Airport Dynamics
Towards Airport Systems

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Towards Airport Systems
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The Airport Regions Conference (ARC) is a network of regional and local authorities across Europe involved in the current activities and the future development of a major international airport located within or near their territory.

The ARC was launched in 1994 and legally fully established in 1999. There are currently twenty member regions together representing a population of over 70 million people and more than 20 international airports in western Europe.

Early studies of the ARC’s Transport Interest Group were focused on surface accessibility to airports, considered destination points. The result was the booklet “Promoting Public Transport at Airports” published by ARC in 1999. Following studies considered the airport both as a complex intermodal node and as a core of large spatial developments, airport cities. The result was the book “From Airport to Airport City”, issued in 2001.

The current step enlarges even more the scope of study considering broad regions served by groups of airports, airport systems. These regions can be either metropolis (London, Paris...), regions (Lombardia, Catalonia...), countries (Finland...), or even an archipelago (Canary Islands, Balearic Islands...). Different airports tend to perform as a network to cover the territory with different functions each one. This process has important effects on the regions, such as the consolidation of current intercontinental hubs or the emerging of new ones. In addition, the establishment of low cost carriers or the specialization in freight brings new opportunities for regional airports development.

This study aims to put light on these new “airport dynamics” from the point of view of public administrations, concerned about the environmental impact of air transport increases, but also very much interested in the improvement of their regions accessibility and the economic benefits of air activity, positioning themselves in global economy’s map.
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1. Introduction

In the last decades, mobility has undergone a progressive growth. In addition, air traffic has benefited from deregulation policies that reduced former market barriers.

Traffic forecasts predict increases between 200% and 300% in the following two decades. These values mean that a dedicated development at major airports will be insufficient to absorb air traffic in many regions.

In addition, several airports, particularly the major platforms of each region, are close to their full capacity. Considering the stiffness of airports as infrastructures, the development of measures providing more capacity faces a great challenge, from both economical and social viewpoint.

Even though the construction of new facilities would be the most evident solution to ease the problem, everyday there is more concern and social pressure about the environmental impact of infrastructures. In particular, noise pollution in airports nearby areas may advise not to expand them, preventing the interests of the community. Apart from environment, the lack of space due to geographical or urban development aspects means that the expansion of platforms is generally unfeasible.

In a whole regional or metropolitan area there is usually air traffic capacity available in regional airports, generally failed into disuse. Promoting regional facilities, territories have an opportunity to reach more balanced and community respectful air traffic distributions, being able to absorb higher increases of air traffic.

The consideration of airports belonging to the same territorial unit leads to the study of airport systems. In this issue, the options in hands of regions in order to manage air traffic in a more efficient way are detailed; and opportunities for regional airports to acquire an strategic position, either in the system or in the international air traffic market, are identified.
1.2 Towards airport systems

Since the foundation of College Park Airport (Maryland, USA) in 1909, airport behavior has evolved rapidly, from being punctual locations handling mail and military operations to territorial nodes, linking their region with worldwide destinations. The history of airports is closely related to the development of its land and airside; both have directly influenced the evolution of airport dynamics.

Apart from being strictly a center of air traffic operations, nowadays airports have a strategic position in regional development, generating economic activity in their nearby areas, creating employment (both direct and indirect) and being multimodal focuses.

The development of airport's air and landside has driven to airport systems

The first airfields were mostly conceived in the 20's (Heathrow, Rome Fiumicino, La Guardia, Schiphol, etc.). However, the end of the World War 2nd meant an increase of mobility, whether for people or goods, and was the starting point for the consolidation of the commercial airport concept still existing nowadays. Examples of this stage are the conversion of Heathrow airfield into a commercial facility (1943), the inauguration of the present Kennedy airport in New York (1948), the surfacing of Madrid Barajas runway (1944) or the conversion of Frankfurt Rhein Main and Berlin Tempelhof into commercial airports (1945-1946). In the 50's and 60's, the development of aircraft industry producing faster and larger aircrafts (Douglas DC-8, Boeing 707-320) meant the need of longer runways to handle their operations. In addition, airport and airway technologies, as the Instrument Landing Systems (ILS), approach landing systems or the very high frequency omnidirectional range and finding (VOR) eased airport operations.

In the late 50's and early 60's, many of the most famous airports were built, as Newark in New Jersey, San Francisco International or Rome Fiumicino. These airports were located far away from the city centre, in order to take up areas allowing airport expansion and having less social impact.

Important innovations appeared in the 70's at major airports in order to facilitate the internal movements within the airport, as automated people movers, mobile lounges or moving sidewalks. Airport improvements were complemented with the development of accessibility facilities. The construction of non congested road accesses followed by the promotion of public transport have transformed airport from mere transport infrastructures into regional hubs that concentrate a wide variety of services in a small area.

The concentration of the totality of air traffic operations in a single airport nowadays faces with capacity problems, from both technical and social viewpoint. This problem was anticipated in main world urban concentrations since the last decades, where a single airport was unable to absorb air traffic demand. For instance, Gatwick is London's second airport since the 50's, New York / New Jersey region has three commercial airports (Kennedy, Newark and La Guardia) since the 60's and Tokyo inaugurated its international gateway, Narita, in 1978.

Nowadays, the limited capacity of major airports and the existence of new niches in air traffic market are allowing the development of regional airports. Therefore, regional needs have evolved from airports to airport systems.
1.3 Definitions

Airport System concept has been latent for several years; its evolution can be depicted as follows.

The study Planning Multi-Airport Systems in Metropolitan Regions in the 1990s (2000), by Professor Neufville from MIT (Massachusetts Institute of Technology) defined an airport system as a

“Set of airports serving a particular metropolitan area”

A different definition of Airport System, adopted by COFAR (Common Options for Airports Regions) in its study Airport Systems (2000), was ACI’s (Airport Council International) definition of airport network, as

“one operating authority or company responsible for managing a number of airports”

However, from regional viewpoint, an airport system has to be indifferent to the ownership of the infrastructure. Furthermore, the expansion of airport hinterland or airport domain of influence, from a metropolitan to a regional scope, suggests the adoption of a looser definition, which considers an airport system as a group of airports belonging not exclusively to a particular metropolitan but to a regional area. In conclusion, airport system definition could be the following:

“Airport system: group of airports serving a particular regional or metropolitan area whose ownership may be either separate or joint”

The spreading of this airport system concept is weak, only used in specific American regions, as New England, Houston, San Francisco Area or the city of Chicago.

However, airports belonging to a particular area are commonly ruled together, whether from territorial or management sense, but without being explicitly named airport systems. In several European metropolitan areas the airports are administrated by a single private organization and the concept is being implicitly considered from management point of view. In America, the grouping of airports usually follows only territorial aspects.
1.4 Layers

The looseness of the territorial concept in airport system’s definition allows making different hypothesis depending on the size of the studied area: airport system’s layers.

**AIRPORT SYSTEM’S SIZE MAY VARY DEPENDING ON THE SCOPE OF THE STUDY: THERE ARE DIFFERENT AIRPORT SYSTEM’S LAYERS, FROM METROPOLITAN TO CONTINENTAL**

Schematically, the following levels of study have been identified:

- **Metropolitan / Regional**

  Airports that belong to a particular city, metropolitan area or region which is generally smaller than the country. It is the intuitive idea of airport system, the closest to regional interests, which allows the development of regional airports completing the functions that major airports cannot meet. It is the most related layer to regional viewpoint and the one that has been thoroughly analyzed in the present issue.

  London, Paris, or Rome are metropolitan systems whereas Barcelona/Catalunya, Lombardia, or Belgium are regional systems.

- **Administrative**

  Layer obtained considering the aggregate behavior of airports belonging to a particular country. Generally, it has a close relationship with the national airline or airport authority structure, having a hub – spoke performance based on the major national airport, national airline’s hub.

  It has weak interest for regional development, being only suitable where administrative and regional layer coincide. Nevertheless, the performance of national airlines in their country shows a proto airport system related to airside evolution.

Apart from countries that have a national airport authority; French, German, or Italian airports, which have different airport owners and managers, could be a good example of this layer.

- **Macroregional**

  Macroregional airport systems have been conceived considering strictly territorial aspects, obtaining a division of the European Territory into 10 major regions independently from administrative or political matters.

  It is a supra-administrative layer that reaches social synergies (economical, transport, demographical) that, starting only from topological references, brings new elements into the study of airport systems, such as the independence of administrative barriers.

  Examples of territories that could be European macroregions are Benelux (Belgium, Netherlands, and Luxemburg), Norte Italia (including Lombardy, Piemonte, Liguria, Trentino, Valle d’Aosta, Veneto, and Emilia Romagna), and West Mediterranean axis (composed by Catalunya, Valencia, East of Aragon and South bordering French Departments).

  An overseas example is New England, located in the East Coast of United States and composed by 6 different States (Massachusetts, New Hampshire, Rhode Island, Connecticut, Vermont, and Maine).

  Finnish airports make up a national airport system where Vantaa airport plays a hub performance.
• Continental

The joint analysis of continental major hubs makes the continental airport system. The interest of this layer is the possibility to compare American and European air traffic structure, obtaining significant differences due to geographical, political, and economical aspects.

Heathrow, Paris Charles de Gaulle, Schiphol, Frankfurt Main, Madrid Barajas, and Rome Fiumicino are the airports that would take part in an European Continental layer.

Airport System’s layers

<table>
<thead>
<tr>
<th>Viewpoint</th>
<th>Europe</th>
<th>North America / United States</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Dense</td>
<td>Unequal and concentrated in Atlantic and Pacific Rims</td>
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<tr>
<td>Administrative</td>
<td>Segmented / divided</td>
<td>Single national identity</td>
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<tr>
<td>Air traffic</td>
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</tr>
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<td>Hub structure</td>
<td>National Hub / Spoke Structure</td>
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<td></td>
<td>Hubs coincide with major megapoles</td>
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<td></td>
<td>International haul</td>
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<tr>
<td>Accessibility</td>
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</tr>
<tr>
<td></td>
<td>Development of HST transnational network</td>
<td>Domestic haul</td>
</tr>
</tbody>
</table>

In Paris, Charles de Gaulle, Orly, le Bourget, and Beauvais make up a regional airport system.
Analysis and methodology

The promotion of airport systems affects not only airports but also territories where they are located. Depending on the necessity to adopt an airport system, several territorial natures have been identified. In addition, several regional ratios define territorial behaviours.

Airport behavior is drawn in two stages. Firstly, features of each facility have been analyzed. Secondly, an own methodology depicting the internal dynamics of the system has been created, showing how a group of airports jointly behave. Internal dynamics is studied through Airport System’s (Internal) Matrix, a figure that shows, apart from the aggregate performance of the system members, the position of a particular airport in the system and the grade of specialization of one of its attributes (freight, category of airline, range of flights).

2.1 Territorial natures

Considering that an airport system depends on geographical and socio economical features, three different territorial morphologies are identified: archipelago, megapolis, and regional.

2.1.1 Archipelago

It is a territory with land mobility constraints. Hence, the accessibility has to be provided by air transport, meaning a forced network of airports forming an airport system.

Generally, this system consists in a major airport connecting the territory with main international nodes, and a group of regional airports linking a particular part of the territory with the central facility, forming the classic hub - spoke structure.
Whereas the major airport combines international and domestic flights, regional platforms are mostly dedicated to domestic destinations, even though they can also hold several long haul services.

Hub / Spoke structure is usual in archipelagos and major airlines

The most significant samples of the above mentioned are the groups of islands. They are archipelagos systems composed by spots of territory, where air traffic is the most important means of transport, providing inter island accessibility. Canary, Hawaii or Balearic are some of island archipelagos.

However, there are also continental systems having extreme weather conditions where archipelago behaviors can be found. Nordic Countries, as Norway and Finland, may be considered as continental archipelagos.

In archipelagos, dependency on major airport decreases with air traffic increases, 2001

REGIONAL AIRPORT IN ARCHIPELAGO: DEPENDENT

2.1.2 Megapolis

World major urban concentrations, annually handling more than 50 million passengers and having more than 5 million inhabitants, are considered megapolis.

They are generally concentrated areas and, although they are able to have large hinterlands, population is located in the city and its periphery, what means that all industrial and economical activity revolves in the city that names the megapolis.

In absolute terms, Megapolis are the main centers of air traffic attraction and generation, where world busiest airports are located. Examples of this territorial nature are London, Paris, Tokyo, or New York.

Air traffic volume is so high that the consideration of a single airport handling the whole regional traffic seems unfeasible due to traffic, social, and environmental matters. Hence, even if the region is in a neutral position to adopt an airport system from geographical viewpoint; the airport system is generally being promoted.

The relationship between the airports is far from dependency. A complementary role is developed by secondary airports, discharging major infrastructures from less profitable activities.

The size of complementary airports may vary from being small regional or city airports dedicated to general aviation (Chicago Meigs Field, Paris Le Bourget, London City Airport) to international facilities, hubs of several carriers (London Stansted, Paris Orly, LA Ontario, or Chicago Midway).

In addition, the system may be composed by Siamese International hubs, as happens in New York with Kennedy and Newark.

REGIONAL AIRPORT IN MEGAPOLIS: COMPLEMENT
Regional territories are less concentrated areas that may possess large hinterlands but smoother urban settlements.

Territory without geographical restrictions, having an initial neutral position towards the consideration of an airport system, as the volume of air traffic is able to be handled by a single airport.

However, the increase of mobility in the area and the presence of different niches of air traffic may lead to the promotion of regional facilities.

Air traffic natural tendency is the concentration of services into a single international airport when possible. The reduction in operational and fixed costs and the income through commercial activities non directly related to air traffic (airport shops, restaurants, parking) mean that the concentration of services is preferred to the diversification or segmentation, specially where a single operator is in charge of the management of the system, as happens in the Netherlands with Schiphol Group or in Berlin with Berliner Flughäfen.

Concentration should be conceived where there is enough margin to absorb air traffic growth at mid-long term (10 years) and there are no environmental aspects that threaten the healthy development of the region. However, the internalization of external costs caused by airports could lead to the recommendation of the promotion of regional airports, conceiving a regional airport system.

**INTERNALIZE EXTERNALITIES!**

The promotion of regional airports is being currently considered when a small platform becomes a specialist in a particular niche of air traffic. The most widespread solutions are freight, destination or low cost airline specialization.

**REGIONAL AIRPORT IN REGIONS: ALTERNATIVE**

The standard secondary airport in regional territories handles low volume of air traffic, generally less than 6 million annual passengers. Its origin maybe:

- Former international airport that has been progressively abandoned
- Regional airport in a distant position. Thanks to the increase of mobility or to the enlargement of the metropolitan or regional area, it has been included in the system

It is a usual performance in Europe, where the increase of air traffic and the birth of new air traffic niches, linked with airport extension problems, have given an opportunity to regional airports to develop and position themselves in regional and European air traffic market.

Orio al Serio and Linate in Lombardy, Girona in Catalonia, Frankfurt Hahn, Glasgow Prestwick, or Skavsta in Stockholm show how regional territories can promote an airport system betting for regional airports development.

**2.2 Regional ratios**

Two ratios have been conceived in order to study territorial behavior in relation to air traffic: air traffic generation and central dependency / concentration ratio. Whereas the first one depicts
the relationship between population and air traffic, the second one draws how dependent the airport hinterland is towards the main urban node of the system.

Before defining both indicators it is necessary to advise that dealing with population data may end up with less precise results, as the delimitation of the system’s hinterland / domain of influence may vary depending on the author.

### 2.2.1 Air traffic generation ratio

Number of annual passengers divided by region inhabitants.

\[ TG = \frac{\text{Passengers}}{\text{Inhabitants}} \]

The use of this ratio shows the capacity of generating and attracting air traffic in hands of the territory and the importance of air traffic activity in the region, varying widely depending on regional features.

Whereas main world metropolitan areas have low values of traffic generation (less than 10 passengers per inhabitant), regions oriented to tourism or owning a hub airport at a continental level easily reach double figures. Hence, whereas megapolis are usually the territorial natures presenting lower values of air traffic generation ratio, archipelagos own the highest.

In regional territories, the ratio widely varies: whereas it may go beyond 10 in hub or few populated territories, generally air traffic generation is lower than 10 passengers per inhabitant. Lowest values of air traffic generation are located in large territories without having a first class airport, which are in a dependent position to country major airport.

### 2.2.2 Concentration

The knowledge of the morphology of the airport system’s urban network is one of the key aspects to conceive airport facilities, from accessibility (deciding the modal supply and destinations from airport) to information (tourist information, hotel booking, etc.).

Even a first approximation can be obtained through the study of territorial density (population / area), it is also necessary to detect the dependency of the region towards its main urban node, achieving the concentration ratio by dividing the population of the major metropolitan area by the total number of inhabitants of airport hinterland / domain of influence.

\[ CR = \frac{\text{Inhabitants (Metropolitan area)}}{\text{Inhabitants (region)}} \]

Megapolis have higher concentration ratios, with values exceeding 0.5. Even though they may take up vast areas, they present an urban and demographical structure where the whole system strongly depends on major city performance.

The casuistry in the rest of the cases is rich, closely related to the urban structure of each country. Central European countries generally have lower values of concentration, due to a more balanced urban network that promotes medium size cities in front of large metropolis, avoiding the desertification of a large part of the territory (Central Places Theory, Christaller). However, Southern European regions are usually more concentrated.

American continent has a different interpretation. The vast surface and the geographical and climate heterogeneity of the United States have meant a concentration of territory in several major urban nodes. Long distances between major cities have boosted domestic air traffic, meaning a spread of medium size airports that link a particular metropolitan area with major international hubs.
2.3 Individual behavior analysis

The description of territorial natures leads to the conclusion that generally airports belonging to a particular system, apart from handling different volumes of air traffic, may have different features. Then, airport analysis starts with the identification of the characteristics that an airport may present individually. Different ratios have been created in order to standardize airport behavior.

2.3.1 Freight

Apart from analyzing the absolute value of tons transported, the specialization of a particular airport in cargo activities is measured by the freight ratio (FR), which relates the freight and the passengers handled by the airport in a particular period of time, generally a year.

\[ FR = \frac{\text{Freight (M.tons)}}{\text{Passenger (MM.pax)}} \]

The values of this ratio vary from almost null in city and leisure dedicated airports (London City, airports located in islands, Nice, Girona, etc.) to several hundreds corresponding to freight specialists (Frankfurt Hahn, Liege, Charleroi, Luxembourg, Houston Ellington, or Vitoria).

30 KILOS PER PAX = CARGO INTERESTS
100 KILOS PER PAX = CARGO SPECIALIST

Analyzing separately airports having freight ratios higher than 30, two different behaviors are observed:

a.- Regional Specialist. Its freight ratio (>100) is originated through the combination of frequent freight with rare passenger services, meaning that the majority of air traffic operations are related to air cargo business, market in which the regional airport is specialist, generally being a hub airport of pure cargo carriers (TNT, DHL, FedEx, UPS, etc.)

b.- Hub with mixed market. Hub airports with high volume of passengers transported where, due to its strategic position, cargo activity also plays an important role.

Major airports usually combine passenger activity with cargo operations, since main cargo carriers, whether world major airlines or some of their subsidiary companies, operate here. World major airports referring to annual passengers transported are also the ones leading freight activity in absolute terms. However, a high number of passengers entails lower freight ratios, meaning the coexistence of both services.

Whereas major airports have moderate values of freight ratio and many tons transported, regional specialists have higher freight ratios with less tons, 2001
2.3.2 Destination

The distribution of flights sorted out by haul depicts the importance of airport’s movements. Generally, major airports handle more international flights, whereas regional platforms receive short haul services. Domestic Ratio (DR) and its complementary International Ratio (IR) show the share of passengers in each kind of flights, and whose addition is always 1.

\[
DR = \frac{\text{Domestic}}{\text{Total}} \quad \text{(pax)}
\]

\[
IR = \frac{\text{International}}{\text{Total}} \quad \text{(pax)}
\]

The distribution of destination ratio values widely varies between Europe and America. Firstly, the different size of the continents and the administrative segmentation in Europe implies that domestic traffic in North America is more important, being a part of European International air traffic. Therefore, American airports have higher domestic ratios, so that its international ratio would be equivalent to the Intercontinental Ratio at major European airports.

In America, major international airports have domestic ratio values between 0.6 and 0.7 (New York Kennedy, Los Angeles International or San Francisco International), whereas secondary airports in megapolis and major airports of smaller systems are close to 1.

In Europe, apart from lower domestic ratios, the value is related to regional features. The administrative segmented structure of Europe shows different values depending on the country where the airport is located: small countries (Netherlands, Belgium, Switzerland, etc.) have domestic ratios lower than 0.10, whereas in larger countries (Spain, France, Italy, Germany, Great Britain) domestic ratios widely vary, from close to 1 in small airports in non tourist regions to almost null in tourist facilities.

Hence, ratio values depend on three factors:

- **Geopolitical.** Country where the airport is located.
- **Economical.** Weight of tourism in the region
- **Aerial.** Position of regional airport in the system / Way of specialization

The heterogeneity of the results depending on regional aspects recommends the analysis of the domestic ratio only between airports belonging to the same system or country.
2.3.3 Transfer

The share of passengers in transfer, or transfer ratio, shows if an airport can be considered as a connector or has point to point features.

The values of transfer ratio are sharply polarized: whereas national hubs, major airlines headquarters, are able to have ratios close to 0.5, the share of passengers in transfer is almost null in small regional airports.

\[ \text{HUB} = \text{TRANSFER} \]
\[ \text{REGIONAL AIRPORT} = \text{POINT TO POINT} \]

Generally, a system is composed by several airports providing point to point destinations and at maximum one airport having a hub performance. However, in megapolis, where the capacity of major airport is almost exhausted, secondary airports can progressively acquire connector features as well.

The most profitable use of this ratio is by comparing the values of major continental hubs, allowing the detection of airport position as world hub and obtaining the real capacity of generation/attraction of air traffic in each region strictly obeying air business.

Share of passengers in transfer related to metropolitan inhabitants and airport size, 2001

2.3.4 Airline

Closely linked with destinations, the airlines operating at each airport also draw the air traffic market where the airport is focused on. Only considering regular commercial airlines, three categories have been identified:

- **Major international airlines.** National airlines in Europe or top American carriers (United Airlines, Delta, US Airways), generally belonging to one airline alliance (SkyTeam, One World, Star Alliance)

- **Regional airlines.** Airlines that generally provide trips within a continent, having a clear domestic orientation.

- **Low cost.** Airlines specialized in offering flights at special low fares. Even they might be also considered as regional airlines, the recent increase of its market advises to consider them independently from those mentioned above.

![Easyjet burst into air traffic market providing low fares](image)

The composition of airlines that operate in an airport is estimated through the share of each category, obtaining the International, Regional and Low Cost airline ratios.

Values of airlines ratio vary depending on the function of the airport. The value of the international airline ratio in major airports depends on the territorial nature and the grade of consolidation of the system, because whereas major airports in large megapolis present values close to 1 (as Kennedy in New York, Charles de
Gaulle in Paris, or Heathrow in London), regional territories dependent on a single hub, combine international, regional, and low cost carriers (Frankfurt Main or Amsterdam Schiphol).

Major airports in regional systems have intermediate values, developing an hybrid role between international and regional / destination airports (Barcelona, Manchester, or Vienna). However, this tendency has an exemption in secondary airports located in large megapolis, which generally combine high volumes of passengers with a lack of major airlines (Paris Orly or London Gatwick).

Regional airports are generally operated by few airlines: national airlines linking the airport to major hub, national airlines’ subsidiaries, or specialized carriers, either in freight or in tourism. Finally, the recent importance of new air traffic niches has to be taken into consideration. It means that several airlines prefer to operate in regional airports obtaining cheaper slots and offering more affordable fares: low cost carriers.

Wrapping up, Major airports features can be depicted as follows:

- Significant share of passengers in transfer.
- Transcontinental links
- Hold operations of major airlines (National airlines)
- Handle the majority of regional cargo without being specialized in cargo carriers.

From major airport’s properties, regional airport’s features can be depicted as follows:

- Point to Point operations
- Handle short haul services
- Combine operations of their national airline with international airlines specialist in a particular air traffic niche
- Play a complementary role in different air traffic niches (tourist, business, freight, low cost, etc.)

However, secondary airports in megapolis combine both regional and major airports performances. Their volume of air traffic might be so high that they are able to handle transcontinental destinations, lots of tons transported, or operations from major airlines; being able to play also a tourist, domestic, or low cost role. They perform an hybrid role, that could be partly explained through their life cycle, because generally they are former major airports that air traffic evolution has turned into complementary platforms.

2.4 Joint analysis. System’s (Internal) Matrix

The use of the different behavior ratios allows drawing the personality of a particular airport. However, the research on airport systems has to provide tools to depict not only airport individual attributes but also joint performances.

Hence, a new methodology that combines collective and individual information of an airport system and its members is presented: the System’s (Internal) Matrix.

\[
\text{INDIVIDUAL + JOINT = SYSTEM’S (INTERNAL) MATRIX}
\]
The System’s (Internal) Matrix has its origin in the Boston Consulting Group matrix (Bruce D. Henderson), a model developed in the early 70’s for portfolio management. Thanks to its simplicity, nowadays it is widely used as a strategic tool that allows a fast position of a particular company in its market using two variables: market growth and company share, which are drawn on two Cartesian axis.

Depending on the combination of variables, four kind of companies are identified:

- **Cash Cow**: large market share in slow growing market, meaning little investment and easily generating cash.
- **Star**: large market share in fast growing market. Stars may generate cash, but as the market is growing rapidly they require investment to maintain their leadership. If successful, a star will become a cash cow when its industry matures.
- **Question marks**: small market share in fast growing market. It usually requires resources to acquire additional market share, but whether they will succeed and become stars is unknown.
- **Dogs**: Small market share in slow growing market. Unless a dog has some other strategic purpose, it should be liquidated if there is little prospect for it to gain market share.

As depicted, the BCG matrix draws the position of a particular company, without considering any relationship between the different components of the market.

In airport systems, once an airport is described by individual behavior ratios, an aggregate consideration joining individual features should be conceived. This requirement can be obtained through the modification of certain parts of the primary BCG methodology, obtaining the Airport System’s (Internal) Matrix.

System’s (Internal) matrix. Methodology that depicts the internal performance of an airport system through the joint analysis of the individual features of its airports. The matrix is conceived as the answer for two subjects:

- Dynamics of air traffic. Depicts the evolution of the internal distribution of air traffic.
- Grade of specialization of airports serving a particular region. The matrix contrasts market segmentations in the system.

Air traffic dynamics will be drawn by the growth matrix whereas the specialization is described by the attribute matrix.

### 2.4.1 Growth matrix

Growth Matrix compares annual passengers between each airport and the major airport of the system, also comparing component’s individual air traffic increases. The values that are drawn in each axis are:

**X axis**: Share Ratio. It is obtained by dividing the volume of annual passengers of the airport studied by the same unit of the largest remaining airport of the system. Hence, whereas system’s major airport is compared to the second, the rest of secondary airports are related to system’s major facility. Instead of using the share of air traffic market of each airport, this comparative index allows the addition of new regional airports in the analysis, without having to recalculate the parameters of the rest of the system’s components.

Major airports have share ratios higher than 1, whereas secondary airports possess values between 0 and 1. The results widely vary.
depending on the polarization of air traffic in a system. So that, the use of a logarithmic scale is more suitable to obtain a clearer representation of system's performance.

Y axis.- Air traffic growth of each airport in the last 5 year period. The 5 year period has been conceived to analyze a segment of time enough to be uninfluenced by punctual contingencies that would distort the analysis if an annual period was taken into account. In order to differentiate between fast and slow growing dynamics a frontier has been established on a 30% increase in five years (5.5% yearly cumulative).

Example. Calculus of Airport System's Growth Matrix composed by 3 airports

The analysis of the internal dynamics of a system is carried out by measuring the horizontal (x) and vertical (y) distances between the components of the system.

X distance. Measures the grade of concentration of air traffic in the region. Shorter distances mean airports with balanced performances, whereas longer distances show that the airports have severe differences and the system is composed by one dominant airport and several facilities with a residual role in regional air traffic activity.

Y distance. Heterogeneity between airport’s attributes. Long vertical distances mean different airport speeds; several growing rapidly and some having a more mature performance with moderate values of air traffic growth.

The combination of vertical (Y) and horizontal (X) distances provides different airport systems structures, Air traffic dynamics, which are described as follows.

• Mature region. The region is close to its operational or social limits or has run out of its capacity of air traffic generation / attraction. So that, all airports of the system are located in the lower part of the matrix, having five year increases lower than 30%.

Generally the mature region presents high values of air traffic generation, in other words, many passengers per regional inhabitants. Examples of mature regions are Dallas, where airports are decreasing; or Hawaii, where airports have imperceptible air traffic increases.

• Hubbing. System’s components have different dynamics: whereas higher increases of air traffic (>30% in five years) appear in system’s major facility, secondary airports present lower growths. The concentration of services around the major facility means the increase of matrix’s horizontal distance, as the increase of regional air traffic is mainly absorbed by the system’s major airport.

It is a desirable solution where components having lower air traffic increases are threatened by environmental problems. However, taking
into account that a constant growth concentrated in a single airport may collapse region at mid / long term, it is recommended the search of new regional facilities to complement major airport's performance.

Paris follows this dynamics, where the social limitation at Orly airport due to a location that forbids the increase of operations means that Charles de Gaulle is overcoming higher increases of air traffic.

• **Changing dynamics.** While system's major airport presents a moderate increase, lower than 30% in the last five year period, regional airports have growths clearly higher than the 30% boundary. In such systems, even though the major airport may be able to keep on growing, the collective system's dynamics is changing towards regional airports. As these facilities have higher increases of air traffic they are taking up a more important position in the system.

It is the classical dynamics of regions having its major airport collapsed, which are betting for regional airports development. This solution is carried out through the move of less profitable activities from major to regional airports. Then, the final result is a *win/win agreement* between airports belonging to the same system, developing new synergies themselves, as major airports win qualitative capacity and regional facilities quantity of services.

**MAJOR AIRPORT QUALITY WINS REGIONAL AIRPORT QUANTITY**

Megapolis are the territories betting for a change of dynamics. Even though they are going against the most basic capital amass principles, the congestion of air traffic in the region almost forces the delegation of some activities to secondary airports.

In London airport system, Stansted and Luton present spectacular increases of air traffic due to their specialization in low cost carriers. San Francisco, where San Jose airport is improving its position in regional domestic market, is also changing its system's dynamics.

In addition, it is common in Archipelagos, where hub airports are losing air traffic share in front of regional airports, as happens in Balearic, Canary islands, or Hawaii.

• **Fast Growing Regions.** The region presents a situation where all its components have increases of air traffic higher than 30% in the last five year period.

The general increase of air traffic usually takes place in young regional territories, where there is a conjunction of available air traffic capacity at its airports, and an improvement of its regional position in the continental market, which is translated into an increase of attraction / generation of air traffic.

**Air traffic dynamics**

Barcelona follows this dynamics: while el Prat is growing rapidly, Girona and Reus are also increasing their regular services thanks to low cost carriers; Ryanair in Girona and Hapag Lloyd Express in Reus.
2.4.2 Attribute Matrix (Freight, destination, and airline)

The attribute matrix in a system presents the same structure than the growth matrix, only that five year air traffic increases that were drawn on the y axis are replaced by one of the attribute ratios that were used to depict each airport: freight, destination, airline or transfer ratios (see chapter 2.3).

Hence, a new matrix is achieved, which draws airport individual features and the grade of system’s specialization. The results of the attributes matrix show the different ways in which regional airports do position themselves in air traffic market, being useful samples to consult when planning air traffic in a region.

**Freight matrix.** The matrix draws the different weight of cargo in the airports belonging to the system, showing the different grade of specialization of each component and the weight of cargo activity.

The cargo distribution in a system is related to airlines and destinations. As main cargo carriers are major airlines that operate at major airports, large facilities usually have higher absolute volumes of tons transported.

Regional airport’s performances vary from being pure cargo specialists to handle only passenger services. So that, related to freight, the following types are identified.

- **Regional cargo.** A system has a regional airport dedicated to cargo, being hub of carriers as TNT, UPS, FedEx, etc. It is a regional airport with values of freight ratio widely higher than the rest of system’s members.

Generally, it is a solution that is only feasible in cargo territories, where the weight of freight allows the existence of regional cargo airports in the system.
b.- Cargo Hub. Hub airports combine passenger and freight services. The high volume of tons transported annually is compensated by the number of passengers, what gives a medium value of freight ratio.

It is the usual performance of system’s major airports, which ratio varies depending on the importance of cargo activity in the region.

c.- Passenger specialist. An opposite trend in regional airports is their specialization in passenger operations. Moreover, most of them have a clear tourist orientation, meaning low values of tons transported, which is translated into freight ratios distant to the ones that regional cargo and cargo hubs possess.

Destination matrix. The matrix depicts the different range of flights that are predominant in each system by representing the domestic ratio on the y axis. Generally, the airport with higher volume of air traffic is the one that handles long haul flights, whereas regional airports are dedicated to domestic and shorter international destinations.

However, Tokyo runs against this trend, where the combination of Megapolis and Archipelago features leads to a situation where domestic flights dominate regional air traffic.

There can also be secondary airports handling long haul services, but it is a solution that only happens in megapolis, where air traffic volume and destinations are so high that, in terms of haul, there is no difference between airports. Examples of this behavior are Paris Orly or London Gatwick, which although they have higher domestic ratios, they also link the region with intercontinental destinations. These airports are conceived as second class airports, connecting the region to tourist destinations or ancient colonies (Paris and Africa; London and India; USA, or Caribbean).

Airline matrix. Closely related to destination matrix, it draws airports behavior depending on the category of its airlines. Generally, major world airlines are located in the major airport whereas regional airports mostly receive flights from national, regional, or specialists (low cost, freight, etc.) companies.

Nowadays, major airports become multi airline hubs, receiving flights from several world carriers belonging to a particular alliance (Frankfurt Main is Star Alliance Hub, Paris Charles de Gaulle is Sky Team Hub, etc.).

This situation gives a chance to secondary airports to become hubs of non allied airlines, whether international or domestic. Nevertheless, the most important opportunity for regional airports is the recent development of low cost carriers that have created a continental network composed by forgotten regional airports, most of them about to be abandoned, without handling any regular service or only operating at peak time periods receiving recreational non scheduled flights.

Airline Alliances provide worldwide coverage

<table>
<thead>
<tr>
<th>Alliance</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>One World</td>
<td>Aer Lingus, American Airlines, British Airways, Cathay Pacific, Finnair, Iberia, Lanchile, Qantas</td>
</tr>
<tr>
<td>Star Alliance</td>
<td>Air Canada, Air New Zealand, ANA, Asiana Airlines, Austrian Airlines, BMI, Lauda, Lufthansa, Mexicana, Scandinavian Airlines, Singapore Airlines, Spanair, Thai, Tyrolean, United</td>
</tr>
<tr>
<td>Sky Team</td>
<td>Aero Mexico, Airfrance, Alitalia, CSA, Delta, Korean Air</td>
</tr>
</tbody>
</table>
Regional opportunities

Thanks to the joint understanding of airports, the promotion of a system in a particular territory has different interests, from a more efficient air traffic management to an approach between different regions.

The options in hands of regions to promote a more balanced distribution of air traffic and to develop territorial synergies between each other are the topics depicted in this chapter.

**AIRSIDE INTERESTS MAY BE ALIGNED WITH LANDSIDE INTERESTS**

### 3.1 Air traffic solutions

An airport system obeys the immediate need to provide solutions of air traffic management in a particular territory through the promotion of regional airports.

Regional airports usually play a complementary role through their specialization in a particular niche of air traffic. Hence, the different options that regions may take are studied following regional airports’ features.

#### 3.1.1 Freight specialization

Freight market is closely related to major airlines structure. As they usually settle their operations in world hubs, in absolute terms, freight operations are concentrated in major international airports. However, there are several cargo carriers, as DHL, FedEx, TNT, or UPS; whose operations are unlinked with passengers services.

Therefore, it becomes an excellent opportunity for regional airports, which are able to acquire a pure cargo hub role. As their passenger activity, related to cargo, is rather low, these airports are considered cargo specialists.

Nevertheless, even the freight specialization is a feasible solution in several territories, two premises should happen in regions and their airports for the success of cargo activity in a particular system.

- **Central placement.** The airport system or the regional airport has to be centrally located, close to major industrialized areas.

- **Accessibility.** Airports’ convenient location should be complemented by an excellent accessibility. The airport should be linked with main transport and logistic nodes, developing intermodal synergies.

The composition of a cargo region, then, combines a major airport having passengers and cargo operations and regional airports where the cargo activity clearly dominates. Airports as Frankfurt Hahn, Glasgow Prestwick, Bergamo
Orio al Serio, or Liège can be considered cargo specialists, complementing the cargo activity of system’s major facility.

Promotion of cargo services in Skavsta

3.1.2 Specialization by destination

The intuitive idea of a regional airport consists in an infrastructure with lack of activity and few regular flights, mostly at peak periods due to tourist interests. On the other hand, international airports are depicted by their long haul, business destinations, and first class flights.

So that, the distribution of airport destinations is an element to discuss when studying airport systems, being able to be analyzed through its haul or its quality.

3.1.2.1 Haul specialization

Regional airports usually have shorter ranges of destinations compared to major international facilities. Whereas major airports combine all kind of destinations, smaller platforms generally provide domestic and international services.

\[
\text{REGIONAL} = \text{DOMESTIC} + \text{INTERNATIONAL} \\
\text{HUB} = \text{DOMESTIC} + \text{INT'L} + \text{INTERCONTINENTAL}
\]

In major hubs, although the share of domestic flights may be important, their main aim is to provide world accessibility to major regional nodes through the promotion of transfer flights.

Therefore, the configuration of air traffic disallows the segregation of the totality of domestic or international (within continent) air services, what would be against the classic hub-spoke structure followed by air traffic. However, regional airports can become short haul specialists, having not only links with their national hub but also point to point services with other regional platforms or continental hubs.

From haul viewpoint, regional airports can be grouped as follows.

- **Domestic.** Regional airports that are linked with major national hubs.

- **International.** Regional and international airports placed in continental tourist locations that have a strong seasonal activity, mainly from international non scheduled services, concentrated in summer months.

- **Intercontinental / Former Colonies.** Large European megapolis usually have high demand of intercontinental tourist services. In addition, they are located in countries with an ancient colonial past, still existing a close economical relationship between the country in the centre and the one in the periphery, so that an intense communication between them is needed.

Then, there are secondary airports in Megapolis where intercontinental services have an important share, as Paris Orly and London Gatwick.

Hence, the performance of regional airports allows the decongestion of the system in the following ways:

- Supply of domestic and international destinations, owning several international point to point services with lack of interest for major airports, or new links that could be promoted through new non centralized services.

- Links with major continental hubs, building a more cohesive airport network from regional and continental viewpoints.

The different ranges of flights in regional airports can vary depending on geography and administrative divisions, but the most paradigmatic haul segmentations are depicted as follows.
• **International/Domestic.** It is the most common structure in American systems and small regional systems in large European countries. Whereas major airports are international hubs, secondary are exclusively dedicated to domestic destinations, being able to become domestic air traffic hubs in American megapolises.

As formerly depicted, Tokyo has a drastic segmentation by destination, where the busiest airport of the system (Haneda) is a domestic specialist, only handling flights within Japan but doubling the traffic of Narita, first international Japanese airport. This situation is explainable due to the dual performance of the region, that has both megapolis and archipelago features.

• **Intercontinental/International.** Whereas major airports provide several intercontinental services, regional airports mostly handle international links due to the country size or tourist orientation of system's air traffic. The abundance of administrative divisions in Europe makes this segmentation to be the most common in this continent.

3.1.2.2 Railport system

It is a system that combines air and rail traffic. The airport is oriented to international destinations, even though it is also able to have a significant share of domestic flights. Nevertheless, its main feature is the promotion of rail services for domestic destinations. The international airport maintains its natural hub/long haul performance handling international flights whereas a share of domestic flights are made by rail.

• **INTERNATIONAL = AIR**
• **DOMESTIC = RAIL**

The feasibility of the system depends on regional size and urban morphology, being recommended in medium territories with a dense urban network without a strong dependency on a particular city (Central Europe alike).

The structure is a hub/spoke performance where spoke airports are substituted by rail stations and point to point services by linear accessibility, obtaining a denser transport network than the one composed exclusively by airports.

- **REGIONAL AIRPORT vs TRAIN STATION**
- **POINT TO POINT vs LINEAR ACCESSIBILITY**

Apart from territorial constraints, the viability of this solution also depends on the following features:

- **Airport rail station location.** Location is the key aspect to success in the intermodal development of the system; the element that may bring convenient modal public transport shares. The station should be easy to identify and a short path within the airport without architectonical barriers should be guaranteed. Then, the most desirable locations are below or adjacent to airport terminal, as the passenger will perceive its trip as a single non stop intermodal journey.

- **Air rail facilities:** In town check in. Checking in at rail stations provides not only continuity to the journey (airport services are available in towns) but also the possibility to passengers to get free from their luggage during the intermodal trip, leaving it at the initial airport/rail station and picking it up at the destination rail station/airport.

- **Promotion and integration of information between services.** On-line information of flights at regional rail stations should be complemented by the promotion and information of collective public services at airports and on board. For example, in Ryanair’s flights to Stansted, discounted Stansted Express tickets are sold (the ticket on board costs 9£ whereas its normal fare is 13£).
Frankfurt air rail station is fully integrated in German HST network

A reference distance to assure railport system’s viability is about 600 kms or 2h30’ trip time. These references level air and rail gate to gate times, but lower cost of rail, and easier accessibility and checking in procedures, make this option more suitable for many passengers.

Frankfurt Main airport station, having 4 High Speed Train (HST) lines that link the airport with major German cities, and Schiphol station that links the airport with more than 70% Dutch rail network destinations are the most representative cases that may develop a railport system.

3.1.2.3 Quality specialization

The quality of flights is another attribute that also differentiates regional from major airports. Closely related to airline specialization, quality segmentation refers to the aim of the journey: whereas tourist and leisure purposes are considered as second class trips, business purposes are classified as first class.

Generally, there is a direct relationship between quality of flights and airport size, as the quality increases with the number of annual passengers.

+ PASSENGERS + QUALITY

The quality of the flight is generally related to its haul, in the way that longer distances mean higher quality. However, some secondary airports may have all kind of ranges, having most of them recreational purposes.

From quality point of view, two different regional airport’s performances are identified.

- **Leisure.** Orientation to tourist and leisure services, mainly non scheduled and concentrated in peak summer months.

- **Mixed.** Combination of leisure and several business regular services to major airports.

Although the quality of destinations is closely linked with the quality of airlines operating in each airport, airline segmentation has been analyzed independently due to the recent growth of new air traffic niches.

3.1.3 Airline / low cost

In the last decade, thanks to air traffic deregulation policies, new niches of air traffic have been born and, in particular, a new kind of airline whose business consists in the supply of discounted regular services: **low cost airlines**.

Low cost carriers undergo an unstoppable growth
Price is the key aspect to guarantee low cost carriers success. In order to supply low fares, several measures to limit costs are carried out as, for example, the possession of homogeneous fleets in order to reduce maintenance costs of the aircrafts, reduction of on board facilities and crew, promotion of on-line sales and, regarding to airports, the search of cheap slots.

Low cost business allows a win / win / win agreement between passengers, carriers, and regional airports.

Ryanair’s cost advantages

Low cost carriers operate in...
• major airports at off peak periods
• regional airports

Air traffic forecasts and the natural trend of concentration of value added services in major airports, recommend the handling of low cost flights at regional airports, measure that will allow a growth in terms of quantity and quality in international airports.

Hence, the consolidation of niches as low cost, that are nowadays having a 7% of European air traffic, is a challenge that should be eagerly welcomed by regional airports.

Even though smaller airports have poorer facilities and locations away from major regional urban nodes, forecasts estimate a share of 14% of low cost carriers at the end of 2007. Then, for a large number of airport passengers, fare is the most important aspect of the trip, specially when travelling for leisure purposes.
Low cost airlines provide a new scenario for regional airports. They may become specialists and, hence, absorb the totality of this niche, what drives to a sharp segmentation between them and major airport of the system, which should be focused on business and long haul services.

The structure of the destinations of low cost airlines shows how regional airports can contribute to the development of air traffic. Depending on the airline size, two different structures are identified.

- **Primary Hub Spoke Network.** Major low cost carriers have this kind of structure. Hub airports may be a major airport of a regional system or a secondary airport in Megapolis. The most paradigmatic low cost hub is Stansted, which has raised its number of passengers a 300% in the last 5 year period, becoming Go Fly/Easyjet, Ryanair or Buzz hub amongst others.

  Even though this structure trends to the centralization of operations in a particular airport, transfer shares are weak. So that, the distribution of destinations obeys regional direct demand.

- **Point to Point.** The most common structure of low cost airlines is a polygon, whose vertex are the different airports where the carrier operates. Both major or small low cost carriers may have this structure. Whereas the firsts combine the hub/spoke structure with several point to point destinations, smaller carriers exclusively follow the last structure. Passengers in transfer are also insignificant, due to low volume of traffic at regional airports, unusual schedules, and short number of services provided in regional facilities.

Low cost carriers’ structures vary from hub / spoke to point to point

Whether the regional airport is a vertex in a polygonal gate to gate structure or a spoke in a more consolidated network, the specialization in low cost airlines is its most direct way to develop. The success of this carriers has meant the reborn of several airports that were almost abandoned during many periods of the year or dedicated to freight and other non commercial air activities.

So that, low cost promotes new territorial nodes through the development of airport landside, providing accessibility facilities and developing business and commercial activities in airport surrounding areas. Even though, due to their air traffic volume, airport city concept is too ambitious, potential income from parking, shopping, and other non directly related to air traffic activities are elements that assure them a healthy life.

Skavsta and Vasteras in Stockholm, Girona in Barcelona, or Frankfurt Hahn show how a regional airport can become a low cost specialist.

### 3.1.4 Split

Regional air traffic is divided into several airports that have common features, combining freight and passenger activity with similar structure of destinations. Hence, the system is split in Siamese parts.

However, the natural trend when airports work together is the segregation of their activities, having far different features. So that, air traffic split only occurs under certain circumstances:
• **Megapolis.** In large metropolitan areas, the volume of air traffic is so large that several airports have to develop the same role. In New York, the system is composed by two split international hubs, Kennedy and Newark, that even having own peculiarities, have high ratios of international flights, similar freight ratios, and parallel category of airlines. The system is completed by La Guardia airport, fully dedicated to domestic services.

• **Regional.** In regions having moderate air traffic activity and where the territory is clearly polarized around certain urban nodes, airports located in each particular city perform in a similar way. The components of the system have international services connecting each city with major continental hubs.

Regional split may be found in regions where the airport system concept is not being considered, meaning that each airport has a direct identification with the city that serves. So that, the system is a conglomerate of infrastructures that maintain their particular features and perform individually. Glasgow and Edinburgh, main Scottish airports, are an example of this performance: they have similar distribution of destinations, volumes of air traffic, and almost common airlines.

In practical terms, split and airport system are non aligned concepts. Whereas the airport system seeks the promotion of regional airports through their specialization, a split would mean a parallel development of different airports and the lose of synergies that could be obtained by the segregation of air traffic activities.

### 3.2 Regional synergies

An airport system has to be analyzed as more than a mere solution of air traffic management. It is also an opportunity to explore the different synergies that can be obtained between territories belonging to different administrative units that share common air traffic infrastructures.

Regional synergies can be obtained through airport sharing

Revised regional synergies can be obtained through airport sharing

AIRPORTS ARE TRANSREGIONAL FACILITIES

The consolidation of this solution can promote the use of medium international airports, which can increase the quality of their operations, acquiring more importance as hub/transcontinental airports thanks to a new hinterland, composed by territories belonging to different countries.

Nevertheless, regional synergies are not properly an airport system; they are closer to a territorial system concept, or a group of territories that are served by one or a group of airports.

**TERRITORIAL SYSTEM: SEVERAL REGIONS FROM SEVERAL COUNTRIES SERVED BY AN AIRPORT / AIRPORT SYSTEM**

Hence, air traffic infrastructures behave as territorial cohesive elements, strengthening the relationship between different areas. Amongst Europe, some paradigmatic examples could be the following:

• Lyon Saint Exupéry and Geneva, which have 30% passengers from Switzerland and France respectively, form the Alpine Airport System.

• Baltic Air Sea link Between Helsinki and Tallinn. Promotion of Vantaa airport (Helsinki) as the major international gateway to Estonian inhabitants.
Oresund bridge allows the development of regional synergies between Denmark and Sweden.

- Oresund bridge between Copenhagen and Malmö promotes the use of Kastrup airport by both Danish and Swedish inhabitants, whereas Malmö airport may be conceived as the secondary airport of the system.

- Consolidation of Vienna airport as Slovak Republic hub; so that a transnational system can be formed, composed by Vienna international airport and Bratislava Stefanik, which is becoming a low cost specialist, market that Vienna airport has not developed.

Helsinki Vantaa is major Estonian international gateway due to the development of an air sea link between Finland and Estonia.
4.1 Management

Once identified the different options that airport systems have from transport viewpoint, the viability of an airport system has to be completed by the search of different management options, obtaining a receipt suggesting the most efficient solution in each case. Systems have to be analyzed from a double viewpoint: integration management and the ownership / body in charge of each airport.

4.1.1 Integration of management

The different components of a system can be either managed by a single body or each one might be owned by different organizations. In addition, intermediate solutions consisting in a group of airports jointly and some individually managed are also feasible. The features that depict each kind of management can be summarized as follows.

4.1.1.1 Individual

Each component of the system is in hands of a different owner that can be either private or public. Decentralization of property is an excellent opportunity for regional airports that belong to investors fully dedicated to airport management, as they search dedicated opportunities in each facility.

Hence, when conceiving an airport system is in a neutral position from air traffic viewpoint, individual management allows the growth and the autonomy of smaller regional platforms.

### INDIVIDUAL MANAGEMENT: DEDICATED OPPORTUNITIES

Several examples can be found both in Europe and America. Some examples are Belgian regional airports; San Francisco Bay Area system, or Skavsta; which even though the existence of LFV in charge of Swedish airports, it is controlled by TBI, a British company specialist in airport management.

4.1.1.2 Collective / Joint

The different members of a system are managed by a single organization.

The success of this solution depends on the guidelines of the company, that can vary from the concentration of services into a single airport to the search of solutions that balance air traffic between system’s components.

As the natural trend of air traffic consists in the concentration of services around a particular airport, this solution is being usually taken where the consideration of an airport system is almost compulsory. Hence, both Megapolis and archipelagos, where the performance of regional airports is almost indispensable, should bet for a joint administration, as it allows a more efficient management of air traffic and the obtainment of group synergies.

A final requirement to guarantee the success of a collective administration is the need of similar regional magnitudes between the airport system and the owner body. State should control a national airport system, whereas regional airport systems should be managed by regional or metropolitan authorities.

Examples can be found in European Megapolis, as Paris and London (with the exemption of Luton and EMA), or regional territories (Milano or Dutch airport system/Schiphol Group); being also the most common option in major American systems.
4.1.2 Airport ownership

A complementary approach to airport management can be carried out through the search of the different owners that an airport/airport system is able to have.

Airport ownership options

4.1.2.1 Private ownership

A private investor, specialized in infrastructure management, is in charge of the airport, seeking the best opportunities for its development.

Investors can manage either the whole system or a particular member. BAA plc, the former privatized British Airports Authority, is an example of the first case, an enterprise in charge of the most important British airports.

Private management is widespread in small regional airports, that are conceived as a business unit to be exploited, generally driving to a sharp specialization in freight or low cost carriers, making corporate airport systems.

Corporate Airport System could be defined as a group of airports managed by a single private organization. Then, an airport network without any territorial sense is created. This definition is aligned with COFAR (Common Options For Airports Regions) airport system concept (2000).

TBI, a British company dedicated to airport management is probably the most illustrative example, owning a transcontinental network with far different members as Bolivian airports, Orlando Sanford, East Midlands, or Skavsta.

4.1.2.2 Public ownership

The airport is owned by a public body, that can vary from a metropolitan to a national authority.

**National authority.** National body managing all airports of a country, becoming the National Airport Authority. It is a common option taken in large countries that have a consolidated hub/spoke structure based on their national airline and their major city.

The rest of the components of the system, even though they can still maintain some quality international links, usually have a strong dependency on their major national hub. Moreover, smaller regional facilities usually have rather interest at short term, what means the lose of regional viewpoint.

There are two bands in Europe, North and South rims, that concentrate the countries that have a national airport authority.

- Southern rim: Mediterranean countries as Spain, Portugal, and Greece.
- Northern rim: Nordic countries as Sweden, and Finland.

**National public authorities are located in European North and South rims (with the exemption of Italy)**
**Regional authority.** The airport is owned and managed by a regional public authority. Examples of this behavior can be worldwide found in all kind of systems: New York / New Jersey airports and several Belgian regional airports as Ostend.

**Metropolitan authority.** Even though airports may be located in towns in the neighbourhoods of the major city, a single metropolitan authority is in charge of the entire airport system. This concept brings opportunities for regional airports located in systems where even though the international airport is clearly dominant, the promotion of small platforms is essential to safeguard a sustainable growth at mid and long term. So that, the metropolitan ownership has great interest due to its micro level scope, that allows an individual dealing.

**3 layer structure.** The structure of the system’s ownership is composed by three steps/layers of implication.

The first layer is composed by airport’s shareholders, that can be either public or private. So that, contrary to former management solutions, the airport can be in hands of several public bodies, from metropolitan to national, having different shares of participation in airport’s capital. Hence, the system is controlled by a balanced system of forces that should make compatible metropolitan, regional, and national interests.

System’s management, however, is in hands of a private company, which is formed through shareholder’s agreement, becoming the second layer of the structure.

First and second layers viewpoints are strategic, whereas the tactical and operational decisions are taken by a new layer, that is composed by specialized companies that develop the most technical activities, supervised by airport management company.

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**3 layer management structure**

The main proof of the success of the structure is its spectacular diffusion in European continent, becoming nowadays the most spread solution related to airport management. Many examples that illustrate how a system can be managed by a 3 layer structure can be found: Schiphol Group, Fraport in Frankfurt Main, SEA in Milan, or Berliner Flughäfen.

The convenience of this solution can be summarized in the following topics:

- Allows the participation of all interested authorities and private investors, and reconciles their opposite interests
- Relies the management of airports on a private organization, promoting a professional, dedicated, and transparent management.

**4.2 Accessibility and commercial diffusion**

Apart from transport, land, and management requirements; there are several aspects that are worth to be considered not only for the consolidation of each member of the system but also for the success of the regional network created by airports.

Accessibility and promotion of public transport to airports combined with the need of commercial and marketing initiatives are the most important issues to be complementary considered.
4.2.1 Accessibility

Accessibility is a key aspect to assure the success of an airport system, as it links land and airside viewpoints. The study of this subject has been carried out, until now, at major airports, but the intense increase and the new dimension that regional airports are acquiring, lead to extend accessibility concern to all members of the system.

50% of passengers and airport workers accessing in collective means of transport is the goal share that has been considered, already suggested in the former ARC publication Promoting Public Transport to Airports (1999).

CHALLENGE: 50% PAX BY PUBLIC TRANSPORT

In addition, when planning airports accessibility some reference values relating passengers with public transport facilities are needed, summarized in the following figure.

<table>
<thead>
<tr>
<th>Transport mode</th>
<th>MM of pax (annual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Station</td>
<td>always</td>
</tr>
<tr>
<td>Rail</td>
<td>10</td>
</tr>
<tr>
<td>HST / Dedicated link</td>
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Considering system’s viewpoint, new connecting facilities are required, what adds cohesion and complexity to regional transport network. The most relevant change consists in the substitution of city accessibility by regional accessibility concept. Hence, new services have to be conceived, adding new facilities for major city inhabitants and also for secondary urban concentrations.

FROM CITY TO REGIONAL ACCESSIBILITY

Different accessibility requirements regarding airport systems are depicted as follows.

4.2.1.1 International airports

Accessibility should be understood as an essential part of the airport city, conceiving the airport and its transport facilities as one of the most important intermodal nodes of the territory. The evolution from city to regional requirements means an extension of the area served by public transports. So that, solutions as regional bus stations or regional rail stations located in airport cities should be conceived.

Major European international airports generally promote direct rail services

4.2.1.2 Regional airports

The most desirable solution should assure collective public transport links from airport to the adjacent city centre and links to other regional nodes if possible. However, the success of public transport means in regional airports is really difficult to achieve due to the usual lack of road traffic problems when accessing to them, and the availability of low cost or free parking slots.

Apart from measures mentioned above, suitable road links should be also promoted, safeguarding constant non congested traffic conditions when accessing to airports.
4.2.1.3 Connectivity between airports

A close relationship between the members of the system may suggest conceiving public transport links between airports.

However, air carriers operations structure is generally centralized around a particular airport, which develops a hub performance promoting transfer services. Hence, the use of different facilities of an airport system to complete a single trip is unusual.

So that, public transport facilities connecting regional airports with their major hub are, in theory, inefficient solutions to promote the increase of its share. Only where the location of each airport allows an easy link between them or in systems having a drastic segmentation by destination (that might allow air-rail links), inter-airports facilities could have a particular interest.

Nevertheless, the existence of public transport networks connecting regional infrastructures is being used in marketing and image campaigns.

Freight specialization. Intermodal facilities are the key to guarantee the development of freight specialists. Cargo should be linked with major industrial and logistic nodes, easing freight distribution within the territory.

Tourist / low cost specialization. Considering the small size of regional airports and the absence of pressure demanding accessibility facilities, regional airports links are clearly backward compared to foreseen needs.

Regarding to accessibility, low cost passengers have a particular profile, as they value the flight fare as the most important expense of their journey. So that, they prefer longer distances to main regional nodes or worse accessibility facilities (lower frequencies, higher travel times or absence of rail links).

A low cost flight should consist in a low cost intermodal journey

Nevertheless, even though air fare is the most important aspect when choosing the service, an advanced customer would consider the cost of gate to gate journey (between city centers) to compare the generalized price of low-cost carriers versus conventional airlines.

Hence, a regional airport without convenient accessibility facilities loses part of its competitiveness in front of other components of the system that are able to combine economic fares with attractive links to major urban nodes.

Therefore, the lack of a correct integration between the airport and its hinterland may transform regional airports in sole infrastructures, having poor locations and being only accessible by private means of transport, dissuading many passengers from its use.

4.2.1.4 New air traffic needs & accessibility

As depicted in former chapters, the future of regional airports is directly related to their bet for specialization in different air traffic niches, which have different features that suggest an independent analysis.

London airport system public transport network

Nevertheless, a regional airport without convenient accessibility facilities loses part of its competitiveness in front of other components of the system that are able to combine economic fares with attractive links to major urban nodes.

Therefore, the lack of a correct integration between the airport and its hinterland may transform regional airports in sole infrastructures, having poor locations and being only accessible by private means of transport, dissuading many passengers from its use.
4.2.1.5 Planning accessibility efficiently: steps to analyze

The different steps of the journey that have to be considered if a successful public transport link is desired, are summarized as follows:

1. Before going to airport: at home
2. Towards public transport trip
3. Baggage
4. City station
5. From city to airport trip
6. Airport
7. Airport public transport station
8. Information
9. Marketing and distribution
10. Image and perception
11. Airport integration in the region

4.2.2 Marketing activities
Commercial diffusion

The final topic that has been drawn is related to the essential role played by communication. If an integrated image of transport network is desired to be promoted, a measure that may decisively contribute consists in choosing the most appropriate message to diffuse to regional inhabitants, capping the system all.

Ideas that should be transmitted must refer to integration and balance objectives, goals that the implementation of an airport system provides to the region. Then, the promotion of the system ought to be taken from two different but convergent viewpoints.

• **Systemic viewpoint.** The network composed by the group of airports belonging to a particular region has to be considered as a single unit, which combines different opportunities located in different facilities and allows not only the growth of traffic but also the chances available for system’s customers.

**ONE MISSION... ONE IMAGE... ONE SYSTEM**

Then, the customer should understand the system as a multiple choice, where his mobility requirements determine the election of a particular airport. In addition, even though the user might be forced to use a particular facility, this limitation has to be understood as a system feature, consequence of an eventual segmentation by destination; never as a lack of destinations provided by a particular airport.

• **Balance viewpoint.** Social benefit of an airport system is a key idea to promote. Some concepts to develop are:

  - **Balance of territory.** By the promotion of regional airports, the airport system allows the birth and growth of new economical nodes in the territory whose activity is a direct consequence of the bet on regional airports.

  - **Balance of air traffic.** The release of major hub’s slots and the promotion of regional airports may be a convenient strategy for both facilities and, therefore, for the whole system.

**Massport: Promoting a balanced distribution of air traffic in New England**

![Massport Map](image)
Wrapping up,

Airport systems...

• are nowadays a solution to absorb air traffic increases, becoming the only alternative at long term

• are located in territories that can be classified depending on regional morphology and air traffic, obtaining 3 different cases: archipelagos, megapolis and regional

• promote the participation of regional airports in air traffic market

• allow the development of new niches of air traffic focused on regional airports. Freight and low cost niches are the most common solutions.

• allow a quality growth of major international airports, which can strengthen their business class performances

• contribute to unite territory, creating new economical centers of activity and intermodal nodes

• Have different dynamics that can be analyzed by an own methodology: System’s (Internal) Matrix. Several behaviors can be found

a. Fast Growing Regions. All airports quickly growing

b. Hubbing. Major airport grows faster than secondary ones, absorbing regional air traffic increase

c. Changing Dynamics. Regional airports grow faster than major airports, absorbing regional air traffic increase

d. Mature Regions. All airports develop slowly

the 10 Commandments

1. Planning at long term. Use of air traffic forecasts to conceive best solutions for territory, considering the stiffness of airports as infrastructures

2. Airport system cannot be analyzed as an exclusive air transport matter. Socioeconomic and land planning aspects should contribute to establish the most suitable solution

3. Internalize airport’s external costs in order to obtain better diagnoses when planning an airport system

4. Understanding regional infrastructures from a joint viewpoint instead of an arithmetic addition of transport facilities: take advantage of system’s synergies

5. An airport should not be considered as a mere transport infrastructure, but as an economical node. The promotion of different components of an airport system adds regional cohesion thanks to new urban developments in the region

6. Regional airports are able to play a complementary role and have to be jointly conceived with major facilities when planning measures to absorb regional air traffic demand
7. Regional airports should take profit of the proliferation of new air traffic niches, as low-cost or freight carriers.

8. Local or regional administrations should take part in airport management in order to safeguard regional interests in front of concentration tendencies that national administrations promote.

9. Provide adequate accessibility facilities to major and regional airports, linking them to main urban nodes.

10. Airports help breaking administrative barriers, allowing the creation of spontaneous synergies between regions belonging to different countries.
# Showroom

30 Airport System’s Tales

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The Irish state company Aer Rianta is one of the most paradigmatic examples of how airport ownership and management, complemented by the development of some of their services, can drive to a corporate airport system. Nowadays the company is in charge of major Irish airports and has increased its activity towards different European regional facilities. In addition, duty free activities at many platforms all over the world are being promoted.

I.- From airport to system managers

Aer Rianta, as a state company, is born in 1937 with the mission of "operate lines of aerial conveyances directly or by means of Aer Lingus Teoranta."

The close relationship between the airport company and the national Irish airline drove Aer Rianta to own and operate major Irish Airports: Dublin, Shannon, and Cork.

After a period focused on the development of Irish airports, the first abroad business unit was carried out in 1988, when new Duty Free Shopping facilities were opened at Moscow airport thanks to Aerofirst alliance with Soviet Airlines.

The inclusion of Great Southern Hotels, Irish hotel company, to Aer Rianta Group in 1990 was the second milestone in its diversification process.

Nevertheless, the most historic event from system's viewpoint was the acquisition of 40% of Birmingham airport with Natwest Ventures Ltd in 1996, which was followed by the acquisition of 50% of Düsseldorf Airport with Hochtief AirPort GmbH (its German partner) in 1997, what strengthened Aer Rianta's position in airport ownership field.

II.- The company nowadays

Currently, Aer Rianta develops two different activities directly related to airports:

II.1. - Airport management and ownership
Dublin, Shannon, and Cork, Irish major airports, are still being owned and managed by the company.

In addition, the company has different stakes in Birmingham (40%) and Düsseldorf (50%), a group of infrastructures that makes up the corporate airport system formerly introduced, where an airport network is conceived without any territorial viewpoint.

II.2. - Duty free retailing
Airport retailing is the activity that has felt the largest development, being nowadays settled in a wide range of countries. There are four geographical business units in which the activity is organized:

Europe: Hamburg, Cyprus, and Greece.

CIS: Moscow, St. Petersburg, and Kiev.

Middle East: Bahrain, Qatar, Kuwait, Beirut, Damascus, Kuwait, Syria, and Karachi.

Canada: Edmonton, Ottawa, Montreal, Winnipeg, and Halifax.

Apart from airport management, duty free airport shops and Irish hotels are activities also developed by Aer Rianta.

AMS

Amsterdam

Concentration around Schiphol

Even though the concentration tendency around Schiphol, several regional airports compose Dutch airport system.

The Amsterdam/Dutch airport system is located in the northern vertex of the triangle composed by Frankfurt, Paris, and Amsterdam. The territory included in the above mentioned polygon concentrates the majority of continental freight (80%) and most of intercontinental links from continental Europe.

Dutch airports, mostly managed by Schiphol Group, form a particular system that spins around Schiphol airport development. The recent decision about the construction of a new runway at Schiphol shows that the concentration of services around a single airport is preferred to the promotion of regional airports participation.

I.- Fast Growing Region concentrating around Schiphol airport

The Amsterdam/Dutch airport system is composed by Schiphol, Eindhoven, Rotterdam, Groningen, and Lelystad airports.

The territorial analysis shows that air traffic generation presents high values due to a dense regional structure and to the clear position of Schiphol airport as an European hub, which handles around 40% passengers in transfer.
In addition, all members of the system have had spectacular increases of air traffic in the last 5 year period. So that, Dutch system belongs to a fast growing region, what means that the region is still able to absorb air traffic increases in several facilities. Nevertheless, comparing the different increases of each system’s component, a slight concentration of services around Schiphol airport is also noticed.

In addition, the construction of the fourth runway at Schiphol airport will sharp concentration tendency, as Schiphol Group’s decision to concentrate as many operations as possible around Schiphol airport may hold regional facilities development back.

II.- Individual performances

The performance of the different system’s members is clearly polarized: whereas Schiphol is the fourth European airport (in volume of passengers), KLM hub and, with Frankfurt, the major link between Europe and Asia; the rest of regional airports handle rather modest operations.

An slight freight specialization is noticed at Eindhoven airport, which is also promoting its specialization in low cost carriers, being a member of Ryanair’s airport network, and handling regular destinations mainly with England. In addition, as the rest of Dutch regional airports, it has high increases of operations in summer months.

Rotterdam airport also concentrates its activity in holiday periods, linking the Netherlands with regional Mediterranean airports, as Girona, Alicante, or Malaga. The rest of its services are oriented towards England (Manchester, Birmingham, or ) ersey), Germany (Hamburg), and Belgian regional airports. The airlines that regularly operate in Rotterdam airport are VLM, Dutch regional carrier, and Transavia, Dutch low cost carrier.

Moreover, as usual in Dutch regional airports, Groningen airport behaves similarly, presenting a sharp seasonal holiday activity, while the rest of the year is basically dedicated to business flights.

Finally, Lelystad airport is almost exclusively dedicated to general aviation, handling small aircraft operations (350 daily average).

III.- Three layer structure management

Schiphol group is the company in charge of Dutch airport system management. It is controlled by Dutch Government (75.8%) and Amsterdam (21.8%) and Rotterdam (2.4%) municipalities, even though it is a financially independent enterprise (PPP management). The group structure is completed with the companies that are responsible of airport operations.

Dutch airports three layer structure, 100% public, combines national with regional interests, very suitable in many European territories where different interests belonging to different administrations should be reconciled.

IV.- Domestic accessibility

The small area of Dutch territory combined with the future available traffic at Schiphol airport implies that regional airports perform a poor role in the system.

Generally, regional airports are mostly dedicated to handle domestic destinations, but in countries where the regional and national layer coincide, domestic flights are provided by other means of transport.

In the Netherlands, a conveniently situated rail station at the airport can develop a domestic hub role. Schiphol rail station, located below airport terminal, directly links the airport with more than 70% Dutch railroad stations, supplying both an efficient metropolitan direct link and a wide range of regional destinations from airport.

Barcelona

Challenges for an European Macroregion

Barcelona airport is nowadays the second international airport in Spain. It has an intermediate position, between the dependency on Madrid and the aim to become the west Mediterranean hub.

Barcelona/Catalan airport system is completed by Girona and Reus regional airports, which although they are far from handling a million passengers respectively, both combine non scheduled tourist with low cost operations.

II.- First class tourist system

Located in the western shore of Mediterranean sea, Barcelona is one of the major European and world tourist focuses (Catalonia, a country, would be ranked sixteenth in the world).

Hence, in all of its airports, leisure traffic plays an important role. Both Girona and Reus airports have a very seasonal activity, receiving the majority of their operations, mostly non scheduled, in holiday periods. Another consequence of a marked tourist orientation is the poor weight of freight activity recorded in all components of the system.

Nevertheless, Girona airport has changed its dynamics thanks to low cost carriers, as it has daily Ryanair services to London Stansted, Frankfurt Hahn, and Milan Orio al Serio amongst others.

Reus airport has an strategic position in the south Coast of Barcelona (Costa Dorada), one of major tourist destinations of the region. So that, the most convenient solution should be the low cost specialization through the acquirement of links that nowadays are held in Barcelona or by creating new regular international services. For instance, Hapag–Lloyd Express has recently opened regular services from Reus to Köln and Hamburg.
Barcelona el Prat airport combines business and leisure operations, receiving flights from either major or low cost carriers (Easyjet, Virgin Express, Transavia Basiqair, or Air Berlin). However, el Prat should promote a quality specialization to fulfil its objective of becoming a world class airport, promoting links with major international hubs and abandoning less profitable operations, which could be developed by its regional partners.

III.- New facilities... new objectives

Many new facilities are planned around Barcelona airport in order to achieve its consolidation as west Mediterranean hub. The third runway and a new terminal will allow doubling current air traffic, reaching 40 million annual passenger capacity.

At first glance, the new planned works would suggest the concentration of current regional services around Barcelona airport. However, the specialization of regional airports in low cost market would allow a sustainable growth of all members of the system, avoiding the sale of Barcelona airport's slots at a loss, what would unnecessarily congest the airport at short term, disallowing the promotion of intercontinental services, measure that clearly interests el Prat if a qualitative growth is desired.

Apart from airport facilities, there are more plans around El Prat, as the development of its airport city, that will turn the airport into one of the most important economical nodes in Catalan Territory. A new rail station at the airport will be one of its master pieces, as it will hold conventional and, probably, HST (High Speed Train) links with the city and major regional focuses.

IV.- Need of regional management

Barcelona airport system, as the totality of Spanish airports, is managed by AENA, the national airport authority in Spain. A national public management tends to the concentration of services around the major national hub, Madrid Barajas in Spain, what subtracts development opportunities for the rest of Spanish airports.

In order to safeguard regional objectives at Barcelona airport, a new ownership and management structure should be promoted. The most desirable option is the widespread three layer structure (PPP management) that combines all stakeholders interests. Girona and Reus could either be members of the Barcelona airport authority or be in hands of local administrations or private investors, which could watch over their interests in a dedicated way.

V.- Towards Madrid dependency?
The development of a high speed train link between Madrid and Barcelona and the centralized management of Spanish airports, draws another possibility for Barcelona airport, consisting in the development of a complementary role to Madrid Barajas, through which Iberia, Spanish national airline, and One World allied carriers would double current Barajas daily slots through timetable fitting between Barajas and el Prat, providing a more continuous service from a national viewpoint.

However, Barcelona, as suggested, should look for a quality and autonomous position in European market, goal that could not be reached being Barajas' subsidiary platform.

BEL

Belgium

Regional airports’ uprising

Belgian territory has an strategic position in Europe, as it is placed in the centre of the triangle defined by Paris, Amsterdam, and Frankfurt.

So that, the region develops an intense air traffic activity, allowing the position of each regional airport in different air traffic niches.

I.- Regional diversification

Despite the reduced area of Belgian system, where regional and national layer coincide, several Belgian regional airports have different ways of specialization.

Brussels Zaventem is the major airport of the system, which although it has several intercontinental links, also handles low cost operations. Moreover, Zaventem is the hub of one of low cost carriers pioneers, Virgin Express.

So that, Brussels airport cannot be considered as an European major hub, but it has an intermediate position, comparable to Vienna or Zurich, other medium national airports.

However, the most important feature of Belgian airport system is the heterogeneity of its regional airports behavior.
Charleroi handles low cost (Ryanair) and charter flights. In order to succeed in low cost business, Charleroi airport is being promoted as Brussels South with successful results.

Antwerp, the Flanders airport, is a regional facility that operates rather independently from Brussels, which main feature is its lack of any specialization. The airport handles several regular services with central European destinations, mostly held by VLMAirlines.

Ostend is currently almost fully dedicated to freight activity. It handles not only international flights but also regular intercontinental links with Russia, Persian Gulf, India, or Pakistan.

Finally, Liège also develops a cargo role, being hub of TNT cargo carrier and combining secondary airlines’ passenger flights with cargo carriers operations. The central position of the airport, located in the southeast of Brussels, in the barycentre of AMS–FRA–PAR triangle, makes the airport a suitable platform to develop a complementary role to one of major European hubs. Liège is controlled by ADP (Aéroports de Paris) through an agreement subscribed with SAB, a private enterprise that obtained, in 1990, a 50 year concession from the Walloon government to develop and promote the airport.

II.- Changing dynamics

The diversification of services supplied in every regional airport drives to a changing dynamics performance, where regional airports are acquiring more importance due to their specialization in different air traffic niches.

Analyzing air traffic increase, different behaviors are noticed. Except Antwerp airport, that has not increased its air traffic demand, Zaventem and the rest of regional facilities have had spectacular air traffic increases, specially Charleroi, which has grown a 800% in the last five year period thanks to low cost business.

Antwerp illustrates the need of specialization that regional airports have in order to get a more solid position in regional air traffic, differentiating themselves from the rest of the members of the system.

Apart from air traffic growth, freight dynamics has also undergone a drastic change. Whereas in 1995 Zaventem handled the 97% of system’s freight, nowadays cargo is shared between Liège, Charleroi, and Ostend, which handle altogether around the 50% of national cargo.

Hence, Belgium should be considered as one of the references when promoting regional airports’ participation, as in the last five year period it has come from a concentrated performance to a diversified system, where the participation of regional airports is essential.

III.- Individual management: regional airports’ challenge

The change in Belgian airport system performance cannot be conceived as an spontaneous process. The promotion of air traffic niches and the strategic position in Continental Europe territory has been complemented by an individual management of each member of the system, allowing the development of regional airports in different ways, searching the best alternative in each facility.

Some airports are managed by private organizations, Zaventem by BIAC, Charleroi airport by Charleroi SA, and Liège by SAB and ADP. However, Antwerp and Ostend are public managed by Flemish government. Whereas the members in hands of private investors present a continuous development, the ones managed by regional authorities follow slower dynamics.

IV.- Accessibility: gateway to Europe

A key subject for Belgian airport system development is the connectivity of its regional infrastructures with national major urban nodes and its neighbouring countries, allowing not only the promotion of a national airport system but also the development of more efficient complementary performances by regional airports, taking part in transnational systems.

The most significant example is Liège, where Belgian railways connect the airport with Düsseldorf, Antwerp, the Netherlands, and France, promoting the airport as a logistic focus in west central Europe.

In addition, new HST lines that will link Brussels and Liège with Frankfurt, Paris, and London have been planned, adding cohesion and connectivity to Belgian airport system.
I.- Brief history note
Berlin Tempelhof airfield, the eldest airport in Berlin, was opened in 1923, handling regular flights from Berlin to Munich and Königsberg. However, the Second World War and the division of the country and the city led the latter to conceive new airports in order to fulfill each side requirements.

In the eastern side, the Henschel Aircraft works (HFH) were occupied by soviet troops in 1945, that used those facilities to handle Aeroflot operations. In 1947, a civil airport began to be constructed in Schönefeld and, opened in 1955 for commercial services, afterwards became German Democratic Republic major hub. However, the slower development of the eastern side of the city meant a poorer growth compared to western Berlin airports.

During the 50’s Tempelhof was the third European airport after Paris and London. Nevertheless, the construction of Tegel, conceived as West Berlin major civil airport beside the former Tegel Rocket launcher grounds, subtracted Tempelhof activity.

Opened in 1960 for civilian operations, during the 70’s and specially the 80’s, major international airlines moved from Tempelhof to Tegel, what meant the consolidation of the latter as the city major airport. After the reunification in 1991, the first joint timetable of Schönefeld, Tempelhof, and Tegel airports was published; undoubtedly, a crucial milestone in airport system’s history.

II.- Airport overlap

One of the consequences of the parallel development is the similar behavior that Tegel and Schönefeld had, presenting however different destination structures; Tegel linked Berlin with western European countries and America, while Schönefeld was Berliner eastern destinations hub.

Nevertheless, nowadays Berlin airport system has a quality segmentation. Schönefeld mostly handles vacation traffic, concentrated in summer months, whereas business and regular services are mainly hold in Tegel, in part due to the construction of the new Berlin Brandenburg International where Schönefeld is located, what tends to the current concentration of services around Tegel.

The close position of Tempelhof from Berlin city centre makes the airport to lose its share in the system, handling Lufthansa and minor airlines domestic and international within Europe flights, becoming Berlin city airport.

III.- Berlin Brandenburg International: concentrating services

Berlin airports future is located in current Schönefeld facilities, where the existing airport will be expanded an renamed Berlin Brandenburg International airport, BBI. The project not only consists in the expansion of air facilities, but also in the planning of new accessibility services, as the air rail link below terminal and the airport city.

The existing airports on the west side of the city, Tempelhof and Tegel, will be progressively abandoned as long as the new international airport increases its activity; Tempelhof will be closed in 2003 while Tegel is planned to be abandoned in 2007.

As the volume of air traffic is moderate (around 13 million annual passengers) and air traffic prognosis show comfortable volumes at long term (30 million annual passengers in 2030), the concentration of services around a single airport is probably the most suitable option in Berlin.

IV.- Privatization of Berliner airport system

A final feature that culminates Berliner airport system’s evolution is the sale of current public shares to a private investor who will own and manage the airport system.

Berlin Brandenburg Flughäfen Holding BBF is nowadays owned by three shareholders: the State of Berlin with a 37%, the state of Brandenburg with a 37% and the Federal Republic of Germany that has a 26%.

Nevertheless, Berlin Brandenburg International will be a private enterprise. The 3 public shareholders will sell off 100 percent of their holdings in the new company, BBI, meaning the most extensive airport privatization process ever made in continental Europe.

CAN

Canarias

Double hub archipelago

The airport system composed by Canary Islands airports follows the classic hub/spoke archipelago’s structure. Some airports develop a hub performance between the region and major continental hubs, whereas the rest of the components combine international with domestic destinations.

Tourism, as happens in the majority of archipelagos, is one of the most important economical activities in regional economy, what induces airports to have a seasonal
activity concentrated in holiday periods, rather long in Canary islands due to a convenient location providing almost constant favorable weather conditions.

I.- Ultra periphery

Canary Islands are located in southern European ultra periphery, what drives the region to mostly develop a spoke performance at a continental level, receiving flights from major European Systems and being forced to use European hubs in order to fly to intercontinental destinations.

Madrid Barajas, Iberia’s national airport, is the most convenient hub for Canary Islands, as it has a close position providing frequent daily regular services to Canarian Hubs.

II.- Tourism and airport activity

The system is composed by 8 airports: Tenerife South, Tenerife North, Las Palmas, Lanzarote, Fuerteventura, la Gomera, la Palma, and el Hierro.

The particular morphology of Canarian archipelago, which has its two major islands located in central position, allows a double hub/spoke structure, where Tenerife South and Gran Canaria airports link Canary islands with major European hubs.

The high number of tourist charter flights is the main attribute of these airports, as they have many international non regular services.

Finally, la Palma, la Gomera, and el Hierro are small regional airports, which activity varies from being internal general aviation spokes of Canarian system to receiving rare international non scheduled flights, mainly from Germany.

III- Mature & Changing dynamics

The global analysis of the system shows that although the region has not spectacular increases of air traffic, what could be understood as a mature region, there is a different behavior between central and islands on the periphery. Whereas both Tenerife South and Gran Canaria have moderate values of air traffic increase; Lanzarote, Fuerteventura, and Tenerife North have higher growths.

The promotion of direct flights from continual Europe to regional airports and the move of national air traffic from Tenerife South to Tenerife North lead to a change of system’s dynamics.

The location of Tenerife South airport is tourist oriented, near beach areas but far from island major towns. The inconvenient location is being solved by the promotion of the other airport of the island; Tenerife North, which after a period of poor use, has recently opened a new terminal and improved its facilities.

So that, northern airport only handles domestic destinations while Southern airport receives the majority of international and non scheduled tourist flights.

Fuerteventura and Lanzarote airports combine domestic and international traffic.

The high number of tourist charter flights is the main attribute of these airports, as they have many international non regular services.

Finally, la Palma, la Gomera, and el Hierro are small regional airports, which activity varies from being internal general aviation spokes of Canarian system to receiving rare international non scheduled flights, mainly from Germany.

IV.- Challenges: logistics, stopover and North Africa hub

The location of the archipelago at half way between America and Europe, in front of the African Atlantic Coast, allows conceiving new challenges for its development, which are summarized as follows.

• Promote cargo activity in Tenerife South and Gran Canaria airports. Nowadays, no cargo specialists are settled in Canary islands, as NAYSA (Canarian regional carrier) and IBERIA, with rather poor volumes, are the major carriers related to cargo. Promoting idle hold of charter services (charter passenger shares in system’s hubs: 45% in Gran Canaria and 64% in Tenerife South), Canary Islands could become an excellent logistics platform, linking Europe with Africa and South America.

• Turn of Fuerteventura airport towards north Africa, which would provide, apart from passengers; logistics and freight services to

major north African centers, allowing the consolidation of Fuerteventura airport as one of the most important logistics hubs in European ultra periphery.

However, AENA’s joint airport ownership and management in Spain has a clear dependency on Madrid development, what makes difficult to promote projects betting on regional airport’s development.
I.- Congested airport system

Chicago airport system is close to its congestion, what is translated into an almost negligible growth of the regional air traffic, clearly observed in O’Hare, world major airport, which due to its congestion often suffers flight delays.

As O’Hare, United Airlines’ hub (major largest airline), is in a mature stage of its life cycle, Midway is acquiring more importance, changing airport system’s dynamics. It presents reasonable air traffic growths, partly due to the move of regular flights from Chicago O’Hare and the promotion of new services.

The bet on Midway airport coincided with Airport Terminal Development Program, when new facilities (gates, parking services, etc.) were opened.

The other two members of the system are Meigs Field and Gary/Chicago, two airports that are mainly dedicated to private flights and general aviation. The former is located very close to the city centre, so that regular commercial services cannot be promoted due to environmental matters, specially owing to noise pollution. Hence, general aviation and commuter flights going to the city centre are the most frequent services provided, being the most suitable choice for business passengers traveling to Chicago Downtown.

Gary airport has a worse location in relation to Chicago downtown and it is generally used by private flights and general aviation, mainly traveling either to Chicago or northwest of Indiana.

II.- Segmentation by destination

O’Hare, as happens in major world hubs, handles first class destinations, combining domestic and international services from major world airlines.

Midway only handles domestic destinations (within USA, Mexico, and Canada) and non-scheduled leisure flights not only from major national airlines but also from main American low cost carriers. The airport is Southwest Airlines and ATA, north American low cost carriers, hub in Chicago.

The development towards domestic and low cost business has meant a decrease of freight transport in Midway airport, having its tons failed a 50% in the last five year period. Hence, almost the totality of freight is now being handled in O’Hare, according to its more international orientation.

In addition, private services, concentrated in Meigs Field and Gary/Chicago airports, also have a clear domestic orientation.

III.- System management

The airport system is jointly managed by the Department of Aviation of Chicago, a public authority controlled by the municipality of Chicago.

In megapolis a joint control of airports present some advantages in front of individual management, as the region is forced to conceive an airport system to balance regional air traffic, secondary airports are usually promoted as short haul, leisure, or low cost facilities.

Copenhagen and Malmö develop a transnational airport system

A transnational airport system, composed by Copenhagen Kastrup and Malmö airport could be feasible, taking advantage of regional synergies that were developed.

I.- Copenhagen Airport system

Kastrup and Roskilde are the two airports owned and managed by Copenhagen Airports A/S. The first is the major international airport of Northern Europe. It has a close location from Copenhagen downtown (8 kilometres), being both passenger and cargo hub. SAS Scandinavian carrier and Maersk Air, Cimber, or DHL are Kastrup’s most important carriers.

Roskilde is a regional facility located 25

Oresund bridge promotes the development of regional synergies

kilometres south from Copenhagen that handles short haul flights within northern European countries.

The aggregate behavior of this Danish system shows a concentration dynamics towards Kastrup, and a progressive disuse of Roskilde. Nevertheless, the future plans around Roskilde consisting in the extension of its runway in order to accommodate larger aircraft’s operations could promote the airport as the regional complement to Kastrup.

Oresund synergies

After the opening of the Oresund bridge that links Denmark with Sweden, Copenhagen has found new opportunities consisting in the promotion of its expansion towards the latter country, what would increase its airports’ hinterland.
With such an aim, Copenhagen Airports A/S is negotiating with Easyjet/Go and Ryanair the possibility to establish regular services from Roskilde, a measure that would relaunch the airport and benefit regional inhabitants.

II.- An airport company

Copenhagen Airports A/S is a public limited company that owns and operates Kastrup and Roskilde airports. In 1990, the public Copenhagen Airports Authority transferred its airports to a public limited company, maintaining the 100% of its stake. However, in the 90’s some public stakes were sold to private investors, reaching the current structure where the state maintains a 34% stake in the company. The rest of shareholders are small investors having less than 5% stakes.

The private ownership of airports converts Copenhagen in a corporate airport system. Moreover, the company is recently seeking its expansion to new markets, as it participates into several airports widespread located. Newcastle (8% share); the 9 airports of ASUR, Aernuertos del Sureste in Mexico (6.3% share); Meilan (20% share) in Hainan Chinese province; and Norwegian Rigge Syvile (35.3% share) form Copenhagen Airports A/S international corporate airport system.

III.- Towards Sweden: Copenhagen - Malmö link

The opening of Oresund Bridge in 2000 allowed the extension of Copenhagen airport hinterland to Swedish territory, what almost doubled the population of its catchment area, raising from 3 to 6 million. Moreover, the convenient placement of Kastrup airport and public transport facilities from airport to major south western Swedish cities, allows the development of regional synergies (for instance, between 10-12% of cars parked in Kastrup international destinations car park are Swedish).

So that, the bridge may ease the consolidation of a transnational airport system composed by Copenhagen Kastrup and Malmö Sturup, complemented by Roskilde and Billund.

The system would belong to a fast growing region, as, with the exception of Roskilde, all members present spectacular air traffic increases.

Sturup combines internal commuter services, with Stockholm (mainly to Bromma) and Gothenburg, with leisure non scheduled flights.

Billund, the major Airport in west Denmark, combines freight international links (hub of Maersk air) with low cost, charter, and general aviation services. The airport has a high value of freight ratio, becoming the only freight specialist in the system.

Following current features, a possible organization of the airport system could be summarized as follows:

- **Kastrup.** International airport that links the region with major worldwide nodes.
- **Roskilde.** Regional airport holding regular low cost and charter flights in summer periods.
- **Billund.** Cargo specialist, which may also have several passenger services, mainly low cost and leisure.
- **Malmö Sturup.** Regional airport combining regular commuter flights to major Swedish cities with low cost and leisure non scheduled flights.

### City | Time from Copenhagen
---|---
Stockholm | 4 hours
Gothenburg | 2.5 hours
Malmö | 20 minutes

Frankfurt

Central Europe hub

Frankfurt is probably the most important European area in terms of air traffic generation, comparing annual passengers with regional inhabitants. The area is served by two airports with far different features, Frankfurt Main, located in Rhein Main Area, and Frankfurt Hahn, located in Hünsbruck region.

Considering Rhein-Main area, airport hinterland has a population of 4.87 million inhabitants, 0.65 of them corresponding to Frankfurt metropolitan area. Hence, as air traffic generation ratio is about 10 passengers per inhabitant in Rhein Main Area, air traffic activity plays an strategic role in regional economy.

I.- Frankfurt Main: European hub

Frankfurt Main airport is ranked first in passengers and freight traffic in continental Europe. Its central location in Europe has allowed an spectacular development, being nowadays Lufthansa and Star Alliance major hub.

Main airport has a marked hub performance, handling around 50% passengers in transfer. As one of world major airports, it handles operations from major world carriers, what drives to a balanced distribution of destinations (17.9% domestic, 46.5% international and 35.6% of intercontinental passengers). However, compared to the rest of European hubs, it handles more Asian, Middle East, and Eastern Europe services.

The progressive growth of air traffic in Frankfurt Main airport led to forecast its congestion in 2005. In order to solve the problem, immediate measures were studied: the improvement of the runway system with the construction of the airport’s fourth runway or the optimization of operations through technical improvements. Hence, Frankfurt Main would maintain its services concentrated.

However, the existence of close regional airports and new market niches with rare interest for Frankfurt Main airport drove to the search of solutions that made major and regional airports’ interests compatible.
II.- Promoting regional airports

The promotion of Frankfurt Hahn is the perfect complement to the construction of a new runway in Frankfurt Main. Located around 100 km west from the city centre, this former military base is being used since 1993 as a civil airport. In its recent history, Hahn shows constant growth of passengers, becoming a valid alternative to manage a part of Rhein Main Region air traffic.

Nowadays, the airport can be considered as freight and low cost specialist, as it has one of world major freight ratios (handles Air France, Aeroflot, or Malaysian Airlines pure cargo services). Nevertheless, in absolute values, Hahn is still away from Frankfurt, as its 134,000 annual tons are equivalent to a 9% of Frankfurt Main cargo.

Moreover, Hahn holds Ryanair services, being Irish low cost carrier’s second continental hub after Charleroi. In addition, leisure charter flights take off from Hahn in summer periods, mainly going to Mediterranean major tourist focuses.

As most of regional airports in ways of development, its main lack is public transport accessibility facilities. Nevertheless, a new accessibility plan that will link Hahn with the city downtown and with Frankfurt Main airport by rail is being studied, what illustrates the aim of promotion of a regional airport system.

III.- Fast growing cargo region

The global analysis of Frankfurt airports shows a regional fast growing tendency. Despite being near its collapse, Frankfurt Main airport has undergone an unstoppable progression during the last five year period. Hahn’s dynamics is also very positive, owing to a young stage in its life cycle that is translated into spectacular growths in its first decade of operations.

Considering air traffic attributes, both airports have high freight ratios; whereas Hahn is dedicated to freight specialists carriers, Frankfurt Main is Lufthansa cargo hub.

Referring to segmentation by destination, the system presents the classic European distribution of air traffic: a major hub that combines international with intercontinental regular services complemented by regional airports holding operations within Europe.

IV.- Fraport

Fraport AG is the manager and operator of Frankfurt Main Airport. In 2001, the company went to the stock exchange, being the first trading day for Fraport AG June 11th, 2001. Current shareholder structure is the following: 32.1% State of Hessen, 20.5% City of Frankfurt, 18.4% Federal Republic of Germany, 29.0% free float.

The company traditionally betted for the concentration of services around a single airport. On the other hand, congestion problems in Main airport and the 74% stake in Frankfurt Hahn suggested the consideration of a regional airport system.

V.- Railport system

One of the major advantages of Frankfurt Main airport is the excellent accessibility from the airport to not only the city centre but also to major German cities. Apart from conventional city and bus services, Frankfurt has two rail stations in its airport city.

- Air Rail terminal is probably the most important airport rail station in Europe, as it has 4 High Speed Train lines (ICE) connecting the airport with cities as Hamburg, Basel, Stuttgart, Berlin, Nuernberg, Dresden, Passau, or Köln.
- The second railway station is Regionalbahnhof, which is served by S-Bahn and regional trains.

The convenience of rail services from Frankfurt airport and the dense and decentralized German urban structure, drives to consider the viability of a German railport system around Frankfurt Air Rail terminal. Domestic flights would be carried out by rail while international services by air. However, although an expensive commercial campaign has been developed, the real use of rail services shows poor results: around 8-10% of passengers prefer rail to air services.

VI.- Airport system with Munich?

Frankfurt Main and Munich airports are Lufthansa’s major platforms, what is being developed by the German carrier creating a national airport system without any regional viewpoint.

Nowadays, Munich airport is being used to decongest Frankfurt Main that, as depicted, is very close to its capacity. The way how these airports work together is by complementing their hourly flight schedule, through the integration of Lufthansa and Sky Team’s allied carriers daily timetables. The capacity of an hypothetical FRAMUC German airport system could almost double current Frankfurt Main’s, obtaining new synergies at a national level.

Frankfurt airports could be complemented by Munich in order to obtain synergies at a national level

Frankfurt Hahn’s hinterland

Air rail terminal in Frankfurt Main
Hawaii

Mature archipelago

Hawaii archipelago is a string of 137 islands located in the middle of the Pacific Ocean. 6,000 km from Japan and about 4,000 km from the west rim of the United States, the system is composed by 8 major islands, that, sorted from West to East, are Niihau, Kauai, Oahu, Molokai, Lanai, Kahoolawe, Maui, and Hawaii.

As in the majority of archipelagos, tourism is one of its major economical activities, meaning a high value of air traffic generation.

I.- Centrality of the system

The major islands of Hawaii archipelago are mostly located in the southeast of the capital of the state, Honolulu, located in Oahu island, which takes up a smaller area compared to its neighbours.

The relationship between island locations and their air traffic activity shows the weight of centrality in archipelagos, as larger peripheral islands have poorer air traffic volumes.

II.- System’s dynamics

Hawaii presents the classic hub/spoke structure around a central airport. The distant location from continental land emphasizes such a performance, as the majority of international flights are held in Honolulu, airport system’s hub.

System’s spokes are mostly dedicated to general aviation and commuter services, apart from regular flights within the archipelago, specially to its hub.

III.- Freight in Archipelago

Hawaii airport system is the archipelago with higher freight ratios, about 14 kilos per passenger. In archipelagos, tons transported increase with distances to continent. Hence, as Hawaii is located in a central isolated position in the Pacific Ocean, about 6 hours by plane from California, most cargo is handled by air.

Honolulu airport, as it has regular overseas destinations, leads system’s freight specialization with 17 kilos per passenger. Moreover, despite a decrease in passengers and movements in the last five year period, freight activity shows a continuous growing tendency in Honolulu.

On the other hand, in regional airports, which that are mostly dedicated to general aviation, freight activity plays a secondary role.

Helsinki

Baltic regional synergies

Nowadays, Helsinki Vantaa airport has not enough passengers for the region to consider an airport system.

However, the vast area of Finnish Territory, extreme climate conditions, and its close position to Baltic republics are aspects that enrich the study of Helsinki and its neighbouring airports, which can be analyzed as a national airport system or also as an airport which use may mean the development of regional synergies between different countries.

Several ferries link Helsinki with Estonia
I.- Continental archipelago

Helsinki Vantaa is the major Finnish airport, Finnair’s hub; nevertheless it has moderate air traffic volume that is trying to raise acquiring a more important role in European sky. The development of Vantaa’s airport city, AVIOPOLIS, should promote the airport as one of the reference economical nodes in Helsinki and, in consequence, in Finland.

Referring to airport destinations, the polar route to North America is being promoted, even though current distribution of destinations combines international with domestic links (60% of passengers are international). Finnish airports perfectly follow a hub/spoke distribution, where regional airports are linked with international destinations through Vantaa.

Finnish regional airports have rather low values of air traffic, far from the ones recorded in Vantaa. For instance, Rovianemi, second national airport, only handles around 700,000 annual passengers, while Vantaa has 10 million.

Hence, Finnish air traffic follows an archipelago airport system structure formed by 25 members, where the islands developing spoke performances are not isolated by sea, but use Vantaa as their hub.

II.- Regional Synergies with Estonia

Helsinki has a strategic position in Northern Europe, close to Baltic Republics as Estonia, which although it is located in the southern Shore of Baltic Sea, develops an intense relationship by air and ferry with Finland.

A common option when traveling from Helsinki to Estonia is the ferry that links both countries through a 3 hour trip. A balanced modal split between Helsinki and Tallinn, 57% air versus a 43% ferry, shows the feasibility of an air-sea link between both regions.

In addition, around 300,000 passengers of Vantaa airport are estimated to come from Estonia, showing the importance of Helsinki airport for Estonian development; as its national air facility, Tallinn, only handles 570,000 annual passengers, mainly traveling to German and Russian major cities.

Tallinn’s carriers show an orientation towards Baltic and Eastern Europe, as the airport holds regular flights from SAS, Finnair, Estonian, Aeroflot, and Polish airlines amongst others. Hence, Helsinki Vantaa may become Estonian American and south and west Europe gateway.

Exit routes for Vantaa passengers residing in Estonia.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>52.7%</td>
</tr>
<tr>
<td>Ferry Helsinki - Sweden</td>
<td>14.3%</td>
</tr>
<tr>
<td>Ferry Helsinki - Tallinn</td>
<td>36.0%</td>
</tr>
<tr>
<td>Other</td>
<td>2.4%</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Hence, Vantaa is the major facility: located 35 km from Tallinn’s international airport.

Commercial use of airport system concept.

Hobby has an stagnated performance. To fully dedicate to freight services, while Ellington combines a civil and military use, supporting a wide range of flights from NASA, Continental Express, UPS, and general aviation as well. The activity that better defines the airport behavior are UPS’ services, which bring an spectacular freight ratio, around 800 kilos per passenger.

Major world airlines operate in Bush Intercontinental, although the share of international traffic is lower compared to major American hubs located at both sides of the country. As domestic traffic is airposes, the demand is absorbing almost the totality of regional air traffic.

In addition, Ellington airport is tending to fully dedicate to freight services, while Hobby has an stagnated performance.

Ellington combines a civil and military use, supporting a wide range of flights from NASA, Continental Express, UPS, and general aviation as well. The activity that better defines the airport behavior are UPS’ services, which bring an spectacular freight ratio, around 800 kilos per passenger.

Globally, the system is tending to the concentration of services around Bush International airport, which is absorbing almost the totality of regional air traffic.

In addition, Ellington airport is tending to fully dedicate to freight services, while Hobby has an stagnated performance.

Houston

Airport System’s concept commercial use

Houston is the only region that is nowadays commercially using airport system concept to identify the airports that serve its metropolitan area.

The system is composed by three facilities: George Bush, Hobby, and Ellington; which are international, domestic, and freight specialists respectively.

I.- System’s dynamics. Specialization.

Houston airport system history follows major megapolises evolution, as the growth of air traffic has driven to the progressive conceiving of new facilities to adapt the system to demand.

Hobby, opened in 1937, was the first airport of the system and has the closest location to Houston downtown, 13 km south.

Some decades later, Bush international airport and Ellington were incorporated in the system, in 1969 and 1984 respectively, forming the current structure. Nowadays, each member has marked features, being specialist in different air traffic niches. Bush intercontinental airport is the current system’s major facility; located 35 km from Houston downtown, combining domestic and international destinations.

II.- A new brand: airport system

The main contribution of Houston to airport system’s study is the application of airport system concept for commercial purposes; Houston Airport System is pioneer using a brand that defines the joint concept of the three airports above depicted.

The region, which has been holding the airport system for more than 30 years, has conceived an integral approach of all its air facilities, allowing the individual development of each component, safeguarding global interests for Houston area.
III.- Public ownership/private management

Houston airport system, even though is public owned and managed by the municipality of Houston, applies private sector philosophies to airport management.

The system is organized as an enterprise and airports do not burden with local taxes to pay for operations, maintenance, or capital improvements. Furthermore, surplus generated is reinvested into capital development and bonding support.

I.- Changing regional dynamics

London metropolitan area, with close to 10 million inhabitants, is one of major world metropolis regarding area and population.

The isolated location towards continental Europe, British colonial past, and the close relationship between the region and United States, make air traffic a key activity for regional economy development.

London has always been one of world major focuses of air traffic, what has been translated into an unstoppable increase of demand that has meant the progressive construction of new facilities to serve the region. In addition, new regional airports close to metropolitan area have been recently incorporated in London airport system concept, becoming nowadays the world leader airport system related to passengers.

II.- Individual features

Heathrow is the system’s major hub, historically the major air facility in London, which holds both international and intercontinental flights, linking the region with major world air traffic focuses. The airport is identified as London first class air facility, attribute that has been sharper as long as leisure flights have been segregated to other airports. Nowadays, the airport is the European hub with North America and holds world leading airlines’ services.

Gatwick airport handles second class destinations, linking the region with world major tourist centers, from Mediterranean to Caribbean or Orlando first intercontinental link in Gatwick). Moreover, due to a sharp specialization in tourist activities, many charter operations are also held, what means a passengers orientation, translated into a low freight ratio, common attribute in tourist airports.

Both Heathrow and Gatwick are close to their capacity levels, what has obligated the promotion of new airports to absorb London’s air traffic demand.

Stansted airport was born with the aim of becoming Heathrow and Gatwick complement, what was reached after a period of misuse, taking profit of the development of low cost business activity. Nowadays the airport is hub of several low cost carriers as Easyjet/Go, Ryan Air, or Virgin Express. Apart from low cost services, non scheduled tourist flights are also provided, mainly in summer peak months.

Luton airport complements Stansted. Located in Hertfordshire (north London), in a further position from the city centre, it handles both low cost and charter flights with tourist purposes.

Finally, London City airport mainly holds private and business non scheduled flights, developing a city airport role, as its name shows.

III.- Low cost business

The recent growth of air traffic in the region has been mainly absorbed by Stansted, the first European low cost hub, center of several low cost carriers; feature that has meant the highest air traffic growth in London airport system, around a 300% in the last five year period. Moreover, Luton confirms the regionalization of the system, as it has almost doubled its passengers also due to low cost business success.

So that, London airport system has two members almost permanently dedicated to low cost carriers, leading European systems in such an specialization.
IV.- Central/individual private management

One of the key aspects for regional airport system success is the private management. The components that were originally associated the metropolitan area of London are owned and managed by BAA plc, private company in charge of most British airports; what has allowed the leisure segmentation towards Gatwick and the low cost specialization in Stansted.

On the other hand, Luton is in hands of TBI, a private investor, which has promoted an autonomous development taking profit of regional opportunities that the rest of system’s components left.

V.- New runway?

As it has been occurring in London aviation history, the system is close to its capacity, as most of its components present evident congestion symptoms.

In order to fulfil air traffic demand, several options are being studied, as the construction of a new runway in an existing airport. However, the environmental impact of such a solution has induced a firm opposition towards the extension of current London airports.

VI.- Accessibility success

The extension of London Metropolitan area has meant that younger London airports have been established away from the city centre. Considering the high congestion levels of the city, convenient public transportation facilities are needed.

Services as Heathrow, Gatwick, and Stansted Express are dedicated rail links from airport to the city center. In addition, some airports have also links with metropolitan and regional rail network, as the Thameslink that connects Luton with Gatwick through the city center, or the underground service to Heathrow. The excellent modal supply makes rail the most convenient means of transport from airport to city, what is translated into shares higher than 50% in system’s major airports.

I.- Segmentation by destination

Los Angeles has three airports mainly dedicated to commercial flights that, even though they serve different markets, have similar imperceptible growths of air traffic. The system is living a mature stage, having reached its limit of air traffic generation.
Wrapping up, the system has a sharp segmentation by destination, composed by one international and two domestic facilities, related to passengers and cargo services.

II.- Spread of regional airports and general aviation

Commercial services are complemented by general aviation and commuter services that are provided by small regional airports, which role is essential, as they allow the decongestion of major commercial facilities.

Oxnard and Camarillo airports are located in Ventura County, north Los Angeles, and are mainly dedicated to charter and general aviation respectively.

Long Beach, located 30 km south from Los Angeles downtown, is specialized in commuter services.

John Wayne airport, located in Orange county, mainly holds general aviation, the same role that is performed by Van Nuys, which is world busiest general aviation facility, handling around 500,000 aircraft movements per year.

March Inland airport has a joint use, civil and military; the same performance that is carried out by Palmdale. Nevertheless, the development of Palmdale airport as a domestic and cargo specialist, Ontario alike, is being studied in order to acquire additional capacity of commercial services in the region.

Freight specialization is also a feasible option in the system, as shown at Southern California, the only cargo specialist in Los Angeles area.

Finally, a recent plan that forecasts the conversion of two current military airports, Point Mugu and el Toro, into commercial facilities, illustrates the prominence of Los Angeles regional airports.

III.- Neighbouring airports

The abundance of airports having commuter services (within Southern California and Arizona) in several counties that belong to Los Angeles regional area shows the importance of such a short haul traffic, which could be considered equal to European domestic.

The vast area of Los Angeles and the high air traffic demand in its different counties make feasible a system composed by a dozen of airports having county or city identity, belonging to a metropolitan airport system.
The combination of different airports' features with convenient links between France and Switzerland makes the exchange of passengers between each region usual, about 30% of passengers of each airport comes from the neighbouring region.

In consequence, Geneva airport becomes low cost airport to French passengers and Saint Exupéry takes up a position as French gateway and north African destinations hub for Swiss passengers.

III.- System connectivity

Transport facilities between each airport and the aggregate hinterland is one of the key aspects for the success of a transnational airport system.

Apart from the toll highway that links French Eastern Departments (Rhone, Haute-Savoie, Isère, Ain) with Switzerland, public transport facilities that connect Geneva airport with Lyon are provided as well, despite being rather inconvenient. Moreover, Geneva airport rail station (Swiss Railways), located 300 meters in front of airport terminal, provides direct links to Switzerland and International destinations.

In Saint Exupéry, a high speed train station next to airport terminals links the airport with several domestic destinations. The most frequent service connects Lyon with Paris, Gare de Lyon, in less than 2 hours.

Nowadays, 10 services per day are provided, becoming a competitive alternative to airport’s use, what may drive to the consolidation of a French railport system based on TGV (French HST train) railway structure.

The modal share of passengers between Paris and Lyon is clearly dominated by rail, which has a 90% share, while only 700,000 passengers flew between Lyon and Paris in 2002. So that, the HST link to Lyon is a solution to absorb part of domestic traffic from Paris airports and, why not, brings the possibility to develop synergies between both regions, expanding current Paris airport system’s hinterland at a national level.

The move from Rome to Milan is a milestone in European air traffic history, that was usually based on the capital city of each country, where headquarters of national airlines were located. None of these conditions occur in Milan, which is promoting an autonomous international development.

I.- Leading Italian airport system

Nowadays Milan/Lombardy is the largest airport system in Italy, having displaced Rome from the first position that historically held. The leadership is not only in passengers, as Milan has also acquired many cargo and logistic services that were formerly provided in Rome.

In addition, the promotion of regional airports assures the absorption of future air traffic demand, what consolidates the leading position of Milan in Italian air traffic market at mid and long term.

II.- Regional airports friendly concentration of services

Milan illustrates how an airport system can bet on an international airport and also on the development of regional facilities, through the segregation of less profitable operations from major airport.
System's dynamics shows how Malpensa and Orio al Serio have grown spectacularly in the last five year period, around a 400% and 200% respectively, presenting a clear Hubbing tendency towards Malpensa.

At first glance, the promotion of the major airport of the system and Bergamo would drive to consider that Linate is being abandoned. Far from that, Linate, although it has decreased about a 30% in the last five year period, maintains a rather constant share in passenger's market, holding short haul flights according to its closer position from the city centre.

The final result is the consolidation of an airport system composed by a first class international airport completed by two specialized regional facilities.

III.- Airport specialization

Malpensa, the new Milanese airport, was conceived to become an international hub, in a position immediately after the ones belonging to major European megapolises. Located 50 kms northwest from Milano downtown, it handles all ranges of flights from major international world carriers. Cargo activity in Malpensa also plays an important role, due to a convenient airport location in central Europe.

After the opening of Malpensa, Linate has decreased its activity. The location of the former Milanese major airport, 7 km from downtown, recommended to convert Linate into a city airport, dedicated to general aviation and having several domestic and international links, most of them provided by low cost operators (Easyjet/Go, Virgin Express, or Buzz).

Orio al Serio is having a fast growth due to the promotion of cargo activities and low cost services, becoming one of Ryanair hubs in continental Europe; holding also regular Sterling, Air Berlin, or BMI baby flights.

IV.- Bet on cargo

The location of the system in one of the most industrialized European areas makes cargo activity to play a prominent role in system's performance.

Apart from Linate, which is becoming a city airport and has gotten rid of its freight operations, Malpensa and Orio al Serio have important investments in order to develop their cargo activity.

Malpensa, which has doubled its tons transported in the last five year period, has an ambitious project to promote cargo services. The Cargo City is a logistics platform that has the objective of becoming leading cargo hub in southern Europe. The aim of such a logistics centre is to integrate the maximum number of services for goods in a single platform: a multimodal centre (railway is planned) that will become the industrial side of Malpensa airport.

On the other hand, Orio al Serio is more specialized in cargo, as around 100 kilos per passenger are transported. Traditionally, the airport has had a clear cargo orientation, closely related to DHL and UPS pure cargo carriers. In addition, the airport holds operations of other cargo specialists as Lufthansa cargo, TMA cargo, Meridian, or Luxair.

V.- SEA corporate airport system

Malpensa Spa and Linate airports are managed by SEA (Società Ezerzizi Aeroportuale), a public owned company whose major shareholders are the Municipality of Milan (84.55%) and the province of Milan (14.45%).

Not only airport management is carried out by SEA Spa, but the company also develops several operational activities, as airport handling or aircraft, passengers, and baggage assistance.

Apart from Milanese Malpensa and Linate, SEA has different stakes in companies in charge of several regional Italian airports, becoming a corporate airport system at a national level. Its stakes are:

- 49.98% of Sacbo Spa (Bergamo Orio al Serio)
- 12.5% of Aeradria (Rimini)
- 5% of Gesac (Napoli)
- 0.96% of Sagat (Torino Caselle)

NEG

New England

Interstate macroregion

New England is an interstate area located in the east shore of United States which major city is Boston, composed by the states of Rhode Island, New Hampshire, Connecticut, Vermont, Maine, and Massachusetts.

Moreover, it is one of the pioneers considering an airport system from an environmental and sustainable viewpoint, promoting a cohesive performance of air traffic.

I.- Prominence of regional facilities

The search of a sustainable solution consisting in a balanced distribution of regional air traffic in New England macroregion is the premise around which the airport system turns.

Promotion of Milan/Lombardy macroregion

New England macroregion is composed by six US states
The increase of regional air traffic and the limited capacity in Boston Logan international airport, system’s major facility, was the starting point to consider a joint approach to regional facilities.

The most immediate measure, the construction of a new secondary airport in Boston, was discarded; opting for the promotion of several airports that all together would fulfil regional air traffic demand.

So that, the supply of air services in New England should be conceived as a multiple choice, making the passengers use their closer air facility for domestic journeys. T.F. Green, Manchester, Worcester, and Hanscom are regional airports located in a 60 minutes isochrone from Boston, which combine general aviation with commercial services.

II.- Changing regional dynamics

The bet on regional airports development has meant a change in system’s dynamics. Whereas Logan airport is hardly increasing its activity, promoted regional airports are recording spectacular growths, thanks to important investments that have increased and modernized their capacity and facilities, making them more competitive.

An outstanding contribution of New England to airport system’s study is the capacity limitation that has been imposed on regional airports, around 6 million annual passengers, what could mean a progressive changing dynamics performance as long as new regional facilities were promoted due to the collapse of former promoted airports.

The system is segmented by destination. Logan airport plays the classic hub role and is the only air facility that holds international services, attracting passengers from short haul flights and small aircrafts traveling to overseas destinations. Logan is an international facility with an outstanding importance of general aviation that should not be removed from the airport, as concentrates short haul services having long haul destinations.

The rest of system’s components have rather common features, as a clear orientation to domestic market (including Canada and Mexico), with an increasing importance of low cost operations.

T.F. Green, located in Rhode Island, combines leisure and business activities. The airport has a refurbished image, promoting the additional comfort that a smaller regional airport can supply (smaller distances, more affordable parking services, or non congested road access). Domestic destinations from American Airlines, Air Canada, Northwest, or United are provided.

Manchester airport is the fastest growing regional airport (75% increase in 2002). Located in New Hampshire, it combines services from major American (US Airways, Continental, Delta, or United) and low cost carriers (Southwest). Moreover, Manchester cargo services are also being promoted, as the airport holds operations from the freight specialists FedEx and Airborne.

Hanscom airport is located in Massachusetts, and has a sharp leisure orientation, having a seasonal activity that complements regular services provided by Pan Am and US Airways.

Finally, Worcester is the air facility that is going to be promoted in the immediate future. A convenient location in the centre of Massachusetts and the refurbishing of airport facilities would allow a rather important airport growth, which nowadays has a marked regional performance.

The airports that have been depicted are not only members of New England airport system, but also take part in a corporate airport system, which is controlled by Massport (see point iii).

Although the organization manages the majority of regional airports, there are several exemptions that belong to New England airport system and are managed by other public bodies. Bradley international airport is managed by Connecticut Department of Transportation and, holding around 5 million annual passengers, is ranked second in New England airport system. As in the majority of American regional airports, only domestic services are provided, having a leisure orientation but handling business flights as well.
III.- Massport: Promoting the change from Public sector

Massport is a self-supporting independent public authority that manages regional infrastructures: airports, bridges, and ports.

The joint management of air facilities has allowed the development of a network of airports that guarantees the fulfilment of regional air traffic demand at mid and long term, in a sustainable and community respectful way.

Apart from the improvement of regional airports, new ground transportation facilities are planned in New England, as the new HST service between Boston and the city of New York. Although the line was initially conceived as a suitable option to decongest New England regional air traffic, forecasts show that only a million of annual passengers will change air services for the rail link, insufficient to absorb future air traffic demand.

I.- Towards Siamese performances

La Guardia was the first New York's international airport. Located in Queens, very close from city downtown, nowadays handles exclusively domestic flights (including Mexico and Canada) due to environmental matters. La Guardia airport is Delta and American airlines domestic co-hub with Kennedy airport.

JFK is the major international facility in New York. Located in Queens, but in a more distant site from Manhattan than la Guardia, the airport links the city with major world hubs. It handles all range of flights from world airlines, what converts JFK into system's first class airport.

On the other hand, Newark also handles international flights, having approximately the same structure of destinations as Kennedy. Considering that both airports also have similar freight ratios, it can be considered that New York has split its air traffic into two international facilities having similar features.

However, some differences between Newark and Kennedy can be found. Kennedy has a higher amount of International operations of American, Delta, and major European Airlines; on the other hand, Newark is the hub (domestic and international) of Continental Airlines, having a slightly lower percentage of international passengers.

Referring to cargo, JFK has a developed cargo center and holds operations from FedEx and world major carriers subsidiary companies (United Cargo, Korean, Nippon, etc.), while Newark is UPS and DHL hub, pure cargo specialists, handling mainly domestic cargo and having lower freight ratios.

II.- System maturity

The global analysis of the system shows that it is in a mature stage, as all its members have had moderate or negative values of air traffic growth in the last five year period, due to progressively lose of its hub performance, which is being moved towards central American hubs (Houston, Atlanta, or Dallas) and Chicago.

Hence, the origin of air traffic growth mainly obeys air traffic demand increases from regional inhabitants or visitors. So that, current projects related to the airport system are oriented to improve airport accessibility to the city by public means of transport. Airtrain is the major project that is being conceived, consisting in a light rail link from Kennedy airport to Jamaica Station, where links with NYC subway and commuter services are provided.

III.- Integrate public property and management

The Port Authority of New York/New Jersey Port is a public body that owns and manages not only the airport system, but also ports and singular infrastructures and transport services; as tunnels, bridges, bus stations, and ferries amongst others.

Although a public management usually tends to the concentration of services towards a single airport, New York illustrates how diversification of services can be feasible where the consideration of an airport system is almost compulsory, usual in Megapolis. Such a solution is the most common in United States, where the regional Department of Aviation or the Metropolitan or Regional Transport Authority owns the airports belonging to a particular area.
The major megapolis of continental Europe holds a metropolitan airport system, where air traffic increase is observed with preoccupation due to environmental and social matters.

With more than 70 million annual passengers, Parisian airport system is ranked 7th in the world, 2nd after London referring to international passengers.

Primary composed by airports located in the metropolitan area of the city, it is nowadays searching new options to accommodate future increases of air traffic demand.

The development of regional synergies between territories conveniently linked by public transportation, promoting a railport system with Lyon, or obtaining a social acceptance of air traffic growths are measures currently being considered.

### I.- Airport features and system’s dynamics

The distribution of air traffic in Paris region follows the usual structure in Megapolis. Current major airport, Charles de Gaulle (CDG), was constructed foreseeing increases of air traffic that Orly was not able to manage.

Air traffic forecasts suggested to place CDG airport in a further position from the city centre, as Orly’s location was too close from downtown, what led to socially limit its operations. The larger and more modern facilities provided by CDG airport, opened in 1974, gave progressively to Orly a secondary role in the system, holding nowadays mostly domestic destinations within France and Francophone territories. European and intercontinental services, mainly from secondary air carriers, are also provided in Orly.

CDG has a more international orientation, becoming one of world intercontinental hubs. International Air France and major world carriers operations are handled, as well as an intense cargo activity from FedEx and other freight operators.

The different distributions of destinations in each airport is noticed analyzing French passenger shares. Whereas Orly has 85% of French passengers, CDG has only a 40%.

The share of passengers in transfer also illustrates different behaviours: 33% in CDG and 14% in Orly.

The hub performance of Parisian airport system is noticed analyzing the origin of its passengers, as 30% are from Paris-Ille de France, another 30% are from the rest of French Departments, while the 40% remaining are foreign passengers.

The metropolitan system is completed by le Bourget airport, which develops a city airport performance, holding both general aviation and private services.

### II.- Social and environmental concern

Under strict control by the central government, far from their capacity levels, Paris airports have their operations limited due to social and environmental aspects, even though pressure has been recently released on CDG.

At Orly, the maximum number of annual movements is limited at 250,000, what after several years has driven to an air traffic stabilization around 25 million annual passengers; falling in the last decade from the third to the eight place in European market.

In CDG, a previous limitation of 55 million annual passengers has been suppressed by the present government, promoting an environmental friendly increase of air traffic (limitation of night flights …), which with its four runway system is planned for handling more than 80 million passengers.

### III.- Internationalizing cargo services

Paris metropolitan area, as one of major world megapolis, generates and attracts a huge amount of air traffic. Commercial passenger operations are the most profitable services for both Paris airports and passengers.

However, as cargo services are also an important activity in the region, Paris is encouraging regional airports that are located some hundreds kilometres away to become its freight specialists.
Nowadays, there are two airports controlled by ADP with a clear freight orientation: Chateauroux-Deols Airport, located 230 kms far away from Paris, and Liège, located in Belgium. They become strategic focuses for regional development towards Benelux and West Germany.

Moreover, the transfer of a part of CDG’s cargo services to Vatry airport, located in Champagne, is being demanded by local inhabitants.

IV.- Low cost opportunities ?

Low cost business in Paris airports is less developed than in most European systems, being only available few services from companies like Easyjet and Virgin Express, which generally operate in major international airports.

The recent promotion of low cost services is due to Orly’s released slots from Air Lib failure (44.500 slots), which were shared out among different carriers; Easyjet obtained 7.300 and Virgin Express 5.840.

As formerly depicted, social limitations at Paris airports allow limited development of low cost traffic in the region, despite having technical facilities to succeed.

Beauvais Tillé airport, located in Oise region (north Paris) has regular low cost destinations and, as usual in such these airports, it uses the name of Paris for commercial purposes in order to acquire a low cost specialist position in Paris airport system. Ryanair and Volare are the carriers that regularly operate at the airport, providing services to Sweden, United Kingdom, Ireland, and Italy.

There are regular bus links from Paris to Beauvais and, as the services provided are poor, each bus is related to a particular flight, what adds continuity to the journey, being able to be understood as a single air-road intermodal trip.

V.- Solutions to absorb air traffic growth

The absorption of forecasted increase of air traffic in Paris is one of the key questions to be solved by French Authorities. Different measures are nowadays being studied:

- Even though last government decided the construction of a third airport 100 km northeast from Paris, current government, without abandoning the hypothesis, tends to the promotion of a national airport system. Apart from Lyon, linked by HST with Paris, two additional airports are planned, which could be able to develop an strategic performance in French air traffic market. Toulouse and Nantes vicinities are the locations where future French secondary airports will be settled.
- Optimization of national and European HST network role to release pressure on Paris airports.
- Working to reach social and political consensus accepting an ambitious growth in CDG.
- Optimization of operations held in Orly within the current limitation of 250.000 movement per year, through the increase of average load per passenger.

ROM

Rome

Fall of the empire towards Milan

Rome has historically been the major air traffic generation focus in the country. Major Italian airport, Leonardo da Vinci/Fiumicino, is complemented by Ciampino, which was former Italian major hub.

Although a promotion of Rome airport system is being carried out, the close position to Ciampino airport from the city centre and the outlying location of Rome from continental Europe has driven the city to lose the first place that historically had in Italian air traffic market, which has been moved to Milan/Lombardy Airport system.

I.- From airport to airport system

Rome airports’ history coincides with world major urban concentrations. Ciampino, a military base, was inaugurated in 1916 and became one of major air facilities during the first part of the twentieth century, holding memorable events, as the first Polar flight made by Amundsen in 1923.
Rome’s decrease in cargo activity is due to the freight development around Milan Malpensa (200% increase in the last five year period), which becomes a more suitable facility for logistics operators due to its central European location.

III.- Privatization

Rome airport system is managed by ADR (Aeroporti di Roma), a fully private society. The privatization process began in 1997, when a 45% of the capital was sold in the Stock Market of Milan. In year 2000, ADR, the company that got in 1974 a concession to manage Rome airports, became 100% privatized.

The current scenario shows a corporate airport system that coincides with territorial scope. As major airports operators, the future foresees an international development of the company, exporting its airport management know how, what would probably drive to an international corporate airport system.

I.- German tourist focus

Four major facilities compose Rhein Region airport network: Düsseldorf, Köln–Bonn, Dortmund, and Münster in minor grade; playing a secondary role in German air traffic market, but having important volumes of air activity.

Düsseldorf is region’s major airport, which holds domestic, international, and intercontinental destinations. Although the most frequent service is Munich, the airport has a clear holiday orientation, as the most common destinations are Majorca, Antalya (Turkey), and other Mediterranean tourist focuses. The distribution of airlines also shows Düsseldorf tourist vocation, as LTU, the German tourist carrier, charter specialist, is the second operator in the airport after Lufthansa, German National airline that provides the majority of domestic links.

The same performance is followed by Köln–Bonn airport, although it combines holiday destinations with cargo activity. Spain, Turkey, Tunisia, and other Mediterranean centres are, as Düsseldorf, the most usual destinations. In addition, around 80 kg per passenger are handled, drawing a cargo specialist performance.

Hence, whereas passengers are mainly held in Düsseldorf, cargo activity is shared with Köln. Düsseldorf cargo comes from passenger operations and Köln has cargo dedicated activities, what rises its freight ratio.

Both Dortmund and Münster also have seasonal activities concentrated in holiday periods. Dortmund, as it is closely located and conveniently linked with Düsseldorf airport has a poorer volume of air traffic; however Münster plays a more independent role due to its further location from major Ruhr cities.
Essen has an own airport, Mühlheim, but the high density of air facilities in an small area and the excellent regional connectivity makes the airport to be mainly dedicated to general aviation, having a residual performance in regional dynamics.

II.- HST Domestic flights

The excellent HST network in Germany makes many of former domestic flights to be nowadays carried out by train, which is competing with air to take the lead in short haul operations within Germany. For example, the structure of Düsseldorf’s destinations shows that Frankfurt, the major international German airport, is only its fifth busiest city, meaning that an important part of internal mobility is absorbed by car and public transportation services.

So that, being domestic flights within West Germany partly substituted by rail services, the airports are dedicated to connect their city with international tourist centres, major European megapolises, or further German cities.

Düsseldorf airport illustrates such a performance, as it is an integrated facility in German rail network, having a direct rail link to a station where ICE (German HST), IC, and national rail network services are provided, becoming a central infrastructure in Ruhr region.

III.- Owning and managing German airports

Each airport is managed by a different body or organization where different private investors and administrations have a part of the capital, owning each airport a different three layer management structure.

For instance, Düsseldorf Airport Corporation’s shareholders are the city of Düsseldorf with a 50% and a private group with the 50% remaining (Hochtief AirPort GmbH holds a 60% and Aer Rianta plc holds a 40%). Moreover, Flughafen Köln/Bonn GmbH shareholder structure is the following: 30.94% Federal republic of Germany, 30.94% Federal State of North Rhine-Westphalia, 31.12% city of Köln, 6.06% city of Bonn, 0.59% Rhein-Sieg district, and 0.35% Rheinisch-Bergischer district.

Germany becomes a paradigmatic example of airport management, where each interested administration participate in airport’s structure of capital, safeguarding regional interests and making them compatible with national air traffic directives.

I.- Cost advantages

Ryanair is able to provide a one way trip from Barcelona Girona airport to London Stansted for 6 euros. Economically unfeasible at first glance, several measures are carried out in order to burst air traffic market through price policies.

Apart from frequent commercial campaigns that offer particular seats at very low prices, Ryanair’s fares are usually far lower from the ones provided by major international carriers. So that, most of company’s benefits have its origin in a well planned cost structure that makes these fares feasible and allows the economical viability of the company.

As depicted in low cost chapter, Ryanair costs per passenger are about a third compared to the ones that national air carriers have. Some aspects that make Ryanair so competitive are the taxes and ground services perceived by airports.

Regional airports, less congested and, in many cases, close to their abandon, are the facilities supplying cheaper slots. So that, Ryanair is able to follow promoting reduced rates and regional airports have found a solution for a part of their problems, through which they can develop a regular activity complementing major airports in a particular system, or just becoming spokes of a new European regional airport network, European Second Airports Division.
II.- Regional airport network

Low cost carriers and, in particular, Ryanair have allowed the development of regional airports that nowadays form a new airport network that serves the majority of European air traffic focuses.

The different members of the corporate network have common features, as the low volume of air traffic, mostly non scheduled and concentrated in summer peak periods, and the distant location from the city center.

The inconvenient location of regional airports, generally more than 100 km far away from the major city, is one of the major handicaps for low cost carriers success. However, Ryanair supplies regular bus services, allowing the development of regional facilities that some years ago did not handle any regular public transportation link.

The fast development of Ryanair is noticed analyzing its operations structure, a multi hub/spoke network that has several consolidated hubs in Great Britain (Stansted and Dublin). In addition, several regional airports in the Continent are being also promoted as Ryanair hubs (Hahn, Charleroi, Skavsta, and Orio al Serio).

The rest of the components are a string of regional facilities whose activity is fully related to Ryanair, usually the only carrier providing regular services in those airports.

III.- Low cost future

Undoubtedly, the segmentation of flights through fare policies has created a new niche in air traffic market. If low cost airlines follow its current trend, regional airports performances will surely change.

So that, the promotion of secondary airports that nowadays is a suitable option to decongest regional air traffic may drive these facilities to have the same problems that major international airports are facing nowadays (noise, air, etc.). Hence, current aviation problems would be exponentially expanded to a larger number of facilities, what could be, paradoxically, against regional interests.

San Francisco Bay

Regional conglomerate...

Aggregate facilities

San Francisco Bay area airports have usually had a rather autonomous performance. By serving each one its closer counties (Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and SF are the counties that compose San Francisco area), they have never been conceived as a unique airport system, but as a group of infrastructures located in the same regional area.

A particular regional morphology and a vertiginous urban and economic development based on Information Technology Industry are the engines that lead airport system's evolution in the Bay.

I.- Segmentation by destination

The importance of domestic traffic in United States is reflected in airport system's behavior, which is composed by three major members: San Francisco International, Oakland, and San José. These airports are complemented by a minor facility, Sonoma, mainly dedicated to general aviation.

International services are only held in San Francisco International, system's busiest airport that has regular worldwide services. Domestic destinations are the most common, representing a 75% of total passengers, mostly provided by United Airlines, airport's major carrier. Major American urban concentrations are the busiest services in San Francisco, as 10% of passengers travel to Los Angeles and 6% to New York. Moreover, it also plays an international hub role, linking the area to Far East (10% of the total number of passengers) and major European hubs (7%).

Oakland airport has a mixed market, as it holds regular domestic services and has an intense cargo activity as well, due to a close position to Oakland port, a key infrastructure for regional development. The airport has a clear domestic orientation, as the majority of its services are within the States, even though several international links are provided as well, but

Finally, San José airport is the fastest growing air facility in the region in terms of passengers. The change in the system's dynamics follows the recent urban development occurred in Silicon Valley area, the world High Tech capital.

Major carriers in San José are Southwest and American airlines, that provide regular domestic destinations. Other American airlines provide services in San José, as well as the Dutch KLM, the only international one. Apart from the recent increase in the number of passengers, the decrease of movements shows the promotion of regular services, mainly dedicated to passengers.

II.- BART: Uniting the airport system

BART (Bay Area Rapid Transit) is a rail network that serves major locations in the San Francisco Bay Area, becoming the most common option to avoid regional congestion. Different services connect an area integrated by 5 counties, which links San Francisco with the eastern side of the Bay.

Both San Francisco and Oakland airports will be integrated in regional rail network (BART)
BART network nowadays includes the access to Oakland airport through its AirBART service. In addition, the prolongation to south San Francisco, which is nowadays under construction, will have an easy accessible stop at San Francisco International airport. So that, BART would provide not only public accessibility from cities to airports, but also will add territorial cohesion and connectivity in the Bay Area.

SCO
Scotland

Low cost system

The axis composed by major Scottish cities, Edinburgh and Glasgow, holds three international air facilities that can be considered as a single airport system.

Due to a peripheral position either in Europe and United Kingdom, and a moderate air traffic activity; each member of the Scottish airport system has a metropolitan conception, becoming a spoke in European and British airport network.

I.- Siamese system

The system is composed by two different layers or internal systems: Glasgow and Edinburgh. Glasgow International airport and Prestwick are Glasgow airports, which are completed by Edinburgh international, forming Scottish Airport System.

The major airports of the system, Glasgow and Edinburgh, have common features directly related to the properties of the city they serve, having similar air traffic increases and distribution of destinations. Hence, the system is composed by two Siamese airports that are complemented by a cargo and low cost regional specialist, Prestwick.

The global performance of the system shows a change in its dynamics towards Prestwick airport, which is also identified as Glasgow South for commercial purposes.

II.- Low cost opportunities

Undoubtedly, the increase of low cost business is the most important milestone in the recent history of Scottish air traffic business.

Nowadays, the three airports have regular low cost services to many European destinations, what is translated into high increases of air traffic in each facility, becoming Scotland one of European fastest growing regions.

Easyjet/Go, BMI Midlands, or Flybe are low cost carriers that have regular services in Glasgow and Edinburgh; which hold also flights from British Airways and other major international carriers. In addition, all airports have a very marked seasonal traffic, holding many charter operations in summer holiday periods.

III.- Individual differences

Domestic and international within Europe destinations are the most usual services in Glasgow, but several intercontinental destinations to America are provided as well.

Edinburgh airport has the same air carrier structure but has a more domestic/European orientation, as it does not have any regular intercontinental service.

Finally, Prestwick is one of Ryanair hubs and combines the regular low cost services within Europe (mainly to Mediterranean tourist centres) with charter flights in summer months, apart from military services. The recent expansion of Ryanair has meant the airport to play a hub role in the carrier’s destinations structure, having doubled the passengers and the tons transported in the last five year period.

IV.- Segmenting and changing freight activity

Scottish airport system has a curious freight segmentation; in the internal airport system serving Glasgow area, freight activity is concentrated in Prestwick, the less congested airport, what converts Glasgow International in a passenger facility, combining business and leisure services.

The combination of almost all Glasgow freight with a moderate volume of passengers transported, converts Prestwick in a cargo specialist, tendency that is being soften by Ryanair’s bet on the airport. Most frequent cargo destinations from Prestwick are Northern Europe and North America.

Scottish highway network

Prestwick is Glasgow’s cargo specialist

On the other hand, Edinburgh develops also an intense cargo activity, recording 600% increases of tons transported in the last five year period, showing a change in system’s freight dynamics.

Scotland has not only suffered an spectacular increase of freight activity, doubling the number of tons, but also has undergone an internal change of distribution, consisting in moving cargo activity from Glasgow International airport to Prestwick/Glasgow South and Edinburgh.

Hence, Scottish regional cargo is currently a balanced activity between Glasgow and Edinburgh metropolitan areas, reached after a period of concentration around the two Glasgow airports.
Stockholm

Promoting regional participation

Moderate values of air traffic generation, a peripheral location in European continent, and a joint management by a national airport authority, LFV, drive Swedish airports to concentrate around Stockholm.

Arlanda and Bromma are Stockholm airports, which are being recently complemented by Skavsta and Västeras, regional facilities that are positioning themselves in European air traffic market thanks to low cost and freight specialization.

I.- Environmental concern: Towards a regional airport system

Air traffic in Stockholm has undergone major cities classic behavior: a first airport located in a close position from the city that has been substituted by a new larger and further platform that nowadays handles the majority of operations.

Bromma airport, former Stockholm international, is nowadays conceived as a city airport. Its adjacent position from city leaded to worrying noise pollution levels, what suggested the move of commercial operations to a further location that, apart from avoiding environmental constraints, allowed the absorption of regional air traffic growth thanks to larger and more modern facilities.

A first system composed exclusively by Stockholm airports, Arlanda and Bromma, could be studied. However, the recent increase of low cost carriers and freight specialization in regional airports located in Stockholm hinterland has enlarged the system: Skavsta and Västeras are regional infrastructures that complement Stockholm airports.

II.- Dualism of System performance

As already depicted, Stockholm city airports' internal dynamics consist in a concentration of services around Arlanda airport and a progressive disuse of Bromma, nowadays almost exclusively dedicated to regular domestic services and general aviation.

Arlanda presents a quality growth, absorbing air traffic increase from major airlines operations and allowing regional airports specialization in low cost carriers and other market niches, changing system's dynamics.

Both Skavsta and Västeras have become Stockholm low cost airports. They are members of Ryanair's regional airport network and record higher increases of air traffic compared to Arlanda due to their low value of air traffic in absolute terms. In addition, cargo operations are combined with low cost services in Skavsta, what converts it in system's second facility, having still a wide margin to grow in the following years.

III.- New Management solutions

As other Nordic and several Mediterranean countries, Swedish airports are owned and managed by a national authority, LFV (Swedish Civil Airport Administration).

Nevertheless, Skavsta airport is going against the national trend, nowadays managed by TBI, a British airport company specialized in airport ownership and management that bought its stake from the city of Nyköping, even though a 10% stake is still in hands of the city of Västeras. A private management promotes the search of new income sources through regional airports specialization, because the airport is conceived as an specific business unit which benefits should be maximized.

IV.- Accessibility

Accessibility facilities available in each airport are according to its volume of air traffic. Whereas in Arlanda there is a convenient air rail link, Arlanda Express, connecting the airport rapidly with the city centre, in regional airports accessibility facilities are rather poor.

In these smaller airports, bus is the only collective public transportation facility. Low frequencies combined with long distances (longer than 100 kms) between them and Stockholm discourage the majority of passengers from its use.

Switzerland

Disintegrated airport system concept

In the small area taken up by Switzerland, several international airports are located. Its most important feature is the individual orientation to different European regions, developing transnational systems.

So that, the Swiss airport system is just an administrative/political concept, a conglomerate of air facilities each one having a particular orientation without developing any internal synergy.

I.- Border locations serving foreign regions

Most of major Swiss cities are located in the frontier area of the country, specially in its western side. Such a particular location promotes the development of cities like Geneva and Basel towards France and Germany.
In Geneva, the airport forms a transnational system with Lyon Saint Exupéry, the Alpine airport system (see LYG case).

Basel – Mulhouse airport, as its name shows, is the only binational airport in the world, as the government board is composed by French and Swiss administrators, completed by German advisors. The airport stands in an enclave between Switzerland, France, and Germany; 15’ far from Basel, 30’ from Mulhouse, and 55’ from Freiburg, reaching a 4 million inhabitants hinterland defined by a 60 minutes isochrone.

The share of passengers sorted out by nationality shows the strategic location of the airport: France and Switzerland contribute with a 38%, and Germany adds the remaining 24%.

Basel airport has an intermediate position in European air traffic market, because although it has a clear seasonal performance leaded by leisure destinations (Mediterranean tourists areas), the airport also links the region with major European hubs and has regular services to America.

II.- Swiss airport system ?

As depicted, Basel and Geneva, national second and third airports, cannot be properly considered as members of a Swiss airport system. However, the independent development of Geneva and Basel indirectly decongests Zurich, Swiss major air facility.

Zurich and Bern, the rest of Swiss international facilities, have also an unlinked performance; what means that, from a national level, a country system could only be analyzed from an administrative viewpoint.

Zurich, Swiss airlines hub, country national airline, has one of the highest shares of passengers in transfer, around a 40%, and links Switzerland to major world hubs. The distribution of destinations shows that although the airport holds worldwide services, European cities are the more frequented.

Although the airport is having an important air traffic growth, its current facilities (3 runway system) technically allow large increases of air traffic. It is probably due to such a wide margin to grow that none of other regional airports is developing any specialization.

Apart from Basel, the closest international airport from Zurich is Bern, which could be a facility to be promoted. Nowadays, it only holds leisure services to Mediterranean tourist focuses in summer peak periods, and regular flights to Paris and London. Other regional airports, as Lugano or Saint Gallen, are mainly dedicated to tourism, located also near Italian, and Austrian and German frontiers respectively.

TBI Corporation

The airport company

TBI is a British company specialized in airport business, owning and managing several airports, but also providing different operational services. TBI’s grades of involvement are:

• Airport ownership
• Airport management
• Provision of services to airports

I.- Airport ownership

TBI owns an intercontinental network of regional airports, presenting all of them spectacular increases of air traffic in the last years, as London Luton, Cardiff International, Belfast International, and Stockholm Skavsta.

Luton is the largest corporate airport (TBI’s share is 71.4%), located about 45 kilometres north of London. Together with Stansted, it is changing air traffic dynamics of London airport system, having a significant growth over the last few year period due to the development of low cost carriers. Apart from regular low cost links, the airport has an important share of charter flights, especially during summer months, when links London with major European tourist destinations.

Belfast International airport is also mostly dedicated to low cost carriers, connecting not only Northern Ireland with England (Liverpool, London Stansted, or Bristol) but also with Amsterdam.

All services formerly mentioned are handled by EasyJet/Go. Other companies that also operate in Belfast airport are BMI British Midland (low cost carrier) and Maersk International (freight specialist).
Finally, regular services are complemented by holiday charters to tourist destinations, such as Canary Islands, Costa Brava (Barcelona-Girona), Tunisia, or Italian lakes and mountains.

Cardiff International is one of the UK’s fastest growing airports, combining business and leisure flights.

Skavsta airport may be considered as Stockholm secondary airport. It combines freight with low cost operations, being one of Ryanair’s continental Europe hubs; also having several regular links with Finland and Poland. As the location of the airport is about 120 km far away from Stockholm, the key for its success is the construction of an air rail link, solution that Swedish government is nowadays considering.

Apart from European airports, TBI owns Orlando Sanford International (SFB) and several Bolivian airports (SABSA).

Orlando Sanford mainly receives British leisure charter passengers from companies such as Airtours, Air 2000, Trans Air, or Monarch. In addition, it has several links provided by secondary airlines (Aeropostal, Vacation Express or Pan Am).

The 3 Bolivian airports are understood as a long term investment, handling altogether about 2 million passengers.

TBI illustrates how a private company is able to look for new market opportunities fulfilling regional airport needs. So that, private is preferred to public ownership and management in small regional airports, as new opportunities can be developed.

II.- Airport management

In larger airports, TBI manages different activities that vary from gate management to parking services. Atlanta Hartsfield International Concourse E, flight information display system, and ramp control at four of its six ramps are services provided by TBI, which also manages Toronto Pearson Terminal 3, as well as its public-parking facilities, amongst others.

Apart from some activities in major international hubs, TBI also provides airport management to smaller regional airports, as Albany or Burbank.

III.- Airport services

There is a wide range of services supplied by TBI, which can be summarized as follows:

- Aircraft ground handling and passenger services. Direction of aircraft to the ramp, receiving and launching aircraft at the gate, and loading and unloading aircraft on the ramp
- Cargo services. Cargo build-up, breakdown, loading and unloading, and warehousing
- Facilities maintenance and operations. Maintains, repairs, and services passenger terminal facilities and aircraft support equipment
- Fuel Farm management
- Into-plane fuelling
- GSE fuelling and maintenance
- Public transportation management

I.- Asia international gateway

Tokyo Narita airport is the first Japanese international air facility and, together with Hong Kong Chep Lap Kok, Asian major international gateway.

Megapolis in archipelago

The world major megapolis has a system composed by two airports: Haneda and Narita, presenting both evident congestion symptoms.

Apart from the natural air traffic generation usual in megapolis, the city develops a double function that can be easily identified in each airport: Asia international gateway and Japanese air traffic hub.

Traffic forecasts in Japan still predict air traffic demand increases and, as nowadays both Haneda and Narita are close to their capacity levels, the construction of a third airport is being studied by Japanese Government.

A dense private and public transport network links Tokyo airport system with major regional focuses
Narita could be considered the platform that fulfills megapolitan requirements, being the hub of Japan's national airline, JAL, and handling flights from other major international carriers, linking Japanese destinations with most important international hubs.

II.- Japanese domestic hub

Haneda airport is the busiest airport in Japan, being the national domestic hub, as only destinations within Japan made by local air carriers are held.

Such a performance perfectly fits the hub airport concept introduced in archipelago territorial natures, where a particular facility concentrates internal domestic operations, becoming a link between regional destinations. Then, Haneda can be understood as Japanese archipelago’s hub.

III.- System’s performance

Narita and Haneda airports have well defined features, which reveal a sharp destination and airline specialization.

As usual, the oldest facility, Haneda, has a closer position to city downtown, being dedicated to less profitable activities, such as domestic flights held by Japanese domestic carriers.

Narita handles the totality of Tokyo international air traffic, connecting world hubs with major Japanese secondary cities.

Tokyo’s destination and airline specialization, very common in megapolises (see New York, London, Los Angeles, or Paris) has a peculiarity that only occurs in the Japanese capital city; in Tokyo, the domestic airport, Haneda, handles more passengers than the international platform, Narita; in other words, archipelago features are more important than Megapolises ones.

IV.- In town airport system

Undoubtedly, the main contribution of Tokyo to airport systems’ study is the development of in-town facilities that allow a global concept of the system’s components and the development of new synergies between them.

The most important innovation is the development of in-town airport terminals. ITAT, from where passengers receive on line information of flights held in the different airports of the system; TCAT (Tokyo City Airport Terminal) and YCAT (Yokohama City Airport Terminal) are the system’s city terminals from where public transportation services that regularly link the city with both airports are also provided.

V.- Accessibility

The huge congestion in Japanese road network drives to a modal split of airport accessibility dominated by rail services.

Haneda airport has two rail links, the monorail to Japan Rail-East, used by 70.5% of airport users and the Kehin-Kyuku network that has a share of 1.7%. Collective public means of transport are also dominant in Narita airport, where 54% of passengers use the airport rail link Narita Express and 18% prefer bus services.

VIENNA

Towards Eastern Europe

Located 20 km east from the city center, Vienna International airport is Austrian national hub. Airport hinterland includes several Austrian, Slovak, and Hungarian regions, what makes the airport a key infrastructure for their development.

Bratislava, the Slovak capital city is located 60 km far away from Vienna, and even though it has own international air facility, the wider range of services and destinations available at Vienna, makes the latter to be major Slovak international gateway.

On the other hand, Stefanik Slovak national airport is specializing in low cost business, becoming the hub of Sky Europe, Slovak low cost carrier. Hence, the aggregate concept of both airports may allow the development of a transnational airport system.

I.- Promoting regional synergies

Vienna and Bratislava airports have marked different features that contribute to a richer supply of services in the region.

Vienna international airport is the second European hub for Eastern Europe destinations after Frankfurt. Apart from links to major European hubs (London, Frankfurt, and Paris), Antalya, Prague, and Moscow are the most frequent services provided; about 1 million annual passengers travel to Eastern Europe destinations, what represents about a 10% of airport activity.

The metropolitan area of Vienna has about two million inhabitants, but it raises to six million in less than 2 hours by car, what means a vast hinterland; Vienna is located 20 km from the airport, Bratislava is about 60 km, and Budapest is at 200 km.

Combining passengers and cargo services, the airport has a lack of low cost flights as it has betted on higher quality services, promoting a business oriented activity. The business performance of Vienna airport becomes an opportunity to promote adjacent airports in different air traffic niches that are not developed in Vienna.

Even though there are Austrian regional airports that are low cost specialists, the closer position of Bratislava Stefanik airport allows its conception as the best alternative to handle low cost traffic demanded by Vienna.
Stefanik airport is located 40 km far from Vienna, in the west of Bratislava. The major air facility in the Slovak Republic is CSA (Czech Airlines) and Sky Europe hub, also having regular services from major European carriers as British Airways or Air France, and low cost carriers as Air Berlin.

Whereas CSA, Czech national airline, is probably the best option for Viennese passengers traveling to Prague, Sky Europe is an Slovak low cost carrier that links the region with several German, Croat, Swiss, and north Italian destinations. It is especially convenient the Sky Europe link between Bratislava and Zurich, becoming a more affordable alternative for Austrian passengers traveling to the Swiss Hub.

II.- Accessibility: a key for success
Accessibility facilities between Austria and the Slovak republic allow the promotion a transnational airport system. Both Vienna and Bratislava airports are understood as key regional intermodal nodes, having developed convenient public transportation facilities between each airport and their neighbouring region.

Apart from A4 highway, major Austrian ground gateway to eastern destinations, Bratislava airport has a regular bus link to the city of Vienna.

In Vienna, a higher volume of metropolitan inhabitants (2 million of Vienna in front of 500,000 in Bratislava), suggested to solve city instead of regional accessibility, what drove to conceive a direct air rail link from the airport to the city center, Airport Express, which will make the city come close to its air facility.

III.- Corporate system and regional opportunities
In terms of management, whereas Vienna International Airport plc is in charge of Austrian hub, Stefanik is public owned and managed.

Bratislava illustrates how an airport that was almost unused several years ago, nowadays is able to have an spectacular development through the promotion of new markets that can, in addition, expand its domain of influence in the territory.

On the other hand, Vienna is tending to become a corporate airport system. Apart from managing and owning Vienna airport operations (handling, safety, flight information, etc.), the company (40% public, 10% Self Workforce, and 50% free float) is expanding its business.

Participations in BBI (Berlin Brandenburg International) and in Malta (23% in Malta International Airport plc) are examples of such a corporate internationalization. Moreover, different facilities in Vienna airport city are also being promoted by the company, as the new VIE-Skylink terminal through which the airport will be able to reach 20 million annual passengers, or Airport Express, previously depicted.

Washington airports... Washington brand
An American macroregion composed by the States of Maryland, Virginia, and the District of Columbia makes up the airport system that serves the capital city of United States.

The small area taken up by Columbia District and an intense urban development drove Washington international airports (Dulles and National) to Virginia state, despite maintaining the name of the US capital city, becoming airport’s best brand.

I.- Hubbing after a change in system's dynamics
Baltimore, National, and Dulles airports compose Washington airport system. Globally, the region is one of the fastest growing in the States, having a 43% of overall increase of passengers in the last five year period.

The growth of air traffic demand has meant a recent change in system’s dynamics; former smaller airports, Dulles and Baltimore, are nowadays major international facilities.

National, major Washington airport until the 90’s, takes up a constant position due to environmental aspects, what means a lose of share in system’s traffic. So that, system’s dynamics shows a Hubbing tendency towards Dulles and Baltimore airports, with a slight advantage of the last mentioned.
On the other hand, cargo activity has been traditionally concentrated around Dulles airport, even though Baltimore is recently handling more tons annually. National, passenger oriented, has few important cargo activity.

II.- Individual features

Baltimore airport is located in Maryland and in the last five year period has changed its position in the system, from being the less crowded airport, it has become the busiest in terms of passengers.

The airport, which in the 80's was the first American air facility to have an air rail link (AMTRAK), combines domestic with curious international destinations as Ghana, Iceland, or Jamaica. Apart from being Southwest hub, major American low cost carrier, it has almost doubled its freight activity as it handles FedEx, UPS, and DHL operations amongst others.

Ronald Reagan National airport, located in Virginia, nominally belongs to District of Columbia. Its close position from city downtown suggested a change in airport’s concept. Opened in 1941, the former major international airport of the system is nowadays dedicated to short haul flights (2,000 km is the maximum flight distance allowed, owing to noise pollution). Hence, domestic services from American carriers predominate in airport’s schedule.

Dulles international airport is located in Virginia, around 40 km far from Washington downtown. Opened in 1962, was already conceived to absorb Washington air traffic demand, and nowadays has become major international gateway, system’s long haul airport. Having around 25% international flights, Dulles is one of the American airports with higher ratios of international traffic, linking Washington with worldwide destinations. Apart from American carriers (hub of American Airlines and US Airways), major world airlines fly to Dulles. In addition, Dulles handles cargo services from world airlines cargo subsidiaries and freight specialists, as FedEx or UPS.

III.- Different public managers

Traditionally, Washington airport system was composed by National and Dulles airports, jointly managed by the Metropolitan Washington Airport Authority (MWAA), organization where all regional stakeholders are represented in a 13-member government board; 5 appointed by the Governor of Virginia, 3 by the mayor of Columbia District, 2 by the Governor of Maryland, and 3 by the president of the United States. Despite a public ownership by Washington airports, MWAA, is financially independent, becoming an organization alike the European 3 layer structure concept in airport management.

However, Baltimore has the usual performance of American airports in terms of management, being owned and managed by Maryland Aviation Administration, governed by Maryland authorities.
Appendix
Airport System’s Results

2001 Data
Promoting Public Transport at Airports

Regions and Airports Partners for Sustainable Prosperity

Airport Regions Conference Business and Employment Working Group

From airport to airport city

Assessment of good practice on environmental issues (2002)

Airport Dynamics Towards Airport Systems

Air freight and Airport Region