: Hellenic Statistical Authority, processed by the authors

The average population density of the case study islands is currently 59 inhabitants/ km^2, but this conceals important differences: Santorini has the highest density with an average of 234 inhabitants/ km^2 followed by Rodos (109 inhabitants/km^2) and Koufonissi, Naxos' satellite, with 72 inhabitants/km^2. Lesvos and Symi have a density of 53 inhabitants/km^2, Naxos 43 inhabitants/km^2, Chalki and Schinoussa roughly 25 inhabitants/km^2. Finally, Tilos, Donoussa and Herakleia are the most sparsely populated, with under 13 inhabitants/km^2.

3.2 Transportation Supply - Accessibility

Transportation patterns for tourists and residents and information of transportation supply characteristics for the case study islands are provided in Table 2. There, the average weekly frequency of routes is presented from the islands to the mainland, by sea and air for the month of February, along with the routes from the small satellite islands, to the main islands.

Table 2: Transport Connections of the Case Study Islands, February 2013

a/a	From	To	Weekly Frequency of Routes		Average Travel Duration (hh:mm)	
			by sea	by air	by sea	by air
1	Mytilene (capital of Lesvos)	Athens	10	23	12:27	0:50
		Kavala	2		10:45	
		Thessaloniki	1	6	15:00	0:55
2	Santorini	Athens	10	12	8:23	0:47
		Lavrio	1		14:30	
3	Rodos	Athens	8	44	18:26	1:00
		Thessaloniki		7		1:17
	Chalki	Athens	2		23:22	
		Rodos	9		1:22	
	Symi	Athens	2		16:45	
		Rodos	4		1:05	
	Tilos	Athens	2		15:15	
		Rodos	4		2:18	
4	Naxos	Athens	13	6	5:27	0:40
		Lavrio	1		8:20	
	Donoussa	Athens	2		7:10	
		Naxos	5		2:40	
	Schinoussa	Athens	3		7:20	
		Naxos	9		1:36	
	Herakleia	Athens	3		7:00	
		Naxos	9		1:16	
	Koufonissi	Athens	3		8:05	
		Naxos	9		2:20	

Source: Greek Travel Pages, processed by the authors

Four international airports operate in the case study islands, on Lesvos, Santorini, Rodos and Naxos, and at least one port on each island. Air traffic is of higher frequency than ferry traffic and therefore more alternatives are offered in air travel for the passengers, on the islands where airports are located (Rigas, 2012). Taking into account the total weekly frequency routes by sea and air, the classification of the main islands in descending order is: Rodos (44 weekly routes by air) Lesvos, Santorini, Naxos. The Athens–Lesvos, Athens–Rodos and Athens–Santorini air services are run as commercial operations; while the Athens–Naxos route has been granted a Public Service Obligation (PSO) status being effectively subsidized by the Greek state. Only on Naxos are the frequency of sea routes almost twice as frequent as air routes, mostly due to the proximity to Athens (a 5 hr ferry trip away, compared to 12.5 hr for Lesvos and 18 hr for Rodos).

On the main islands, connection by sea with Piraeus exists from eight times a week for Rodos, to thirteen times a week for Naxos. Also, a connection with North Greece (to Kavala and Thessaloniki) is offered to Lesvos by sea and air and to Rodos only by air.

As previously mentioned, none of the satellite islands has an airport. At the same time, weekly frequencies of ferries to the mainland are particularly rare: two ferry arrivals/departures per week in the case of Rodos' satellites and Donoussa; and three for the remaining satellites of Naxos. Their connection with the main island in each case ranges from four weekly routes for Symi and Tilos, to nine for Chalki, Koufonissi, Schinoussa and Herakleia, with an average travel time of about one hour to two and a half hours. In the case of Rodos' satellites, with just two weekly routes to Piraeus, the average travel duration is from fifteen to twenty three hours. Figure 1 provides a graphical representation of the connections in question. The actual routes of the ferry schedules are very important for smaller islands and groups of islands,as the example of Donousa reveals: the ferry trip to Naxos and Athens lasts less than that of Koufonissi, due to one weakly route that links only Donousa with Naxos and Athens (and Amorgos), while the rest of the routes go though all islands from Herakleia to Donousa (Figure 1). The example of the Rodos satellites also demonstrates that proximity and accessibility are not always direct functions of distance but also of the ferry schedule and routes: the distances of Symi and Tilos are comparable (approx. 45 km and 70 km respectively), the durations are very different (1:05 hr 2:18 hr respectively) as the ferry stops to Chalki first (distance 65 km, duration 1:22 hr) and then takes another hour to get to Tilos.

Figure 1: Transport Network in Case Study Islands

3.2.1 Quality of Ferry Transportation

Sea transport is the dominant mode of transportation for all case study islands. This renders critical a number of quantitative (e.g. the frequency of the ferry schedule) and qualitative (e.g. the time that the ferries arrive and leave, the quality and capacity of boats) characteristics (Kizos, 2007),. Therefore, the coastal passenger fleet is presented and analyzed in this section. This analysis is performed with a number of indicators such as: the average age of the ferries serving each island, travel speed, carrying capacity and ‘‘transport power’’, which is a measure of the fleet's capability to perform transport work in unit time. The ship's transport capacity is calculated by multiplying number of passengers by the ship's speed in knots (Tzanatos, 2005).
Furthermore, the coastal lines of Piraeus (Athens), Lavrio and North Greece (Kavala, Thessaloniki) are presented and analysed in terms of passenger transport supply, quantitative and qualitative involvement of the fleet and network complexity and coverage. There are five main ferry companies: NEL Lines, Hellenic Seaways, Blue Star Ferries, Anek Lines and Lane Lines. All are subsidized for at least one of their routes, but not for all. They offer connections between the islands and Piraeus; but only one of these companies offers connections between the islands and Lavrio and Thessaloniki. On the main islands of Lesvos and Santorini, three companies operate routes, while two companies operate routes in the case of Rodos. In the cases of Naxos and its satellites as well as of Rodos' satellites, only one company operates routes, a fact that identifies the vulnerability of the transportation pattern, should this company financially collapse or decide to remove this route from its schedule.

The number of companies serving the case study islands is never more than three as shown in Table 3. In most destinations, just one ferry company monopolizes transport,

which is typical across the whole Aegean (Rigas 2012). Although economic orthodoxy in coastal maritime transport claims that a competitive transport environment is expected to improve the quality of transport services (e.g. Rigas, 2012, Hernandez Luis, 2002), for many of the smaller islands this is not the case, as the transport potential is very low for commercial interest and competition, a fact recognized by the Greek State that subsidizes the so-called "non-profitable lines".

Table 3: Coastal Passenger Fleet for Case Study Islands, February 2013

a/a	Islands	Destination	No of operating companies on route	Mean Age of vessel (years)	Mean Speed of vessel (knots)	Mean Transport Capacity (Passengers per vessel)	Mean "Transport Power" (mean Speed X mean Transport Capacity)
1	Lesvos (port of Mytilene)	Athens	3	21	15.6	1,594	24,863
		Kavala	1	38.5	11.4	1,330	15,096
		Thessaloniki	1	38	5.2	1,660	8,632
2	Santorini	Athens	3	27	17.3	1,188	20,558
		Lavrio	1	13	15.9	1,675	26,633
3	Rodos	Athens	2	23	18.3	1,436	26,321
	Chalki	Athens	1	33	16.9	991	16,748
	Symi	Athens	1	23	17.3	1,462	25,293
	Tilos	Athens	1	23	17.3	1,462	25,293
4	Naxos	Athens	1	11	21.7	1,474	31,912
		Lavrio	1	13	15.9	1,675	26,633
	Donoussa	Athens	1	11	22.0	1,474	32,428
	Schinoussa	Athens	1	11	22.0	1,474	32,428
	Herakleia	Athens	1	11	22.0	1,474	32,428
	Koufonissi	Athens	1	11	22.0	1,474	32,428

Source: Greek Travel Pages and www.marinetraffic.com, processed by the authors

All vessels operating in the case study area are of the Ro-ro/ passenger type, allowing the transport of passengers and vehicles. Service levels cannot be considered as homogenized across the market, as the technical characteristics of the vessels are not uniform (Rigas, 2009). The information provided in Table 3 reveals that Naxos and its satellites have the "best quality" ferries on average, according to their age, speed and capacity. In contrast, the case study islands of Lesvos and Chalki seem to have the 'worst quality' transport, when taking into consideration these transport supply characteristics. "Transport power", as already mentioned, is calculated for coastal passenger ships and the high average values are mostly based on the high average speed rather than on the fleets' mean carrying capacity (Tzanatos, 2005, Lekakou, 2007).

3.3 Transportation Demand of tourists and residents

For transportation demand, the main difficulties deal with the proper identification of who the 'tourist' is (Baldacchino & Ferreira, 2013). First, not all passengers on flights and ferries are tourists; many are local residents. We use February as a benchmark, assuming that all passengers then are residents and they represent the average number of residents that travel in a typical month. Results are presented in Table 4 for the year

2011. Number of tourists is negative in the case of Tilos because it is serviced by smaller boats from Rodos usually for day trips and this data is not recorded.

Significant disparities exist in terms of recorded arrivals among the case study islands but also regarding the mode of travel (sea and air). The most noticeable difference is Rodos, with more tourist air arrivals than all the other islands combined. Differences for residents are smaller but indicate the limitations of our assumption and higher mobility propensity for larger islands. For example, on Lesvos and Rodos, each resident travels three times on average per year either by sea and air; while on Santorini, a resident travels off island almost nine times per year, on average. As may be expected, the residents of smaller islands travel off island more often, given that the small island scale can sustain only limited urban amenities including hospitals, higher education institutions and banks.

Table 4: Transportation Demand of tourists and residents by sea and air and Real Distance for the case study islands, 2011

a/a	Islands	Tourists		Residents		Total Passengers (tourists and residents)		Tourist arrivals / population	Residents arrivals / population	Tourist arrivals / area size	Real distance (km)
		by sea	by air	by sea	by air	by sea	by air				from Athens
1	Lesvos	97,972	108,083	115,748	122,928	213,72	231,011	2.4	2.8	126	285
2	Santorini	455,302	332,747	116,044	42,888	571,346	375,635	44.4	9.0	10,398	237
	Rodos	139,401	1,813,003	162,736	253,920	302,137	2,066,923	12.8	2.7	1,396	439
	Chalki	3,475	n/a	2,496	n/a	5,971	n/a	5.0	3.6	124	399
	Symi	79,807	n/a	26,000	n/a	105,807	n/a	26.0	8.5	1,374	398
3	Tilos	-1,366	n/a	2,844	n/a	4,21	n/a	-1.7	3.4	-22	368
	Naxos	199,455	7.857	133,304	4,416	332,759	12,273	11.3	7.5	484	181
	Donoussa	37,525	n/a	1,984	n/a	39,509	n/a	213.2	11.3	2,784	213
	Schinoussa	9,598	n/a	2,700	n/a	12,298	n/a	42.7	12.0	1,234	206
	Herakleia	29,149	n/a	2,260	n/a	31,409	n/a	194.3	15.1	1,656	203
4	Koufonissi	43,098	n/a	4,204	n/a	47,302	n/a	104.6	10.2	7,561	208

Source: Hellenic Statistical Authority and Hellenic Civil Aviation Authority, processed by authors.

An indication of the significance of tourism can be observed when comparing the number of tourist arrivals to the resident population. This is because, as for most small islands, tourist arrivals exceed the size of the resident population,sometimes many times over (Papatheodorou and Arvanitis, 2009; Rigas, 2012). Also, the ratio of visitors to the local population is the most common indirect measure of tourism's socio-cultural impact (McElroy, 2003, Coccosis, 2002). In the Aegean, tourist numbers to Lesvos are over twice as large as that island's population, those to Rodos and Naxos are over ten times as larger, and those to Santorini almost forty times larger. Extreme cases are the satellites of Naxos, with tourists arrivals ranging from one hundred times larger than the resident population (in Koufonissi) to over two hundred times (in Herakleia and Donoussa). These ratios are extremely high during peak season especially in August; however absolute numbers of tourist arrivals and resident population are relatively small.

Another important index is tourism's environmental impact, i.e. the ratio of visitors to the area size. Figures on Santorini (10,398) and Koufonissi (7,561) are very high, while even though Rodos receives the highest number of tourists, (1.95 million), the island has a relatively low index value because of the size of its land area (1,398 km^2) and finally having almost the same index value with Symi (1,374) instead of their different absolute numbers. On the other hand, Donoussa, with its low number of tourists (37,525) has a relatively high index value because of its small area size (13.48 km^2).

Real distance expressed in this case study in kilometres, emerges as another factor affecting the mode of travel. The ferry appears to be the mode of choice for destinations closer to Piraeus (Rigas, 2011). Rodos being the most distant island from Piraeus had a high air transportation percentage which in all categories (for both tourists and residents) exceeds 60%; while Naxos, being the least distant island, had a low air transportation percentage in all categories (on average 3.5%). Lesvos and Santorini have equal distribution of percentages for tourists and residents by sea and air, except for the residents of Santorini, many of whom prefer to travel by sea (73%).

3.3.1 Seasonality of tourism demand

Tourism in the Aegean islands is mostly a summer activity peaking in July and August as holidays are predominantly related to warm water, sea, sand, sun and relaxation. Most islands have at least one of these characteristics, many have more than one and some have them all (Kizos, 2007). Given that demand for traveling to islands is mainly associated with leisure tourism, a high seasonality effect is expected in tourism arrivals. Table 5 demonstrates this seasonality by comparing tourism demand levels in July and August as a share of total tourism flows in 2011.

Table 5: Tourist arrivals by sea and air for case study islands, July - August 2011

a/a	Islands	Tourists in July and August	% Tourists in July and August/ Total	Tourists in July and August			% Tourists in July and August/ Total
		by sea		by air			
				Domestic	International	Total	
1	Lesvos	31,638	32.3	18,143	27,340	45,483	42.0
2	Santorini	107,759	23.7	52,725	107,559	160,284	48.0
3	Rodos	25,885	18.6	44,524	724,782	769,306	42.0
	Chalki	919	26.5	n/a	n/a	n/a	n/a
	Symi	7,158	9.0	n/a	n/a	n/a	n/a
	Tilos	42	-3.1	n/a	n/a	n/a	n/a
4	Naxos	48,083	24.1	2,404	384	2,788	35.0
	Donoussa	24,132	64.3	n/a	n/a	n/a	n/a
	Schinoussa	4,501	46.9	n/a	n/a	n/a	n/a
	Herakleia	13,681	46.9	n/a	n/a	n/a	n/a
	Koufonissi	5,543	12.9	n/a	n/a	n/a	n/a

Source: Hellenic Statistical Authority and Civil Aviation Authority, processed by authors

From the total number of disembarked tourists at the ports (1,093,416), 25% visit the case study islands in July and August, compared to 44% disembarked tourists at the airports (total tourists by air: 2,261,690). However, a more detailed examination of both air and sea arrivals reveals a fundamental difference: air arrivals during these months

are mostly international (38.8%, with domestic at 5.2%), while sea arrivals are only domestic (all the 25%). Schinoussa, Herakleia and Donoussa, which are Naxos' satellites, present a high seasonality demand ranging from 46% to 64% respectively; while Koufonnisi and Naxos present low seasonality demand due to arrivals being dispersed throughout the whole year.

4. DISCUSSION

The transportation network of the Aegean Sea displays a virtually mono-hub structure based upon the Port of Piraeus and the Athens International Airport (Tzanatos, 2005). Theoretically, the hub and spoke model is a system which makes transportation much more efficient by greatly simplifying a network of routes (Lekakou, 2007; Stabler et al., 2010). It is extensively used in commercial aviation for both passengers and freight, and the model has also been adopted in the technology sector. The model is named after a bicycle wheel, which has a strong central hub with a series of connecting spokes.
In archipelagoes, the "central" island is typically the one where public services are based and the bulk of the population resides. It is often the only island with an international airport or seaport: all visitors on commercial flights or sea trips to central islands must then transit the hub alongside. Inter-island links that do not involve the central hub are rare or non-existent, or else not advertised or communicated to visitors (Baldacchino & Ferreira, 2013). In the case study islands, several smaller hub and spoke systems (mini-archipelagoes unto themselves) emerge, with small sea companies that inter-connect these spokes, all of them included onto a larger canvass: the Aegean archipelago. There are, of course, disadvantages to a hub and spoke model. Any disruption at the hub, such as bad weather or a security problem, can create delays throughout the system. The overall operating efficiency is also limited by, and dependent on, the capacity of the hub (Lekakou, 2007; Stabler et al., 2010).

This network of hubs and spokes is served mainly by ferries. In the late 1990s and early 2000s, an attempt to replace older vessels by new ones was supported by a bullish stock market. But, with its collapse, many of the ferries that service the islands are now aged (a number of them were built in the 1970s). In spite of some modernization attempts, low service levels remain, especially in network coverage and frequency of services. In 2004, more than 300 vessels of various types were serving the entire Greek network, with almost 70% of them operating in the Aegean (Rigas, 2011). According to Tzanatos (2005), this fleet is continually improving on the basis of the transport power index, mainly based upon the increase in the fleet's average speed. But this finding reflects only larger island lines, or the popular central Cyclades lines (i.e. Siros, Paros, Naxos and Mykonos islands). At the same time, the situation for many of the smaller and remote islands has worsened significantly, with old vessels and lower frequencies, especially since the companies complain about increasing fuel prices (which, they claim, account for over 60% of their total operating costs) along with crew restrictions. An improvement in commercially viable lines took place mostly through an increase of travel speed and only partially through increasing vessel size (Tzanatos, 2005).

Another interesting finding for the case study islands in transportation demand by both tourists and residents is that the ferry appears to be the mode of choice for destinations closer to the Piraeus hub. It has to be noted, however, that ferry and air service frequencies play a major role here as well, since the ferry connection to and from Naxos

is one of the best in the Aegean, with relatively new and fast ferries that make the trip to Piraeus comfortable and fast.

With respect to tourism demand, transportation patterns demonstrate that the existence of direct air flights to a large island such as Rodos, increases the possibility for tourists to visit, compared to smaller, satellite islands that do not benefit from these flights directly. This issue is of course related to the "image" of the island, as Rodos can be considered an island with a distinctive character, as well as within the overall 'Aegean islands' framework. Meanwhile, smaller islands struggle to differentiate themselves and stand above the noise of their larger competitors, especially since after 2009 many of them are part of larger municipalities. This is typically the case of a "periphery within a periphery" (Papatheodorou, 2004).

The case studies presented here have served to explore the transport practices of different types of islands and island clusters within a broader and larger archipelago. The differences observed are not surprising; larger islands and islands with a developed tourism sector are served better (Bardolet and Sheldon, 2008). The findings also demonstrate that the spill-over of this link of the larger islands to their satellites remains rather limited, especially in the case of Naxos' satellite islands. These cases seem to represent different archipelagoes within the broader archipelago, presenting on a smaller scale features similar to those of the greater system: high spatial differences and high degrees of dependency (Papatheodorou, 2004).

In archipelagos, the potential exists for both collaboration and competition (i.e. co-opetition) between the islands of the same archipelago (Bardolet and Sheldon, 2008). Prideaux and Cooper (2002) argue that the destination brand is the tangible and positive outcome of the achievement of unity and collaboration amongst the stakeholders of a tourism destination. The conceptualization of destination branding as a collaborative process can be considered as the central theme that characterizes how tourism literature has described the interrelationships amongst stakeholders in the process of branding a tourism destination (Marzano and Scott, 2009). For the Aegean Islands in general, an international image and brand already exists, as an archipelago. But, despite historical, geographical, climatic, linguistic, landscape and other similarities, there remain considerable differences in perception, representation and imagination within this ancient archipelago. For example, Santorini is a well-known international "brand" in itself, at the same time within and outside of the Aegean Islands brand.

Another point worth mentioning that does not emerge directly from the transportation data is related to the difference in transport links between residents and tourists, especially for smaller, satellite islands. Tourists and residents have diverging needs in terms of the timing of transport. For example, for a resident of Tilos, it is important for the local ferry to leave in the morning *from* Tilos and return some time in the afternoon, in order to use the public and private services of Rodos. But, for a tourist in Rodos, this timing is not convenient as it means that s/he would arrive on Tilos late in the afternoon and have to leave early in the morning, obliging at least an overnight stop; a morning ferry *to* Tilos would be preferred for day trippers. Such qualitative aspects of transportation are hard to depict in statistical tables, but are nevertheless of great significance (e.g. Vannini 2012).

5. CONCLUSION

How can the actual differences observed in archipelagoes be used to cover or improve issues of access and tourism planning? The findings of the case studies suggest at least two important observations:

A number of different spatial configurations emerge as the scale increases or decreases. A number of archipelagoes emerge, or are merged into broader spatial entities. The scale where finer spatial configurations are more evident, that of small islands, appears to be the most suitable to handle dependence and transportation issues. This is inevitably related to the concepts of liminality and fractality in space (Thomassen, 2009) as most islands play the role of a mainland to smaller islands; whereas those smaller islands play equally the role of a mainland to even smaller islands, and so on. As discussed by Papatheodorou (2004), the tourism landscape is characterized by a notable dualism in market and spatial structures: core tourism areas have adequate transport accessibility and accommodation infrastructure, occasionally due to the operations of transnational companies; whereas peripheral resorts are served poorly and usually host small, traditional tourism establishments. Core resorts may cast an "agglomeration shadow" on smaller, peripheral ones. This would be the case of Rodos vis-à-vis Chalki, Symi and Tylos, which are denied autonomous development and have a relationship of substantial dependency with Rodos. In any case, however, each territorial area may simultaneously play the role of a core in a lower spatial order and the role of a periphery in a higher one. For example, Rodos is clearly the business and administrative centre of the Dodecanese Islands and a core tourism resort of the Aegean Archipelago. At a wider Greek level, however, Rodos plays only a modest role as a business centre, while its role in the global tourism map is noteworthy but certainly not core.

On these grounds, within the archipelago, the image of smaller islands is overshadowed by that of larger ones or of the archipelago itself. Of course, to consider that *all* small islands could have their own, distinctive and unique image is perhaps impossible (Baldacchino and Ferreira, 2013). The exploitation of existing differences within the archipelago needs to be carefully managed within a simple but effective marketing strategy that puts the focus on the Aegean and on smaller archipelagoes inside it, *as a whole*, and as the provider of a multiple tourism product. Local island councils, where they exist, not surprisingly, disagree: these have their own tourism strategic plans, and archipelago issues do not feature prominently (Baldacchino & Ferreira, 2013). In fact, the Aegean Archipelago is administratively divided in only two regions: the North and South. Had these regions been granted the necessary powers by the state not only *de jure* but also *de facto* (i.e. in terms of financial means), a self-regulated and unified island governance framework could have gradually emerged. At present, nonetheless, the regions are overwhelmed by local micro-politics (at an island level) whereas they remain strongly financially dependent on the central government.

In the case of the Aegean, the image of the archipelago is very powerful despite the existence of islands such as Santorini (an international 'brand') and Lesvos (a regional 'brand') that manage to stand out on their own. The question of how neighbouring or satellite islands can benefit from these brands is a complex one, but also of great importance for smaller islands in the Aegean. A possible solution would have to consider benefits for both sides: larger islands would benefit by offering an opportunity

to tourists to experience something different compared to their satellite islands; and smaller islands have an opportunity to receive some of these tourists, even if only for day trips.

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7. REFERENCES

Baldacchino, G., & Ferreira, E.C.D. (2013). Competing notions of diversity in archipelago tourism: transport logistics, official rhetoric and inter-island rivalry in the Azores. *Island Studies Journal*, 8(1), 84-104.

Bardolet, E., & Sheldon, P.J. (2008). Tourism in archipelagos: Hawai'i and the Balearics. *Annals of Tourism Research*, 35(4), 900-923.

Butler R., (1996). Transportation innovations and island tourism. In D. G. Lockhart and D. Drakakis-Smith (eds.), *Island Tourism: Trends and Prospects*, (pp. 36-56). London: Pinter.

Coccosis, H. (2002). Island tourism development and carrying capacity. In Y. Apostolopoulos and D. J. Gayle (eds.), *Island Tourism and Sustainable Development: Caribbean, Pacific and Mediterranean Experiences*, (pp. 131-144). Westport CT: Praeger.

Eurostat (2014) Introduction into the NUTS Classification, available online: http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction (accessed 13/01/2014)

Greek Travel Pages (2013) Various Reports, Available online: http:// www.gtp.gr (accessed 10/12/2013)

Hellenic Civil Aviation Authority (2013) Various Reports, Available online: http://www.hcaa.gr (accessed 09/10/2013)

Hellenic Statistical Authority (2013) Various Reports, Available online: http://www.statistics.gr/portal/page/portal/ESYE (accessed 05/11/2013)

Hernandez, L.J.A. (2002). Temporal accessibility in archipelagos: inter-island shipping in the Canary Islands. *Journal of Transport Geography,* 10(3), 231-239.

Kizos, T. (2007). Island lifestyles in the Aegean Islands, Greece: heaven in summer, hell in winter? In H. Palang, H. Sooväli and A. Printsmann (eds.), *Seasonal Landscapes*, (pp. 127–149). New York: Springer.

Lekakou, M.B. (2007). The eternal conundrum of Greek coastal shipping, in Pallis T. (ed.) *Maritime Transport: The Greek Paradigm*, Vol 21 in Research in Transportation Economics Series. Oxford: Elsevier Science, pp. 257–296.

Marine Traffic (2013) Various Data, Available Online: http:// www.marinetraffic.com (accessed on 10/11/2013)

Marzano, G., & Scott, N., (2009). Power in destination branding. *Annals of Tourism Research*, 36(2), 247–267.

McElroy, J. L. (2003). Tourism development in small islands across the world. *Geografiska Annaler,* 85B(4), 231-242.
Papatheodorou, A. (2001). Tourism, Transport Geography and Industrial Economics: A Synthesis in the Context of Mediterranean Islands. *Anatolia*, 12(1): 23-34.
Papatheodorou, A. (2004). Exploring the Evolution of Tourism Resorts. *Annals of Tourism Research*, 31(1): 219-237.
Papatheodorou, A., & Arvanitis, P. (2009). Spatial Evolution of Airport Traffic and Air Transport Liberalization: The Case of Greece. *Journal of Transport Geography*, 17: 402–412.
Rigas, K. (2009). Boat or aeroplane? Passengers' perceptions of transport services to islands: the example of the Greek domestic leisure market. *Journal of Transport Geography*, 17(5), pp. 396-401.
Rigas, K. (2012). Connecting island regions: a qualitative approach to the European experience. *SPOUDAI Journal*, 62(3-4), 30-53.
Rigas, K., Sambracos, E., & Gatzoli, A. (2011). Air and sea transport: competition strategies under normal and economic crisis environments. *SPOUDAI Journal*, 61(3-4), 65-84.
Spilanis, I., Kizos, T., Vaitis, M., & Koukourouvli, N. (2012). Measuring the economic, social and environmental performance of European island regions: emerging issues for European and regional policy. *European Planning Studies*, 1(1), 1–22.
Stabler, M. J., Papatheodorou, A., & Sinclair, M. T. (2010). *The Economics of Tourism*, 2nd edition, London: Routledge.
Thomassen, B. (2009). 'The Uses and Meaning of Liminality' *International Political Anthropology,* 2(1): 5-28.
Tzannatos, E.S. (2005). Technical reliability of the Greek coastal passenger fleet. *Marine Policy*, 29(1), 85–92.
Vannini, P. (2012). *Ferry Tales: Mobility, Place, and Time on Canada's West Coast*.