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FUTURE STRATEGIES FOR AIRPORTS

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Abstract

In air transport, the evolution of traffic depends upon many economic factors, and on the way in which the markets participants respond to those factors. Although airlines are the main actors, the airports are by no means passive, and their strategies will also have an impact on airline behaviour and route development. Our methodology analyzes the potential evolution of airport strategies in the next decade and its impact on the distribution of traffic at airports, using a typology of airports that has been designed for this purpose. It shows in particular that diversification strategies, which are usually reserved for large firms, can also be successfully applied to smaller airports.

1 Introduction

During the last decade, the European air transport market saw the emergence and development of the low cost carriers which now represent a significant share of intra-European flights. Another noticeable trend was the change in the way many airports are managed: many went from public to private ownership and/or management. In this context, airports have tried to play a more active role in the air transport industry, by improving their attractiveness and their competitiveness. Instead of waiting for airlines and traffic, they have developed more active strategies towards airlines and particularly towards low cost carriers.

In this context, it is worth focusing on airport strategies and their future evolution. Although airlines' strategies will be the main drivers of traffic evolution, the airports are by

no means passive, and their own strategies will have an impact on airline behaviour and route development. Will new trends in airport strategies appear? Which strategies will be adopted by which airports? What could be the impact of airport strategy implementation on the traffic distribution at airports?

The present paper provides some answers to these questions by analyzing the potential evolution of airport strategies. After examining the characteristics and requirements of airport clients (passengers and airlines), we identify the generic strategies that could be developed by an airport towards those clients. Not all strategies, however, are feasible for any airport: it depends on the airport characteristics. This fact led us to build an original typology of airports, taking into account three elements: airport size and potential for growth in capacity and in demand.

Even though they are less optimistic than a few years ago, traffic forecasts are indeed still very good for the air transport sector. The relevant question at the airport level is the ability to receive more passengers in the future, i.e. its capacity to grow. This element will characterize the possible evolution/adaptation of supply to a general increase of demand. Of course, certain destinations will receive even more passengers, and taking into account the specific demand of an airport is very important. The role of the third element, airport actual size, is to take into account the current situation of an airport. This allows us to take a picture of the past strategies of a given airport.

With the help of this typology and the generic strategies defined, we are able to describe the future strategies available to a given airport.

The next section sets up a framework in which we describe all the possible airport strategies and develop an airport typology. Section 3 uses the former elements to identify the strategic options by airport type and the possible evolution of the route network of an airport. We illustrate this methodology by an application to Bordeaux airport in France.

2 Methodology

2.1 Airport strategies

2.1.1 Airport customers and revenues

As a service platform, airports have several types of clients or customers. From the aeronautical perspective, the main airport clients are airlines of all types: traditional airlines, low cost airlines, but also freight airlines and integrators. Airports provide them with infrastructure (e.g. runways, taxiways and aprons) and services (e.g. refuelling and handling). Services can be provided directly by the airport, or externalised to private firms. Passengers are also direct clients of airports in the sense that they are provided with terminals which they use to gain access to the planes.

From the non-aeronautical perspective, shops, restaurants and bars provide services to the passengers and bring revenues to the airport. Firms providing support services to airlines are also airport clients. Airports will have to cater to the different needs of the above identified customers. Their needs or preferences can be conflicting: for example, passengers wish to have short connections between flights, while shop owners would prefer to have passengers stay longer in the terminals to increase the potential for sales.

The revenues of an airport are usually separated into aeronautical revenues and non-aeronautical revenues. The aeronautical revenues are directly related to the aeronautical activities of passengers and aircraft, and the non-aeronautical revenues are all other revenues: These can in turn be separated into two groups: revenues from service providers located at an airport, providing services either to

the airlines or to the passengers; and revenues from activities the airport has diversified into in order to use its expertise, such as consultancy or management services. The strategies of specialization will aim at developing the aeronautical revenues, whereas the strategies of diversification will have the objective of increasing the non-aeronautical revenues.

2.1.2 Strategies of specialization

Strategies of specialization are used to develop the aeronautical activity of the airport. Some will be related to aeronautical infrastructure, while others will aim to increase service levels, or improve the communication or marketing towards clients.

Concerning the infrastructure, examples are:

- Increase of the runway capacity by extending the existing runway and/or building a new runway and/or investing in all other aeronautical infrastructure (for instance taxiways, car parks)
- Investment in passenger terminal capacity by building a new terminal or extending existing ones
- Investment in freight terminal capacity by building a new terminal or extending existing ones
- Investment in a low-cost terminal to enable differentiation of the airport service quality

Strategies of specialization centred on quality improvement can include:

- Improvement of airport accessibility via bus shuttles, car parking, road and/or rail infrastructure (which often requires financial support from the region, town, etc.)
- Investment in terminal infrastructure to improve the efficiency of aeronautical services (e.g. luggage transfer and passengers flows)
- Development of intermodality with a high-speed rail interconnection (which requires financial support from the country, region, town, etc.)

Finally, policies towards clients could include:

- Development of commercial policies to airlines (e.g. lower passenger taxes to airlines reaching a certain level of traffic at the airport, lower taxes on subsidized routes and lower taxes for passengers in transit)
- Investment in communication and marketing towards airlines (market studies, advertisement) or towards passengers (advertising the region's attractiveness, ...)

2.1.3 Strategies of diversification

A diversification strategy of a firm consists in developing activities which are not related to its core business. This strategy can correspond to a reduction of a firm's exposure to a risk. Indeed, if its core business is affected by a crisis, the firm can still generate profits through another strategy. For airports, strategies of diversification aim to develop the non-aeronautical activities. They are considered increasingly important strategic axes by airports to stabilize and balance the airport economy.

These diversification strategies mainly aim at:

- Improving the financial results by increasing non-aeronautical revenues with the development of commercial activities
- Diversifying the financial risks by investing in other airports or other economic sectors
- Finding a way to allocate the airport's capital elsewhere than in the airport capacity when the potential of capacity growth of the airport is low

The most common strategy of diversification is the development of commercial activities by increasing the areas for shops, restaurants, car rentals, etc., at the airport. An emerging strategy of diversification concerns the development of services to the airport passenger independently of the airlines (lounges, wireless internet (free or not), trip planner websites...). The objective is to increase revenues and to secure the loyalty of passengers toward airports. This type of strategy improves revenues, but does not reduce the exposure to

risk, because the revenues are still mostly dependent on the number of passengers attracted by the airlines. In case of a traffic decrease, these revenues will also be impacted. These strategies are applicable to any airport, even small ones, and particularly the strategy consisting of developing the commercial activities.

Other strategies of diversification of midsize or large airports consist in selling the airport know-how to other airports by developing consultancy or management services. Airports can also invest in other airports or other economic sectors. These last strategies of diversification however require financial resources and are therefore generally developed only by large airports.

2.2 Typology of airports

The strategies available to a particular airport depend on its characteristics not only in terms of current traffic, but also considering the potential of this airport with regards to capacity and demand. The current situation of an airport in terms of passenger numbers, or traffic flows, is not necessarily a good indicator of what the airport could become in 10 or 20 years. Some airports have grown tremendously in the past 10 years, while others have not. Analyzing the future evolutions of airport strategies therefore requires us to confront the information on the airport traffic with other elements.

We are interested in identifying the characteristics of an airport in terms of potential: what can explain why a given airport will develop, while another will not? We are looking at airports from the point of view of traffic evolution. To be able to grow, an airport need to have "good characteristics" in terms of supply (mainly capacity) and demand.

2.2.1 Airport capacity

There must be capacity for passengers or freight and capacity for aircraft. Indicators of the airport potential for growth in capacity relate to the current runways and terminal capacity and to their possibility of extension.

2.2.2 Airport demand

In order to grow, an airport should have spare capacity, to accommodate more flights and/or more passengers, but it would be to no avail if there is no demand. Indicators of the potential for growth of the airport in terms of demand are based on passenger numbers on incoming/outgoing segments of the market. Some airports have mostly incoming passengers, leisure or business, because of some attractiveness of the area. Others have mostly outgoing passengers, and this has to do with different factors, linked to population wealth in the region (depending on an adequate supply of flights at the airport). Some airports are hubs, and have an important proportion of connecting passengers, for whom the region around the airport will be unimportant. Last, cargo demand will have different requirements. Overall, indicators of the potential for growth in demand relate mainly to intrinsic characteristics of the airport region.

2.2.3 Typology

All indicators of the airport potential for growth in capacity and demand can then be used to develop a typology of airports that will be used as a basis for the FAST project. In addition to the potential for growth in capacity and demand the analysis of the possible strategies takes into consideration the airport size according to the ACI airport size typology:

- Small size for airports with no more than 5 million passengers a year

- Medium size for airports with more than 5 million passengers a year and fewer than 10 million passengers a year
- Large size for airports with more than 10 million passengers a year.

Our typology of airports is therefore based on three measuring scales: the airport size as number of passengers, the level of potential for growth in capacity, the level of potential for growth in demand. Both levels of potential for growth are decomposed into low, medium and high potential levels. Table 1 illustrates this three dimensional typology with examples of airports.

Application to Bordeaux airport:

Bordeaux is a small regional airport with available capacity. The airport is in a monopoly situation (in a single-till context) but may be in strong competition with the high-speed train in the future with a reduction of one hour in the journey time between Bordeaux and Paris (two hour journey time in 2016 instead of three). Bordeaux has a high potential for growth in capacity (with possibilities of building a new runway and a new terminal) and a medium potential for growth in demand (by taking into consideration the population around the airport which is 1.5 million within a one hour drive, and the region's attractiveness for tourism and business).

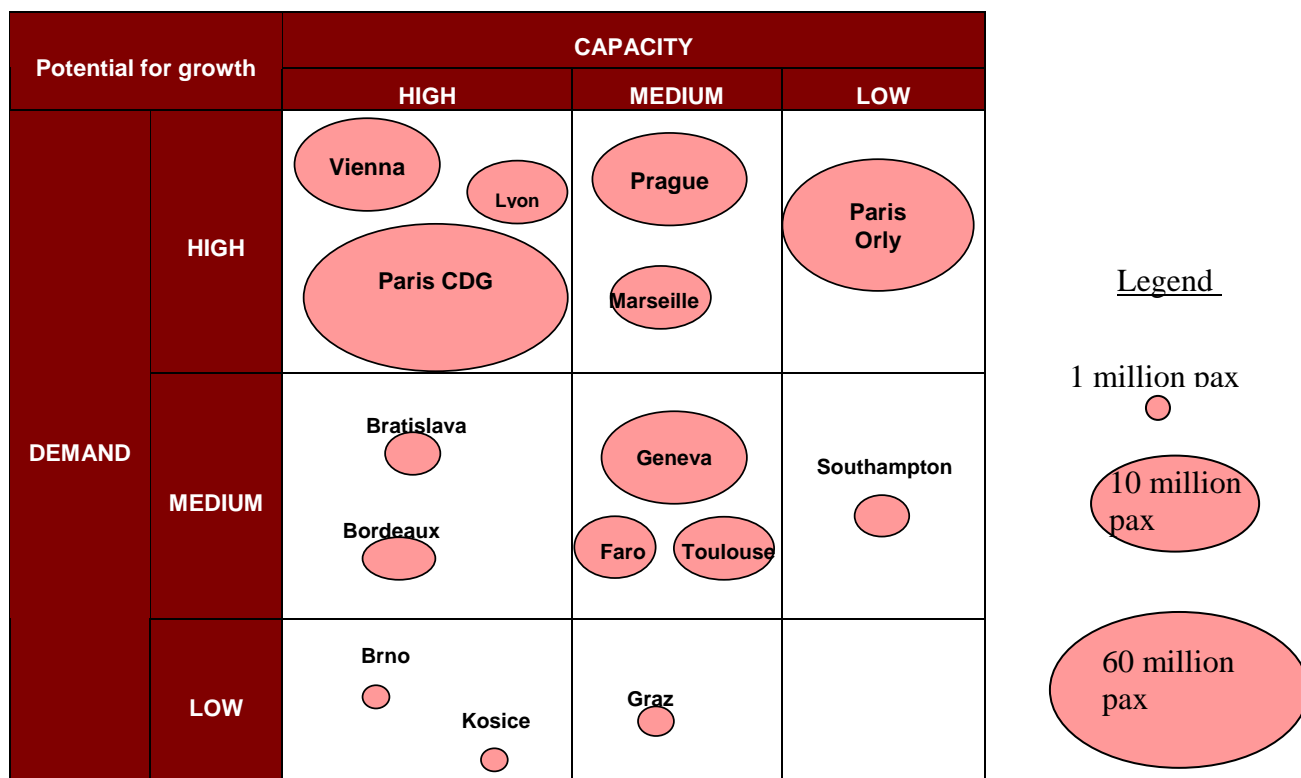


Table 1: Illustration of the three dimensional typology

3 Strategic options and future network

3.1 Method of identification of strategic options

The approach we used to identify the strategic options for a particular airport and to make predictions of its future route network evolution can be broken down as follows:

- Description of the past strategies of the considered airport
- Identification of the future strategic options of the analyzed airport according to its position in our typology of airports
- Identification of a reference airport which has developed past strategies similar to the future strategies of the considered airport
- Analysis of the past route network evolution of the reference airport following the strategy it developed
- Use of this past route network evolution of the reference airport to make

predictions on the future route network evolution of the analyzed airport

3.1.1 Past strategies

The future strategic options of an airport are strongly related to the strategies it developed in the past. These past strategies were influenced by the airport characteristics and environment.

It is therefore essential to analyze the past strategies of an airport before being able to identify its future strategic options.

Application to Bordeaux airport:

In order to find a way to revitalize the traffic that decreased by 8% between 2001 and 2003 (following the 9/11 crisis) the airport decided to develop an active strategy from 2004. The strategy guaranteeing graduated discounts on passenger fees during a three year period proved successful since the airport traffic grew by 18% between 2004 and 2007. This large growth was mainly due to the low cost traffic increase that was multiplied by a factor of three in three years, to represent 11% of the total traffic in 2007

(source: www.usinenouvelle.com).

3.1.2 Future strategies by airport type

The strategies that can be developed by an airport will first be strongly dependent on its type. For example, a medium sized airport with spare capacity will not behave in the same way as a large airport with capacity constraints. The situation in terms of demand will also condition the type of passengers the airport wishes to attract (local or foreign? business or tourists?). Besides the type of the airport, the degree of development of these strategies will be strongly linked to the level of competition with other airports, the level of congestion of the airport but also to the airport ownership and management and the perimeter of regulation of the airport.

Our method of identification of the possible strategies of an airport therefore comprises three steps: We first identify all the possible strategies of specialization for this type of airport, then all the possible strategies of diversification. Finally, we refine these strategic options (specialization and diversification strategies) with other factors: congestion level, competition level, regulation type, airport status. As a result, we identify the airport objectives and strategic options at a five to eight year time horizon.

Application to Bordeaux airport:

Table 2 highlights with a red circle all the possible strategies of specialization for Bordeaux. It highlights the most relevant strategies of specialization for a medium-sized airport (between 5 and 10 million pax a year). Figure 2 highlights the most likely strategies of diversification for a medium-sized airport (Note that the strategies of diversification exist whatever the potential for growth in capacity and demand, but will be more or less developed according to the situation of the airport).

This analysis leads us to conclude that the airport, in its effort to anticipate the future drop in demand due to the strong incoming competition with the high-speed train, has two main objectives:

- - *Securing the loyalty of passengers and airlines*
- - *Attracting additional low cost airlines on the platform*

To reach such objectives, we have identified the following future strategic options for Bordeaux in a 5-8 year time horizon.

Future strategies of specialisation of Bordeaux airport:

*Airport accessibility improvement
Development of commercial policies to airlines
Investments in communication and marketing
Investment in a low cost terminal*

Future strategies of diversification of Bordeaux airport:

*Development of commercial activities
Development of services to passengers*

Potential for growth		CAPACITY		
		HIGH	MEDIUM	LOW
DEMAND	HIGH	<ul style="list-style-type: none"> - Accessibility improvement - Commercial policies to airlines (<i>reduced fees on hub traffic</i>) - Investments in communication and marketing - Investment in passenger and/or freight terminal capacity - Investment in a low-cost terminal - Investment in runway capacity - Investment in infrastructure for efficiency - Development of intermodality 	<ul style="list-style-type: none"> - Accessibility improvement - Commercial policies to airlines (<i>incentive fees to use large aircraft</i>) - Investments in communication and marketing - Investment in passenger and/or freight terminal capacity - Investment in a low-cost terminal 	<ul style="list-style-type: none"> - Accessibility improvement - Commercial policies to airlines (<i>incentive fees to use large aircraft</i>)
	MEDIUM	<ul style="list-style-type: none"> - Accessibility improvement - Commercial policies to airlines (<i>reduced fees on hub traffic</i>) - Investments in communication and marketing - Investment in passenger and/or freight terminal capacity - Investment in a low-cost terminal - Investment in runway capacity 	<ul style="list-style-type: none"> - Accessibility improvement - Commercial policies to airlines (<i>reduced fees on traffic volume</i>) - Investments in communication and marketing - Investment in passenger and/or freight terminal capacity - Investment in a low-cost terminal 	
	LOW	<ul style="list-style-type: none"> - Accessibility improvement - Commercial policies to airlines (<i>reduced fees on traffic volume</i>) - Investments in communication and marketing 		

Table 2: Strategies of specialization by airport type

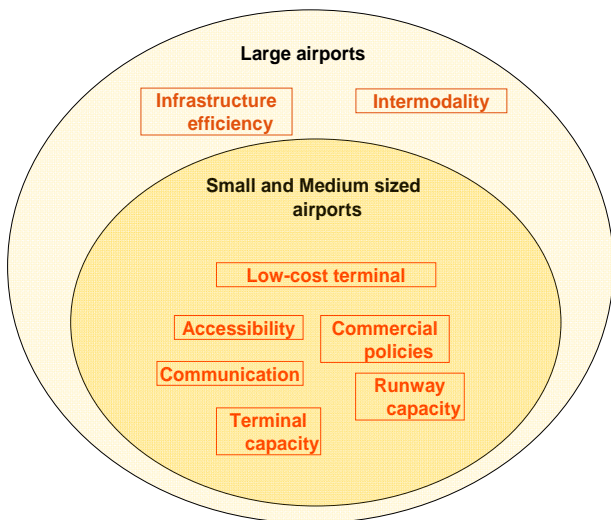


Figure 1: Strategies of specialization by airport size

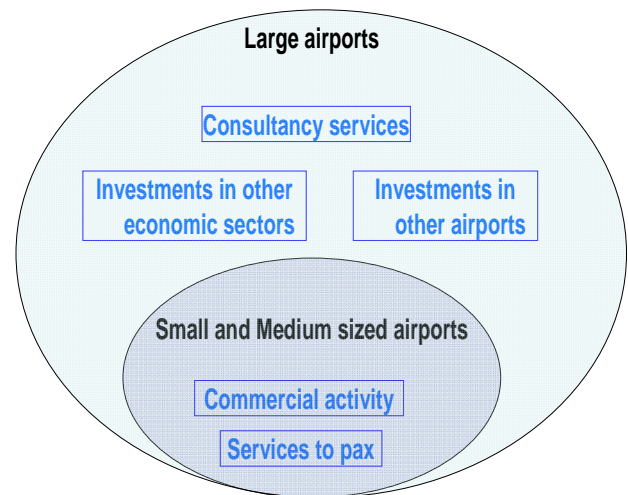


Figure 2: Strategies of diversification by airport size

3.3 Future route network of an airport

3.3.1 Description

Once the future strategic options of an airport have been identified, the next step of the analysis consists of identifying a reference airport which already developed similar strategies in the past. The analogy is clearly never perfect, but it provides insights as to the results of the said strategies.

Application to Bordeaux airport:

Bordeaux is very similar to Marseille airport (ten years ago). Marseille has developed the strategies that Bordeaux could develop today. The traffic level at Marseille airport grew by 27% between 1997 and 2007. Between 2001 and 2003, the airport faced a traffic decrease due to strong competition with the Marseille-Paris high-speed train and the Airlib Express bankruptcy (mainly operated flights to Paris). The arrival of EasyJet at the airport helped limit the traffic decrease in 2003.

Past strategies include:

- *Low cost terminal building: MP² terminal was designed in collaboration with EasyJet and Ryanair*
- *Communication on the MP²: the strategy was a success by highlighting the non cannibalization of the traffic by low cost carriers to reassure Full Service Carriers*
- *Commercial policies to new carriers: 90% discount on landing, lighting and parking charges during the first year, 50% discount on the second year (source: Albatross Airports database)*
- *Promotional campaigns in neighbouring cities: Montpellier, Avignon and Toulon, so as to increase its catchment area*
- *Investment in runway capacity*
- *Development of the commercial activities: between 2006 and 2007, the airport increased its non-aeronautical*

revenues by 19.3% mainly due to the passengers spending using MP²

The current situation of Bordeaux presents similarities with the past of Marseille. Being aware of the future strong competition with the high-speed train and encouraged by its attractiveness for low cost carriers, Bordeaux should develop a future strategy aimed at increasing the low cost market share at the airport while securing the loyalty of full-service carriers. This objective was also the same for Marseille.

3.3.2 Possible route network evolution

The past evolution of the reference airport route network is then analyzed by identifying abandoned routes, new routes, routes originally non-scheduled which became partly or fully scheduled, and routes with a high level of development.

By making comparisons with the past route network evolution of the reference airport it is possible to make assumptions for the potential routes: non-scheduled routes which could become partly or fully scheduled as well as for routes which could have a high level of development in the future.

Application to Bordeaux airport:

Marseille airport route network evolution, between 2003 and 2007 was the following:

- *Only 6 abandoned routes to southern Europe, North-western Africa and West Africa*
- *Main changes in the route network concern Northern Europe:*
- *Germany: 6 new, 3 existing routes in 2003 with a strong traffic increase*
- *United Kingdom: 4 new, 1 existing route in 2003 with a strong traffic increase*
- *Sweden: 2 new, 1 existing route in 2003 with a strong traffic increase*
- *Other changes in the network concern Southern Europe, especially with the 3 new routes to Croatia (not served in 2003)*

- *Only two non-scheduled routes in 2003 became mainly scheduled in 2007*

Potential evolution at Bordeaux:

- *Several new routes could potentially appear in the future to Germany, Sweden, Croatia and Italy*
- *At least one additional route could potentially be created in the future to Belgium, Norway, Netherlands and/or Spain*
- *A potential transfer from non-scheduled to scheduled traffic on the Agadir destination could occur*
- *The comparison with Marseille does not allow us to make assumptions on the potential traffic evolution on the current routes with a low traffic level*

4. Conclusion

Airports are becoming essential actors in the air transport market, with a growing role and independence in strategic decision-making. Analyzing the impact of these strategies on the evolution of the airport route network is significant and could give important clues as to the direction of future development of the industry.

This paper describes some aspects of the FAST project, which developed a methodology for identification of the future airport strategies that can be applied to any European airport, and analyzed the potential impacts of these strategies on airport route networks. In particular we showed that while strategies of diversification are often considered the preserve of large firms, they have been successfully applied by (and should be considered by) rather small airports.

The future airport strategies should also put more stress on avoiding so called “curb-to-curb” approach. Airports should be considered as an integral part of regional, national or international transport infrastructure rather than being perceived as an isolated transportation system. Quality of airport ground access/egress and level of airport integration into ground transport network significantly influences its

competitiveness, operations and capacity. While several traffic forecast methodologies exist, few deal with the evolution of route networks, which is at the center of our study. In this respect, our work complements forecasts dealing with traffic increase on existing routes (e.g. the 2008 STATFOR/Challenges to Growth study), and to studies dealing with traffic increases on existing origin-destination (e.g. Dennis, 2002), by identifying new destinations which could be developed in the future.

While only applied to a few airports in the study, the conceptual framework we developed could be applied and extended to all airport types, including airports in the new European member states, but also to airports with overlapping catchment areas as well as to the competing hubs, or to complementary airports in case of multi-airport management as well as in case of complementarity between hub and secondary airports.

The relevance of the results of our methodology was confirmed by the Bordeaux airport strategy. In June 2009, three months after the end of the FAST project, Bordeaux Merignac airport decided to build a low-cost terminal which will be opened in May 2010. This strategy is fully in line with the results we obtained for Bordeaux airport: attracting additional low-cost and securing the loyalty of passengers in expectation of strong future competition with the high-speed train in 2016.

References

- [1] Barrett, D. (2004). How do the demands for airport services differ between full-service carriers and low-cost carriers? *Journal of Air Transport Management*, 10, 33-39.
- [2] CAA (2006). No Frills Carriers: Revolution or evolution? A study by the Civil Aviation Authority. CAP 770, November 2006.
- [3] CAA (2007). CAA Passenger survey report 2006. Economic regulation Group, Survey of passengers at Belfast City, Belfast International, Birmingham, Gatwick, Heathrow, London City, Londonderry, Luton, Manchester, Nottingham East Midlands & Stansted.
- [4] CAA (2008). Recent trends in growth of UK air passenger demand. January 2008.

- [5] CCI Marseille Provence (2008). Profils des voyageurs et nouveautés S08. Chambre de Commerce et d'Industrie Marseille Provence, www.marseille-aeroport.fr
- [6] Conseil National des Transports (2007). Dossier n°8: les stratégies aéroportuaires en Europe. Observatoire National des Transports, March 2007.
- [7] De Neufville, R. (1995). Management of multi-airport systems: a development strategy. *Journal of Air Transport Management*, Volume 2, Issue 2, June 1995, Pages 99-110.
- [8] Dennis, N. (2002). Long-term route traffic forecasts and flight schedule pattern for a medium-sized European airport. *Journal of Air Transport Management*, 8, 313–324.
- [9] DGAC (2007). L'utilisation du transport aérien, Enquête sur le taux de pénétration du transport aérien en France. Direction des Affaires Stratégiques et Techniques, July 2007.
- [10] EUROCONTROL (2008). Challenges of Growth 2008. Summary Report, Eurocontrol, STAFOR, November 2008.
- [11] European Commission (2002). Study on competition between airports and the application of State Aid Rules. Final report Volumes 1 and 2, Directorate General Energy and Transport, Directorate F – Air transport.
- [12] European Commission (2007). Directive of the European Parliament and of the Council on airport charges. COM(2006) 820 final.
- [13] Forsyth, P., Gillen, D., Knor, A., Mayer, O.G., and Niemeier, H. (2004). The economic regulation of airports. Ashgate
- [14] Gillen, D., Niemeier, H.-S. (2006). Airport economics, Policy and Management: The European Union. Rafael del Pino Foundation, Comparative Political Economy and Infrastructure Performance: The case of airports, Madrid, September 2006.
- [15] Graham A. (2004). Airport strategies to gain competitive advantage. University of Westminster, GARS: Slots, Airport Competition and Benchmarking of Airports, Bremen, 19-20 November 2004.
- [16] IATA (2007). Economic regulation. IATA Publishing.
- [17] M3 Systems, ENAC, University of Zilina (2008). WP1: Actual air transport situation and market environment. FAST project, EUROCONTROL CARE INO project, June 2008.
- [18] M3 Systems, ENAC, University of Zilina (2008). WP2: Airport strategic options and future tendencies. FAST project, EUROCONTROL CARE INO project, December 2008.
- [19] M3 Systems, ENAC, University of Zilina (2008). WP3: Impacts of airport strategies on traffic distribution. FAST project, EUROCONTROL CARE INO project, March 2009.
- [20] Ries, A. and Trout, J. (1986). *Marketing Warfare*. McGraw-Hill, 1986.
- [21] Starkie, D. (2002). Airport regulation and competition. *Journal of Air Transport Management*
- [22] Starkie, D. and Yarrow, G. (2002). The single-till approach to the price regulation of airports. Civil Aviation Authority, London, UK.
- [23] Stefanik, M. (2009). Problems of Airport Capacity Assessment, Doctoral thesis, University of Zilina, Slovakia
- [24] Tretheway, M. (2001). Airport ownership, management and price regulation. InterVISTAS Consulting Inc. Research conducted for the Canada Transportation Act Review, March 2001.
- [25] Walker, W., Marchau, V., (2007). Low-cost airports for low-cost airlines: flexible design to manage the risks. Paper Prepared for Special Issue of *Journal of Transportation Planning and Technology*, editors, Richard de Neufville, Massachusetts Institute of Technology, Cambridge, USA.

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