U.PORTO

DOCTORAL PROGRAM IN TRANSPORTATION SYSTEMS

Faculdade de Engenharia da Universidade do Porto

MIT Portugal Program

Airport strategic planning in the context of low-cost carriers ascendency: insights from the European experience

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October 2014

Submitted in partial fulfilment of the requirements for the degree of

Ph. D. in Transportation Systems

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Abstract

Airport strategic planning in the context of low-cost carriers ascendency: insights from the European experience

During the last decades the airport industry has undergone significant structural changes. Before, airport planning used to follow broad political goals and extensive governmental regulation. Airports were mere providers of infrastructure that favoured the construction of monumental facilities, often reflecting a kind of national or regional pride. This form of airport planning and design became a paradigm that still applies for many major airports.

Liberalisation of the air transport market has played a key role in reshaping the entire aviation industry. Low-Cost Carriers (LCC) have proliferated in liberalised markets and have disrupted the industry by offering a different value proposition and operative model with impacts in traditional airlines and airports alike. The emergence of LCCs allowed underused airports and former military bases, particularly in Europe and the United States, to grow significantly. Yet, as the low-cost segment matures, LCCs move to bigger airports to keep growing. The impact of this trend for airport strategic planning is not clear in the existing literature.

This dissertation combines qualitative and quantitative methods to analyse in detail the airports in which LCCs operate in Europe, by using empirical data, unstructured interviews with key informants, direct observations at airport visits and a comprehensive document review. A transversal study analyses the characteristics of a sample of 171 airports and their relation with the importance of LCCs at each of them. A longitudinal study, covering a second sample of 42 airports over the past decade (2004 to 2013), identifies relevant dynamics in airport evolution concerning the developments of the low-cost segment.

A comprehensive understanding of the airport business in the current context supports the definition of an integrated framework that complements other methods for airport strategic planning: the *[New] Airport Business Network*. This framework may assist planners and managers in incorporating, in the same process, the planning and design of infrastructure, and the definition of a corresponding business strategy. Moreover, given the inherent uncertainty of the aviation industry, the framework allows airports to set the attributes of their product and shape their own future.

Keywords: airport planning, airport strategies, airport development, airport management, low-cost carriers, low-cost airports

Resumo

Planeamento estratégico de aeroportos no contexto da ascendência das companhias *low-cost*: lições do caso europeu

A indústria dos aeroportos tem testemunhado mudanças estruturais significativas nas últimas décadas. Anteriormente o planeamento dos aeroportos estava mais determinado por objetivos políticos e uma vasta regulação governamental. Nesse contexto, os aeroportos eram considerados simplesmente como fornecedores de infraestrutura e era favorecida a construção de edifícios monumentais, com frequência refletindo algum tipo de orgulho nacional ou regional.

Um dos aspetos chave nas mudanças que têm redefinido a indústria da aviação é a liberalização do mercado de transporte aéreo. Num mercado liberalizado as companhias *low-cost* (LCC) têm proliferado. As LCC revolucionaram a indústria ao oferecer uma proposta de valor e um modelo operativo diferentes com impacto tanto nas companhias tradicionais quanto nos aeroportos. O surgimento das LCC permitiu a alguns aeroportos secundários subutilizados e a antigas bases militares, particularmente na Europa, atrair um significativo incremento no seu tráfego. No entanto, à medida que o segmento *low-cost* se consolida, as LCC têm vindo a utilizar aeroportos principais com maior relevo. O impacto desta tendência no planeamento estratégico dos aeroportos ainda não é completamente entendido na literatura.

Esta dissertação combina métodos quantitativos e qualitativos para analisar em detalhe os aeroportos que as LCC utilizam na Europa, servindo-se de dados empíricos, entrevistas não-estruturadas, observação direta em visitas a aeroportos e revisão documental. Num estudo transversal são analisadas as características de uma amostra de 171 aeroportos e a sua relação com a importância que as LCC têm em cada um deles. Um estudo longitudinal, que abrange uma segunda amostra de 42 aeroportos na última década (2004 – 2013), serve para identificar as dinâmicas mais relevantes na evolução dos aeroportos em relação ao tráfego *low-cost*.

Neste sentido, um claro entendimento do negócio aeroportuário no contexto atual serve de apoio para a definição de um modelo geral que complementa outros métodos de planeamento estratégico de aeroportos: a *[Nova] Rede de Negócios do Aeroporto*. Este modelo serve como ferramenta para apoiar os gestores e projetistas na incorporação, no mesmo processo, do planeamento e dimensionamento da infraestrutura, bem como da definição de uma estratégia de negócio concordante. De igual forma, considerando a incerteza inerente à indústria da aviação, o modelo permite aos aeroportos definir as características do seus produtos de forma a construir com sucesso o seu próprio futuro.

Palavras chave: planeamento de aeroportos, estratégia de aeroportos, desenvolvimento de aeroportos, gestão de aeroportos, companhias *low-cost*, aeroportos *low-cost*

Resumen

Planeación estratégica de aeropuertos en el contexto del crecimiento y predominancia de las compañías de bajo coste: enseñanzas de la experiencia en Europa

La industria aeroportuaria ha sufrido cambios estructurales durante las últimas décadas. Anteriormente la planeación de aeropuertos estaba más determinada por objetivos políticos y una vasta regulación gubernamental. En ese contexto, los aeropuertos eran considerados meros proveedores de infraestructura y se favorecía la construcción de edificios monumentales, a menudo asociados de cierta forma al orgullo de una nación o región. Esta forma de planeación y diseño de aeropuertos se convirtió en un paradigma que aún aplica para muchos aeropuertos principales.

La liberalización del mercado aéreo ha jugado un papel clave en la revolución de la industria de la aviación. En un mercado liberalizado las compañías de bajo coste (LCC) han proliferado y han revolucionado la industria ofreciendo una propuesta de valor y un modelo de operaciones diferentes que han impactado tanto a las aerolíneas convencionales como a los aeropuertos. El surgimiento de las LCC permitió que aeropuertos subutilizados y antiguas bases militares, especialmente en Europa, crecieran significativamente. Sin embargo, a medida que el segmento se consolida, las LCC han comenzado a utilizar aeropuertos principales a gran escala. El impacto de esta tendencia aún no ha sido totalmente comprendido en la literatura.

Esta disertación combina métodos cuantitativos y cualitativos para analizar en detalle los aeropuertos que las LCC usan en Europa, por medio de datos empíricos, entrevistas no-estructuradas, observación directa en visitas técnicas a aeropuertos y revisión documental. En un estudio transversal son analizadas las características de una muestra de 171 aeropuertos y su relación con la importancia de las LCC en cada uno de ellos. Por otro lado, un estudio longitudinal, que comprende una segunda muestra de 42 aeropuertos durante la última década (2004 – 2013), sirve para identificar las dinámicas más relevantes en la evolución de los aeropuertos, sobre todo en relación al segmento de tráfico de bajo coste.

Un claro entendimiento del negocio aeroportuario en la actualidad sirve como punto de partida para proponer un modelo general que complementa los métodos existentes para planeación estratégica de aeropuertos: la [Nueva] Red de Negocios del Aeropuerto. Este modelo sirve como herramienta para ayudar a los administradores y planeadores de aeropuertos en la incorporación, en un mismo proceso, tanto la planeación y diseño de la infraestructura como la definición de una estrategia de negocio coincidente. Además, teniendo en cuenta la incertidumbre inherente a la industria de la aviación, el modelo permite a los aeropuertos definir las características de sus productos de manera que puedan forjar su propio futuro.

Palabras clave: planeación de aeropuertos, estrategia de aeropuertos, desarrollo de aeropuertos, administración de aeropuertos, compañías de bajo coste, aeropuertos *low-cost*

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Acknowledgements

A Ph. D. is a learning process in which the process itself is as important as the end result. It requires patience and proper guidance. Jorge, João and Richard were always kind to provide me with both endless patience and marvellous guidance. I have only words of appreciation for the time they devoted to this work and to myself in very fruitful and enjoyable conversations. Their wisdom, which combined perfectly for this work, improved this dissertation in every aspect and allowed me to learn something valuable in so many different areas. Their kindness and permanent support made us, me and my wife, feel always at home in Porto and Boston.

I am also very grateful to Xavier Fageda at the University of Barcelona, Mike Wittman and Peter Belobaba at MIT's International Center for Air Transportation, and Jodie Armstrong and the team at Pinkfroot (makers of planefinder.net) for their collaboration with data collection and valuable comments that certainly improved the quality of this work.

My most heartfelt thanks to my wife Cata for her permanent support and encouragement to go ahead and finish my thesis. For being always there even when I was away. For being inspiring, lovely, sincere and, overall, immensely *fofinha*.

I also appreciate the unconditional support of my entire family along all these years. Special thanks to may parents for always believing in me. I know this accomplishment is as rewarding for them as it is for me.

To all my friends and colleagues in Portugal and the USA, in particular at INESC TEC, FEUP and MIT. The list is endless to put all names here, but I am very grateful for especially valuable comments, discussion and support for this whole project.

To all my old friends in Colombia and the new ones in Europe that made this whole experience unforgettable and so much valuable.

Special thanks to the people and friends at Universidad de Ibagué in Colombia that were always ready to support and assist me in this adventure.

The author gratefully acknowledges the funding support provided by Fundação para a Ciência e a Tecnologia – FCT (Portuguese Foundation for Science and Technology) through the MIT Portugal Program under Grant SFRH/BD/51128/2010. Parts of this work were also financed by the ERDF European Regional Development Fund through the COMPETE Programme (operational programme for competitiveness) and by National Funds through FCT within the project Airdev/MIT-Pt/TS-AAS/0046/2008.

Table of Contents

[blank page]

List of figures

List of tables

[blank page]

1 Introduction

During the last decades the airport industry has undergone multiple structural changes (GAO, 2006; Gillen, 2011; Goetz and Vowles, 2009). The controlled environment of the past, dominated by extensive governmental regulation, favoured the building of monumental facilities, often reflecting a kind of national or regional pride. This form of airport planning and design, which considered airports as mere providers of infrastructure, became a paradigm that still applies for many major airports (de Neufville, 2008).

Bilateral agreements still play a major role in international air transportation but the new context of the airport industry is increasingly dominated by less regulation, both within countries and across borders (Belobaba et al., 2009). In addition, the widespread growth of the Internet and the World Wide Web is decreasing the cost and effort for airlines to reach new markets, and for consumers to compare travel alternatives. In this context, airports are becoming commercially-oriented firms that offer multiple services – not just access to air travel – to a variety of customers (Graham, 2003; Jarach, 2001; Jimenez et al., 2013a).

Arguably, liberalisation of the air transport market, with different forms around the world, played a critical role in reshaping the entire aviation industry. A liberalised market provides an ideal ground for low-cost carriers (LCC) to proliferate. LCCs disrupted the industry by offering a different value proposition to customers and by implementing a different operative model that impacted traditional airlines and airports alike. At the same time, the growth of LCCs provided a good opportunity for underused airports and former military bases, particularly in the USA and Europe, to attract the segment of low cost airlines and travellers (de Neufville, 2008).

During the initial rise of the LCCs many secondary airports emerged to satisfy their need for simple, affordable and uncongested facilities. In this sense, the growth of LCCs catalysed the development of 'low cost airports', largely as part of Multi-Airport Systems (MAS) in which primary airports were dedicated to the 'legacy' airlines (de Neufville, 2008).

The ascendency of LCCs is nowadays undeniable. As their market share increased, most LCCs turned to the larger traditional airports to keep growing (Abda et al., 2012). At the same time, traditional or 'legacy' airlines modified their business model and operation strategies to reduce costs or, in many cases, established 'low-cost' subsidiaries to compete more directly with incumbent LCCs. To a large extent, these 'low-cost' subsidiaries use the same airports as their parent companies. Hence this trend expands the impact of LCCs beyond the initial 'low cost airports' and challenges their sustainability.

The adaptations that the aviation industry has implemented to accommodate the ascendency of LCCs may imply a significant shift in the standards for airport planning and design. The traditional paradigm of the *master plan* does not account for the increased uncertainty that airports experience in a liberalised context due to increased competition (Jimenez et al., 2013a) and market volatility. In particular, master plans do not provide flexibility to adapt to unavoidable changes, such as the rise of the low-cost model for airlines (de Neufville, 2008).

Indeed, the inherent rigidity of master plans led some airport managers to overlook the value of LCCs in the air transport market. A lack of understanding about the actual requirements of LCCs may result in the development of infrastructure that is not well suited for the operational requirements of this type of airlines. Moreover, as LCCs mature, new opportunities and challenges for airports may emerge.

This dissertation argues that a new paradigm in airport strategic development should incorporate in the same process the planning and design of infrastructure, and the definition of a matching business strategy. Such a paradigm must take into account the existence of different airline business models that entail differences in airport facilities and operation, or that may challenge airport strategies. Furthermore, airline business models will inevitably continue to evolve and their requirements may differ slightly in the near future and substantially in the long-term, with a clear need to deal with the inherent uncertainty of the aviation industry.

Overall, the ascendency of LCCs has been in the core of the changes that the airport industry witnessed in recent decades. These changes may have impacted the way some airports approach their long-term planning, partially because LCCs increased competition between airlines, which, in turn, increased the uncertainty for airport planning. In a

volatile environment airports are more likely to be affected by tactical decisions made by airlines that face difficult market conditions, such as abandoning an airport due to hub relocation, abandoning or downsizing operations due to bankruptcy or restructuring, or refusing to use facilities that do not meet their operational requirements (de Neufville and Odoni, 2003).

The research presented in this dissertation combines qualitative and quantitative methods for the analysis of the airports that LCCs use in Europe. Then, building upon the insights of the European experience, it proposes an integrated framework as a tool to support airport strategic planning.

1.1 Research design

1.1.1 Research questions

The traditional paradigm of long-term airport planning, the *master plan*, has proven ineffective in dealing with the dynamic environment that prevails in the industry today and is likely to continue in the future. The aviation industry in general has been revolutionised by the ascendency of LCCs but the impact of this trend on airport planning, particularly in the long-term, remains unclear. Moreover, airport planning has been too much infrastructure-centric, with the definition of strategies to attract customers left for subsequent phases in the process, often when investments in infrastructure have already been committed. This hinders the possibility to tailor airport facilities to the requirements of the different types of customers.

Thus the challenge of integrating airport infrastructure and strategy development in a context dominated by changing paradigms in airline operations (in which LCCs are now prominent) remains and becomes even more critical. The research design of this dissertation is framed by two main hypotheses that summarise the gaps in the literature (see chapter 2 for a detailed review of relevant literature):

1. The emergence and expansion of transnational, innovative (generally low-cost) airlines impacts the planning, design, and practical operation of airports, in a way that is similar to the way this trend has revolutionised the business plans and operational practices of airlines.
2. Some airport strategies deliver value for airport owners and customers, particularly in the case of airports that consider low-cost carriers as relevant partners. In addition, the design of flexible infrastructure facilitates the implementation of such strategies.

Having in mind these hypotheses, and in order to address the challenge proposed above, the following research questions guide this dissertation:

1. How should European airports design strategies to deal with the increased uncertainty produced by the liberalisation of the airline/airport industry and the ascendency of LCCs?
2. In what way have LCCs influenced airport strategic planning? In particular:
   2.1. To what extent have European airports implemented low-cost facilities?
   2.2. To what extent do LCCs operating in Europe use airport facilities developed for traditional airlines?
   2.3. Is the implementation of low-cost facilities setting new standards for airport design? If so, in what ways?
   2.4. Is the establishment of LCCs in existing facilities setting new guidelines for airport strategy? If so, in what ways?

1.1.2 Methodological approach

This research follows an engineering systems perspective. It studies airports as systems where social, technical, environmental, managerial and regulatory elements interact (Bonnefoy, 2008; de Neufville and Odoni, 2003). Therefore it explicitly recognises that airport strategies may provide a better, hardly "optimal", performance in all these aspects. Moreover, some airport systems may favour one aspect over the others in response to their particular interests.

Following this perspective, a mixed methodological approach (i.e. one combining quantitative and qualitative methods) should provide a better understanding of the research problem and an appropriate answer for the research questions. As Yin (2009) states, such approach allows researchers to "collect a richer and stronger array of evidence than can be accomplished by any single method alone". The unit of analysis of this dissertation is the airports.

The mixed research approach is non-experimental in the sense that existing conditions of the unit of analysis will not be modified. The quantitative part of the analysis includes a transversal study as data collection concerns a single period of time (mostly 2013 or the latest available information), as well as a longitudinal study to identify and analyse trends in the dynamic evolution of airports (in most cases with data for 2004, 2008, 2012 and 2013).

i) Geographical scope

This dissertation has a greater focus on the European context. The aviation industry in Europe presents quite interesting features in what concerns the development of airports and airlines in the recent decades. The liberalisation process in Europe is unique because it encompasses a large number of different countries with a varying degree of maturity in their aviation markets and of government involvement. So far, it has been the only region in the world in which airlines can exploit all nine freedoms of the air[1] (including domestic services by foreign carriers).

All these elements have produced an equally unique competitive environment. A mix of airlines that includes: private and government-owned flag carriers (some in the process of privatisation) that have extensive intercontinental networks based on bilateral agreements; small and large regional carriers that provide access to smaller markets; leisure (usually charter) airlines focused on largely seasonal destinations for holiday makers; and a wide range of diverse LCCs, from small to huge, that have taken the most of liberalisation opportunities. In addition, Europe has a large number of war-time aerodromes and bases that have been gradually converted to civilian use, especially in regions eager to support aviation as a means to attract employment, tourism and business opportunities.

On top of that, the liberalisation process is already two decades old and thus the aviation market is regaining some maturity. It followed some trends of the pioneering deregulation in the USA but with clear differences (particularly concerning airport privatisation and the approach to the airport business, in which airlines normally do not develop their own facilities through long-term leases). Studying the European experience can then provide some lessons for the future, not only for Europe but also for other regions in which LCCs are still incipient.

The quantitative methods followed in the research design are largely based on airline capacity data from Innovata Schedule Reference Service database (IATA, n.d.). Thus the geographical scope of this research is framed by the definition of Europe included within the database. This classification includes countries that straddle the border between Europe and Asia (Turkey, Georgia, Azerbaijan, Russia and Kazakhstan) and also some countries that are often politically associated to Europe (Cyprus and Armenia).

ii) Qualitative research methods

The qualitative component of the study includes an extensive document review, non-structured interviews with airport representatives, direct observation at airport visits, and the formulation of a conceptual framework to articulate the analysis performed along the

1 See Belobaba et al. (2009) for more details on the freedoms of the air.

dissertation. The document review follows a thorough and comprehensive review of airport documentation on planning and marketing, as well as industry and specialised trade press reports (such as anna.aero, CAPA Centre for Aviation or ACI Europe's Airport Business). In addition, nine unstructured interviews with key informants within the airport industry – from ANA Aeroportos de Portugal, Fraport AG, Schiphol Group, Flughafen Zürich AG, Athens International Airport S.A., S.A.C.B.O. S.p.A., London Gatwick Limited and S.A. Aéroport de Bordeaux Mérignac – were conducted between 2011 and 2014 (see Table 1 for details).

Table 1: Summary of key informants and interview topics.

Airport company [Airport]	**Key informant(s) [Position]**	**Interview topics [Duration of the interview]**	**Place [Date]**
ANA Aeroportos de Portugal S.A. [Lisbon Portela Airport]	Leonel Horta Ribeiro [Strategy and marketing director]	Airport marketing, airport strategy, airport stakeholders, airport-airline relationship [1 h 30]	ANA HQ at Lisbon Airport [July 2011]
	Jose Tomas Baganha [Director ANA Consulting]	Airport stakeholders, airport development, airport competition [1 h 00]	
Fraport AG [Frankfurt am Main Airport]*	Sascha Schmitt [Business development senior project manager]	Airport development, airport city, airport strategy [1 h 00]	Fraport HQ at Frankfurt am Main Airport [January 2012]
Schiphol Group [Amsterdam Schiphol Airport]*	Maurits Schaafsma [the GROUNDS initiative]	Airport city, airport stakeholders, airport strategy [1 h 00]	Schiphol-Centrum (Schiphol airport city) [January 2012]
Flughafen Zürich AG [Zurich Airport]*	Andrea Jorger [Marketing and real state "The Circle"]	Airport strategy, airport city, "the circle" project [1 h 00]	Zurich Airport [January 2012]
Athens International Airport S.A. [Athens Airport]*	Stratos Papadimitriou [Chairman of the Board of Directors] Ioanna Papadopoulou [Director, communications and marketing] George Kallimassias [Director, corporate planning]	Airport marketing, airport strategy, airport stakeholders, airport development, airport-airline relationship [2 h 30]	Athens Venizelos Airport [January 2012]
S.A.C.B.O. S.p.A. [Milan Bergamo Airport]	Alberto Cominassi [Planning and process improvement manager]	Airport development, airport infrastructure, airport-airline relationship, 'low-cost airports', airport strategy, airport competition [1 h 30]	Orio al Serio International Airport (Milan Bergamo) [June 2013]
Gatwick Airport Limited [London Gatwick Airport]	Colin Garland [Senior manager, economic regulation]	Airport strategy, airport competition, airport-airline relationship [0 h 45]	European Aviation Conference at St. Gallen, Switzerland [November 2013]
S.A. Aéroport de Bordeaux Merignac [Bordeaux Airport]	Jean-Luc Poiroux [Development director]	Bordeaux Airport low-cost terminal (billi), airport-airline relationship [0 h 30]	2014 ATRS World Conference at Bordeaux, France [July 2014]

* Interview conducted within the scope of MIT Portugal's Airdev Research Project accompanied by other interviewees.

The original intention was to perform semi-structured, recorded interviews. For the first interviews there was a guiding script, but the interviewees expressed their preference

not to be recorded and were open to discuss more topics than those set in the script. Hence we opted for unstructured interviews, taking notes during the meetings. Nonetheless, the airports that were the object of the interviews were studied beforehand in order to guide the questions and frame the answers of the interviewees.

Except for the last two, the interviews took place in or near the airport sites that were being discussed. This allowed for a better contextualisation of the answers or helped raise more questions than originally intended. The last two interviews were not previously arranged, as they were performed during conferences. However, they happened in a later stage of the research, with sufficient background information about the two airports covered.

Interviews are a flexible research tool that can be used at any stage of the research process and can be combined with other approaches in a mixed-method design, as it is the case. The main objective of unstructured interviews is to obtain rich, salient data from the individuals interviewed. Unstructured interviews give the researchers freedom to address any topic they consider interesting for the research (Brewerton and Millward, 2001), and allow the interviewees to convey information that they deem important for the issues under analysis (Bryman, 1989). This type of interview also allows researchers to collect relevant information outside the previously defined topics.

The advantages of unstructured interviews were critical given the diversity of implementations, contexts, scale and main focus of the airports that the key informants represented. This justified the use of unstructured interviews instead of other types of primary data collection (namely surveys, questionnaires, or close-ended structured interviews). Nevertheless, unstructured interviews hinder comparability between the responses of the different subjects due to the open-ended and flexible nature of questions. Moreover, the interview is more likely to drift towards the interests of the interviewee. And interviews are also subject to bias and shortcomings in terms of reliability and validity of the information (Brewerton and Millward, 2001).

To overcome these shortcomings and corroborate the validity of information, the unstructured interviews were complemented with direct observations, ranging from formal to casual data collection activities, and used as yet another source of evidence. “Direct observations might be made throughout a field visit, including those occasions during which other evidence, such as that from interviews, is being collected” (Yin, 2009). Table 2 summarises the technical visits to a variety of airports, including some of the airports visited for the interviews.

The qualitative part of this research was closed with the formulation of an integrated framework to analyse airport strategic planning (in chapter 7). This conceptual framework

consolidates and integrates the quantitative and qualitative methods. The unstructured interviews and the airport visits have therefore strongly influenced the building blocks of the framework, with the quantitative analysis supporting the definition of different strategic focuses from airports.

Table 2: Summary of technical visits to airports.

Airport	Air-side	Land-side	Notes
Amsterdam Schiphol (AMS)	X	X	
Athens International (ATH)	X	X	Airdev Research Project, visit granted access to restricted areas, air-side included platforms
Atlanta Hartsfield–Jackson (ATL)		X	Airdev Research Project
Barcelona El Prat (BCN)	X	X	Air-side only in terminal 2
Barcelona Girona (GRO)	X	X	
Brussels (BRU)	X	X	Air-side only in pier A
Brussels South Charleroi (CRL)	X	X	
Bordeaux Mérignac (BOD)	X	X	Air-side only in low-cost terminal *Billi*
Dallas Forth Worth (DFW)		X	Airdev Research Project
Frankfurt am Main (FRA)	X	X	Airdev Research Project, included a visit to airport city project and *The Squaire*, air-side only in terminal 1
Frankfurt Hahn (HHN)	X	X	
Geneva International (GVA)	X	X	
Katowice International (KTW)	X	X	Air-side only in terminal B
Krakow (KRK)	X	X	Air-side arrivals only
Lisbon Portela (LIS)	X	X	
Madrid Barajas (MAD)	X	X	
Milan Bergamo (BGY)	X	X	Visit granted access to restricted areas land-side
Munich (MUC)	X	X	Visit granted access to restricted areas air-side
Paris Beauvais (BVA)	X	X	Air-side only in terminal 2
Paris Orly (ORY)	X	X	
Pisa (PSA)	X	X	Air-side arrivals only
Porto (OPO)	X	X	
Rome Ciampino (CIA)	X	X	
Vancouver International (YVR)		X	Airdev Research Project
Venice Marco Polo (VCE)	X	X	
Warsaw Modlin (WMI)	X	X	
Wroclaw Copernicus (WRO)	X	X	
Zurich (ZRH)	X	X	

The integrated framework constitutes a conceptual model that builds upon and extends our previous work on the subject (Jimenez et al., 2013a). To validate this new approach the dissertation includes the application of the framework in a case study defined for the Lelystad Airport in the Netherlands. Lelystad is the largest general aviation airport in the Netherlands and is owned by Schiphol Group, owners of the Amsterdam Schiphol Airport. To support the strategy of Amsterdam Schiphol as a world-class hub, the Group wants to redevelop Lelystad as a commercial airport.

The strategic planning for Lelystad is in fact an interesting opportunity to apply the proposed framework. The airport would need to change its infrastructure in order to accommodate larger aircraft and passenger processing, and would therefore require an associated strategy to attract non-hub related traffic. In addition, the converted airport

would operate in a very competitive environment and would require a differentiated position within the Amsterdam Multi-Airport System in order to be attractive for both airlines and passengers. That said, the case study cannot be viewed as a comprehensive representation of the entire planning process, but rather as a brief example of how the framework can be applied.

iii) Quantitative research methods

In this research, qualitative methods are combined with a detailed analysis of two samples of airports using quantitative methods. An empirical study was performed on a first sample of European airports. Considering the ascendency of LCCs is key for the recent changes in the airport industry, the first task for the quantitative analysis was to identify LCCs operating in Europe in 2013. Chapter 4 details this process that led to the selection of 20 airlines matching the value proposition of LCCs.

The next step was to identify the destinations served by these airlines in Europe. We used Innovata's Schedule Reference Service database (IATA, n.d.) that contains schedules information for the large majority of the world airlines. In this task we used aggregated data for 2013 on the capacity offered by all the airlines (low-cost and others) at European airports, in terms of seats per carrier.

Overall, in 2013 the 20 LCCs identified offered scheduled services to 401 different airports in 41 European countries (see chapter 4 for details). In order to select a representative sample of airports to study in more detail, we identified the destinations served by the six largest LCCs (Ryanair, easyJet, Norwegian, Vueling, Wizzair and Germanwings[2]). To be included in the sample, airports had to satisfy any of the two following basic criteria:

1. be a base for any of the six airlines;
2. be a destination for at least three of them.

We also considered 14 additional airports due to their low-cost facilities, high proportion of low-cost traffic, or for being recently emerging airports. The first sample contains 171 airports.

In the analysis of this first sample we determined the level of importance of the low-cost segment at each airport according to the capacity deployed by LCCs, in terms of available seats in 2013, as per Innovata SRS database (IATA, n.d.). In particular, we developed two main indices to measure the relative importance of LCCs in European airports. One is the market share (i.e. the capacity share in terms of available seats) of LCCs

2 Pegasus, which is also among the largest, is not included because most of its passengers and airports are within the Asian part of Turkey.

at each airport in the sample. The other is a ranking that compares the capacity of LCCs in each airport with the total capacity deployed by LCCs in all European airports (always in terms of available seats), normalised with respect to the airport with the largest absolute number of LCC available seats (which in 2013 was Barcelona El Prat – BCN). Chapter 5 describes the process and the rationale for these measures.

We then built a database by collecting empirical data on over 30 different variables that convey information on crucial airport processes and resources, organised in various parameters: identification, size, organisational structure, location, infrastructure, congestion, managerial strategies, route network, financial conditions, and operational conditions. The main sources of information were the airport annual reports and websites, but also an extensive review of industry reports and documents, academic papers, specialised trade press (namely CAPA Centre for Aviation, anna.aero, ACI Europe's Airport Business, International Airport Review and Air Transport News), and other on-line resources (mainly Geographic Information Systems).

A different approach for data collection and analysis was required for aircraft turnaround times (one of the key operational parameters). According to the literature review (see chapter 2) aircraft turnaround time seems to be a critical aspect of the business model for LCCs and may influence the airports they use. However, there is little information on how the turnaround practices differ between airlines in a larger scale (i.e. how do they vary for different airlines at different airports over a considerable period of time). Indeed, gathering significant and comparable turnaround time data at several airports is rather complex. As we found no empirical information, particularly in the European context, we resorted to aircraft tracking technologies as suggested by Budd (2012).

For the sake of simplicity in data collection, but also as a way to reflect the confidence airlines have on airport performance, we considered scheduled turnaround times. In this sense, a *scheduled turnaround* (see Figure 1) goes from the aircraft arrival to its departure as expressed in the airline timetables (in contrast, a *technical turnaround* extends between aircraft "in-block" and "off-block", during which the tires are literally blocked at the stand). We used historical data from the aircraft tracking website Planefinder.net (Pinkfroot, n.d.) to identify the rotations performed by tracked aeroplanes during one month (September 2013). Then we computed scheduled turnaround times based on departure and arrival times for the routes that were part of the same rotations according to the aircraft registration number.

For comparison purposes, we computed the turnarounds performed by 14 European airlines: seven Full-Service Carriers (FSC) – Air Berlin, Air France, British Airways,

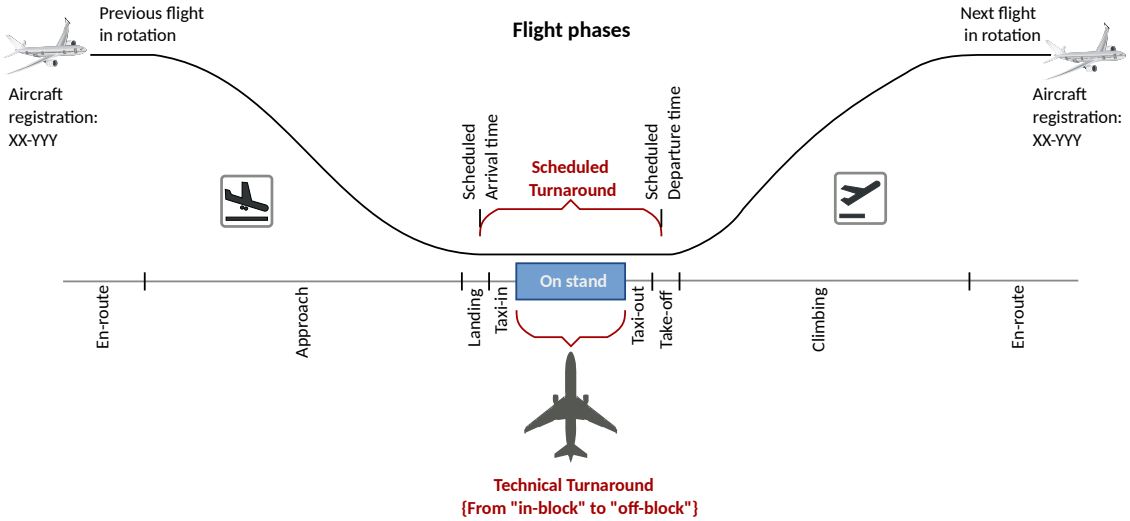

Figure 1: Graphical definition of a scheduled turnaround, as opposed to the actual technical turnaround, in between two successive flights of the same aircraft.

Lufthansa, Iberia, KLM and Turkish Airlines; and seven LCCs – easyJet, Germanwings, Norwegian, Pegasus, Ryanair, Vueling and Wizz Air. To control for aircraft size and stage length, we have only included the rotations performed with aircraft from the Airbus A320 and Boeing 737 families. In total, we identified over 139 000 individual turnaround times in order to compare results by airline and airport.

In chapter 5 we analyse measures for the relative importance of LCCs in association with each variable in our database according to the parameters they represent. This information forms the basis to characterise the airports in the sample by identifying common attributes and marked differences among them.

The measures of relative importance of LCCs also provide some guidance to describe the extent to which an airport can be considered 'low cost' or not. We use this information to select a second sample of airports to perform a dynamic longitudinal analysis in order to identify relevant trends in the evolution of these airports and the extent to which those trends can be generalised. As most of the airports with the largest offer of low-cost capacity belong to Multi-Airport Systems (MAS), we included all the airports in every relevant MAS to analyse their evolution and mutual influences.

Chapter 6 presents this dynamic analysis for 42 airports, with 38 of them being part of Multi-Airport Systems with a significant participation of low-cost traffic: Alicante, Amsterdam, Barcelona, Brussels, Copenhagen, Glasgow, Istanbul, London, Manchester, Milan, Oslo, Paris and Rome. The airports of Malaga, Dublin, Madrid and Palma de Mallorca complete the selection due to their relevance for European low-cost traffic. Again, this analysis is primarily based on airline capacity (seats) data from Innovata database (IATA, n.d.) aggregated for the years 2004, 2008, 2012 and 2013. However, for Spanish airports (Barcelona MAS, Madrid, Alicante MAS, Malaga and Palma de Mallorca) we preferred to use

data provided by AENA Aeropuertos, the airport operator, in terms of passengers per airline for the years 2005 to 2013 (AENA, 2014).

The qualitative analysis, in particular the interviews and field visits, support this quantitative dynamic approach in proposing a conceptual model to depict the evolution of airports concerning the consolidation of the low-cost segment.

1.2 Dissertation structure

This dissertation is organised in eight chapters that follow the logic thread suggested by the proposed methodology in order to tackle the research questions. Figure 2 shows the structure of the main chapters and the dominant methodological approaches.

Chapter 1 introduces the subject of the dissertation and covers the elements that frame this research. Chapter 2 summarises the most relevant aspects of the literature review and thus identifies the gaps in the current state of the art that this projects aims at contributing to close.

Chapter 3 describes the current context of the airport industry and presents the main aspects to consider in the development of a competitive strategy. This section identifies the

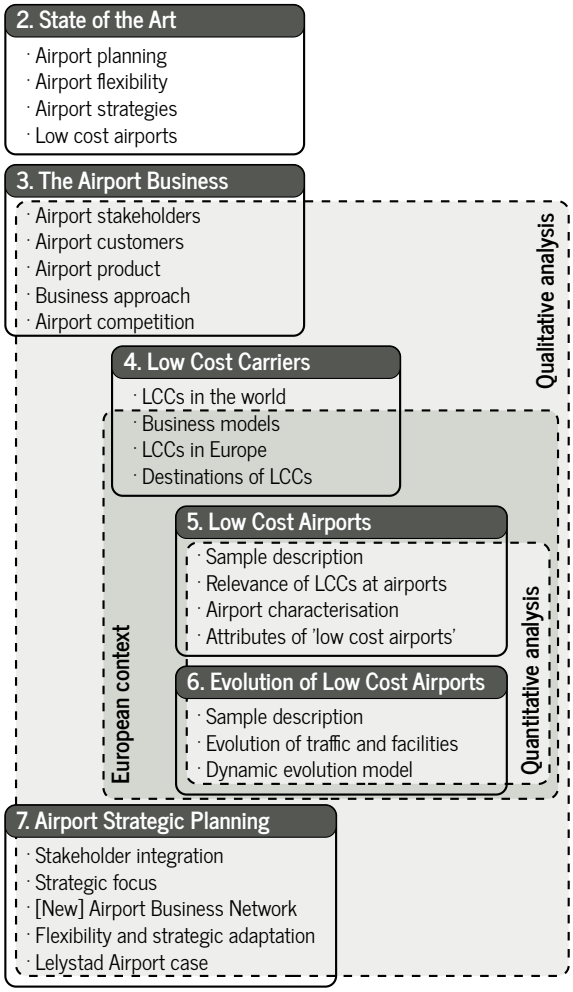

Figure 2: Schematic structure of the body of the dissertation.

most relevant stakeholders involved in airport development and operation. Then it contributes to a redefinition of the airport customers and the airport product and, based on these aspects, to a categorisation for different approaches to the airport business. Finally, it presents an analysis on competition between airports.

Chapter 4 reviews the most relevant aspects of low-cost carriers, particularly those that influence the analysis of the impact the business model of these airlines has on airports. A brief review of the evolution of LCCs around the world leads to a more detailed appraisal of the situation in Europe. Finally, the airports that LCCs use in Europe are identified, as an input for the following chapter.

Then, chapter 5 analyses in detail the characteristics of the European airports used by LCCs. Based on a sample derived from the destinations served by all LCCs in Europe in 2013 we then propose a way to measure the relevance of LCCs in the airports, followed by a characterisation of the airports in the sample and an analysis of the capabilities or attributes that 'low cost airports' may provide.

Chapter 6 presents a dynamic assessment on the evolution of the most interesting airports derived from the analysis in the previous chapter. Such assessment is based on the development of low-cost traffic at a second sample of European airports. The chapter ends by proposing a conceptual model that represents the main trends in the evolution of LCCs in airport systems.

Chapter 7 introduces an innovative framework to complement airport strategic planning. It builds upon the findings of the previous chapters to structure a conceptual framework that integrates the different airport stakeholders in defining a strategic focus. The chapter presents the framework itself, referred as the [New] Airport Business Network, and defends flexibility for airport design and adaptability in its business strategy. Finally, a case study on the Lelystad Airport in the Netherlands serves to illustrate the applicability of the framework.

The final chapter (8) summarises the research results, the main contributions of the dissertation and the key findings of the entire analysis. It also presents ideas for future developments based on this research.

1.3 Publications

During the development of this doctoral project, two papers were published in indexed peer-reviewed journals (Jimenez et al., 2013a, 2012), along with several other publications in peer-reviewed conference proceedings (Jimenez et al., 2014b, 2013b, 2011). The first journal paper (Jimenez et al., 2012) provided much of the motivation to focus the dissertation on the relationship between airports and LCCs, whilst it served as an

exploration of alternative research methods. This paper, which partially feeds the discussion on airport competition in chapter 3, presented a specific case of airports in Portugal.

The second journal paper (Jimenez et al., 2013a), forms a large part of chapter 3 in this dissertation because it provides a sound understanding of the airport business in the current context. However, the section dedicated to the airport stakeholders, presented also in chapter 3, constitutes an updated and extended version of what is in the paper. On the other hand, this paper also provided the inspiration and initial framework to develop the work presented in chapter 7, which also presents a complete reformulation of "the airport business network" that originally appeared in the paper (hence the name of the section in chapter 7: "the [New] Airport Business Network").

Chapters 4 and 5 extend a working paper that was discussed in a peer-reviewed conference (Jimenez et al., 2014a). The final paper is based on the contents of these chapters and is in the process of enhancement prior to submission to a pier-reviewed journal. The contents of chapters 6 and 7 are now being adapted to be soon submitted for publication.

2 State of the art

Liberalisation of the air transport market around the world has profoundly changed the evolution trends of the aviation industry in the second half of the past century. Prior to deregulation, international agreements and domestic regulations effectively prevented competition between airlines by defining a strict set of rules regarding carriers, routes, frequencies, and even prices. The regulatory framework also prevented competition between airports because the agreements included provision for market access at particular airports (Belobaba et al., 2009).

The outcomes of liberalisation often include lower fares, higher demand, service concentration for airlines that use hub-and-spoke network strategies, and service de-concentration thanks to low-cost carriers that favour point-to-point networks (Bounova, 2009; GAO, 2006; Goetz and Vowles, 2009; Jimenez et al., 2012), reduced service in remote regions (Metrass-Mendes and de Neufville, 2011; Reynolds-Feighan, 1995; Reynolds-Feighan, 1998), and increased industry instability (Goetz and Vowles, 2009).

Liberalisation also contributed to a change in airport ownership and management, especially during recent decades. A number of airports around the world have been privatised and many others run now as commercial firms (ACI Europe, 2010; Gillen, 2011). A new perspective from airport management implies a different relationship with the airline customers that is more direct and goes far beyond airport charges. Moreover, different owners or new operators may define wider goals to target other type of customers. Thus the traditional business approach, as a public utility provider, evolved to incorporate the increased relevance of non-aeronautical activities that foster revenues (Jarach, 2001).

At the same time, increased competition and lower fares induced higher demand for air travel that, in turn, increased congestion in many airports around the world. Whilst

liberalisation eliminated restrictions on airport access, congestion effectively limits competition in airports where access is restricted by some form of demand management (Belobaba et al., 2009). This creates opportunities for other airports that are less congested, but it also highlights the importance of defining long-term strategies that optimise the use of existing infrastructure.

A liberalised market created a proper environment for LCCs to emerge and favoured their rapid expansion. Yet after decades of liberalisation the academic literature is not conclusive on the long-term impact of this trend for airports (Graham, 2013). There is concern about the growing market power of LCCs and its implications for airports, and there is uncertainty about the future evolution of the business models, not only for LCCs but for traditional airlines too (European Parliament, 2007).

Liberalisation also increases uncertainty for airport planning and operations, mainly because airlines are free to launch and close routes at will from whatever airport they deem convenient. But also because more competition creates a volatile environment in which airlines and airports are more likely to rise and fall.

In this context, our literature review focuses on four areas that are relevant for the topic of this dissertation: airport planning, airport flexibility, airport strategies and 'low cost airports', with a particular focus on the European context. Airport planning because we consider the ascendency of LCCs may have influenced the way airports approach this process. Airport flexibility because we consider it may add value to airport design in the context of increased uncertainty. Airport strategies because we consider there is room for improvement and for integration with infrastructure development. And 'low cost airports' because it seems they have implemented strategies that are attractive for LCCs.

2.1 Airport planning

Airports are part of a broader aviation system that, among other components, includes airways, air traffic control, airlines and the aircraft manufacturing industry. Theoretically, there could be a joint planning process for the whole aviation system, but its high complexity and sophistication, let alone the wide variety of players in each subsystem, makes such task very difficult in practice (Ashford et al., 2011).

Airports are systems on their own as well. Given that airports cannot operate independently (a given commercial flight needs two distinct airports at least), there are usually different levels of planning for airport networks (de Neufville and Odoni, 2003). A general form of airport planning usually occurs at a national level by the national government or any specialised authority. In the United States, for instance, the Federal Aviation Administration (FAA) elaborates and updates a National Plan of Integrated

Airport Systems (NPIAS). This plan identifies all airports that may be candidates to receive federal grants for airport improvement and estimates the total amount of funding required. Although it is not the case for the NPIAS, national level planning normally helps in the prioritisation of projects or the identification of critical infrastructures. Additionally, national plans also classify the existing airports in some way and allocate resources accordingly.

Similarly, at regional or metropolitan levels other entities may carry additional airport planning. At a local level, for individual airports, *master plans* are the most used and traditional way of airport planning. According to the International Civil Aviation Organisation (ICAO) an airport master plan "presents the planner's conception of the ultimate development of a specific airport" (ICAO, 1987). According to the FAA "the goal of a master plan is to provide the framework needed to guide future airport development that will cost-effectively satisfy aviation demand, while considering potential environmental and socioeconomic impacts" (FAA, 2007).

The ICAO Airport planning manual (ICAO, 1987) describes the full process of master planning around five general steps:

1. inventory of existing conditions;
2. forecast future demand;
3. determine facility requirements (types and characteristics of runways, taxiways, buildings, baggage system, cargo facilities, airport access, etc.);
4. analyse different alternatives according to the requirements;
5. select the most appropriate alternative and develop a detailed airport layout plan for that alternative.

By carefully following this process, the master plan provides a guide for the development of physical facilities in the airport and the land use for the areas surrounding the airport, for the determination of the environmental effects of that development, and for the establishment of the requirements regarding airport access through surface transport modes (Ashford et al., 2011). Hence master plans are specifically concerned about the physical development (i.e. infrastructure) of the airport.

Even though master plans are widely used all around the world, they have fundamental weakness in the sense that they do not recognise uncertainty. A master plan assumes that a single forecast (the second step in the list above) is a full description of a very likely future. It prepares the airport to deal with that future, but does little to prepare it for a different scenario or to deal with the possibility that airport managers could shape

the future by defining the characteristics of their product (de Neufville and Odoni, 2003), as most industries do.

Proactive planning, in which airport planners and managers explicitly intend to shape the future instead of just react to it, is a powerful alternative to master plans (de Neufville and Odoni, 2003). Rather than simply forecasting an uncertain future traffic and designing a plan to meet the requirements of such demand, proactive planning deals with the strategies to attract the desired level and characteristics of traffic. Nevertheless, this type of planning has been barely used in the airport context, mainly because the past airport ownership structure has favoured the role of infrastructure provision as a public service (Belobaba et al., 2009). As airport privatisation and commercialisation gains relevance, proactive planning is likely to be more used. However, there is no clear and standard framework to develop proactive airport plans, as it is the case for master plans.

An approach that overcomes the flaws of master planning without diverting too much from its process and methods is the so-called *dynamic strategic planning*. It is strategic in the sense of long-term thinking, not with the mind on a specific possible future but on the path to the several futures that may unfold. It promotes thinking ahead the way chess players do, recognising the possibility of different moves and their consequences, and establishing a position from which they are able to respond to the actual events as they happen. It is dynamic in the sense that it emphasises flexibility. Therefore "airport operators must adjust their plans and designs dynamically over time to accommodate the variety of futures that may occur" (de Neufville and Odoni, 2003).

In a similar direction, Kwakkel et al. (2010) propose an adaptive airport strategic planning "that is flexible and over time can adapt to the changing conditions under which an airport must operate". This type of planning involves an iterative process that defines a set of policies (mainly alterations to the airport infrastructure), and the contextual vulnerabilities and opportunities that may affect or promote the applicability of such policies. It then identifies a contingency plan (a set of actions to be launched when certain monitored thresholds are reached), and an implementation plan (the actions to be taken immediately). The authors, however, do not explore the applicability of their model in practice.

From these different planning alternatives, master plans are clearly the most widely used. Despite their flaws, master plans are part of a series of international technical standards and recommendations emanated from ICAO, the International Civil Aviation Organisation (Belobaba et al., 2009). Therefore, in many cases master plans are mandated by national regulations for any airport with significant commercial traffic. Likewise, investments are usually guaranteed only if they have been presented in an approved

master plan. Then, the real practical challenge is to overcome the drawbacks of master-planning with long term strategic planning that can be adapted to fit the structure of master plans.

2.2 Airport flexibility

Flexible design is becoming a new paradigm for engineering systems planning (Burghouwt, 2007). In particular, real options theory (borrowed from financial options where one has the right, but not the obligation, to exercise a given action – buy or sell – in the future) is proving to be very valuable. “Unlike financial options, real options regard a physical structure or system. However, the role of the option is the same; real options, like financial options, allow investors the opportunity to purchase the right to delay expensive or irreversible decisions. [The investors] therefore recognize the role that active management can play in either minimising the damage from or taking advantage of an uncertain future.” (Chambers, 2007)

Real options can be either “on” or “in” a project. The main difference between these two cases is that the latter intends to change the way the project or the system is designed in its technical details, while the former includes more managerial decisions (such as deferring investments) treating the technical functioning as a black box (Wang and de Neufville, 2005). In general, there are four types of real options “on” systems:

1. the option to acquire (buy) engineering systems – the right to start a project;
2. the option to divest (sell) engineering systems – the right to shut down a project before it gets unprofitable;
3. the option to expand the size of engineering systems – the right to easily scale up a project to meet a larger demand;
4. the option to reduce the size of engineering systems – the right to scale down if demand happens to be lower than expected.

Real options “in” systems, on the other hand, are in general more complex than their “on” counterpart (Chambers, 2007). Since they result from a conscious decision implemented in the system's design, they require a deeper knowledge about the way the system operates. Current research for flexible design of airports is more focused on real options “on” the projects. However, in other engineering systems real options “in” the projects have a higher value for flexible design when compared to the rigid versions for the same systems (de Neufville and Scholtes, 2011). Indeed, the topic of real options in flexible designs is relatively novel in the literature.

In the airport context, Burghouwt (2007) distinguishes between *ex ante* and *ex post* flexibility. “Ex ante flexibility refers to actions taken now which allow the organization to be flexible in the future. Ex ante flexibility has to do with anticipation (...) Ex post flexibility refers to actions that are adjustments to change now, which are possible because of decisions taken in the past.”

The idea of a flexible design is to incorporate the ability to adjust easily to different scenarios. In order to do so, de Neufville (2008) defines three basic steps for a flexible design process for airports:

1. Recognition of the range of uncertainty: identify all the possible future outcomes of the system, from the least favourable to the most advantageous. Normally, this can be stated in terms of future demand (passengers and cargo, for example).
2. Definition of flexible design opportunities: determine the technical implementations that enable the adjustments in the system. I.e. the physical or managerial characteristics that will, for example, allow the airport to reconfigure its facilities to meet different technical or market developments.
3. Analysis of the development strategies: select the 'inaugural' airport plan. I.e. the initial configuration that provides the best starting point for future changes; and the strategies to exploit opportunities.

Since master plans dominate airport planning, flexible designs for airports have not been common (de Neufville, 2008). Yet, some forms of flexibility have been studied or implemented to some extent. One of these forms, associated to the real option to defer an investment, is the staged deployment of facilities. For airports, capacity is regularly incremented in lump, discrete, amounts and at a significant cost. Hence, the more the investment can be postponed, whilst providing a reasonable level of service, the better (considering the value of money in time). Such investments may include additional passengers or cargo buildings, additional runways, full length taxiways, or new apron areas (Chambers, 2007).

Land banking is another type of flexibility used in the airport context, but it is also an important requirement for implementing other types of flexibility. Land banking consists of reserving space to develop future configurations or expansions. Land banking is normally used in two situations: when a new airport (the second of a large city, for instance) is foreseeable some time in the near future; or when an existing airport needs to be expanded (eventually most airports need it) to meet demand growth. In both cases the actual need for construction is not certain, so it usually pays off to reserve the land when it is easier and cheaper to acquire (de Neufville, 1990).

When it comes to flexibility “in” airport systems (the two situations above are more related to real options “on” systems because they do not affect the actual design), examples are scarcer. In general, shared-use space and modular buildings are becoming common practices in modern airports. Shared-use space refers to the fact that some activities inside an airport can share the same space. Hence, the total space needed is less than the sum of the space required for the individual activities (de Neufville and Belin, 2002). Modular buildings involves for example the use of non-load-bearing walls to separate activities that are required to occur independently. The most common case is that of the “swing gates” that can be used for domestic (no passport control) or international (with passport control) traffic in accordance with traffic peaks (de Neufville and Odoni, 2003).

Butters (2010) identifies more detailed cases of flexible design “in” airports. He argues that a master plan can implement flexibility by taking into account different development scenarios. For building design, large uninterrupted space clearly favours adaptability to different uses. In this sense, the inner layout should be designed at the latest to allow for unforeseen changes in market or regulation. Structural core elements and utilities should not be concurrent with main processes, such as security or check-in, to provide room for growth. Airports with high seasonality can implement passenger buildings with piers or wings that can be completely shut-down during the low-traffic season.

In a survey of 19 airports around the world (Magalhães et al., 2013), airport representatives identified the flexible implementations that their airports feature, from a previously defined list. Common answers included available land for expansions (i.e. land banking), utilization of available land for non-aeronautical activities, changing design and layout of retail areas, swing gates, and available space in the passenger buildings. Magalhães et al. (2013) also distinguish between flexibility at strategic (e.g. land banking), tactical (e.g. movable walls) and operational (e.g. swing gates) levels.

Yet flexibility is not only about identifying and deploying flexible options “on” or “in” the system design. It is also important to secure the right to use flexibility when it becomes necessary, otherwise it looses value (de Neufville and Scholtes, 2011). Another important aspect of flexible design is that it changes the perspective towards uncertainty. Thus flexibility can be also seen as an opportunity to profit from different conditions (or to avoid loses) and not only as a mechanism to deal with risk or something inherently bad.

It is also important to recognise that decision makers may implicitly consider uncertainty and consequently adapt their plans, even if there is no explicit mention to flexibility in the process. The key aspect here is that there may be opportunities for future

adaptations that are probably not specified in advance, but that could be triggered if changes in external factors require them to be made.

2.3 Airport strategies

Existing literature on airport planning focuses more frequently on the development of physical facilities alone than on the relationship between infrastructure development and airport business strategy. Often, the development of a business strategy is considered as a task of the airport marketing department, usually when facilities are already in place (Graham, 2003). But in the current context, airport operators should develop strategies to enhance their competitive position with the same fervour as they plan for infrastructure improvements.

As Barret (2000) suggests, before market liberalisation the world of non-competing airlines was mirrored by a world of non-competing airports. In deregulated markets airports are subject to a competitive pressure, partly because airlines are free to choose where to fly. Moreover, the changes in airport organisational structure towards privatisation and commercialisation, further contributed to the emergence of competition between airports (Starkie, 2002).

Traditional studies on airport competition focus on the competition for passengers within the catchment area, especially in the case of several airports in a metropolitan area, as Lian and Ronnevik (2011) summarise. Starkie (2008) analysed the case of the airport industry in the UK with a broader scope, Forsyth et al. (2010) compiled a selection of studies that discuss several aspects of airport competition with more detail, and a recent report (Copenhagen Economics, 2012) presented evidence for airport competition in Europe. Yet, in order to define successful strategies for airports, it is important to understand not only their competitive environment but also the way airports relate to their multiple stakeholders to align their strategies.

An airport typically provides a wide range of services through different agents. Thus the business environment in an airport is, in fact, the interaction between highly diverse actors. From an operational perspective, Schaar and Sherry (2010) presented a model that attempts to describe the interrelationships between the airport stakeholders in terms of their responsibilities and needs. Their model (see Figure 3 in the next chapter), however, is based on common practices in the airport industry in the United States that do not apply worldwide (in particular regarding airport ownership, regulation and provision of capital for infrastructure development). In addition, the model becomes too complex for the analysis of the airport operator role in defining the characteristics of the airport business, mainly because it divides the planning process among several stakeholders.

From a marketing perspective, Jarach (2001) introduced the notion of an “air transport pipeline” as a model that describes the business relations in a network of actors around the airport. These actors complement each other in order to bundle service packages to final consumers. Although it allows an analysis considering multiple customers and airport competition, this model is probably too simplified for developing strategies within the wider scope of airport business nowadays.

Also from a marketing point of view, Tretheway and Kincaid (2010) used the “classic paradigm of the 'four Ps of marketing'” to elaborate on “strategies that airports can utilise to compete with other airports”. The authors discussed different dimensions of the airport Product to suggest strategies regarding Price (direct fees and facilitation of airline cost reductions), Promotion (marketing, naming and branding), and Physical distribution (airport positioning on computer reservation systems, on their websites and with travel agents). However, there is no formal model to analyse the process of strategy creation.

Graham (2010) performed a competitive analysis for the airport industry based on Porter’s five forces framework (threats of new entrants and substitutes, the bargaining power of buyers and suppliers, and the rivalry within the industry). One limitation of this model is that, in the airport context, there are several customers that act as buyers and suppliers at the same time. This notwithstanding, the author described strategies that some airports have used in line with Porter's generic framework (Porter, 1979).

Frank (2011) developed a conceptual framework in an attempt to describe the business model of airports. By applying the framework to three airports, she concluded that airport business models are highly dependant on the context in which the airport operates. Kalakou and Macario (2013) applied and extended Osterwalder and Pigneur (2010) business model canvas to the airport industry. They also found much diversity in the business models of 20 airports. However, the canvas was used more to describe the current business model of airports than to aid in the formulation of future strategies.

We may therefore conclude that, despite the growing body of literature in the area, there is still a missing link between the physical development and the business strategy of an airport. Moreover, there is no clear definition of a systematic process for strategy formulation that is applicable to the particular context of the airport industry.

2.4 'Low cost airports'

The continuous growth of LCCs during the last decades motivated a number of research studies on the implications of this trend for airports. However, there is no consensual definition of what a 'low cost airport' may be. De Neufville (2008) states “that the ascendency of low-cost airlines entails an increased importance and expansion of low-

cost airports and airport facilities", in such a way that LCCs catalyse the development of low-cost airports.

That is an important point because it means that it was the expansion of LCCs that triggered the emergence of 'low cost airports' and 'low cost facilities', and not vice versa. It also explains why most studies assume that a 'low cost airport' is one that is used by LCCs to a large extent, or one that somehow resembles another that has been traditionally considered as a 'low cost airport' because it accompanied the noticeable expansion of an LCC (as it is the case of Luton and easyJet in London, for instance).

To Jarach (2001) 'low-cost' is one of five different market positioning that airports may adopt to improve weaknesses in a highly competitive environment. In this sense, a 'low cost airport' is one that "aims to attract low-cost operators and thus re-engineers its whole production chain as to minimise cost and thus prices to airline operators". Then he cites London Stansted, London Luton and Dallas Love Field as examples of this low-cost, market-driven approach.

De Neufville (2008) explores some characteristics of 'low cost airports', which, as LCCs, "emphasize economy through operational efficiency and minimal frills". In this regard, low-cost airports may include three elements:

1. They avoid monumental buildings by signature architects. Instead, they favour simple designs. Grandiose buildings with bespoke design are normally more expensive and difficult to build, mainly because the whole structure tends to be a unique project with few standard elements.
2. The passenger buildings of 'low cost airports' have lower levels of service, which in practical terms translates to less space per person. The increased efficiency and higher performance standards of LCCs reduces dwell time and increases annual capacity per square metre, such that the interior spaces of the buildings can be used more intensively.
3. Retail and commercial space is limited in 'low cost airports'. De Neufville (2008) argues that building and operating retail areas is expensive and cumbersome, hence "the economic rationale for building airport terminals as shopping arcades is not clear".

Sabar (2009) analysed 'low-cost terminals' (LCT), which do not necessarily imply they are implemented as 'low cost airports'. In this sense, an LCT is "an airport terminal that has been developed with low capital investment cost". LCTs offer limited facilities due to space restrictions and favour simplified and efficient services. LCTs key customers are LCCs and charter airlines attracted by lower charges (passenger service fees) and quick

turnaround times. The author distinguishes two types of LCTs – converted and newly-built – and lists some typical characteristics, including: basic terminal facilities, avoidance of air bridges, limited retail and catering, single storey terminals, no executive or business lounges, usually (but not always) only road access and coach services to nearest cities or towns, and short taxiing distances to and from terminal building.

Segregated 'low cost terminals' may provide an opportunity for airports to grow in the low-cost segment (Njoya and Niemeier, 2011), but they have also been criticised for duplicating expensive facilities that are required regardless of the market focus (such as security, passport control and baggage handling), for cannibalising traffic from other terminals, or for lacking the ability to easily expand (Blackman, 2011; Njoya and Niemeier, 2011; Toh, 2013). Also, Hanaoka and Saraswati (2011) argue that the efficiency gains at LCTs "seem to be driven largely by the location of the terminal, rather than its configuration".

A recent analysis (Kalakou and Macario, 2013) of the business models for different airport categories found that 'low cost airports' do not follow a unique model. Yet the authors highlighted that in this category "the majority of the airports does not pay attention to the development of retail activities". They studied Milan Bergamo, Brussels Charleroi, Rome Ciampino, London Luton, Liverpool and London Gatwick as 'low cost airports'. However, airports like Milan Bergamo, Brussels Charleroi and London Gatwick have expanded space for retail stores and food courts in recent years. Overall, the authors concluded that the volume and type of traffic have a strong influence on the airports business model. It would be interesting to analyse whether the opposite interaction also occurs (i.e. whether the business strategy influences traffic types and volumes).

Conversely, a report from the European Low Fares Airline Association (ELFAA, 2004), naturally not an unbiased source, stressed that 'low cost airports' concentrate on non-aeronautical revenues and thus increase terminal shopping area. They argued that in a liberalised context "airports are no longer able to dictate the price and conditions to airlines" and thus not able to pass on their inefficiencies to airlines and subsequently to passengers. As a consequence they highlighted that "the main difference now between traditional and low cost airports is that the latter no longer consider aeronautical charges to be their main source of income".

ELFAA (2004) also supported the view that LCCs favoured the development of previously loss-making secondary airports into major international airports serving large metropolitan areas. This encouraged other airports to make the transition and compete to offer low cost, efficient facilities to the growing number of LCCs. However, they do not describe how should those "low cost, efficient facilities" be like.

The reports also highlighted that the trend in Europe mirrors the situation in the US where “airports like Chicago Midway, Baltimore International and Oakland enabled [LCCs] to provide competition to the network carriers (...) and also led to competition between the airports. For example, Southwest has been able to provide strong competition to the likes of American Airlines on the Chicago to Las Vegas route without having to deal with American’s dominance at Chicago O’Hare Airport, where it would have been virtually impossible to have obtained sufficient slots in order to be a viable competitor.”

Besides the study of 'low-cost airports' or terminals as differentiated facilities with their own business practices and characteristics, the impact that LCCs have on airports have also been a matter of research. Graham (2013) reviewed 60 papers on the relationship between airports and LCCs and concluded that “the academic literature is far less clear and conclusive about the overall impacts of LCC operations at airports and the extent to which airports benefit from LCCs, particularly in the long-term, and this suggests that more studies are needed.” Moreover, the review argued “that the LCC’s choice of airport is very much determined by its operating model, although through time a wide variation of models have evolved which has complicated the situation.”

Barret (2004) identified seven factors for airports to be attractive for LCCs based on an interview with Ryanair's CEO. At the time of the interview (January 2003) Ryanair was carrying 15.7 million passengers per year using 56 aircraft and only two bases in continental Europe (Charleroi and Hahn). But by 2013 the airline carried 81.4 million passengers with over 305 aircraft operating from 61 bases across Europe and Morocco. Thus the current importance of those original factors is debatable, even for an airline that has until recently largely adhered to its original model (Alamdari and Fagan, 2005; Klophaus et al., 2012).

Warnock-Smith and Potter (2005) surveyed 8 LCCs operating in the UK to analyse and rank 15 “airport choice factors”. These and other similar studies (Francis et al., 2004, 2003; Gillen and Lall, 2004) provide important insights but do not detail whether or how the airports implement those factors.

It appears to be consensual that LCCs have high aircraft utilisation thanks to quick turnaround times on the ground (Graham, 2013). In fact, LCCs in general are able to execute quicker turnarounds than traditional 'legacy' carriers, which are limited by their hub-and-spoke strategies when scheduling flights. Learmount (2002) raised the issue of turnaround times for LCCs in an interview with Ryanair's CEO. Gillen and Lall (2004) studied in more detail the case of Southwest on a given day at Albany Airport and, more in general, the organisational aspects of Southwest's business strategy in comparison with that of Ryanair and easyJet. They found that, controlling for aircraft size, Southwest turns

their planes quicker than the other airlines operating at Albany. Despite these contributions, there is little information on how exactly do turnaround practices differ between airlines at a larger scale and, more importantly, how exactly do they differ between airports (even for the same carrier).

It is also commonly agreed that LCCs used to prefer 'secondary' airports (Barbot, 2006; de Neufville, 2008; Dobruszkes, 2013, 2006; Zhang et al., 2008). However Abda et al. (2012) found that, in the USA, the market shares of LCCs were bigger at the largest primary airports, "contrary to the common perception that LCCs avoid primary airports and direct competition with the [Full Service Carriers]" (Graham, 2013). This indicates that LCCs are becoming increasingly dominant in some markets (in particular the intra-USA and intra-European markets) and, as they keep growing, they move to the primary airports. In fact, the recent evolution of the networks of LCCs in Europe (Dobruszkes, 2013, 2009, 2006) suggests similar developments as the business models of the airlines evolve.

2.5 Summary

This literature review shows the lack of a comprehensive framework for strategic planning in airport systems that integrates infrastructure development with business strategy. Except for proactive planning – which is scarcely used in the airport context – long term airport planning approaches assume their objective is solely to provide the required infrastructure to support a given level of demand (some claim that level is deterministic, others more correctly assume it is stochastic and variable). The definition of the ways in which that infrastructure could be offered to the different customers is very often let for subsequent phases, usually when the airport has already been built or expanded.

Furthermore, a sense of low uncertainty coming from a regulated era in the airline industry seems to be imprinted on airport master-planning. Arguably, liberalisation, airport competition, business complexity and the rise of LCCs have made the airports more exposed to uncertainty. Therefore it is critical to evaluate opportunities to implement flexibility that may provide value to the airport infrastructure and its business strategy.

Finally, a poor understanding of the impact of the growth of LCCs in the aviation markets, particularly in Europe, generates confusion as to what are the best strategies to pursue in what concerns airport planning. A narrow and incomplete vision on the matter may lead to investments in airport developments that are not able to attract the expected levels of demand, if used at all, or that are much more expensive to build and operate than they should – in a context in which airlines and passengers are more and more price-conscious.

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3 The airport business in the current context

Airports were traditionally considered monopolistic utility providers with little potential to develop market opportunities (Graham, 2003). Yet the liberalisation of aviation markets introduced new dynamics that increased complexity in the airport industry. The emergence of competition between airports (Copenhagen Economics, 2012; Forsyth et al., 2010; Starkie, 2008, 2002) and the transition in ownership towards privatisation or commercialisation[3] (de Neufville and Odoni, 2003; Donnet et al., 2011) require a different perspective in airport management. Such a perspective should embrace the opportunities created by the existence of a variety of customers for the airport product (Doganis, 1992).

This chapter aims at explaining the complexity of the airport business nowadays. To accomplish this goal, it identifies the different stakeholders that play a role in defining the elements of the airport business. Then it presents the different customers of the airport product, and a redefinition of the airport product itself as a combination of several service packages. Based on the interaction between the stakeholders and the customers, mediated by the airport product, it explores several approaches to the airport business. Finally, it provides a comprehensive, broad scope review of airport competition.

3.1 Stakeholders in the airport industry

Well beyond the original role as infrastructure provider, now a typical airport provides, through a number of different agents, a wide range of facilities, activities and services. Moreover, the level of involvement of the owner or operator in providing all services varies a lot from airport to airport. Thus the business environment in an airport is

3 Privatisation implies transferring some ownership rights (management control and residual income, but rarely property ownership), fully or in part, from government entities to private investors. Commercialisation involves a change in management attitude (increased orientation to profits and efficiency), even under full government ownership (de Neufville and Odoni, 2003).

composed by a highly diverse interaction between disparate actors. Indeed, Macario (2008) highlights the need to shift the airport management logic towards a more business-oriented activity that requires a complex interaction between agents with diversified interests.

These agents are the relevant stakeholders that influence or are influenced by airport operations. In order to identify them, first we define the airport management team, which represents "the airport as a firm" (Jarach, 2001), as the core element in a network of stakeholders that are responsible for delivering the "airport product" (see section 3.3). The definition of the airport as a firm, as opposed to the airport as a public utility, reflects the market-driven management logic that is required in the current competitive context to ensure the sustainability of airports.

In the document review that guides this analysis we found that Swedavia, the Swedish airport operator, presents a very simple but comprehensive classification of their stakeholders: "our most important stakeholders are our owner, passengers, employees, society and our partners" (Swedavia, 2013). From a pure academic perspective, Schaar and Sherry (2010) present one of the most comprehensive analysis of airport stakeholders (see Figure 3). Yet their approach is exclusively related to airport operations in the USA and thus limited to particular arrangements that do not apply worldwide.

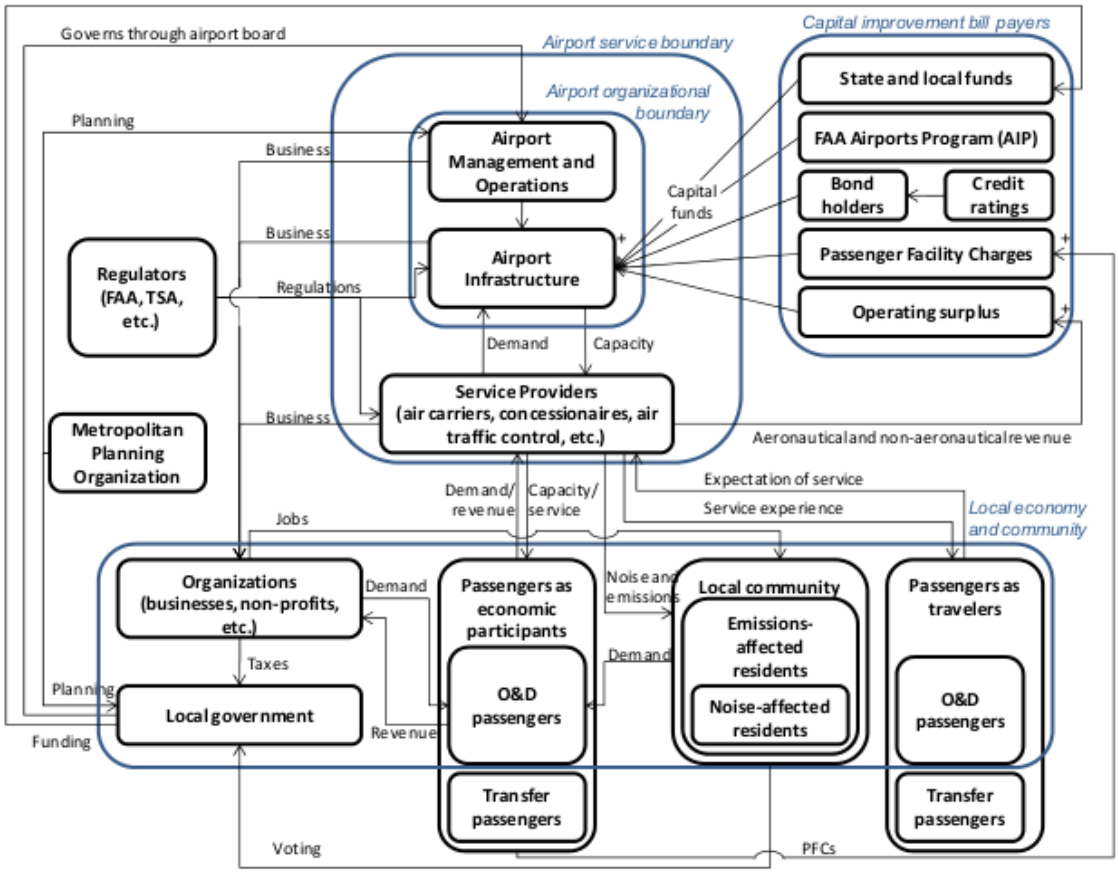

Figure 3: Relationships between airport stakeholders, from Schaar and Sherry (2010).

We take these proposals as a starting point to characterise groups of stakeholders according to their level of involvement in defining the airport product. Thus we focus more on the actors that influence airport operations than on those that are influenced by the airport. Nevertheless, given the extensive economic and environmental impact of airports, the stakeholders that are affected by airport operations are increasingly considered for airport planning.

To help classifying the stakeholders, we consider then three generic groups: airport, partners and society. The degree to which the different stakeholders are involved in defining airport operations increases as they get closer to the "airport" group, as Figure 4 shows. The following sub-sections describe in detail the stakeholders in each group.

3.1.1 Airport

i) Airport management

The airport management team is in charge of defining the specific strategy and development alternatives for an airport. The management may be autonomous and independent for one airport site, but it also may be subject to the managerial guidance of a larger group. The latter case is clear when several airports are operated by a governmental agency, authority or company, such as AENA (that manages 47 public airports in Spain), the Hellenic Aviation Authority (that operates public airports in Greece, except for Athens International) or the Port Authority of New York and New Jersey (that, besides other transport infrastructure, operates 6 airports in the New York area, including three major airports for New York City); or by an airport group such as Vinci or Aéroports de Paris.

The degree of centralisation within these organisations may significantly limit the scope of the activities of the local management team, or may be crucial for distributing investments across the airports in the group or agency (Bel and Fageda, 2009). However,

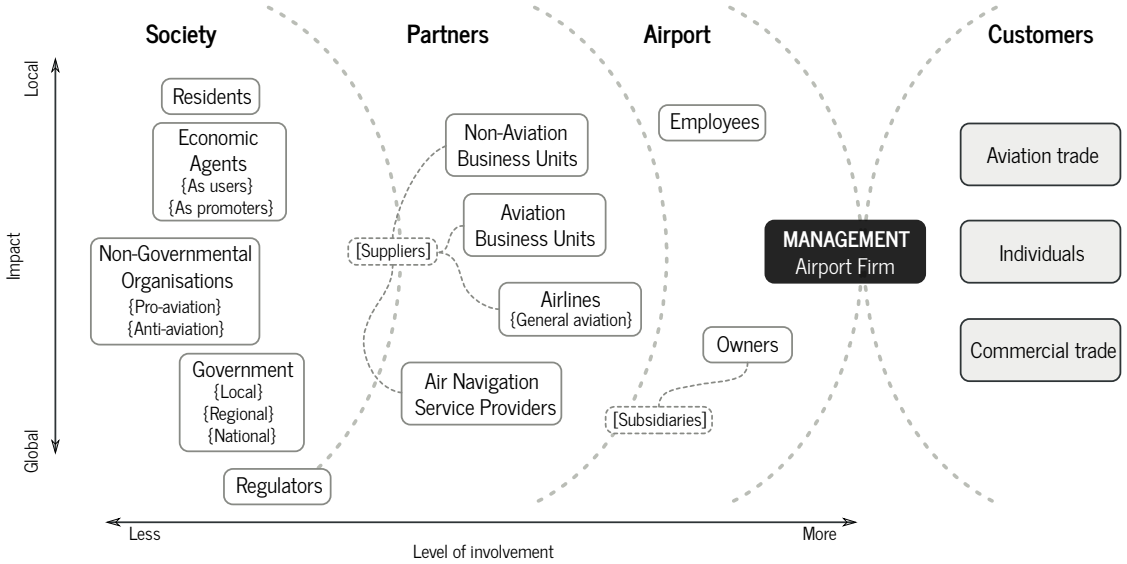

Figure 4: Schematic representation of airport stakeholders, including customers.

even when limited in its autonomy, we consider the local airport management team has at least two main tasks: defining and controlling tactical day-to-day operations, and communicating and explaining strategic concerns to central management.

ii) Airport owners

The airport management team is liable before the actual owners of the airport or the airport group. Depending on the ownership structure of the airport, the owners may be individual shareholders, branches of local, regional or national governments, private companies, chambers of commerce, or a combination of several of these entities (ACI Europe, 2010; de Neufville and Odoni, 2003; Gillen, 2011). Irrespective of their nature, airport owners can set general goals that the management team must follow, either in terms of public service, environmental objectives, trade facilitation, self-sufficiency, profitability or a combination of multiple criteria. In addition, airport owners support capital investments that determine the physical development of an airport.

As mentioned before, the same airport owners may hold interests in several airports (or other type of companies). We consider other *subsidiaries* of the airport owners – in case they exist – may influence their position over a particular airport strategy, but the degree of influence may vary from case to case. Therefore in this work we do not consider them directly as airport stakeholders.

iii) Employees

Employees ultimately execute the intended strategy of airport management. But as airport services are provided by several different agents, not all of them part of the airport operator, "the employee category includes both direct employees of the airports organization as well as employees of companies operating at the airport" (Schaar and Sherry, 2010). Employees are also essential to deliver the quality of service that the airport and the airlines expect to deliver to their customers. Moreover, employees may as well drastically impact airport operations, for instance in the case of a strike.

3.1.2 Partners

i) Airlines

Airlines, including commercial airlines (scheduled and charter, passengers and cargo) and executive and general aviation, are in the core of the airport business. However, the traditional perception of airlines merely as the main airport customer is being challenged. In the current context, the relationship between the airport and the airlines must be directed towards a real partnership. This implies a better understanding of the actual requirements of airlines in terms of infrastructure and operations. Airports should adapt to serve the diverse business models of different carriers and alliances.

In addition, a closer cooperation between airports and airlines is a key factor for the success of the airport business, partially because besides aeronautical fees, airlines provide customers for the non-aeronautical services of the airport. Moreover, an airport may influence the carrier decisions regarding network expansion, and market new destinations together to attract more users.

ii) Aeronautical business units

The aeronautical business units comprise a series of agents that provide services to the airlines, and to the airport, that are essential for aviation-related activities (such as meteorological services, communications, baggage handling, passenger handling, cargo and mail handling, aircraft cleaning, fuel provision, aircraft maintenance, in-flight catering, airport security and fire fighting, internal transportation, and general safety services). Some of these services may be provided by the airport itself, but they are often delivered by third-party providers (Doganis, 1992).

Airlines can contract the services of the aeronautical business units (outsourced handlers, for instance), they can perform some of the related activities by themselves or they can buy them from other airlines. The airport must ensure airlines have access to competitive services and a sufficiently attractive business environment for the aeronautical units, while fulfilling all applicable regulations.

iii) Non-aeronautical business units

Like its aeronautical counterpart, the non-aeronautical business units are not necessarily part of the airport company, but they provide essential services that complement the airport product with non-aviation activities. Among others, the tenants and concessionaires of retail shopping, food and beverage services, parking or car rental are part of these business units, as well as the providers of security, cleaning and maintenance services for the terminals and other airport buildings, or surface transport operators. Normally the airport and the non-aeronautical business units share the goal of increasing passenger and visitor volumes or level of expenditure.

iv) Air Navigation Service Provider

An efficient system for air traffic management (ATM) ensures a safe, economic and reliable service for air transport users. At the airport level it is essential to coordinate ground and terminal control, but with the implementation of Airport Collaborative Decision Making (A-CDM) it is important to keep close interaction with ATM during the entire phases of a flight, as well as with stakeholders in the departure or destination airport at the other end of the leg (Eurocontrol, 2012). Usually, the Air Navigation Service Provider (ANSP) is a government agency or a state-owned company, but other arrangements such as multi-lateral organisations (Eurocontrol, 2014) or Public-Private

Partnerships (NATS, 2014) exist. This means that the relationship between ANSPs, airport operators and other stakeholders may also lead to a more business oriented, rather than solely operational, approach.

v) Suppliers (aviation value chain)

Suppliers of the four previous groups of stakeholders (such as airframe and engine manufacturers) also play a role in the airport business. However, we do not consider them directly in our analysis. Instead (as Figure 4 suggests) they are related to each of the airport partners and thus connect the airport with the rest of the aviation value chain (Tretheway and Markhvida, 2013).

3.1.3 Society

i) Regulators

Despite liberalisation of the air transport market, regulation still plays an important role in an industry where safety and security are a primary goal. Besides, bilateral Air Service Agreements still abound for international markets, most states hold restrictions to airline ownership by foreigners, some airports with congested facilities have controlled access to slots, others are bound by curfews or other artificial limitations to airport capacity (Belobaba et al., 2009). Moreover, as privatisation and commercialisation extends, airports are increasingly subject to economic regulation, allegedly, to control their market power (Czerny, 2006; Starkie, 2002).

Regulators do influence airport operations and airport strategies by providing positive or negative incentives, with impacts in terms of efficiency, and thus we can view them as relevant stakeholders. Usually, regulators are part of some government branch or agency, but as they have a very specific task, we consider them independently. However, in the light of direct airport-airline commercial agreements, regulation may play a lighter role (Bush and Starkie, 2013; Starkie, 2012).

ii) Government (local, regional, national)

Different forms and levels of government may be involved with airport operations by an active participation of local, regional, national or even supra-national authorities (as in the case of Basel-Mulhouse-Freiburg EuroAirport). Governments (at all levels) may hold or share ownership of a given airport, but in this case they are included within the *airport owners* group of stakeholders described before. On the other hand, governments should follow the objectives of the communities they represent, trying both to maximise the positive effects and to minimise the negative effects of airport operations (Schaar and Sherry, 2010).

The relationship between the airport and the government is normally associated with the role of the airport as a promoter of employment, tourism and trade opportunities. The airport may act as a facilitator to establish common goals for infrastructure development and sustainable growth. This is key because, besides directly investing in improving or expanding the airport, different government agencies may as well provide (or cooperate with the airport in the provision of) incentives for air services.

Conversely, in representation of public interest and of the concerns of local communities, governments must ensure that the negative impacts of airport activity, particularly noise and contamination, remain within controllable limits. Moreover, governments and airports should work together to ensure that airport expansion and development does not conflict with wider land use policies.

iii) Economic agents (as users and as promoters)

By economic agents we mean local (in the sense of within the airport's area of influence) businesses, organisations and institutions, both for-profit and non-for-profit, that derive some value from airport activities. Following Schaar and Sherry (2010), who refer to "business, commerce, tourism, arts, sports, and education organizations", some of these economic agents are direct airport users (business travellers, dispatchers or receivers of air cargo, etc.), whilst others are indirect users as a result of their customers (e.g. tourists) travelling through the airport.

Moreover, as airports "drive and support economic activity in several different ways" (Schaar and Sherry, 2010), we also include here economic agents that act as promoters of airport activity. Trade associations, tourism boards and development associations are the sort of institutions that would support airport operations and, like governments, they may as well provide (or cooperate with the airport in the provision of) incentives for air services.

iv) Non-Governmental Organisations

Other stakeholders that need to have a voice in defining airport strategies are aviation-related Non-Governmental Organisations (NGO). In general terms, NGOs can be divided in those that are 'pro-aviation' and those that are 'anti-aviation' to some extent. Both may lobby their interests directly with the airport or with government representatives and both can promote or affect airport activities. On the 'pro' side we include industry-specific associations such as Airports Council International (ACI), the International Air Transportation Association (IATA) and, with a narrower scope, the European Low Fare Airlines Association (ELFAA). On the 'against' side there are mainly environmental or advocacy groups such as the International Council on Clean

Transportation (ICCT), AirportWatch, the Aviation Environment Federation and many other local groups.

v) Residents

As Schaar and Sherry (2010) suggest "residents near the airport can be considered a particularly significant subset of the overall group of communities affected by airport operations". In fact, residents suffer adverse effects, such as noise, air pollution or even traffic congestion, on a daily basis. As such, there should be permanent communication between the airport management and local residents to understand their concerns and alleviate them as much as possible, and, at the same time, to communicate the potential benefits of the airport or of some specific actions. This is even more important because residents can be also employees, retired employees, and even customers of the airport.

Indeed, one last group of airport stakeholders is formed by the customers of the airport product (see Figure 4). But as they are key to generate revenues for the airport and, in general, they make the airport business happen, we consider them separately in the next section.

3.2 Airport customers

Over the last decades airports have in general evolved from public utilities to commercial enterprises. As infrastructure providers, airports face airline opposition and regulation constraints to increases in aeronautical charges, and government pressure to become financially self-sufficient (Doganis, 1992). As commercially-oriented enterprises, airports realised the potential of new sources of income in non-aviation activities (Jarach, 2001). Within this context, the perception of who are really the airport customers has evolved too.

Airports allow the interchange between air and surface transport by providing aeronautical facilities and services to airlines, which in turn, sell seats to passengers and cargo space to shippers. They also take advantage of the passenger throughput to offer a variety of non-aeronautical services that have become more and more important for airport operators (European Commission, 2002). The traditional business as public utilities evolved towards a steady increase of non-aeronautical activities that, in some cases, represent a higher income than aeronautical revenues, especially in Europe, North America and Asia (Graham, 2003). Now multiple stakeholders interact to make the airport a multi-service provider firm. Therefore an airport-airline-passenger chain is no longer valid, in general, to define its customers.

Indeed, defining the airport customers is an ambiguous task that reveals some conflicts of interest. Airport operators are interested in offering a good level of service to

airlines and passengers by providing quick and easy access to aircraft. But they also want passengers to spend more time – and money – by enjoying the non-aeronautical services of the airport (Francis et al., 2003). Accordingly we take into account the multiple interests that diverse consumers share to propose a classification of customers in three groups, as in Table 3. Not all airports will have all customers in the three groups, but the classification is comprehensive enough to include all potential customers.

Table 3: The most relevant customers for the airport product classified in three groups.

Aviation trade	Individuals	Commercial trade
Commercial airlines (cargo and passenger, scheduled and charter) General aviation Travel agents Tour operators	Outbound travellers (passengers) Transfer travellers (passengers) Inbound travellers (passengers) Visitors Local residents Employees	Tenants and concessionaires Local and global businesses and organisations Other airports [Non-user stakeholders]

3.2.1 Aviation trade

The aviation trade group includes the customers directly interested in using the airport as a gateway to provide air traffic. Their focus lies on the air-side facilities and aeronautical services that the airport and other suppliers provide; although they may be interested in land-side developments too, such as offices or warehouses. This group includes commercial airlines that transport cargo (including freight integrators), passengers or both, with scheduled or charter services; general aviation users such as corporate/executive aviation, air taxis, flight instruction, aircraft rental, aerial applications, aerial observation and leisure flights (Schaar and Sherry, 2010); and travel agents and tour operators that contract the services of charter and scheduled airlines.

It is important to notice that, as explained before, some of these clients are also key stakeholders in the production side of the airport business, especially airlines. In the previous section they were considered as vital in the supply of some of the airport products, such as seats for passengers and space for cargo shippers (see section 3.3 for more details), and here they are viewed as key buyers of other airport products, such as infrastructure and aeronautical services.

3.2.2 Individuals

Individuals are customers that do not represent any organisation with a business perspective, i.e. they act on their own behalf. Their main interest is to have a pleasant “stay” at the airport while they travel, shop or work there. Here we distinguish travellers (passengers) and non-travellers because their expectations and requirements differ, and because many people access an airport without any intention to take a flight.

As for the passengers, we consider outbound, transfer and inbound travellers, to whom the airport may offer differentiated products and services. The non-travellers are

visitors (including those who come to meet and greet travellers), local residents and employees (including those who work for the airport itself, for airlines and for the companies established in or around the airport). These individuals may also profit from surface commuting connections or from extended opening hours at retail shops.

3.2.3 Commercial trade

The commercial trade group includes those customers whose main focus lies on the land-side developments of the airport. They are normally not interested in the aeronautical services, but rather in the opportunities presented by the *individuals* throughput. This group includes tenants and concessionaires (of retail stores, car rentals and hotels, for instance); local and global business and organisations enticed by logistics facilities or by the ease of connectivity provided by the airport. Moreover, given that the airport business is global (as the next section discusses), other airports are also potential customers of consultancy or managerial services.

Finally, we also consider in this broad group some of the non-user stakeholders that were mentioned in the previous section which, although not directly interested in *buying* the airport services, may be crucial to provide funds and public support to the airport. These non-user stakeholders include the economic agents and government entities or institutions whose interest is mainly driven by the positive impacts produced by the airport. To them airports may *sell* the benefits they can obtain from the airport activity.

3.3 Airport product

The relationship between the airport stakeholders and its customers is mediated by the *airport product*. According to Jarach (2001) the "airport as a firm" concept can be achieved "through the implementation of more complex forms of service packages in order to satisfy evolving needs of enriched audiences". In fact, practice shows that airports can successfully bundle their portfolio of activities and products into *service packages* targeted at particular groups of customers. Moreover, these packages are the result of conscious interactions between the airport firm and other stakeholders in the airport business.

To frame their revenue structure, airports are usually constrained to one of two types of regulation: *single till*, when all types of revenue are considered to set aeronautical charges; and *dual till*, when only aeronautical revenues are used. Even though the single till approach to airport regulation is widely used (CAA, 2000; Czerny, 2006), evidence suggests that airports are increasingly focusing on commercial activities to increase revenues and profits, and that such focus may be even greater as the pressure to control aeronautical revenues grow (Graham, 2009).

in this work we have defined six service packages that integrate the airport product. The first two packages – infrastructure and aeronautical services, and transport network – are directly related to aeronautical revenues, and the other four to non-aeronautical revenues. This setting highlights the possibilities of increasing income from non-aviation activities, as an increase in aeronautical fees normally faces opposition from airlines and regulators. Conversely, non-aeronautical revenues can be obtained from previously unexplored opportunities and less regulated markets.

3.3.1 Infrastructure and aeronautical services

This is the basic product of an airport, i.e. what makes it an airport. This service package includes the physical and technological infrastructure, along with the necessary human operators, that allow planes and their content (passengers, cargo and mail) to land and take-off, as well as being handled on the ground, safely and efficiently. That is, the runway and taxiways system, the air traffic management system, the platforms, aprons or ramps, and all associated aeronautical services (fuelling, handling, catering, cleaning, inspection or maintenance, fire-fighting and emergency, etc.). In addition, it includes all the buildings that are required to process passengers, cargo and/or mail, and their associated services (baggage/cargo/mail handling systems, safety and security, cleaning, functional activities like check-in, boarding, etc.).

The specific type and characteristics of the infrastructure varies a lot and depends substantially on the scale, the strategy, and types of traffic served at the airport. A small airport dedicated exclusively to general aviation may not need buildings to process passengers, cargo or mail, for instance.

3.3.2 Transport network (air and surface)

The second service package bundles the destinations that can be reached by air from the airport with the connectivity it offers on the ground. In order to provide an integrated air-surface transport network, it may be necessary to provide additional infrastructure and services for passengers and cargo to transfer efficiently and seamlessly.

According to the scale and the strategy of the airport, this service package may include access roads, railways, bike paths or walkways, as well as parking lots and stops or stations for public transit. Some airports may provide specific products or services such as shuttles, dedicated desks or rooms to facilitate passenger and baggage transfer between the modes. They can also encourage airlines to increase their route networks with specific strategies (e.g. incentives for route development).

3.3.3 Retail and non-aeronautical services

Airports may offer retail (e.g. duty free stores, souvenirs, food and beverages, books and magazines, supermarkets, travel-related products, fashion goods, and so forth) and complementary non-aeronautical services (e.g. car parking and car rental) taking advantage of the throughput created by the aeronautical services. This package can be expanded according to the airport possibilities, in such a way that passenger buildings may become actual shopping malls.

3.3.4 Activities and events

Airports can implement a fourth type of service package (activities and events), in order to entertain passengers or to attract visitors, and to satisfy the needs of other customers in the individuals customer group (e.g. local inhabitants or employees of the airport and the companies settled in or around it). These services can range from airport tours, to concerts and sport events, to art and commercial exhibitions, to business meetings and congresses.

3.3.5 Real estate development

The airport may, itself or through business partners, provide real estate development of the land surrounding the airport. This package is actually a natural extension of the previous one and includes all sorts of projects in the airport vicinities to explore the opportunities created by the airport. Possibilities abound: from logistic parks, hotels, office buildings and convention centres; to medical centres for quick surgeries and academic clusters for top management graduate schools (as in The Circle of Zurich airport); or research centres for high-mobility scientists (as in Frankfurt airport city); or even other developments such as the photovoltaic park for electricity generation in Athens airport. Some airports have land-side development departments inside their organizational structure, whilst others opt for creating separated companies or joint ventures with property developers.

3.3.6 Consultancy and managerial services

In the process of developing all these service packages, the airports gain expertise and know-how in several areas, and accumulate valuable technical and human resources. Therefore, another type of service package includes the consultancy and managerial services that the airport firm offers to other airports or actors within the airport industry.

Not all airports implement the entire set of service packages. However, no current evidence suggests that it is impossible for any airport to implement all of them, except for

the lack of available physical space that limits the scale of some of the packages (especially real estate development). In fact, all packages are scalable and may be implemented according to the particular characteristics of each airport and its surrounding area.

3.4 Approaches to the airport business

The extent to which an airport implements the service packages described in the previous section indicates the business approach their managers pursue. A rather small airport that offers only its infrastructure and associated aeronautical services will surely adopt a *public utility provider* strategic focus. This may be the case of airports specialised in serving particular niches, such as general aviation, pilot training, aerial services (e.g. aerial footage or topography), rescue services, and sport or leisure activities; or airports in less developed or remote regions that lack enough resources or traffic to implement additional services.

As airports gain relevance in their catchment areas, an increased connectivity with surface transport emerges as passenger and cargo traffic increases. Then the airport becomes a *multi-modal interface* that offers air services for public access. Services provided by commercial airlines are essential at this point, since the attractiveness of the airport is strongly linked to its destinations. In this approach airlines are the most important customers.

When traffic increases significantly, airports are more likely to engage in a *commercially-oriented* approach. In this case, non-aeronautical revenues are important for the airport to guarantee higher income levels, and to depend less on the variability of air traffic.

If operators realise that airports attract different types of customers, and that they can actively influence the preference of those customers, a more *consumer-oriented* strategic focus is achieved. At this level, the airport can implement the "activities and events" type of service package in order to satisfy the varying needs of the users.

Depending on the space available, or the ability of the airport to acquire surrounding land or partner with its tenants, the business approach turns into the development of the *airport city* concept. Although this is normally associated to large airports, Peneda et al. (2011) suggest that this concept is rather scalable and applicable to smaller airports too.

Finally, airports can be a truly *global business*. These airports bid for management contracts or acquisition of other airports, and provide consultancy on airport planning, construction or operation.

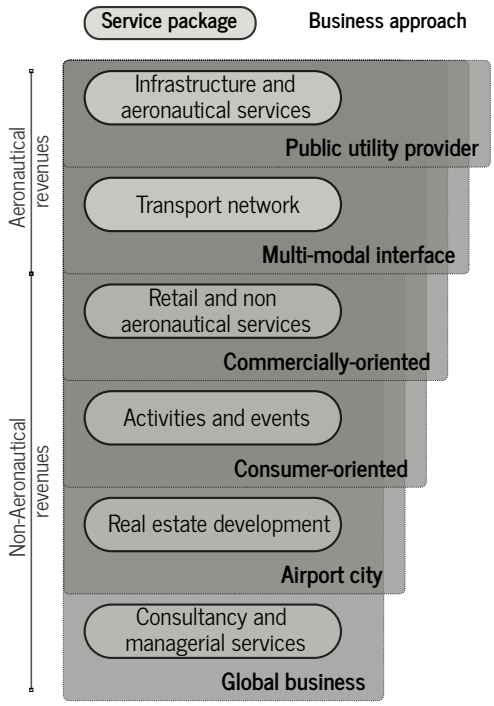

Figure 5: The airport product as six service packages and associated approaches to the airport business according to the packages that the airport implements.

In a concrete airport, the different types of packages could possibly be implemented sequentially, in order to move from one business approach to the next one, as Figure 5 shows. Airports may identify the service packages they wish to implement and the degree to which they are required according to their strategy, available space and infrastructure, and bear in mind that these packages are produced in conjunction with other stakeholders. Similarly, there must be a connection between the packages and the customer groups in order to facilitate the formulation of competitive strategies.

The analysis presented in Chapter 7 tackles these issues after empirical evidence has been described in the other chapters. So far this chapter has covered important elements of the airport business in the current context, but before attempting to analyse competitive strategies it is crucial to understand the competitive environment that airports face nowadays.

3.5 Airport competition

The airport business entered a competitive environment that was practically non-existing a few decades ago. Before liberalisation, the world of non-competing airlines (regulated by the Chicago convention of 1944) was mirrored by a world of non-competing airports (Barret, 2000). Airports now face competitive pressure from the airlines' freedom to choose any airport to operate in (de Neufville and Odoni, 2003; Graham, 2003). Liberalisation also favoured ownership changes towards privatisation or commercialisation that further contributed to the increase in competition between

airports (Starkie, 2002). The emerging, new operational context forced airports to be more focused on costs and commercial revenue, and on the need to attract and retain airlines (Bush, 2010) and other customers.

There are seven possible areas of competition between airports according to the academic literature and to the industry practice, as Table 4 describes. Although not all airports compete in all areas simultaneously, we collected evidence to support their existence as the following sections describe.

Table 4: Possible areas of competition between airports.

Area of competition	Summary
Provision of services to airlines	By attracting airlines to use the airport as a hub, a traffic node, an airline station or an airline base
Traffic: Outbound (catchment area)	By network of destinations and surface connectivity, availability of low fares, and convenience for the users
Traffic: Transfer	By lack of congestion, convenience for the users and low-cost *self-help hubbing*
Traffic: Inbound (destination)	By tourism attraction and supplementary services and activities in the airport or its hinterland
Global competition	By bidding for management of other airports, terminals or retail areas, and as consultants
Competition for funding	By attracting favourable grants, tax reductions and subsidies or incentives
Competition with other modes	High speed rail, private cars, long distance coaches and cruise ships

3.5.1 Provision of services to airlines

Traditionally airports have been considered as competitors in two situations: when their catchment areas overlap, and when large hubs compete for transfer traffic (de Neufville and Odoni, 2003; Forsyth et al., 2010; Lian and Rønnevik, 2011). Under this perspective, competition is strictly dependent on the network strategies adopted by the airlines. Therefore airports strive to provide services to the airlines in order to assure their presence (Morrel, 2010).

Airlines can be established at a given airport with different kinds of operations. Burghouwt (2007) defines the role of the airports within an airline network in three categories: hubs, traffic nodes, and airline stations. Each category requires different characteristics that the airport operator must identify and accordingly provide the right infrastructure and services.

Regardless of the type of operations, airports can also serve as a permanent position for one or more airlines' aircraft and become an airline base. A base provides an airport the opportunity to generate additional revenues associated to aircraft and crew services, and brings more visibility and economic benefits (e.g. employment generation). In fact, Copenhagen Economics (2012) considers bases are similar to hubs in what concerns airport competition.

The *base* concept gains relevance for low-cost carriers, but it is different from a hub in the sense that LCCs normally do not operate coordinated schedules. However, bases are not restricted to this type of carrier, nor are they used exclusively by passenger airlines. Freight integrators deserve particular attention, since they are becoming increasingly important in total air traffic (European Commission, 2003).

To illustrate how airports compete in this aspect, we provide some examples, by no means comprehensive, but easily replicated elsewhere. For an airline hub, Munich Airport attracted Lufthansa to create their second major hub there instead of a second terminal at Frankfurt Airport (de Neufville, 2008). For an airline traffic node, TAP Portugal currently handles most of their operations in Lisbon, but their services could be significantly reduced if the airline is sold to another carrier operating large hubs elsewhere. For an airline station, an Asian airline introducing a new service to Europe evaluates multiple airports, either in terms of local market, connection opportunities with other airlines in the same alliance, or both (Morrel, 2010). For an airline base, easyJet "selected Lisbon over a number of other European cities because of its market potential" (easyJet, 2010).

The steady growth of LCCs has had a particular effect on airport competition. LCCs catalysed the development of 'low-cost airports', and forced legacy airports to compete back. As de Neufville (2008) explains "many legacy airports have lost their previous virtual monopolies. This fact has to motivate their management to build facilities that will be more competitive with low-cost airports".

Attracting and retaining airlines is crucial for airports because these airlines will strive to compete with the services offered by other carriers in other airports. If airports are considered mere infrastructure providers, the burden of competition may fall entirely on the airlines' side and there is little scope for airports to compete beyond this particular area. If, however, the footloose character of airlines (especially, but not limited to, LCCs) and the active role that airports play beyond utility provision are taken into account (Copenhagen Economics, 2012), the role of airports in competition is strong and diverse as the following sections explain.

This is not to say airports are not able to exert some market power, especially regarding legacy network carriers who are captive to their home base. Some of these airlines have invested heavily to develop and operate a hub at their main airport, to which they are also restricted by bilateral agreements for some international services. Consequently, network carriers more strongly depend on their own home market and have fewer incentives to switch between airports.

3.5.2 Passenger demand in the catchment area

The catchment area of an airport is the geographical location of most of the existing or potential demand. This rather dynamic concept varies with the type of services offered by the airport and the particular characteristics of the passengers (e.g. long-haul leisure flights have a larger catchment area than short-haul business trips). The specific ways in which airports compete for demand within their catchment areas reflect these dynamics, since passengers and journeys are not homogeneous.

First, airports compete in terms of network provision. On the air side, they compete to offer the most desired destinations. Thus closely located airports compete more strongly for passengers travelling to comparable destinations. On the land side, competition occurs because a good connection with the surface transport network makes an airport accessible from longer distances, widening its catchment area. Porto airport, in Northern Portugal, illustrates both aspects. Porto offers a larger set of direct destinations than Vigo (a neighbour airport in Spain), and is accessible via motorways, light rail and buses, while Vigo is only reachable by car and bus.

Second, airports compete for passengers willing to have access to low fares. Airports that attract LCCs gain a competitive advantage in the sense that these airlines can offer remarkably lower prices for their flights (Malighetti et al., 2009), expanding the catchment area by attracting price-conscious passengers. For instance, airports such as Brussels South Charleroi, Paris Beauvais and Frankfurt Hahn compete with surrounding airports, thanks to the extensive service and low fares of LCCs.

Finally, airports sharing similar catchment areas compete for outbound traffic by providing a more convenient service to some passengers. Airports that are closer to the place of residence or work for some passengers are more convenient for them. Similarly, airports with more non-stop services allow travellers to bypass hubs, delivering higher quality in terms of travel time; or airports with more frequent service may adjust better to the desired schedule for some passengers. Likewise, small airports offer short walking distances and thus quick access and exit from curb to aircraft. They are also an alternative for passengers that wish to stay away from the confusion of large airports. Other airports offer products that are more convenient for business travellers, such as a central location, a speedy check-in process or the availability of lounge areas. Airport convenience may attract to London Southend passengers that want to avoid the hassle of larger airports; or may take them to Luton or Stansted depending on which one is closer to where they live.

3.5.3 Transfer traffic

Attracting transfer traffic at large hubs is widely recognised as a form of competition between airports (Copenhagen Economics, 2012; de Neufville and Odoni, 2003; Forsyth et al., 2010; Starkie, 2002). This is especially true for airports with airlines that use hub strategies. Therefore, it is crucial for those airports to provide space and capacity for the network airline(s) to use infrastructure that facilitates their transfer processes. The rapid growth of Emirates and Dubai International Airport in competition with the European airlines and hubs (e.g. London/Heathrow, Amsterdam, Frankfurt, Paris/Charles de Gaulle) illustrates this trend (CAPA Centre for Aviation, 2010).

Although in this case, as mentioned before, the burden of competition rests largely on the airlines, airports can also attract passengers that want to choose their preferred point of connection. Travellers may be attracted by the loyalty program of their favourite airline or alliance, thus using the airports in its network. Alternatively, a given airport may offer a wider network with better opportunities to connect to more destinations. The particular characteristics of an airport may also enhance its competitiveness: by a location that minimises detours; an efficient design that minimises connecting time; or shopping and leisure facilities that increase the desirability of longer layovers (as the swimming pool in the transit area of Terminal 1 at Singapore Changi Airport).

Additionally, LCCs allow smaller airports to compete for medium-haul transfer passengers using self-help hubbing (Burghouwt, 2007). Airports with a stronger focus on LCCs and a conveniently central location effectively offer connection opportunities, as in the case of Brussels Charleroi, Paris Beauvais, Frankfurt Hahn or Rome Ciampino for passengers travelling between Eastern and Western Europe. Although Reynolds-Feighan and McLay (2006) claim that such transfers are impractical; Malighetti et al. (2008) provide evidence that suggests the potential of such interconnections, and Franke (2004) argues that legacy airlines may reduce the complexity of their hub models following the example of LCCs practices.

The point is that, since such connections are based on point-to-point services, passengers are not penalised if they transfer to a different carrier; airlines may not provide compensation and special arrangements for missed connections, and airports do not have to deploy expensive and complex transfer facilities. Moreover, given that transfers are not ensured by the airlines, passengers have an incentive to increase their connecting time, so that airports can profit to increase non-aeronautical revenues.

3.5.4 Inbound demand

Another form of airport competition that is barely discussed is destination competition (Tretheway and Kincaid, 2010). It is related to the possibility to appeal to passengers or other users solely by the attractiveness of the surrounding environment (the hinterland) or by the characteristics of the airport itself. This happens in airports with a large share of inbound traffic, which are normally located near tourist destinations.

For instance, Faro Airport in Portugal describes itself as "a competitor of all the airports that serve tourist destinations which compete with the Algarve" (ANA, 2007). The attractiveness of the hinterland is a key factor that is particularly challenging, since the airport operator has little or null control over what the region has to offer.

Nevertheless, airports have higher control of their land side development in order to promote the airport itself as a destination. Some airports offer supplementary services or activities that range from hotels and convention centres to concerts, sport events and airport tours. Other airports actively develop real estate projects to diversify the land use, far beyond a land-air modal interchange. Amsterdam Schiphol airport city and airport corridor, Frankfurt airport city and The Circle project at Zurich airport are some examples of such activities (Macario, 2008).

3.5.5 Global competition

Nowadays there is a well-established process of globalisation for the airport industry, substantially increased with airport privatisation, but not limited to private companies (de Neufville and Odoni, 2003; Graham, 2003). This led airports to compete at a global scale: airport companies can compete to buy, or get the concession of, other airports; they can compete with their consultancy services in areas such as engineering, economics or construction; they can operate retail facilities in other airports; and, they can operate terminal buildings in other airports.

Graham (2003) provides a number of examples in which airport companies (e.g. Aéroports de Paris, Schiphol Group, Fraport) have interests in airports around the globe. The sample is not restricted to companies previously related with the airport business. In fact, many property developers, construction companies, financial investors and other transport companies also have large shares in airports. Not surprisingly, airlines also have interest in airport operations, as easyJet unsuccessfully trying to buy London/Luton airport, Ryanair proposing the construction of its own low-cost passenger building at Dublin, or Lufthansa successfully partnering with Munich Airport to build Terminal 2. Indeed, in Australia and the United States the relationship between airlines and airports is

more direct, for carriers can lease terminals from the airports through long-term contracts.

3.5.6 Competition for funding

Airports may also compete to obtain funds to develop expansions or upgrades, aiming at achieving more competitive positions. Funds can be in the form of grants with special conditions (low interest rates or long repayment periods), tax reductions or subsidies (where allowed by regulators). These funds can come from governmental or private institutions interested in airport activity as a means to foster economic development, tourism and employment in the airport's hinterland. Additionally, some governments may be keen to invest in regional airports in order to reduce the pressure of congestion or environmental constraints in major airports (Davison et al., 2010).

In fact, Bel and Fageda (2009) showed how the Spanish airports competed to attract public expenditure. According to their analysis, between 1994 and 2003 Madrid/Barajas received 60% of the total investments made by AENA, with the remaining 40% invested in the other 46 airports managed by the Spanish company.

Additionally, privatisation of airports creates new opportunities to raise funds in such a way that "remove(s) airports from a position where they compete for public expenditure" (Davison et al., 2010). On the other hand, airports that are not privatised (in the sense that local, regional or national forms of government maintain the ownership), but that have been delivered as a concession to private operators, are likely to raise private funds more easily to gain competitiveness.

3.5.7 Competition with other modes

Previous sections focused on competition between airports. Yet competition between air transport and other modes may also have a strong impact on airports (Tretheway and Kincaid, 2010). The expansion of high speed rail networks in Europe has proven an effective way of competition with air transport. In France, domestic air traffic declined 7% between 2000 and 2007 mostly due to the growth of the TGV network (International Transport Forum, 2009). Unlike airports, train stations are normally better located and provide a more efficient boarding process that increases passenger throughput and decreases wasted time.

The European Union promotes the substitution of air services for high speed rail to reduce congestion and limit CO_2 emissions from aviation (European Commission, 2001). Yet there is a clear potential in exploring the complementarity between both modes as cooperation between airlines and rail companies may prove quite beneficial for all parties (Givoni and Banister, 2007). Competition also occurs between air transport and other

modes, such as private cars and long distance buses; and cooperation with local coach companies can also be explored.

Moreover, besides other modes of transportation, airports may also compete inside their hinterlands with local providers of retail, food and beverages (Tretheway and Kincaid, 2010). This is increasingly the case of larger airports that have become more like shopping malls to profit from the dwelling time of passengers, especially those waiting for their planes air-side.

3.6 Summary

The liberalisation of the air transport market clearly introduced new dynamics in the airport industry. In recent decades, airports evolved from infrastructure providers in a monopolistic context, to commercially oriented enterprises in a competitive environment. The existence of competition between airports, as argued in this chapter, challenges the idea of airports as monopolies.

For some of the areas of competition it is clear that the relationship between airports and airlines is becoming increasingly important for the success of the airport business. This hinders a strict separation of the role of airports and that of the airlines in airport competition. Instead, airports should cooperate with all relevant actors, as identified in this chapter, to enhance their performance and their position in the market.

This chapter highlighted the opportunities created by the current context in the airport industry. It followed the perspective of an airport as a multi-service firm that interacts with a network of stakeholders to deliver a set of service packages to different groups of customers.

The next chapter discusses in more detail one of those new dynamics that impact the airport industry and that has been in the core of the most dramatic changes: the emergence and ascendency of Low-Cost Carriers. In line with the rest of the dissertation, the focus of the discussion remains on the implications of these dynamics for airport development and airport strategy.

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4 Low-Cost Carriers

Although Low-Cost Carriers have proliferated in deregulated environments, their history can be traced back to pre-deregulation times in the United States. Pacific Southwest Airlines (PSA), a carrier flying within California since 1949 (and merged into US Airways in 1988), was the first to provide low fares for regular flights. It also provided much of the inspiration for the corporate culture and operations of Southwest Airlines in Texas, that started intra-state flights in 1971. Both companies remained intra-state operators until market deregulation in 1978. PSA started expansion out of California at the end of 1978 and Southwest out of Texas in 1981.

Southwest is widely credited as the initiator of the 'low-cost model' (Alamdari and Fagan, 2005; Zhang et al., 2008) and the inspiration for other LCCs, particularly in Europe (ELFAA, 2004). The legal struggles that preceded Southwest operations in Dallas Love Field Airport gave them a sort of maverick spirit, making Southwest a special airline. Then, when they had to sell an aircraft (in a fleet of four) and keep operating the same schedules, Southwest created a rather legendary '10 minute turnaround' that translated into high aircraft utilisation and operational efficiency (Sartain, 1998). These two elements seem to be rooted in the 'low-cost model' ever since.

Besides the domestic US market, low-cost ventures started on the other side of the Atlantic as well. Inspired by charter operations, Laker Airways pioneered low-cost long-haul services, mainly from the UK. Laker Airways started operations in 1966 and in 1977, after legal battles with the Civil Aviation Authority, started the *Skytrain* service between London and New York (Flight International, 1977). The service implemented cost-saving measures, such as more restrictive limits for free baggage to reduce overall weight, that allowed the airline to offer low-fare, no-frills transatlantic flights. Laker Airways went

bankrupt in early 1982, but its victories over regulators and incumbent IATA carriers remained, and it also paved the way for later low-fare, no-frills services.

Given the initial limitations imposed by regulations to these pioneering LCCs, liberalisation of the air transport market provided the proper environment for new LCCs to emerge and expand rapidly (ELFAA, 2004). Liberalisation trends started with the US domestic market in 1978, then Canada in 1988, Australia in 1990 and Europe between 1987 and 1997. In every case LCCs gained prominence, especially Southwest, now the largest domestic airline in the US; WestJet, currently the second largest carrier in Canada; Virgin Blue (later re-branded Virgin Australia and shifted to a more traditional model), Australia's second largest airline nowadays; and Ryanair, now the largest intra-European airline (Tretheway, 2004).

Around the world, many LCC models have been tried with different levels of success. Some low-cost airlines evolved from previous Full-Service Carriers (FSC), regional or charter airlines; others started from scratch as LCCs; some of the latter scaled up to become FSCs or 'hybrid' carriers; many others have gone bankrupt (Dobruszkes, 2013, 2006). This chapter presents a review of LCCs worldwide and then focuses on the European context to analyse the most relevant aspects concerning the airports they use.

4.1 Elements of the LCC business model

There is not a single LCC business model (Gillen and Lall, 2004). And therefore, there is no unique definition of a low-cost carrier, with several other terms being used to describe the general concept (Tretheway, 2004). Nonetheless, the term 'low-cost carrier' suggests these airlines are, in an economic sense, lower cost producers (of available seat kilometres – ASK – or miles – ASM, for instance) than their competitors and this can be assumed as a definition (de Neufville, 2008). The problem with this definition is that, apart from the US airlines, detailed data on airline costs of production (unit costs per ASK) are not readily available.

To overcome these difficulties, a natural approach consists in identifying a set of elements that best describe the actual business models for LCCs, and then identify carriers that somehow fit those elements (Alamdari and Fagan, 2005; Daft and Albers, 2013; Dobruszkes, 2006; Klophaus et al., 2012; Mason and Morrison, 2008). Although recent market developments towards hybrid or refined business models somehow hinder airline categorisation (CAPA Centre for Aviation, 2013a; Klophaus et al., 2012), this approach provides reasonable confidence to select carriers that are usually regarded as LCCs.

The elements that constitute the business model for LCCs are frequently studied in the case of Southwest as a starting point. According to Doganis (2001; cited by Zhang et al.,

2008) the Southwest model includes the following key features: “low, simple, unrestricted fares in a point-to-point network with no interlining; direct, ticket-less sales; single-class cabin with high-density, no seat assignment, no meals (snack and light beverages only); high frequency; very good punctuality; single type of aircraft with high utilization (over 11 hours a day); short sectors (city pairs with distance below 800 km); use of secondary or uncongested airports and 15–20 minutes turnarounds; controlled growth (target 10% year on year, maximum 15%); competitive wages, profit-sharing since 1973, high productivity.”

Gillen and Lall (2004) argue that the business model of Southwest is not based solely on operational efficiency, that organisational culture and simplicity provide a better competitive advantage instead, and that this setting is not generic hence more difficult to imitate. Alamdari and Fagan (2005) studied the evolution of several elements of the 'original low-cost model' (inspired by Southwest) for 10 LCCs in the US and Europe. The elements include product features related to network and tickets (routing, connections, through-fares, one-way fares), service (in-flight frills, seat assignment, single-class configuration, frequent flyer program, cargo), distribution (travel agents, on-line booking, code shares); and operational features related to fleet commonality, aircraft utilization, stage length and airport selection and target markets. They concluded that most of the airlines have drifted from the original model, including Southwest.

Table 5: Advantages of the 'low-cost model' over traditional airlines according to ELFAA (2004).

'Low-cost model'	'Traditional airlines model'	Low-cost advantages
Operate from mostly secondary, underutilised, regional airports	Operate from mostly primary international hub airports	Lower airport charges, faster turnaround times, less air traffic control-related delays
Fast turnarounds (25 min.)	Slow turnarounds due to use of congested hub airports	Better fleet utilisation
Direct point-to-point flights, no transfers, short-haul routes	Mix of long, medium and short haul routes with transfers (“connecting flights”)	Lower complexity, higher capacity utilisation
Standardised fleet (only one aircraft type), higher seating density	Various aircraft types, low seating density	Cheaper aircraft financing; Lower maintenance and training costs; Simpler swapping around of flight and maintenance staff; Higher capacity utilisation
Distribution primarily through direct channels (internet, call centres)	Most tickets sold via travel agencies (high GDS costs, travel agent commissions, etc.)	Lower distribution costs, lower complexity
No “frills”, extras paid for (e.g. catering, excess baggage)	Entertainment programs, express check-in, VIP lounges, paper tickets, business class, “free” catering	Lower ancillary costs, less complexity; Additional revenues
Highly incentivised work force (variable proportion of salary up to 40%)	High basic salaries (variable proportion less than 10 %)	High employee productivity

When it comes to the airlines themselves defining their own business model, the European Low Fares Airline Association highlighted (ELFAA, 2004) some of the advantages

of the 'low-cost model' in comparison to the model of traditional airlines, as Table 5 shows. ELFAA refers to their members as low fare airlines perhaps to highlight what is more attractive for their customers. However, low fares may be offered by any carrier, yet only those with a low-cost base can sustain them profitably (Tretheway, 2004).

Furthermore, as presented above, the specific models are subject to evolution over time, and diversity among different carriers. For instance, since the publication of the report (ELFAA, 2004) some airlines have left the ELFAA association because they changed their own models and, arguably, they are not LCCs any more (e.g. Air Berlin), many others have gone bankrupt and new ones have joined. Indeed, despite certain commonalities in their business or operational strategies, LCCs come in many different flavours and specific models

4.2 LCCs around the world

4.2.1 LCCs in the Americas

The evolution of LCCs in the Americas has been completely different in North America and in Latin America. As described before, to a large extent the low-cost model was born in the US and extended to Canada, and then to Mexico and Brazil, and much more recently to Colombia, the three largest aviation markets in Latin America (CAPA Centre for Aviation, 2013b). Nevertheless, most countries in the Americas, especially Central America and the Caribbean, are served by foreign LCCs, mainly from the US.

The phenomenon of low-cost airlines started when deregulation in the US allowed 'regional' LCCs to explore markets across the country, as Southwest did since the 1980's. However, they only gained wide popularity and experienced rapid growth since the late 1990's (Abda et al., 2012). At this time many other airlines populated the low-cost landscape in the US, such as airTran, Frontier, and later JetBlue, and others had been tried like the original People Express. Since 2004 Southwest has been the largest domestic operator in the US confirming the ascendency of LCCs in the country.

Facing strong competition from LCCs, most traditional FSCs in North America went through restructuring and mergers. This trend is producing the convergence of costs, fares and, to some extent, business models of the different types of airlines (Abda et al., 2012; Goetz and Vowles, 2009; Tsoukalas et al., 2008). For the low-cost segment this convergence induced a re-differentiation between the traditional approach, represented by Southwest, an up-scale LCC model represented by airlines like JetBlue or Virgin America, and the emergence of (rather conversion to) ultra-LCCs like Spirit, Allegiant and Frontier that have less frills included in the basic price of the ticket.

The development in Canada has been similar and now WestJet dominates the low-cost segment and is the second largest airline in the country. The major FSCs went bankrupt and merged, and then went bankrupt again. Curiously, WestJet is rather alone in the low-cost segment, with other airlines following an approach that resembles more of charter or regional carriers. Also, and despite a long standing open skies agreement between the two countries, none of the major US LCCs fly to Canada hence most of the low-cost services between Canada and the USA are offered by WestJet. US LCCs, on the other hand, have preferred to expand towards the Caribbean, Central America and the North of South America.

In Mexico the expansion of LCCs started in the past decade following market liberalisation. As elsewhere, it involved rapid growth of start-up LCCs and the bankruptcy of FSCs, including the second largest (Mexicana), as well as some of the initial LCCs. The remaining LCCs accounted for 57% of the domestic market share in 2012. Interjet adopted a more hybrid model, whilst Volaris and Viva Aerobus remained more tied to a traditional 'no-frills' service. The international market is, however, dominated by foreign carriers (CAPA Centre for Aviation, 2013c).

In Brazil LCCs started with the turn of the century with the rapid expansion of GOL (de Neufville, 2008; Evangelho et al., 2005) that bought the demised flag carrier Varig and then another LCC, Webjet. GOL grew to become Latin America's largest LCC and competes head to head with TAM to be the largest domestic carrier. Azul remains the only other LCC in Brazil and will join GOL in operating international services but with a stronger focus on long-haul routes. Both GOL and Azul follow a hybrid model, with more expression in Azul, founded by the same founder of JetBlue in the US (CAPA Centre for Aviation, 2014a). The Brazilian airline industry witnessed significant consolidation in the previous years and there are remarkably few players, particularly LCCs, for a country that features the fourth largest domestic market in the world.

The only other country in the region where local LCCs have emerged is Colombia and the model is currently being tried as the only airline, Viva Colombia, started operations by mid-2012. Although the domestic and international markets are markedly dominated by the flag carrier Avianca, Viva Colombia has achieved a 10% market share during its first two years of operation and will start international services in 2014 (CAPA Centre for Aviation, 2014b). This LCC follows a more traditional low-cost model. International services to Colombia are also widely provided by foreign LCCs, mainly from the US.

4.2.2 LCCs in Asia-Pacific

Although some domestic markets have been liberalised since 1995 (the Philippines, Indonesia, Malaysia, Singapore, Thailand and Australia), regulatory constraints hindered

the development of LCCs in the Asia-Pacific region (Murakami, 2011; Zhang et al., 2008). To overcome these constraints a set of acquisitions, mergers, joint-ventures, affiliations, subsidiaries and similar corporate figures have supported the creation of a large number of LCCs in this part of the world, with more start-ups announced (CAPA Centre for Aviation, 2014c; Gross and Lueck, 2011). The most established and largest of these carriers are linked to the liberalised markets: Cebu Pacific Air from the Philippines, Lion Air from Indonesia, Air Asia from Malaysia, Jetstar Airways from Australia (subsidiary of FSC Quantas), Tigerair from Singapore and Nok Air (subsidiary of FSC Thai Airways) from Thailand.

The geographical characteristics of the region provided a good ground for the emergence, on a larger scale, of long-haul low-cost carriers. In fact, some of the Asia-Pacific LCCs (e.g. Air Asia X and Scoot) are dedicated exclusively to long-haul markets and have a fleet of only wide-body aircraft. Despite this development, there is still more potential for LCC growth in domestic markets, particularly in North Asia (CAPA Centre for Aviation, 2014c), provided regulation allows it.

Zhang et al. (2008) pointed out that, besides regulation, another factor that may have limited the initial expansion of LCCs in Asia was the lack of underutilised secondary airports, as opposed to Europe and North America. Nevertheless, this led to the creation of 'low-cost terminals' in some airports, such as Kuala Lumpur International and Singapore Changi International. Changi's terminal was, however, torn down in favour of a more up-scale building; whilst at Kuala Lumpur the 'low-cost terminal' suffered the same fate and was replaced in 2014 by a new “low-cost” passenger building – KLIA2 – that costed 1.25 billion US dollars (Toh, 2013).

4.2.3 LCCs in Africa

Except for the market between North African countries and Europe and the Middle East, the low-cost segment in Africa is still in an incipient state (E.H., 2013). In Northern Africa the segment is dominated by European airlines and subsidiaries of Air Arabia (Air Arabia Maroc and Air Arabia Egypt). For the rest of the continent, fewer experiences have taken off mainly in South Africa, Kenya and Tanzania (CAPA Centre for Aviation, 2012), with Kulula.com, a subsidiary of Comair (which operates flights for British Airways in South Africa) being the most established one.

4.2.4 LCCs in the Middle East

The Middle East usually gets more attention in the aviation arena for their Full-Service Carriers, often dubbed the Middle-East Big 3: Emirates, Qatar Airways and Etihad (ANNA.aero, 2011a; CAPA Centre for Aviation, 2010). The low-cost segment follows two

main lines: European LCCs serving destinations in the area, mainly in Israel, Lebanon and the United Arab Emirates (UAE); and local LCCs from the region which, in many cases, have been established by governmental decree.

Air Arabia was established in 2003 and is the oldest of the LCCs in the Middle East. As mentioned before, it has subsidiaries in Morocco and Egypt. Flydubai, also from the UAE as Air Arabia, commenced operations from Dubai International Airports in 2009 with a more up-scale product. Flynas, from Saudi Arabia, has a similar scale and also a more refined product. Jazeera airways is a smaller LCC from Kuwait. And UP is a new venture from El Al to compete with LCCs in trips to Europe. Besides Air Arabia, all other carriers offer a business class product (or Economy Class Plus in the case of UP) which is not so common in most of the LCCs around the world.

4.3 Evolution of LCCs in Europe

One of the main outcomes of liberalisation in the European aviation market was the emergence and rapid expansion of LCCs (Jimenez et al., 2012). Perhaps the most representative examples are Ryanair, founded in 1985 as an FSC but restructured in 1991 as a 'pure LCC' to take advantage of deregulation in the Ireland – UK market; and easyJet, started from scratch as an LCC in 1995 to profit from widespread liberalisation in Europe. Today they are the two largest LCCs and among the largest European airlines.

Naturally, the low-cost segment is much more diversified nowadays and include airlines with different value propositions. After an initial stage of growth focused in the British and Irish markets, LCCs have grown to prominence all across Europe and some of them have become truly pan-European carriers, as opposed to the legacy flag carriers form the different countries. Indeed, by May 2013 the market share of LCCs in Europe was about 38% in terms of seats offered, up from less than 10% in May 2004 (OAG, 2013).

We used information from Dobruszkes (2013, 2009), the European Low Fares Airline Association (ELFAA), and the airlines and other industry specific websites to identify airlines operating in Europe in 2013 that qualify as LCCs. According to the discussion in section 4.1, we analysed the following elements in the value proposition of these airlines:

1. Whether they follow a point to point network strategy.
2. The extent to which they perform connections in flights from the same carrier or with flights offered by a different carrier.
3. Whether they enter into code-share agreements with other carriers.
4. Whether they use a single aircraft type (or aircraft family) within their fleet.
5. Whether they offer a single cabin configuration (all economy) on board the aircraft.

6. Whether they offer seat assignment for all passengers (i.e. all passengers have a seat number before boarding, regardless of having paid or not for it).
7. The extent to which they implement frequent flyer programs.
8. The extent to which they use only main airports.
9. Whether they have bases outside their country of registration (to evaluate their pan-European nature).
10. The extent to which they implement fares families (i.e. bundled fares) in ticket sales.
11. Whether they are members of the European Low Fares Airline Association.

In addition we also categorised airlines according to their ownership structure and origin as independent LCCs, FSC subsidiaries, regional LCC, charter/LCC or charter subsidiaries. By these considerations, we identified 20 airlines that were operating in Europe in 2013 (including non-European carriers) with a model that can be regarded as low-cost, as Figure 6 summarises.

Low-Cost Carriers operating in Europe in 2013

#	IATA Code	Airline	Country	Type	Passengers (2011)	Passengers (2012)	Point to Point	Connections	Codeshare	Single aircraft type	Single cabin	Seat assignment	Frequent Flyer Program	Main airports	Bases outside country	Fares family	ELFAA member
European LCC operating in Europe in 2013																	
1	FR	Ryanair	Ireland	Independent LCC	76 430 000	79 610 000	●	○	○	●	●	○	○	◔	●	○	●
2	U2	easyJet [1]	United Kingdom	Independent LCC	55 471 760	59 204 632	●	◔	◔	●	●	●	◑	●	●	●	●
3	DY	Norwegian Air Shuttle	Norway	Independent LCC	15 698 183	17 685 074	○	●	○	◕	◕	●	●	●	●	●	●
4	VY	Vueling Airlines	Spain	FSC subsidiary	12 315 937	14 795 640	○	●	●	●	●	●	●	●	●	●	●
5	PC	Pegasus Airlines	Turkey	Former FSC	11 300 000	13 600 000	●	○	●	○	●	●	●	◑	○	●	○
6	W6	Wizz Air [2]	Hungary	Independent LCC	11 000 000	12 000 000	●	○	○	●	●	○	◑	◔	●	◑	●
7	4U	Germanwings	Germany	FSC subsidiary	7 521 675	[3]	○	●	●	●	●	●	●	●	○	●	○
8	BE	Flybe	United Kingdom	Regional LCC	7 094 604	7 052 819	○	●	●	○	●	●	●	◑	◔	●	●
9	HV	Transavia.com [4]	Netherlands	FSC subsidiary	5 400 000	5 800 000	●	●	●	●	●	●	○	●	◔	○	●
10	ZB	Monarch Airlines [5]	United Kingdom	Charter/LCC	4 541 172	5 356 000	●	○	○	○	◕	●	●	●	○	●	○
11	LS	Jet2.com	United Kingdom	Independent LCC	4 235 752	4 776 257	●	○	○	○	●	●	○	●	○	○	●
12	I2	Iberia Express [6]	Spain	FSC subsidiary	-	2 000 000	○	●	●	●	○	●	●	●	○	●	○
13	DC	Sverigeflyg [7]	Sweden	Regional LCC	600 000	800 000	-	-	-	○	-	-	-	○	○	-	●
14	V7	Volotea [8]	Spain	Independent LCC	-	600 000	●	○	○	●	●	●	○	◑	●	○	●
15	0B	Blue Air	Romania	Independent LCC	-	-	●	◑	●	●	●	-	●	◑	○	○	○
16	QS	SmartWings	Czech Republic	Charter subsidiary [9]	-	-	●	○	○	○	●	-	○	●	○	●	○
17	X9	WOW air [10]	Iceland	Independent LCC	-	-	●	○	○	●	●	○	○	●	○	○	○
18	AP	Air One	Italy	FSC subsidiary	-	-	●	●	●	●	●	●	●	●	○	●	○
19	LZ	Belle Air [11]	Albania	Independent LCC	-	-	●	○	○	○	●	-	○	◑	●	◔	○
Non European LCC operating in Europe in 2013																	
20	G9	Air Arabia [12]	United Arab Emirates	Independent LCC	-	5 301 484	○	●	○	●	●	-	○	●	○	◑	○

Notes: [1] Includes easyJet Switzerland [2] Includes Wizz Air Ukraine [3] Reported within Lufthansa since 2012 [4] Includes Transavia France [5] Only scheduled services [6] Operating since March 2012 [7] Operates as different brands [8] Operating since April 2012 [9] Owned by Icelandair [10] Operating since May 2012 (acquired Iceland Express in October 2012) [11] Includes Belle Air Europe (both went bankrupt in November 2013) [12] Includes Air Arabia Maroc and Air Arabia Egypt

Figure 6: LCCs operating in Europe in 2013 and some characteristics of their value propositions.

From Figure 6 it is clear that only a few characteristics are common among the carriers:

1. The use of single cabin configurations. In fact, only Iberia Express provides a traditional business class and all the other airlines operate an all-economy

configuration. Other exceptions are the long-haul operation that Norwegian started in mid-2013, which includes a premium economy class; and also the premium economy class that Monarch offers in some of its charter long-haul flights. In both cases the aircraft with this cabin configuration are few compared to the total fleet size.

2. The assignment of seats. By 2013 most European LCCs pre-assigned seats for their passengers (Ryanair assigns seats since early 2014 too). This is a strong deviation form the original 'Southwest model' in which unallocated seating aims at speeding up the boarding process. EasyJet argues allocated seating helped improve their revenues (easyJet, 2013) and other European LCCs may pursue the same goal.

3. The exclusive operation of point to point flights. This element is shared to a lower extent because Norwegian, Vueling (which only turned a fully-owned FSC subsidiary in April 2013), Germanwings, Flybe, Iberia Express and Air Arabia use their major bases as simplified hubs for connecting flights (other FSC subsidiaries also connect to their parent companies when possible).

4. The use of a single aircraft type. A considerable number of airlines, especially the largest ones, operate aircraft from a single family, generally from the Airbus A320 or the Boeing 737 families. Yet they may use different variants within the same family (e.g. A319 and A320 for easyJet). Notably, Norwegian uses different aircraft because it selected the Boeing 787 for their long-haul operations. Whilst most of the other carriers not using a single aircraft type are either regional LCCs that must accommodate to varied levels of demand within their network (e.g. Flybe and Sverigeflyg) or descendants of charter operations with some larger aircraft (e.g. Monarch and Jet2.com).

Perhaps surprisingly, a large number of the LCCs operating in Europe use main airports for most of their operations (Chapter 5 details this and other issues concerning airports). A considerable number of the companies has implemented fares families where some of the frills (boarding priority, checked baggage or food) are bundled with the ticket price in different offerings (for instance, flight only, flight plus bag, flight plus bag plus catering). Interestingly, several companies implement different ways to award the loyalty of frequent flyers, although not always on a traditional miles-based program.

Also, some of these carriers (Ryanair, easyJet, Norwegian, Vueling, Wizz Air, Volotea and Belle Air) have set bases outside their main countries of registration to take advantage of full liberalisation in Europe and optimise aircraft and crew utilisation. Others, like Transavia and Flybe only reflect the bi-national nature of their companies so that

Transavia France has bases in France and Transavia Holland in the Netherlands, and Flybe is limited to the UK, except for Helsinki as a base for Flybe Nordic.

There is no detailed public data to investigate the cost structure of all the airlines. Yet secondary information reveals (CAPA Centre for Aviation, 2013d), as Figure 7 shows, that most of the LCCs identified (controlling for sector length) effectively have lower unit costs than their legacy counterparts. Moreover, it is possible to distinguish some groups: Ryanair, Wizz Air and Pegasus have the lowest unit cost (i.e. they can be defined as ultra LCCs); Transavia, Monarch and Jet2.com have similar unit costs and sector lengths, related to their charter networks; easyJet, Vueling, Norwegian and Germanwings have higher unit costs that reflect their more hybrid strategies; and Flybe has higher costs due to their choice of shorter routes as a regional LCC.

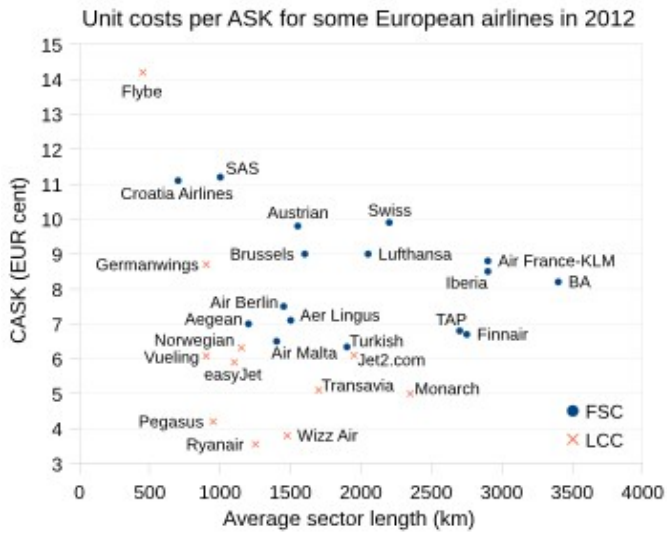

Figure 7: Unit costs per available seat kilometre (CASK) and average sector length for some European airlines in 2012. Source: CAPA Centre for Aviation (2013d).

4.3.1 The origins of European LCCs

As LCCs have different specific business models their behaviour is correspondingly different. Some of those differences impact their decisions on which airports or airport infrastructure to use. The way LCCs originated provides convenient insights for this purpose.

First, there are the "originals", airlines deliberately organised around the 'low-cost' theme (such as easyJet, Ryanair[4] or Norwegian[5]). Second, there are descendants of charter airlines – confronted with decreasing market shares as the “originals” expanded (European Parliament, 2007) – that inherited an operational and network structure (Monarch, Jet2.com or SmartWings for instance). Third, there are spin-offs of the

4 Although Ryanair started as FSC in 1985, it was one of the first to explore the LCC model in Europe as liberalisation unfolded during the 1990's.

5 Norwegian Air Shuttle started as a regional carrier back in 1993, but re-branded as Norwegian in 2002 following a pure LCC model.

traditional, legacy carriers that were set to compete with the “originals” on a similar cost-base (GO, Buzz and Clickair in the past, or Germanwings and Iberia Express more recently).

Table 6 presents an origin-based classification of the 20 LCCs analysed, even if some of them do not fit completely in these groups[6]. Moreover, there are differences in the business models of airlines within the groups. Yet, in general lines, the airlines in each group share some common points, especially regarding their choice of airports.

Table 6: LCCs operating in Europe in 2013 classified according to their origins.

Originals	Charter descendants	Legacy subsidiaries
From scratch: *easyJet* [U2]: since 1995 *Wizz Air* [W6]: since 2004 *Blue Air* [0B]: since 2004 *Volotea* [V7]: since 2012 *WOW Air* [X9]: since 2012 *Air Arabia* [G9]: not European, since 2003 *Belle Air* [LZ]: since 2005, went bankrupt in November 2013 Converted: *Ryanair* [FR]: from 1991, former FSC *Norwegian* [DY]: from 2002, former regional *Flybe* [BE]: from 2002, former regional *Sverigeflyg* [DC]: from 2001, also regional	*Jet2.com* [LS]: from 2003, formerly Channel Express *Monarch* [ZB]: from 2004, only Scheduled flights (86% of total passengers in 2012) *SmartWings* [QS]: from 2004 as a brand from Travel Service charter *Pegasus* [PC]: from 2005	From scratch: *Iberia Express* [I2]: started in-house in 2012 Acquisitions: *Vueling* [VY]: from 2009 through a merger with Iberia-owned Clickair, and from 2013 through a takeover from IAG *Transavia* [HV]: Transavia Holland is in KLM hands since 1991 (100% since 2003), converted to LCC in 2005 from charter; Transavia France started as wholly owned subsidiary of Air France-KLM, and as LCC, in 2007 *Germanwings* [4U]: from 2009 as wholly owned subsidiary of Lufthansa *Air One* [AP]: merged with Alitalia in 2009 and converted to LCC in 2010

The earlier "originals" chose to capture market at secondary airports (e.g. easyJet at Luton, then Liverpool; Ryanair at Stansted, then Charleroi, and so on) and then, once they gained recognition, expanded according to their specific strategies (e.g. for easyJet that meant price-conscious passengers at main airports; for Ryanair smaller regional airports at first). Other start-ups decided to catch on the trend in their particular markets (e.g. Wizz Air and Blue Air in Eastern Europe or Norwegian in Scandinavia) and follow a similar choice (small regional airports first and then expand following market opportunities).

This is different from FSC spin-offs and charter-descendants. For the most part, their origin is rooted in a change of management focus but they had an existing network and operations or available slots to backup the new strategy. Accordingly, these LCCs started service from the same airports as their parents or predecessors. For the charter descendants this usually meant sticking to leisure destinations. Whilst legacy subsidiaries usually had to start from the main airports of their national flag parents, although with some variations in the cases where the FSC acquired initially independent LCCs (particularly Vueling and Germanwings).

6 Transavia, for instance, is a wholly owned subsidiary of Air France-KLM, but Transavia Holland comes originally from, and still performs some, charter operations.

A relevant point here is that the groups represent a dynamic evolution: "originals" become large and take market from charters and FSCs, who respond by transforming themselves or by creating spin-offs. In the USA these dynamics are producing the convergence of costs, fares and business models (Abda et al., 2012; Goetz and Vowles, 2009; Tsoukalas et al., 2008).

In Europe, such convergence might be in sight (Daft and Albers, 2013) but not only from the transformation of traditional airlines. LCCs – including the "originals" – are also refining their product to attract segments that are less price sensitive because, as they mature, their unit costs (labour in particular) tend to increase. As Christensen et al. (2001) explain, across industries "the path to greater revenue is upmarket migration".

As former new entrants go upmarket, the bottom empties enough to encourage "disruptive innovations" of new entrepreneurs. In the USA this resulted in the emergence of so-called ultra-LCCs like Allegiant and Spirit, both transformed from charters (Rosenstein, 2013). Arguably, European companies like Ryanair, Wizz Air and Pegasus already apply the ultra-LCC model, hence there is less room to stimulate new markets with even lower fares. Or perhaps they can do it at major airports that were previously not part of their networks (as Ryanair in Rome/Fiumicino, Lisbon or Brussels/Zaventem).

4.4 European destinations of LCCs

In 2013, the 20 LCCs identified (see Figure 6) offered scheduled regular services to 401 different airports in 41 European countries, including the Asian part of some states that straddle the border between the continents. Figure 8 shows that four of the five largest European aviation markets in terms of passengers according to Eurostat[7] (United Kingdom, France, Italy and Spain) have the largest number of airports served by LCCs. The second largest market, Germany, appears in 7th place with 24 airports. Turkey gets to the 6th place thanks to several airports in the Asian part served at least by Pegasus. Other countries with a significant number of islands or other remote regions (Sweden, Greece, Norway and Finland) complete the top 10.

Over two thirds of the 401 airports were served by only one (159), two (73) or three (43) LCCs. As Figure 9 shows, Pegasus was the LCC serving most airports as the exclusive LCC operator, 32 in total, but that included 24 airports in the Asian part of Turkey, and a couple in Georgia and Russia. Ryanair followed with 30 airports across Europe, particularly in France. Three other airlines with a strong focus on specific regions completed the top 5: Flybe (almost all in the United Kingdom or Finland), Norwegian

7 In 2012 as per "Air transport of passengers" table from Eurostat statistics databases.

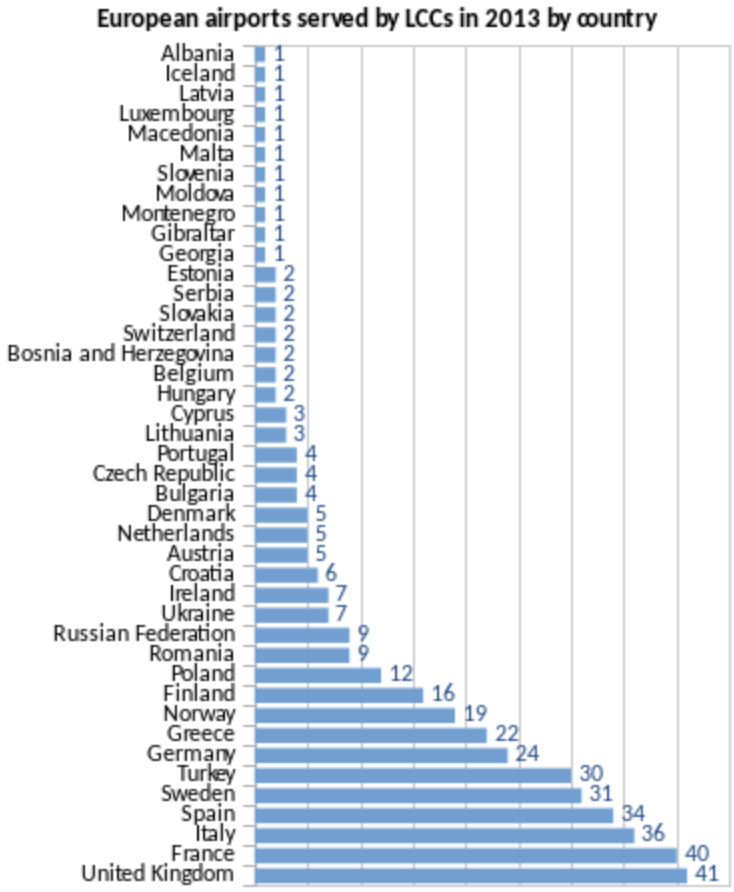

Figure 8: Number of airports served by LCCs in Europe in 2013 by country.

(although Norwegian is one of the pan-European carriers, it is the sole LCC operator in many Scandinavian airports) and Sverigeflyg (all but one in Sweden).

Conversely, other airports were particularly attractive for a large number of LCCs. Figure 10 shows 37 airports that served as a destination for at least 8 LCCs simultaneously during 2013. Barcelona El Prat (BCN) alone had 16 different LCCs. EasyJet was present in

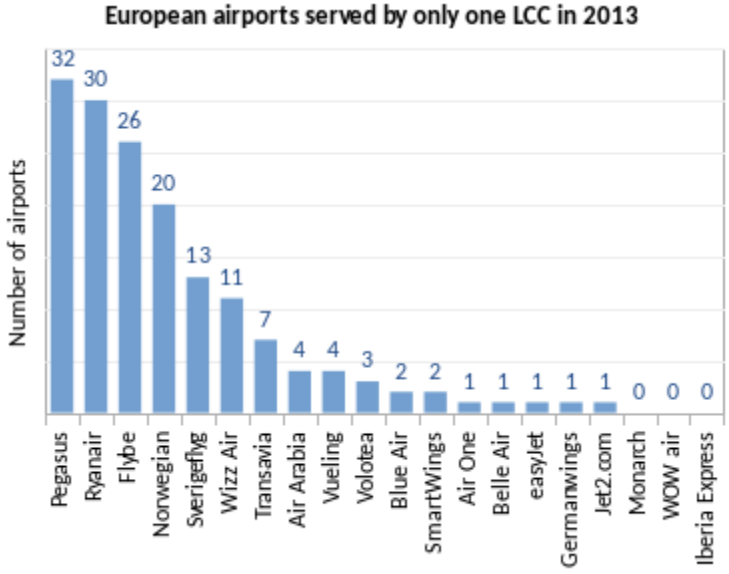

Figure 9: Number of European airports in which the airline shown was the only LCC with scheduled regular services in 2013. Source: Innovata SRS.

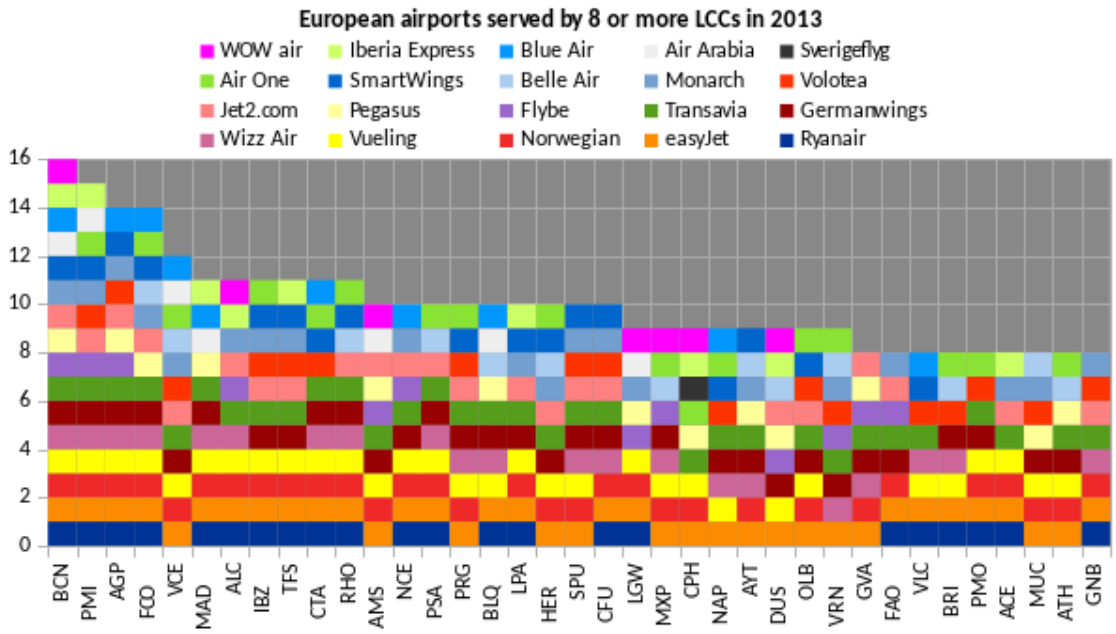

Figure 10: European airports that were served by 8 or more LCCs in 2013. Source: Innovata SRS.

all 37 airports, followed closely by Norwegian, Vueling, Germanwings and Transavia. Most of these airports were located either in Italy or Spain.

As for the airlines, most of them tend to have very prolific networks covering a large number of destinations (in Europe alone), as Figure 11 shows. Ryanair alone served 178 different airports in 2013, followed by easyJet with a network of 128 airports, and Norgewian with 111. The smallest LCCs, WOW Air and Iberia Express (both recently created), offered only 11 and 19 destinations respectively. Although Volotea, another recent start-up already had 47 airports in its network. In any case, most of the airlines (except for Belle Air that went bankrupt) increased the number of destinations in the months following the data collection process.

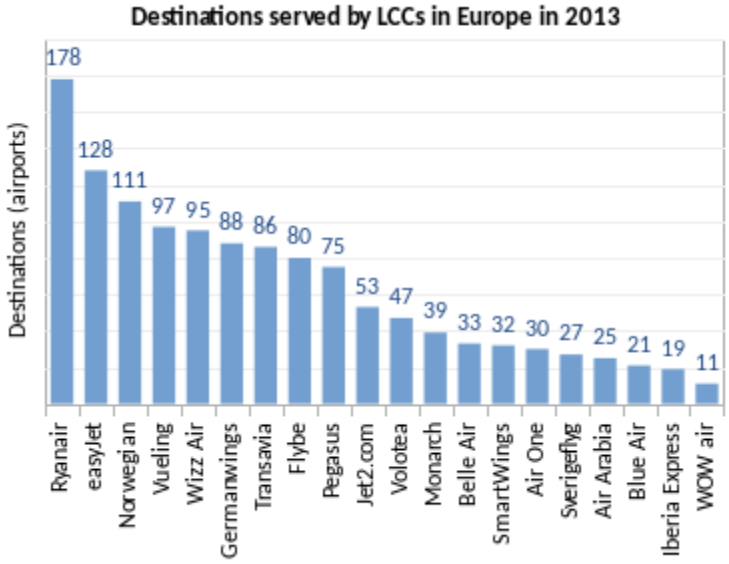

Figure 11: Number of airports served regularly by each LCC in Europe in 2013. Source: Innovata SRS.

4.5 Summary

Air transport market liberalisation has been in the core of the ascendency of the low-cost segment worldwide, with LCCs gaining considerable expression, although with varying degrees. Especially in North America, Europe and Southeast Asia the low-cost segment shows some signs of a mature market. In the US in particular the cost-base of most airlines tends to converge and the growth rates of most LCCs follow industry levels. This notwithstanding, new specific models continue to appear and procure market share.

Irrespective of how airline business models continue to evolve, airports should monitor and be ready to accommodate future changes in those models. If the expansion of LCCs provides any lesson to airports it is that their development should be flexible enough to cope with the uncertain future. The next chapter analyses in detail a sample of the very large number of airports LCCs use in Europe, and discusses how LCCs have impacted both secondary and main airports.

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5 Characterisation of 'low cost airports' in Europe

Low-Cost Carriers (LCC) continue to grow and diversify after two decades of liberalisation in the European aviation market. Yet the academic literature is not conclusive on the long-term impact of this trend for airports (Graham, 2013). Figure 12 shows the 50 largest airports in Europe, in 2013, according to the capacity (departing available seats) provided by the 20 LCCs identified in the previous chapter. These would in principle be the most representative airports for low-cost services in Europe, yet at first sight most of them are not the airports that usually appear in the literature as 'low-cost' (see section 2.4). In fact only a few of these top 50 (London Stansted (STN), London Luton (LTN), Milan Bergamo (BGY), Brussels Charleroi (CRL), Rome Ciampino (CIA), Liverpool

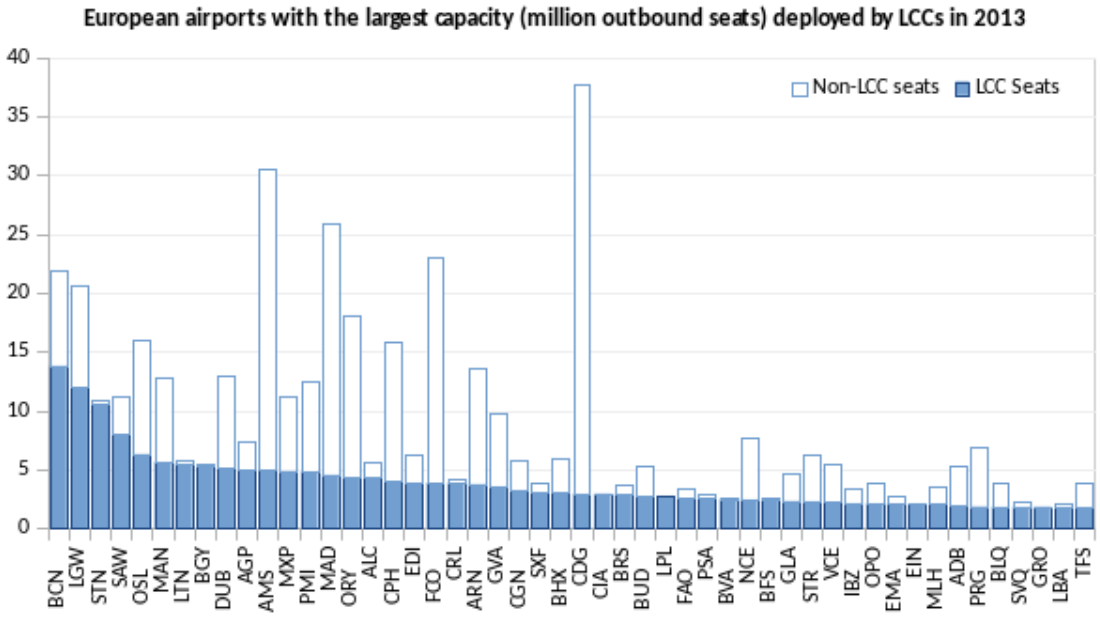

Figure 12: 50 European airports with the most LCC offer in 2013, along with capacity provided by non-LCCs. Source: Innovata SRS.

(LPL), Paris Beauvais (BVA), Barcelona Girona (GRO) and Leeds Bradford (LBA)), would be naturally recognised as 'low-cost'.

As the previous chapter reports, LCCs in Europe use such a diverse range of airports that the very own notion of a ‘low cost airport’ is fuzzy and challenging, in particular as ‘legacy’ airlines and airports compete in a maturing market. However, looking at the top airports served by LCCs is not sufficient. This chapter takes a detailed look at a sample of very different European airports in order to characterise them, and to attempt to identify a set of characteristics airports should have to attract LCCs.

5.1 Sample selection

In order to select a representative sample of airports to study in more detail, we have first identified the destinations served by the six largest LCCs operating in Europe in 2013, in terms of total annual passengers for 2012. These carriers, sorted by descending number of passengers, were: Ryanair, easyJet, Norwegian, Vueling, Wizzair and Germanwings (see Figure 6). Pegasus, which was in fact the fifth largest by total passengers, was not included in this list because over 60% of its passengers use domestic services within the Asian part of Turkey, to/from where most of its international destinations are also served (CAPA Centre for Aviation, 2013e). This notwithstanding, the sample includes the two main airports in the Asian side of Turkey (Istanbul Sabiha Gokcen and Antalya), as well as most of the European destinations of Pegasus, because they have met other criteria selection.

From the destinations of these carriers, airports had to satisfy any of two basic criteria to be included in the sample:

1. be a base for any of the six airlines;
2. be a destination for at least three of them.

We also considered 14 additional airports due to their implementation of low-cost facilities, high proportion of low-cost traffic (in absolute or relative terms), or for being recently emerging airports (opened in 2012 or 2013, or with traffic growth well over 100% in that period). The baseline sample contains 171 airports as listed in Table 7.

Table 7: Summary of airports in the baseline sample.

IATA Code	Airport	Country	Passengers (2012)	Passengers (2013)	LCC seats share (2013)
ACE	Lanzarote	ES	5,169,386	5,334,598	42%
AGP	Malaga	ES	12,582,191	12,922,403	67%
AHO	Alghero	IT	1,518,216	1,563,908	87%
ALC	Alicante	ES	8,855,441	9,638,860	75%
AMS	Amsterdam	NL	51,035,590	52,569,250	16%
ARN	Stockholm Arlanda	SE	19,674,456	20,673,810	28%
ATH	Athens	GR	12,866,689	12,460,440	6%
AYT	Antalya	TR	24,993,667	27,003,712	20%

IATA Code	Airport	Country	Passengers (2012)	Passengers (2013)	LCC seats share (2013)
BCN	Barcelona	ES	35,145,176	35,210,735	63%
BDS	Brindisi	IT	2,097,847	1,992,722	65%
BEG	Belgrade	RS	3,364,059	3,543,194	17%
BES	Brest	FR	1,070,461	1,003,836	23%
BFS	Belfast	GB	4,313,521	4,023,089	92%
BGO	Bergen	NO	5,744,770	6,213,960	39%
BGY	Milan Bergamo	IT	8,888,293	8,964,376	97%
BHX	Birmingham	GB	8,918,896	9,118,579	52%
BIO	Bilbao	ES	4,171,092	3,800,789	45%
BIQ	Biarritz	FR	1,084,339	1,098,079	36%
BLL	Billund	DK	2,734,807	2,829,507	45%
BLQ	Bologna	IT	5,952,396	6,193,783	47%
BOD	Bordeaux	FR	4,433,347	4,624,812	31%
BOH	Bournemouth	GB	691,372	661,343	74%
BOO	Bodo	NO	1,729,991	1,669,191	19%
BRE	Bremen	DE	2,447,039	2,612,627	45%
BRI	Bari	IT	3,777,427	3,599,910	67%
BRS	Bristol	GB	5,917,679	6,129,904	77%
BRU	Brussels Zaventem	BE	18,971,332	19,133,222	9%
BUD	Budapest	HU	8,504,020	8,520,880	52%
BVA	Paris Beauvais	FR	3,862,562	3,952,908	98%
CAG	Cagliari	IT	3,586,677	3,587,907	64%
CDG	Paris Charles de Gaulle	FR	61,611,934	62,052,917	8%
CFU	Kerkyra	GR	1,913,478	2,106,343	36%
CGN	Cologne-Bonn	DE	9,280,082	9,077,346	57%
CHQ	Chania (Crete)	GR	1,836,965	2,109,078	51%
CIA	Rome Ciampino	IT	4,465,830	4,749,251	100%
CLJ	Cluj Napoca	RO	602,813	1,036,438	68%
CPH	Copenhagen Kastrup	DK	23,336,187	24,067,030	25%
CRL	Brussels Charleroi	BE	6,514,383	6,777,389	91%
CTA	Catania	IT	6,242,851	6,400,127	34%
DBV	Dubrovnik	HR	1,480,470	1,522,629	35%
DRS	Dresden	DE	1,886,425	1,754,139	24%
DTM	Dortmund	DE	1,902,133	1,924,386	90%
DUB	Dublin	IE	19,090,954	20,166,783	39%
DUS	Duesseldorf	DE	20,833,246	21,228,226	4%
EDI	Edinburgh	GB	9,196,078	9,776,951	62%
EFL	Kefalonia	GR	377,996	429,770	36%
EIN	Eindhoven	NL	2,977,643	3,396,853	100%
EMA	East Midlands	GB	4,073,228	4,331,073	78%
FAO	Faro	PT	5,673,093	5,981,468	76%
FCO	Rome Fiumicino	IT	36,980,309	36,166,345	17%
FKB	Karlsruhe Baden-Baden	DE	1,287,382	1,059,227	63%
FLR	Florence	IT	1,842,017	1,983,268	21%
FUE	Fuerteventura	ES	4,399,183	4,259,341	25%
GDN	Gdansk	PL	2,905,710	2,870,321	64%
GLA	Glasgow	GB	7,153,229	7,360,186	50%
GNB	Grenoble	FR	314,183	313,499	88%
GOT	Goteborg	SE	4,857,608	4,998,526	13%
GRO	Barcelona Girona	ES	2,844,682	2,736,868	98%
GVA	Geneva	CH	13,899,424	14,436,151	37%
HAJ	Hannover	DE	5,287,831	5,234,909	19%
HAM	Hamburg	DE	13,697,402	13,502,553	13%
HAU	Haugesund	NO	664,475	701,326	51%
HEL	Helsinki	FI	14,858,215	15,279,043	15%
HER	Irakleion	GR	5,076,329	5,791,999	23%

IATA Code	Airport	Country	Passengers (2012)	Passengers (2013)	LCC seats share (2013)
HHN	Frankfurt Hahn	DE	2,790,961	2,667,402	100%
IBZ	Ibiza	ES	5,555,071	5,726,851	64%
IEV	Kiev Zhulhany	UA	862,000	1,838,393	42%
JMK	Mikonos	GR	500,907	583,465	37%
JTR	Santorini	GR	762,365	897,830	22%
KEF	Reykjavik Keflavik	IS	2,380,218	2,751,743	16%
KGS	Kos	GR	1,797,391	2,028,250	31%
KRK	Krakow	PL	3,438,758	3,647,616	64%
KTW	Katowice	PL	2,550,848	2,544,198	80%
KUN	Kaunas	LT	829,827	695,509	97%
LBA	Leeds Bradford	GB	2,972,720	3,314,923	83%
LCA	Larnaca	CY	5,166,224	4,944,384	13%
LCG	La Coruna	ES	845,452	839,837	42%
LEI	Almeria	ES	749,712	705,552	46%
LGW	London Gatwick	GB	34,236,247	35,462,233	58%
LIL	Lille	FR	1,397,602	1,661,741	41%
LIS	Lisbon	PT	15,301,191	16,010,440	15%
LPA	Gran Canaria	ES	9,892,288	9,770,253	29%
LPL	Liverpool	GB	4,459,389	4,186,733	100%
LTN	London Luton	GB	9,618,548	9,698,802	94%
LUZ	Lublin	PL	5,371	189,699	95%
LYS	Lyon	FR	8,451,039	8,562,298	23%
MAD	Madrid Barajas	ES	45,195,014	39,729,027	18%
MAH	Menorca	ES	2,545,944	2,565,466	53%
MAN	Manchester Intl	GB	19,675,505	20,687,423	44%
MJV	Murcia San Javier	ES	1,181,490	1,140,447	91%
MLA	Malta	MT	3,630,416	4,036,566	40%
MLH	Basel Mulhouse (Euroairport)	FR	5,353,892	5,862,455	57%
MMX	Copenhagen Malmo	SE	2,104,746	2,124,682	42%
MPL	Montpellier	FR	1,288,301	1,422,792	30%
MRS	Marseille	FR	8,297,538	8,265,038	22%
MST	Maastricht	NL	331,542	452,193	100%
MUC	Munich	DE	38,362,432	38,672,644	3%
MXP	Milan Malpensa	IT	18,524,812	17,955,075	44%
NAP	Naples	IT	5,791,789	5,444,422	42%
NCE	Nice	FR	11,189,775	11,554,251	32%
NCL	Newcastle	GB	4,358,887	4,415,797	48%
NRN	Dusseldorf Weeze (Niederrhein)	DE	2,208,429	2,487,843	99%
NTE	Nantes	FR	3,520,587	3,930,849	43%
NUE	Nuremberg	DE	3,597,136	3,309,629	11%
NYO	Stockholm Skavsta	SE	2,317,589	2,165,040	100%
OLB	Olbia	IT	1,866,540	1,999,618	31%
OPO	Porto	PT	6,050,330	6,372,535	54%
ORK	Cork	IE	2,340,141	2,258,005	41%
ORY	Paris Orly	FR	27,232,263	28,274,154	24%
OSL	Oslo	NO	22,079,081	22,956,544	40%
OTP	Bucharest Otopeni	RO	7,120,024	7,643,467	28%
OVD	Asturias Oviedo	ES	1,309,640	1,039,409	48%
PEG	Perugia	IT	197,885	215,550	100%
PFO	Paphos	CY	2,242,797	2,161,236	57%
PIK	Glasgow Prestwick	GB	1,067,243	1,145,561	100%
PMF	Parma	IT	176,209	196,820	97%
PMI	Palma de Mallorca	ES	22,666,682	22,768,082	39%
PMO	Palermo	IT	4,605,684	4,349,672	50%
POZ	Poznan	PL	1,595,856	1,355,330	62%
PRG	Prague	CZ	10,807,890	10,974,196	27%

IATA Code	Airport	Country	Passengers (2012)	Passengers (2013)	LCC seats share (2013)
PRN	Pristina	RS	1,527,134	1,628,678	47%
PSA	Pisa	IT	4,487,900	4,479,690	88%
PSR	Pescara	IT	560,471	548,257	88%
PUY	Pula	HR	367,445	354,111	45%
REU	Barcelona Reus	ES	937,446	971,166	77%
RHO	Rhodes	GR	3,815,939	4,200,779	20%
RIX	Riga	LV	4,767,764	4,794,019	22%
RJK	Rijeka	HR	72,762	139,296	84%
RYG	Oslo Rygge (Moss)	NO	1,732,039	1,897,523	98%
SAW	Istanbul Sabiha Gokcen	TR	14,686,052	18,641,842	71%
SCQ	Santiago De Compostela	ES	2,194,611	2,073,055	72%
SEN	London Southend	GB	617,556	969,950	92%
SKG	Thessaloniki	GR	4,177,231	4,239,200	24%
SKP	Skopje	MK	835,527	984,407	44%
SNN	Shannon	IE	1,394,781	1,400,032	38%
SOF	Sofia	BG	3,150,681	3,504,320	25%
SPU	Split	HR	1,425,224	1,581,734	45%
STN	London Stansted	GB	17,469,709	17,857,523	97%
STR	Stuttgart	DE	9,720,877	9,577,551	37%
SUF	Lamezia Terme	IT	2,207,526	2,184,102	54%
SVG	Stavanger Sola	NO	4,392,679	4,668,403	31%
SVQ	Sevilla	ES	4,287,488	3,687,727	78%
SXF	Berlin Schoenefeld	DE	7,097,277	6,727,306	79%
SZG	Salzburg	AT	1,666,487	1,662,834	20%
SZZ	Szczecin	PL	356,006	347,744	69%
TFS	Tenerife Sur	ES	8,530,817	8,701,983	47%
TGM	Tirgu Mures	RO	300,427	363,387	97%
TLL	Tallinn	EE	2,206,290	1,958,801	23%
TLS	Toulouse	FR	7,555,351	7,567,634	24%
TMP	Tampere	FI	570,739	466,671	54%
TPS	Trapani	IT	1,577,476	1,878,557	94%
TRD	Trondheim	NO	4,160,162	4,311,328	39%
TRF	Oslo Torp (Sandefjord)	NO	1,705,762	1,848,603	66%
TRN	Turin	IT	3,516,406	3,160,287	25%
TSF	Venice Treviso	IT	2,240,280	2,175,396	100%
TSR	Timisoara	RO	1,035,929	750,056	41%
TXL	Berlin Tegel	DE	18,163,955	19,591,838	7%
VCE	Venice Marco Polo	IT	8,177,081	8,403,790	41%
VIE	Vienna Intl	AT	22,165,794	21,999,926	5%
VLC	Valencia	ES	4,752,020	4,599,990	59%
VNO	Vilnius	LT	2,208,098	2,666,865	48%
VRN	Verona	IT	3,182,574	2,719,815	24%
WAW	Warsaw Chopin	PL	9,585,532	10,655,633	20%
WMI	Warsaw Modlin	PL	897,612	343,565	100%
WRO	Wroclaw	PL	1,996,552	1,920,179	61%
XCR	Paris Vatry	FR	87,745	101,727	85%
XRY	Jerez De La Frontera	ES	913,301	811,504	19%
ZAD	Zadar	HR	371,256	472,572	70%
ZAG	Zagreb	HR	2,342,309	2,292,892	8%
ZRH	Zurich	CH	24,802,466	24,865,138	3%
ZTH	Zakinthos	GR	871,310	1,004,257	22%

For various reasons we have explicitly opted not to adopt an analysis of the internal cost structure of the airports as a way of identifying those that are 'low-cost'. First, the literature review shows (see section 2.4) that it was the expansion of LCCs that triggered

the emergence of 'low-cost airports' and 'low-cost facilities', not vice versa, thus we analysed the airports that LCCs actually use. Also, the fact that airport costs are driven not only by the level of traffic but also by compliance with strict regulations – mainly on safety and security aspects, irrespective of airport size (ACI Europe, 2013; Adler et al., 2013; ELFAA, 2004) – hinders an objective or useful comparison between airports that are very different in scale. Finally, the difficulty in gathering objective and comparable financial information for a large set of airports (Graham, 2005) makes the analysis of the associated indicators very difficult.

Accordingly, the baseline sample simply represents the airports that LCCs actually use not taking into account any specific physical or financial characteristic. Hence, to analyse and compare the airports in the sample, we collected empirical data about 36 different variables that convey information on crucial airport processes and resources, organised in various parameters (see Table 8).

Table 8: Description of the 36 variables analysed for the European airports in the baseline sample.

Type of parameter	Variable	Description
Airport identification	IATA Code	3 letter IATA airport code
Airport identification	Name	Airport common name
Airport identification	City	Main city served by the airport
Airport identification	MAS City	Main city in the metropolitan (or regional) area served by the Multi-Airport System, in case the airport is part of one, otherwise it is the same as "City" above
Airport identification	Country	Two letter code for the country in which the airport is located
Airport size	Pax 2012	Number of total passengers (incoming, outgoing and transit) handled at the airport in 2012 according to (extended) European Airport Traffic Trends Database (ANNA.aero, 2013a)
Airport size	Pax 2013	Number of total passengers (incoming, outgoing and transit) handled at the airport in 2013 according to (extended) European Airport Traffic Trends Database (ANNA.aero, 2014)
Relative importance of LCCs at the airport	LCC Share (2011)	Market share of low-cost carriers, in terms of total annual passengers, in 2011 (not available for all airports, not in terms of passengers for some airports, not accounting for all LCCs for some airports)
Relative importance of LCCs at the airport	LCC Share (2013) or '***LCC share***'	Market share of low-cost carriers, in terms of total annual scheduled available seats, according to schedules data in 2013 from Innovata SRS database (IATA, n.d.)
Relative importance of LCCs at the airport	LCC served	Number of LCCs that used the airport in 2013 (out of the 20 LCCs identified)
Relative importance of LCCs at the airport	Top 6 LCC served	Number of LCCs that used the airport in 2013 (out of the six largest)
Relative importance of LCCs at the airport	Based Top 6 LCC	Number of LCCs that used the airport as a base in 2013 (out of the six largest LCCs)
Relative importance of LCCs at the airport	LCC pax proxy	Estimated number of passengers using LCCs at each airport in 2013 (LCC pax proxy = Pax 2013 * LCC Share (2013)) Note: As LCCs tend to have higher load factors and seating density this number is more likely to be under- than over-estimated
Relative importance of LCCs at the airport	LCC Share EU (2013)	Capacity share of LCCs operating at the airport in relation to the total number of available departing seats offered by LCCs at all European airports (not only those in the sample) in 2013
Relative importance of LCCs at the airport	LCC EU rank (2013) or '***LCC EU rank***'	Normalisation of LCC Share EU (2013) between 0 an 1, where 1 corresponds to the share of low-cost seats provided at Barcelona (BCN), the airport with the most LCC seats in 2013 LCC EU rank = LCC Share EU / (BCN LCC Share EU)

Type of parameter	Variable	Description
Airport organisational structure	Ownership	Ownership and operational structure according to ACI Europe (2010): Public – Operator as part of administration Public – Corporatised operator Mixed – Public majority Mixed – Private majority Private – Fully privatised and corporatised Note: “Public” means government-owned
Airport organisational structure	Airport group	Indicates whether the airport owner or operator owns or operates additional airports elsewhere: Individual airports Airport companies with shared interest but independent operation Fully integrated airport group
Airport geographical location conditions	MAS	Indicates whether the airport is part of a Multi-Airport System (MAS): Airport is not part of a MAS Airport is part of a “regional” MAS, i.e. alternative significant airports (over 500 000 annual passengers) exist near the (non-metropolitan) regions they serve Airport is part of a “metropolitan” MAS (Bonnefoy, 2008)
Airport geographical location conditions	Location	The airport's location within the region it serves according to Dobruszkes (2006), as summarised by Graham (2013): City main City secondary Regional near city Tourist zone Remote regional
Airport infrastructure	Passenger buildings	The total number of independent passenger buildings (terminals) in use
Airport infrastructure	LCT	Indicates whether the airport markets a passenger building (or part of it) specifically as a 'low-cost terminal'
Airport infrastructure	Jet bridges	Indicates whether the airport provides any contact stands with jet bridges (jetway or boarding bridge)
Airport infrastructure	Runways	Total number of active runways
Airport infrastructure	Ground transport	An array that describes public transport alternatives available for ground access to the airport: 0: No; 1: Yes; in the following order {local bus, coach, metro/tramway/light rail, heavy rail, high speed rail}
Airport congestion	Slot control level	A proxy for the level of (airside) congestion at the airport, it indicates the IATA slot coordination level: Level 1: Non-Coordinated Airport = Uncongested Level 2: Schedules Facilitated Airport = Moderately busy airport (especially during peak seasons/times) Level 3: Coordinated Airport = Congested airport
Airport managerial strategies	Airline incentives	Indicates whether the airport has any formal scheme of incentives or special discounts to airlines (e.g. for route development)
Airport managerial strategies	The route shop	Indicates whether the airport publishes route development opportunities on therouteshop.com
Airport managerial strategies	Strategy	Indicates whether there is a formal, public and documented definition of the airport strategy
Airport route network	Long haul	Indicates whether the airport offers scheduled long haul (e.g. intercontinental) destinations
Airport route network	Non-stop destinations	Total number of direct non-stop destinations available at the airport (most recent available figure)
Airport route network	Largest carrier LCC?	Indicates whether the largest carrier at the airport (in terms of available seats) is one of the 20 identified LCCs
Airport financial conditions	Non-aero revenues	Share of non-aeronautical revenues in the total airport revenues for the last year available (not available for all the airports, in some cases of airport groups the value is only available for the entire group)

Type of parameter	Variable	Description
Airport financial conditions	Profitable	Indicates whether the airport has a positive net profit result for the most recent calendar/fiscal year available (not available for all the airports, in some cases of airport groups the value is only available for the entire group)
Airport operational conditions	Average turnaround time (min) - LCCs	The time it takes LCCs (Ryanair, easyJet, Norwegian, Vueling, Wizzair, Germanwings and Pegasus) on average to turnaround their aircraft (only from Airbus A320 and Boeing 737 families) at the airport (not available for all the airports)
Airport operational conditions	Average turnaround time (min) - FSCs	The time it takes FSCs (Air France, Air Berlin, British Airways, Lufthansa, Iberia, KLM and Turkish Airlines) on average to turnaround their aircraft (only from Airbus A320 and Boeing 737 families) at the airport (not available for all the airports)
Airport operational conditions	Average turnaround time (min)	The time it takes the airlines sampled (Ryanair, easyJet, Norwegian, Vueling, Wizzair, Germanwings, Pegasus, Air France, Air Berlin, British Airways, Lufthansa, Iberia, KLM and Turkish Airlines) on average to turnaround their aircraft (only from Airbus A320 and Boeing 737 families) at the airport (not available for all the airports)

We argue that some of these variables determine the importance of LCCs in each airport and thus the extent to which an airport can be described as 'low cost' (see next section). The other (complementary) variables facilitate the identification of certain attributes interesting to characterise the airports.

5.2 Measuring the importance of LCCs in European airports

LCCs in Europe have extensive networks and some airports serve a large number of LCCs (see section 4.4). However, these numbers alone do not completely explain the relevance of LCCs for each airport. Some European LCCs (see Figure 6) have also established a considerable number of 'bases' in airports well beyond their country of registration (even in Northern Africa). A 'base' is an airport where the carrier permanently bases aircraft and crew who return by the end of the day's rotations (CAPA Centre for Aviation, 2013f). At the beginning of 2013, the six largest LCCs had 127 bases at 105 different airports[8] (in Europe). Ryanair alone accounted for 55 bases in Europe, well ahead of easyJet, second in number of bases with 23.

Bases offer the carriers operational flexibility and cost savings for routine aircraft maintenance and repair, and also play an important role in crew recruitment. Bases also give the airlines significant bargaining power against airports because they induce new routes, passengers traffic, and other economic benefits for the hinterland. This justifies the use of bases as one of our selection criteria to define the sample. We considered that an airport that is able to become an airline base may have more of the characteristics that make it attractive to LCCs.

Although it appears to be relevant for a 'low cost airport' to have a based LCC, this may not be an essential feature. 66 of the airports in the sample were not designated bases

8 Some airlines added more bases in 2013 that were not available at the time of data collection.

(for any of the 6 largest LCCs) at the time of data collection. Paris Beauvais, for instance, handled nearly 4 million passengers in 2013 without any based aircraft. Similarly, London Luton is the second largest airport for Wizz Air in terms of seats, but the airline does not use it as a base. Therefore we consider bases alone cannot explain the importance of LCCs for European airports, hence we propose more indicators for this purpose.

To analyse the level of consolidation of low-cost services in each airport, we have measured the capacity deployed by LCCs in comparison with the total capacity available at the airport in 2013. That is, the proportion of total annual seats available on the departures of the 20 LCCs identified, out of the total seats for all the airlines at each airport. This variable ('LCC Share (2013)' in Table 8, and referred in short as 'LCC share' from now on), reflects the market share of LCCs in each airport market.

To analyse how airports compare with each other at European level, we computed the share of every airport in the low-cost segment in Europe. This variable ('LCC Share EU (2013)' in Table 8) corresponds to the proportion of seats offered by LCCs at each airport in relation to the total number of seats offered by LCCs in all European airports (not only those included in the sample) in 2013. To compare more easily with the previous variable ('LCC share') we created a rank by normalising 'LCC share EU (2013)' with respect to the airport with the highest number of available LCC seats, which in 2013 was Barcelona (BCN). The resulting variable ('LCC EU rank (2013)' in Table 8 and shortened to 'LCC EU rank' from now on) ranges from 0 to 1, where 1 corresponds to the share of low-cost seats provided at Barcelona El Prat Airport (BCN) out of the total low-cost seats available in Europe for 2013.

5.2.1 Quartiles to define how 'low cost' airports are

The variables 'LCC share' and 'LCC EU rank' respectively describe the market penetration of LCCs at an airport and the significance of an airport at European level for low-cost services. Quartiles are useful to characterise the distribution of the sample according to these measures, as Table 9 explains. Airports above the upper quartile (i.e. those in the top 25% of data) for 'LCC share' (72.7%) have significant LCC consolidation. Airports above the upper quartile for 'LCC EU rank' (0.141) are more significant in terms of European low-cost traffic. Conversely, airports below the lower quartiles (i.e. the bottom 25% of data, equal to 25.4% and 0.027 for 'LCC share' and 'LCC EU rank', respectively) are less relevant for low-cost traffic.

Figure 13 shows the 171 airports in the sample plotted against 'LCC share' and 'LCC EU rank' variables. 15 airports are above the upper quartiles for both variables (shaded area): London Stansted (STN), London Luton (LTN), Milan Bergamo (BGY), Alicante (ALC), Brussels Charleroi (CRL), Berlin Schönefeld (SXF), Rome Ciampino (CIA), Bristol (BRS),

Faro (FAO), Liverpool (LPL), Pisa (PSA), Paris Beauvais (BVA), Belfast International (BFS), Eindhoven (EIN), and East Midlands (EMA). Taking only these variables into account, these airports can be regarded as “the most low cost” ones.

Table 9: Quartiles to determine the relative importance of LCCs in airports.

Variable	Quartile	Value	Meaning
LCC share [2013]	Upper (Q_3)	72.7%	Airports above this level have significant LCC consolidation
LCC share [2013]	Lower (Q_1)	25.4%	Airports below this level have low LCC market penetration
LCC EU rank [2013]	Upper (Q_3)	0.141	Airports above this level are significant in terms of European low-cost traffic
LCC EU rank [2013]	Lower (Q_1)	0.027	Airports below this level are not significant for low-cost traffic at European level

However, there are 6 airports in which LCCs have a low market penetration ('LCC share' below the lower quartile), yet contribute significantly to European low cost traffic ('LCC EU rank' above the upper quartile): Amsterdam Schiphol (AMS), Madrid Barajas (MAD), Paris Orly (ORY), Rome Fiumicino (FCO), Copenhagen (CPH), and Paris Charles de Gaulle (CDG). Moreover, the two airports that rank the highest at European level for low-cost capacity – Barcelona (BCN) and London Gatwick (LGW) – are both below the upper quartile in terms of 'LCC share'. Despite LCCs not being as consolidated here as in the “most low cost airports”, they play an important role in the network of the airlines.

Finally, we have also estimated the number of passengers using LCCs at each airport in 2013 ('LCC Pax Proxy (2013)') by multiplying the total number of passengers by the market share of LCCs ('LCC share'). The result does not translate directly into passengers

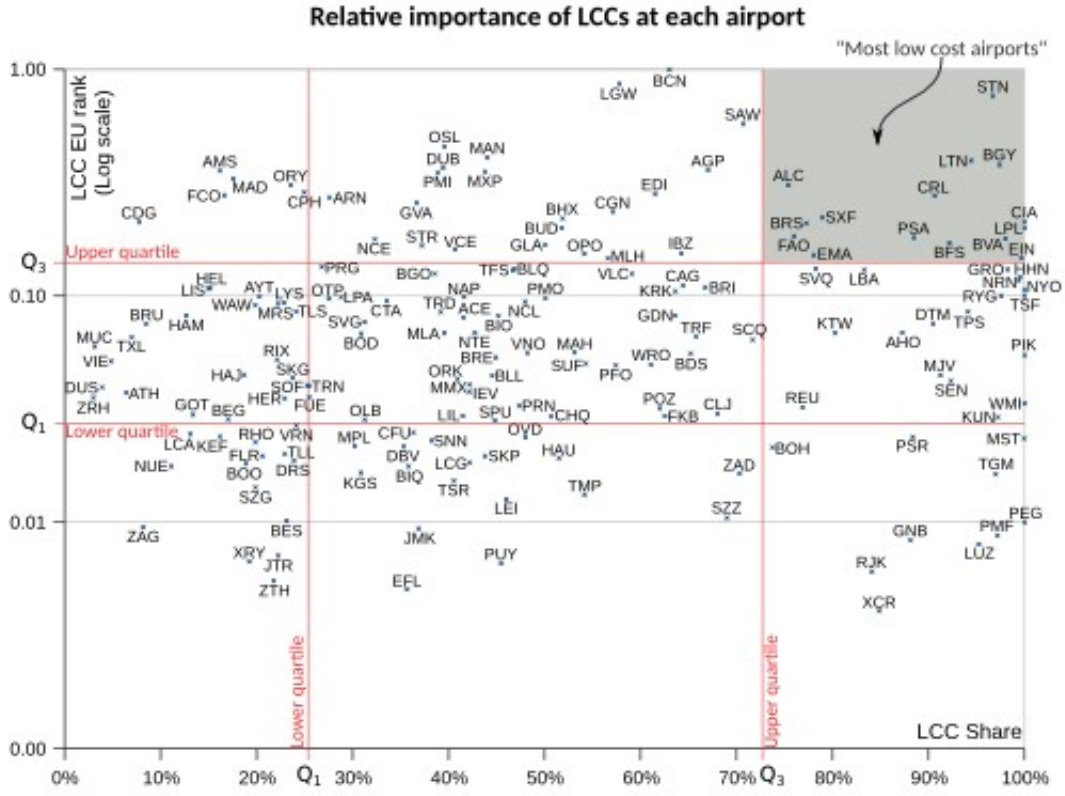

Figure 13: Relative importance of LCCs at sampled airports (market shares as of 2013).

because the market share is expressed in seats, but as LCCs tend to use aircraft with dense seat configurations and high load factors, this number is more likely to be under- than over-estimated. This proxy is used only to visualise, in orders of magnitude, the relative importance of LCCs at the airports in comparison with airport size variables.

Around 30% of the airports in the sample handled over 70% of the estimated low-cost passengers in 2013. This is in line with usual concentration patterns in airport networks where the largest airports tend to handle most of the traffic (according to Suau-Sanchez and Burghouwt (2011), in 2008 the five largest airports in the five largest European aviation markets offered each well above 50% of seat capacity). Moreover, this observation is also consistent with a de-concentration effect, particularly at intra-European level, attributed to the growth of LCCs (Suau-Sanchez, 2013); hence low-cost traffic should be more evenly distributed across a larger number of airports.

5.3 Characteristics of European 'low cost airports'

This section characterises the airports in the baseline sample according to the parameters mentioned above (see Table 8). Besides presenting the main findings for each parameter, it relates the variables with the relative importance of LCCs in the airports ('LCC Share' and 'LCC EU rank') in order to assess their potential impact on the degree of consolidation of LCCs.

The 171 airports in the baseline sample are distributed across 32 countries. Yet 93 are located in the five largest European aviation markets (United Kingdom, Germany, Spain, France and Italy). The sample includes airports of different scales, from Paris/Vatry which handled 101,727 passengers in 2013 to Paris/De Gaulle (CDG) with over 62 million passengers the same year. The smallest 25% airports handled 1.66 million passenger or less in 2013, whilst the largest 25% received 8.46 million or more.

5.3.1 Organisational structure

The organisational structure of the airports was analysed using two variables: 'Ownership' and 'Airport group'.

i) Ownership

The ownership and operational structure that ACI Europe (2010) summarised as follows (notice that “public” means “government-owned” in this context):

1. Public ownership of airport operator

    1.1. *Public airport operator as part of the administration*: “An airport operator is considered part of the administration if the airport operator is functionally

dependent on the national and/or regional/local administration (e.g. Ministry of Transport, Regional and/or City Councils)."

1.2. *Corporatised public airport operator*: "A corporatised public airport operator is an independently acting economic entity, structured according to and complying with normal commercial law, whose shares are wholly owned by public authorities [at least 98% of shares] of the country where the airport is located."

2. Mixed public-private ownership of airport operator: "A mixed public-private ownership of an airport operator involves an independently acting economic entity, structured according to and complying with normal commercial law, whose shares are owned by a combination of public authorities of the country where the airport is located and private investor(s)."

2.1. *Public sector owning a majority share in the airport operator*

2.2. *Private sector owning a majority share in the airport operator*: "investments by public authorities or a public-private airport operator from country A in an airport operator in country B will be considered as fully private, as the investment constitutes an economic activity without specific governmental purpose in country B."

3. Private ownership of airport operator

3.1. *Fully privatised airport operator*: "Private ownership of an airport operator involves a commercial company wholly owned by private investors and/or other corporatised entities wholly or partially owned by public authorities from a country or region other than the one where the airport operator is located."

Most airports in the sample (94 out of 171) are owned by the government but run as corporatised entities abiding to commercial and fiscal discipline, i.e. they have a corporatised public operator. 22 airports are fully privatised and other 19 have mixed ownership with the private sector holding a majority stake. Figure 14 shows the ownership types of sampled airports plotted against the relative importance of LCCs. Although there is no clear correlation between the ownership variable and the relevance of LCCs, it is interesting to notice that most airports in which the operator is part of the government administration have relatively low LCC penetration and are not very significant in the European low-cost segment.

This group includes 9 Greek airports (owned by the central government) and, assuming Basel (MLH) as French for its location, 5 French airports (owned by regional or

local administrations). Within this group, only in Paris Vatry (XCR) do LCCs have a market share that is above the upper quartile of 'LCC share', but this specific airport has not been able to significantly attract airlines, being therefore the lowest ranked in European terms. On the other hand, only Basel (MLH) stands above the upper quartile for 'LCC EU rank', with LCCs accounting for 57% of the capacity offered.

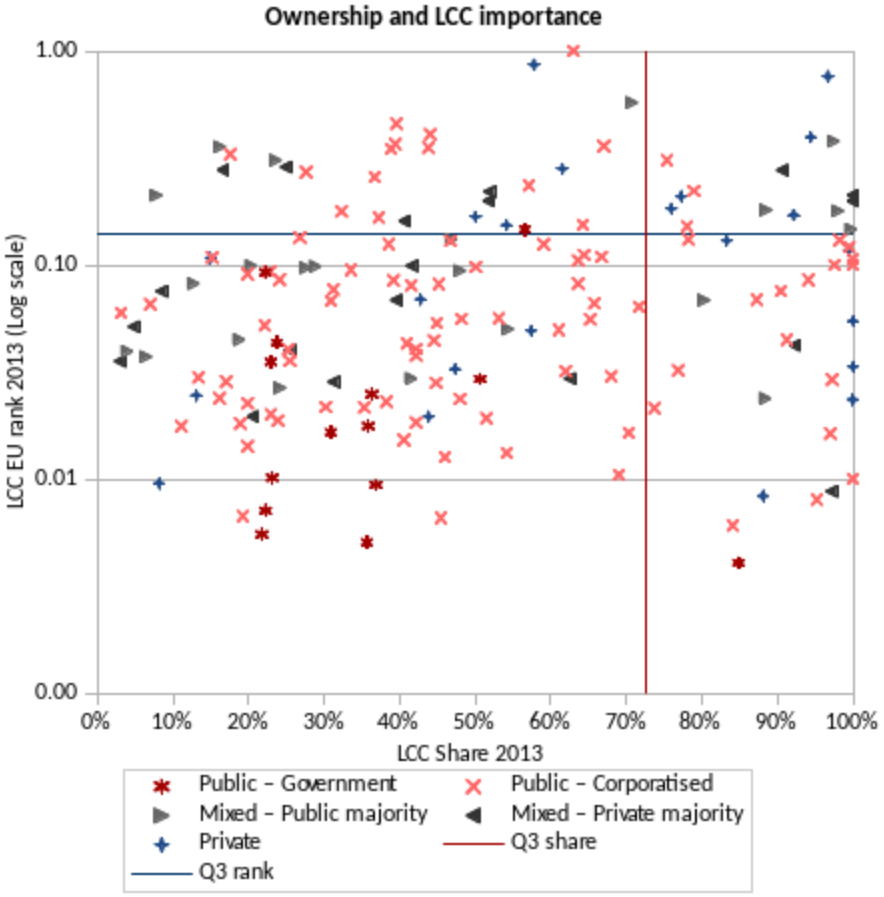

Figure 14: Ownership of sampled airports and the relevance of LCCs.

Fully privatised airports stand more prominently above the upper quartile, either for 'LCC share' or for 'LCC EU rank'. In fact, only 7 of the 22 airports are below both quartiles. Public airports with corporatised operators and airports with mixed ownership are rather distributed along this landscape (see Figure 14). This might suggest that private airports are more likely to consider LCCs as partners, or that airports that are operated within the government administration either lack autonomy to approach LCCs individually, or are subject to broader political goals.

ii) Airport group

We have analysed whether an airport is part of a group in the sense that the owner (or one of the majority owners) or operator owns or operates additional airports elsewhere, according to three cases:

1. individual airports;

2. companies with shared interest but independent operation;

3. fully integrated group.

88 airports from the sample are part of a fully integrated group. This figure includes, among others, 22 Spanish airports operated by AENA and 10 Greek airports controlled by the Hellenic Civil Aviation Authority – HCAA[9]. 55 airports are individual entities, and the rest are part of companies that have interests in other airports but operate independently. Figure 15 shows the airports in the sample according to this variable.

Again, there is no clear correlation between the importance of LCCs and the existence of airport groups. Yet it is interesting that 17 out of the 20 top ranked airports for low-cost services at European level (all above the upper quartile for 'LCC EU rank') are part of a fully integrated group company.

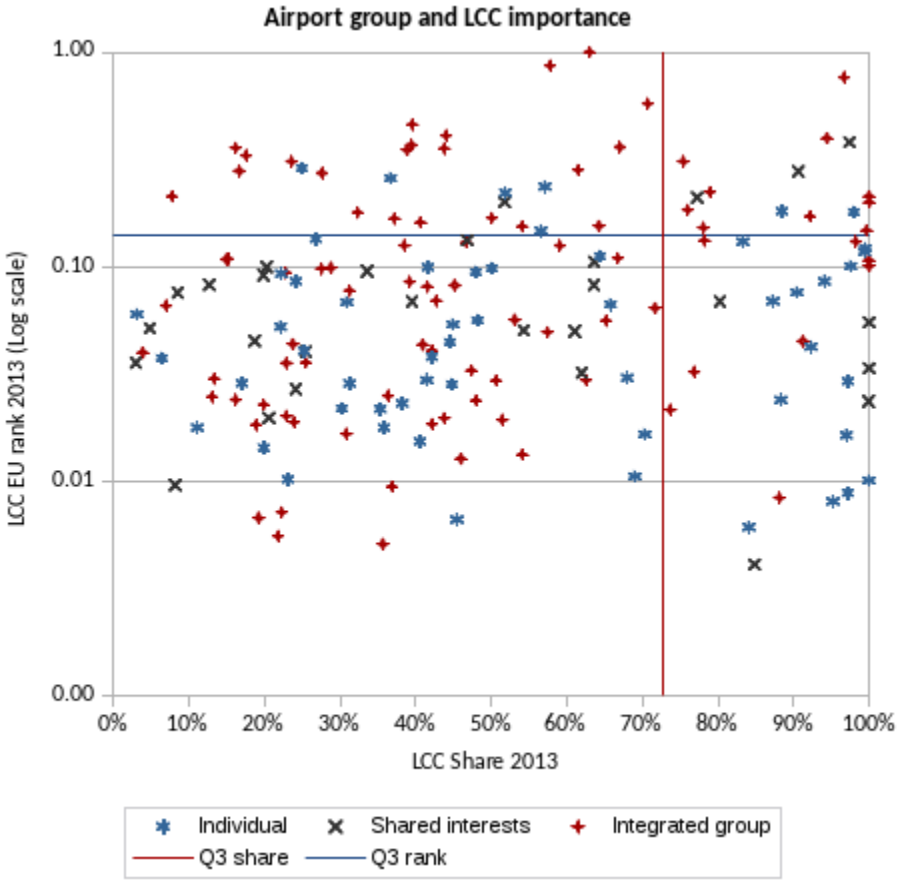

Figure 15: Sampled airports as part of an airport group and the relevance of LCCs.

5.3.2 Geographical location

Two variables are associated with the geographical location of the airports: 'MAS' and 'Location'.

9 AENA is a corporatised operator and the HCAA operates within government administration (in the use defined above). However, each of these organisations is fully integrated, as they are managed as a single organisation.

i) Multi-Airport Systems (MAS)

The 'MAS' variable indicates whether the airport is part of a Multi-Airport System (MAS) in a metropolitan area according to the criteria defined by Bonnefoy (2008). This definition was extended to include the cases in which alternative significant airports (those with more than 500,000 annual passengers) exist near the (non-metropolitan) regions they serve.

56 airports in the sample belong to metropolitan MAS, 40 of which are either above the upper quartile for 'LCC EU rank' or above the upper quartile for 'LCC Share' (see Figure 16). Other 29 airports belong to a regional MAS, i.e. there is an alternative airport nearby. In fact, almost all but one of the 15 airports that score above both quartiles belong to a MAS (11 of them in a metropolitan area).

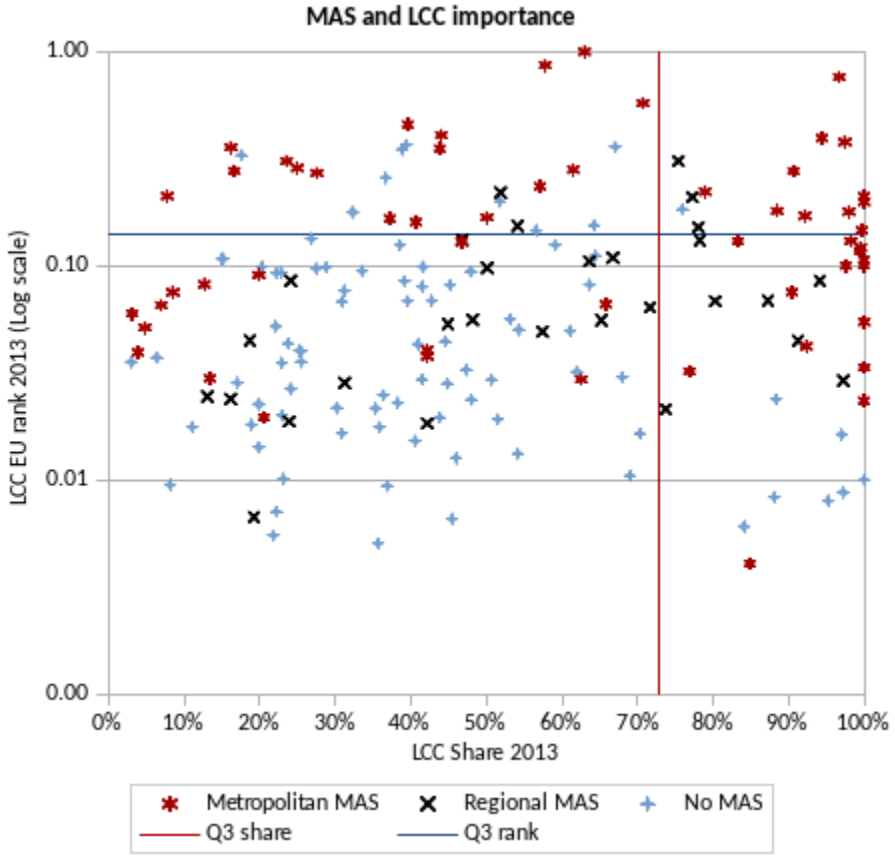

Figure 16: Multi-Airport Systems in sampled airports and the relative importance of LCCs.

As the literature highlights (see section 2.4) secondary airports in Multi-Airport Systems provided an opportunity for start-up LCCs to capture traffic. But in the current stage of LCC evolution even the major airports are not missing the opportunity to attract LCCs. As a matter of fact, in most of the largest European MAS the primary airports served more low-cost traffic than the secondary ones in 2013, as Figure 17 shows. Out of the 20 MAS shown in the figure, only in the cases of Milan, Istanbul, Brussels, Berlin, and Frankfurt, the secondary airports (Bergamo (BGY), Sabiha Gokcen (SAW), Charleroi (CRL),

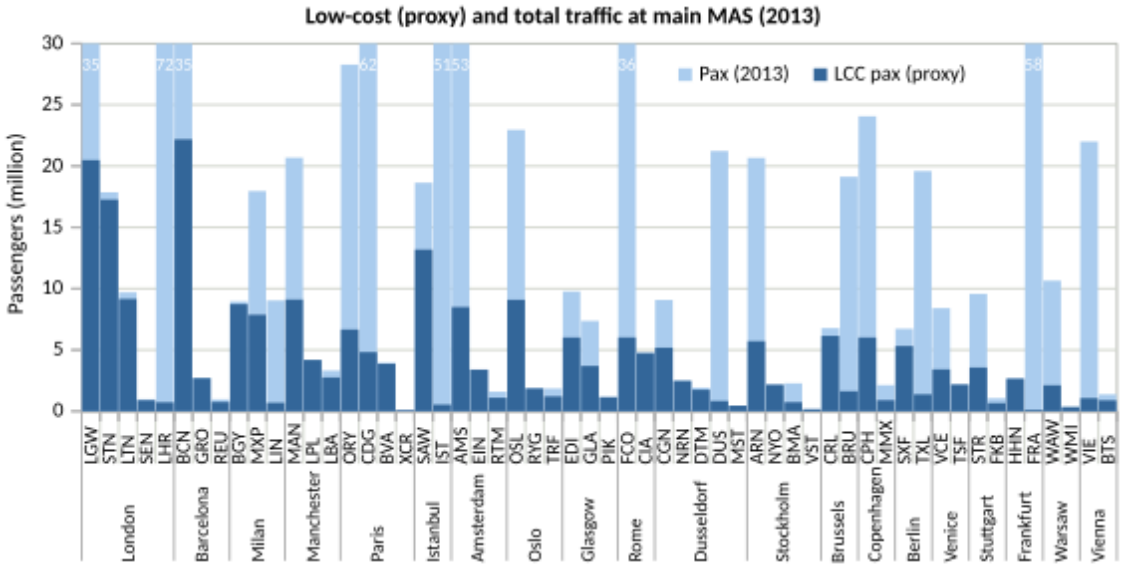

Figure 17: Total and (estimated) low-cost passengers in the airports that are part of the 20 largest metropolitan Multi-Airport Systems in Europe, by total low-cost passengers in the MAS.

Schönefeld (SXF) and Hahn (HHN), respectively) handled more LCC traffic than the primary ones.

Paris is an interesting case: Orly (ORY) led on LCC traffic, but Charles de Gaulle (CDG), the largest airport in the MAS, and Beauvais (BVA) did not lag far behind (traffic at Vatry (XCR) is still negligible for the MAS). In London, low-cost traffic at Heathrow (LHR) was even lower than at recently converted Southend (SEN), but Gatwick (LGW) handled more LCC passengers than Stansted (STN) and Luton (LTN) each, and London City (LCY) had no LCCs at all (although Flybe is planning to start operations there by the end of 2014).

ii) Location

The 'Location' variable describes the type of location within the region served by the airport, according to Dobruszkes (2006) and summarised by Graham (2013) as:

1. *City main*: “medium or large traditional airports”;
2. *City secondary*: “secondary urban airports of large cities”;
3. *Regional near city*: “regional airports serving a large city fairly close”;
4. *Tourist zone*: “traditional airports of beach tourism”;
5. *Remote regional*: “remotely located regional airports that airlines use either as access to tourist areas or points of departure for tours.”

Figure 18 shows how the type of location of the airports in the sample is related to the importance of LCCs. Despite the previous finding that most primary airports handle more low-cost traffic than the other airports in the MAS, in relative terms 'city main' airports still tend to have lower penetration of LCCs. The group of 'city main' airports includes 100 airports, 53 of which are not part of a metropolitan or regional MAS. 27 of these 'city main'

airports contribute significantly to European low-cost traffic (above the upper quartile for 'LCC EU rank').

The group of airports in 'tourist zones' includes 31 airports located along the Mediterranean or the Alps, in zones that normally have high seasonality. It may seem rather surprising that LCCs are not dominant in most of these tourist airports, but in reality charters, and to a lesser extent FSCs (particularly their regional branches), have been able to withstand LCC competition for leisure travellers at these locations. This also happens with many island airports in which regional or flag carriers satisfy commuting needs for residents, often through Public Service Obligations. Usually, as these airports cannot sustain a regular market for their larger aircraft, LCCs flock for a few weeks during summer (or winter) only.

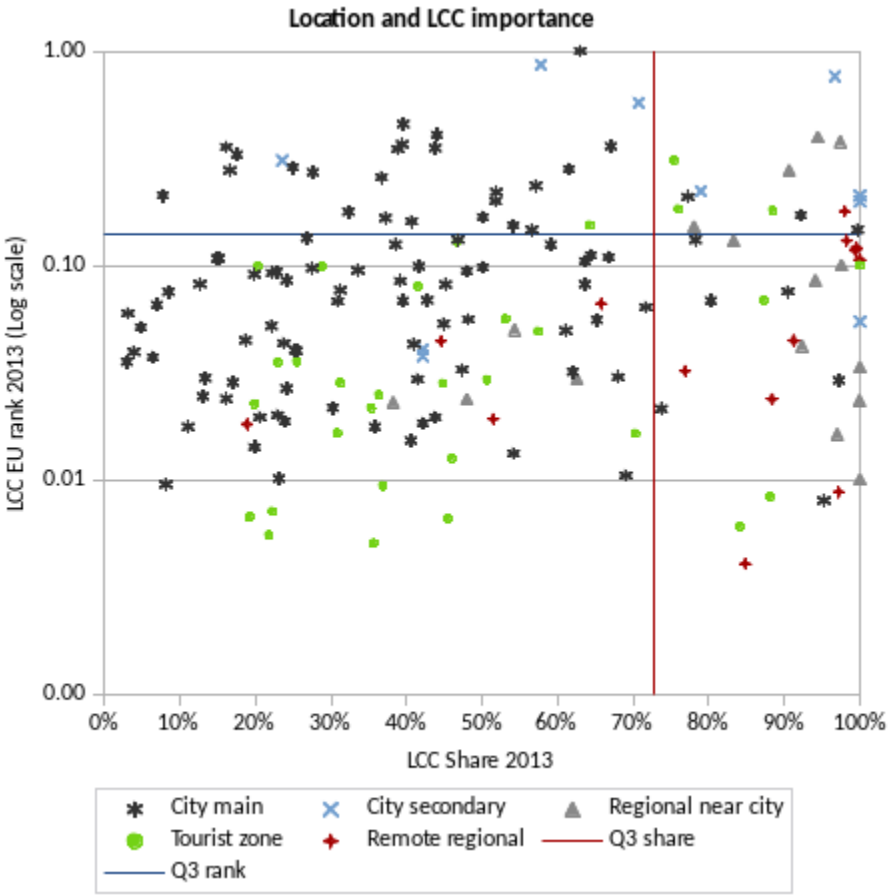

Figure 18: Location of the sampled airports and the importance of LCCs.

Conversely, the consolidation of LCC traffic is more evident for 'regional near city' and 'remote regional' airports. In the first case, 12 out of 16 airports have an 'LCC share' above the upper quartile of the sample distribution. In the second one, 10 out of 14 airports also have significant LCC penetration. Secondary airports of large cities ('city secondary') are evenly divided in terms of LCC market share: 5 are above the upper quartile, and 5 are

below. However, 7 of these airports are significant at European level (above the upper quartile for 'LCC EU rank').

The 15 airports that rank above both quartiles are also well distributed in the groups: there are 3 'city main' airports (Eindhoven – EIN, Bristol – BRS – and Belfast International – BFS), 4 'city secondary' (Rome Ciampino – CIA, Liverpool[10] – LPL, London Stansted – STN – and Berlin Schönefeld – SXF), 3 'tourist zone' airports (Pisa – PSA, Faro – FAO – and Alicante – ALC), and one 'remote regional' airport (Paris Beauvais – BVA).

5.3.3 Infrastructure

i) Passenger buildings

A correlation between total traffic and the number of passenger buildings is not necessarily straightforward or meaningful. This feature depends, among other factors, on the design strategy of airport expansions. Some airports would build new "terminals" to add capacity, whilst others would prefer to remain under one single roof. 123 airports in the sample have a single passenger building, 31 have two and 17 have three or more.

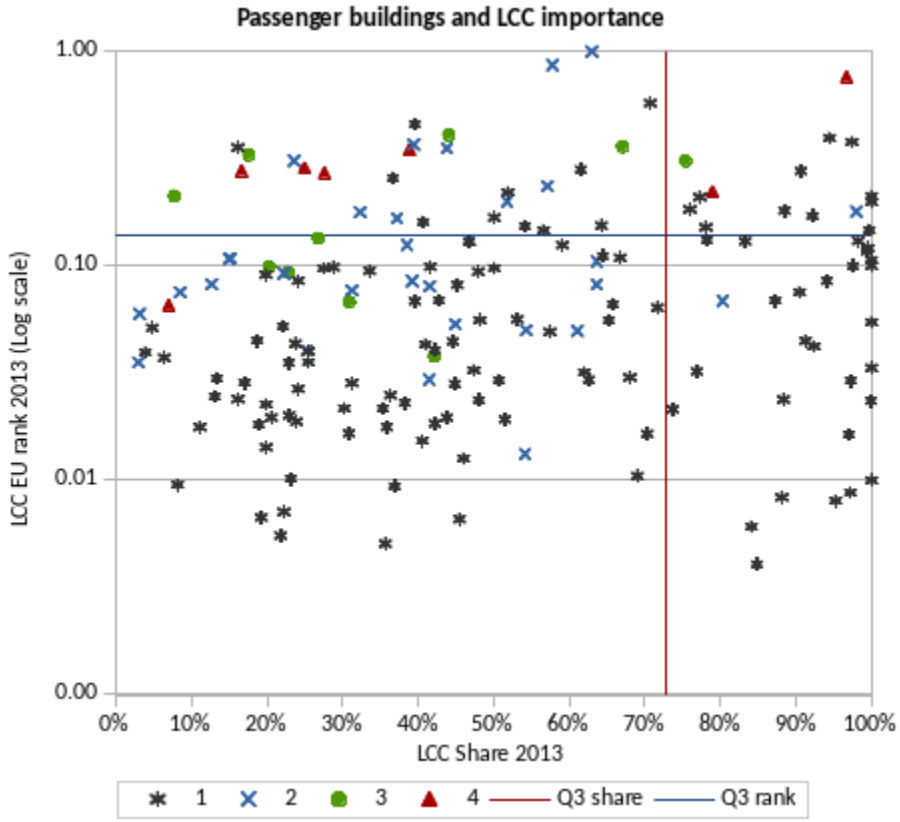

Figure 19: Number of passenger buildings in the sampled airports and the relevance of LCCs.

In relation to low-cost services (see Figure 19), only three (London Stansted – STN, Berlin Schönefeld – SXF, and Alicante – ALC) out of the 17 airports with three or more passenger buildings have significant LCC consolidation ('LCC share' above the upper

10 Liverpool Airport (LPL) is actually halfway between the main airport for the city of Liverpool and a secondary airport for the Manchester Greater Area MAS. LPL is counted as 'city secondary' in this analysis.

quartile). At Stansted three passenger buildings are satellites and accessible only air-side, whilst common check-in, baggage reclaim, security and land-side facilities are located in a main building with no boarding gates. Schönefeld will be replaced, in a near future, by the new Berlin Brandenburg Airport that favours the 'under one roof' concept. And Alicante currently operates only the newest passenger building, as the other two buildings were closed in 2011 after the new one opened. Nevertheless, 11 of these 17 airports (including the 3 above) significantly contribute to LCC traffic at European level (above the upper quartile for 'LCC EU rank'). Conversely, out of 43 airports that have significant consolidation of LCCs (above upper quartile for 'LCC share'), 38 have only one passenger building.

ii) 'Low cost terminals' (LCT)

Some airports have developed segregated facilities that are specifically tailored or marketed for low-cost services. These facilities are referred in the literature as “low cost terminals” - LCT (Hanaoka and Saraswati, 2011; Njoya and Niemeier, 2011; Sabar, 2009). An LCT differs from an airport that has been (re)developed specifically for LCCs in the sense that an LCT is deployed in an existing commercial airport as a somehow separated facility.

From the airports in our sample, 14 have developed some kind of LCT as Table 10 details. These terminals are all at the main airports for the cities they serve (i.e. they are in the 'city main' category in section 5.3.2ii). In none of these airports the market share of LCCs is above the upper quartile, and it is below 50% in most of them. This notwithstanding, 6 of them significantly contribute to low-cost traffic at European level ('LCC EU rank' above the upper quartile).

These 6 airports belong to metropolitan MAS, and this is the case of the rest in this group of airports with LCT. And all 6 are primary airports within their MAS. This may suggest a specific reaction of these airports to market developments, and their willingness to compete in the low-cost segment with other airports in the MAS by establishing facilities with different levels of service, yet not jeopardising the incumbent 'legacy' airlines.

Indeed, only 7 airports developed (or re-developed) their low-cost terminals specifically with LCCs in mind: Amsterdam (AMS), Copenhagen (CPH), Lyon (LYS), Marseille (MRS), Bordeaux (BOD), Bremen (BRE) and Tampere (TMP). And only at CPH and BOD the facilities were built from scratch with that specific purpose. In other cases it was rather a change of users for those particular facilities.

At Lisbon (LIS), for instance, the LCT was built as a temporary solution to provide capacity whilst the main terminal was expanded because the works obstructed some

areas. It was used as a domestic terminal first, and then turned into LCT when easyJet opened a base there. Moreover, low-cost facilities at LIS, as in Rome Fiumicino (FCO), are "only departures". Arriving passengers are taken by bus to non-low-cost facilities to complete their trips. At FCO, the low-cost "Terminal 2" (located in the same building as terminals 1 and 3) provides only bus gates where passengers are taken to remote positions.

Table 10: European airports with 'low cost terminals' in 2013.

IATA Code	Airport	Low Cost Terminal	LCC share	LCC EU rank
AMS	Amsterdam Schiphol	Pier H/M (Non-Schengen/Schengen) in main passenger building. No/few amenities past security for H/M pier. Used by easyJet, Air One, Flybe, Jet2.com and Norwegian. Transavia, Vueling, Pegasus, WOW Air, Iberia Express and Germanwings use other piers. Norwegian and Flybe also use other piers.	16%	0.357*
MXP	Milan Malpensa	Terminal 2 (old passenger building). Used exclusively by easyJet. Air One, Flybe, Germanwings, Norwegian, Vueling, Wizz Air and WOW Air use Terminal 1.	44%	0.353*
CPH	Copenhagen	CPH Go pier connected to Terminal 3 passenger building. Used by easyJet and Transavia. Other LCCs, including Norwegian use other terminals.	25%	0.287*
FCO	Rome Fiumicino	Terminal 2 in the same building between Terminals 1 and 3. Only departures. Used by easyJet, Wizz Air and Blue Air. Other LCCs, including Ryanair and Pegasus use Terminal 3.	17%	0.278*
CDG	Paris Charles de Gaulle	Terminal 3. Bus-gates only. Used mainly by charter airlines, Vueling, Smartwings, Jet2.com, WOW Air and Air One. EasyJet and Flybe use Terminal 2 and Germanwings uses Terminal 1.	8%	0.212*
GLA	Glasgow	East pier within main passenger building. Used mainly by easyJet.	50%	0.168*
LIS	Lisbon	Terminal 2. Only departures. Arriving passengers are taken by bus to arrivals in main Terminal 1. Originally intended to relieve traffic during expansion of Terminal 1. Used by most LCCs, mainly easyJet and Ryanair. Germanwings and Vueling use Terminal 1.	15%	0.108
LYS	Lyon	Terminal 3. Refurbished from old terminal. Used by easyJet, Air Arabia (Maroc) and WOW Air, other LCCs use Terminal 1.	23%	0.093
MRS	Marseille	Mp2. Converted from cargo terminal. Used by LCCs except Norwegian and Vueling.	22%	0.092
BOD	Bordeaux	Billi. Purpose-built passenger building. Used by easyJet and Ryanair. Volotea, Vueling, Flybe and Norwegian use Terminal A.	31%	0.068
BRE	Bremen	Terminal E. Refurbished old warehouse. Ryanair is the exclusive operator.	45%	0.053
SOF	Sofia	Terminal 1. Old terminal. Used by LCCs and charters.	25%	0.040
BEG	Belgrade	Terminal 1. Old terminal. Used by LCCs, except Germanwings and Norwegian, and charters.	17%	0.029
TMP	Tampere	Terminal 2. Converted from cargo terminal. Used by Ryanair. Closed for renovations in May 2014.	54%	0.013

* Above upper quartile for LCC EU rank (0.1405)

The low cost facilities at Amsterdam (AMS), Copenhagen (CPH) and Glasgow (GLA) are piers within existing passenger buildings. There, passengers use common facilities for all processes prior to boarding and after de-boarding (i.e. check-in, security and baggage claim). At Sofia (SOF) and Belgrade (BEG), LCTs are separate areas ("concourses") within a single passenger building.

In many cases (see Table 10) LCCs are not the only users of an LCT, and in several other cases there are LCCs using regular passenger buildings even when an LCT is available. Vueling and Germanwings are the LCCs that most consistently do not use LCTs when available.

iii) Jet bridges

European LCCs often use both aircraft doors (for the most common planes in their fleets) to speed up the process of (dis)embarking passengers, and thus the turnaround. In such cases jet bridges (*jetways* or boarding bridges) are dispensable. Warsaw's Modlin Airport explicitly states that "the airport's specific orientation at low-cost airlines is reflected in certain components of the infrastructure, particularly the terminal with no designated business waiting area, no luxury commercial or food court areas and no jetways" (Warsaw Modlin Airport, 2012).

Our database includes information on whether an airport has or has not jet bridges, but most airports with jet bridges also offer bus gates or direct apron access. Then it is not possible to know if LCCs use jet bridges when they are available. Nevertheless, 71 airports in the sample do not have jet bridges at all (the remaining 100 airports offer at least one contact stand with a jet bridge).

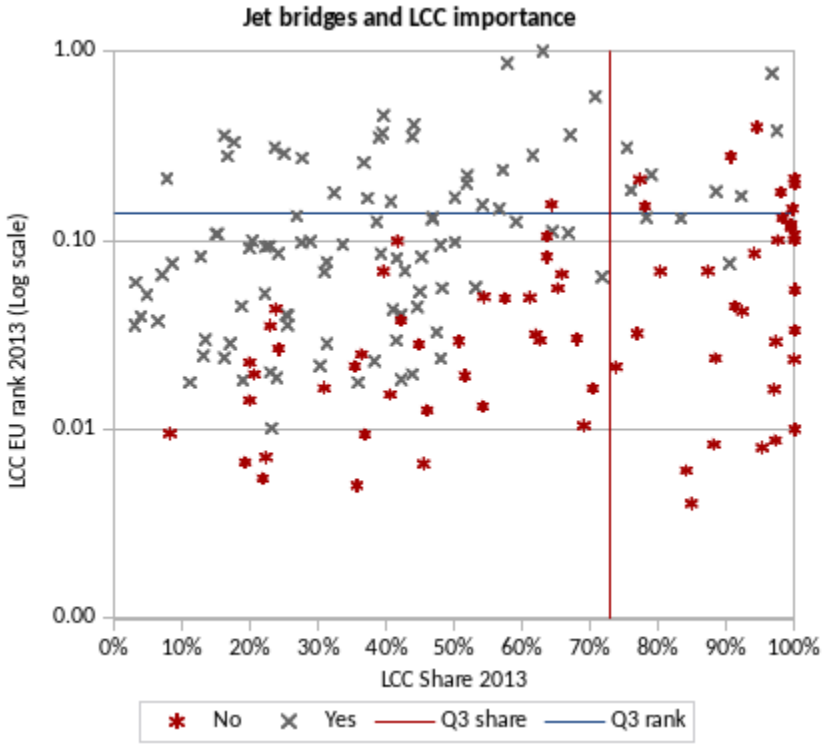

Figure 20: Jet bridges and the importance of LCCs at sampled airports.

The airports without jet bridges are spread across Figure 20, particularly in terms of 'LCC share', yet 8 of them score above the upper quartiles for both measures of LCC relative importance. London Luton (LTN) is the highest ranked in this group and is able to handle

over 9.6 million annual passengers up/down the stairs to/from the aircraft. Brussels Charleroi (CRL) has grown to more than 6.7 million passengers with the same procedures.

Bristol (BRS) was among the first and few European airports to offer covered walkways to access aircraft by foot in all weather conditions. In recent years these structures have been replaced by bigger buildings, rather piers, that extend across the apron. Currently, Bristol is developing a terminal expansion and refurbishment that, as designed, will add several jet bridges along the “walkways” that connect the passenger building to the aircraft stands.

Conversely, 34 airports with jet bridges stand prominently in low-cost traffic at European level (above upper quartile for 'LCC EU rank'). But only 10 airports, out of the 100 that provide air bridges, have significant LCC penetration (above upper quartile for 'LCC share'). Arguably, jet bridges could increase airport-related costs or hamper quick aircraft turnaround for LCCs.

The possible impact of this solution on turnaround time, to the best of our knowledge, has not been studied before. On the one hand, passengers have to negotiate stairs and board more slowly if they walk to the aircraft. On the other hand, the simultaneous use of two doors diminishes the conflicts between passengers who are boarding and passengers who are placing their luggage and themselves. Also, there is no waiting time whilst the jet bridge engages with the plane. In fact, Ryanair's fleet includes several aircraft with incorporated stairs at the front door (Figure 21), and this may clearly decrease the time to start disembarking and perhaps the costs in ground equipment.

Figure 21: Incorporated stairs in a Ryanair Boeing 737-800 at Frankfurt Hahn.

In what concerns the costs, some airports charge an additional fee for the use of jet bridges. At Porto Airport, for instance, easyJet avoids jet bridges, even when using gates that feature them. Yet this might be subject to the specific arrangement between the carriers and the airports. In Bergamo, for instance, Ryanair is able to use the bridges at the

two gates where they are available at no extra cost, as bound by the existing long-term agreement.

Nevertheless, jet bridges were the known cause of a dispute between Alicante Airport (operated by AENA) and Ryanair in 2011-2012. After the construction of a new terminal, with jet bridges at all contact stands, AENA mandated their obligatory use. The airline took the airport to court and reduced their operations there. The judge rejected Ryanair claims but advised the airport to review its policy. In any case, Ryanair uses jet bridges at AENA's airports in Madrid and Barcelona without problems.

Judging by the high representation of airports with jet bridges among those with most significant LCC traffic in Europe (34 airports ranked in the top 25%), these facilities should not be a great concern for most LCCs operating in Europe. Yet from the point of view of the airports that do not have jet bridges (or for new airports), implementing them would obviously increase their capital and operating expenditures.

iv) Runways

Most airports in the sample (111) have a single runway available and only 14 have more than 2. Clearly the impact of airport size in this variable is much stronger than the impact of any other variable related to low-cost traffic alone.

Usually, only the largest airports can afford several runways, and legacy airlines have been more attached to these airports. No airport with 3 or more runways (14 in the sample) has an LCC penetration above the upper quartile for 'LCC share'. Moreover, at 11 of these airports the market share of LCCs is below the lower quartile (25.4%), and only in Barcelona (BCN) and Cologne-Bonn (CGN) it is above 50%.

v) Ground transport

The accessibility of an airport may clearly enhance its competitive position (Budd et al., 2011). As the literature suggested that LCCs would thrive in secondary airports that are often located further away from the cities they serve, ground transportation is expected to increase airport visibility and accessibility. In our sample we have evaluated the existence of different alternatives for surface access using public transportation:

1. *Local bus*: Public transportation provided by the local transit authority in the area where the airport is located. Usually this involves short to medium distance trips in high capacity buses with regular stops.
2. *Coach*: Medium to long distance buses usually provided by the airport or private companies for express lines to link the airport with cities that are further apart. This includes airport shuttles with regular schedules and routes, but not private shuttles (like hotel shuttles) or shared taxis.

3. *Metro, tramway or light rail*: Rapid or semi-rapid public transportation provided by a transit authority using rail vehicles. More common in airports located close to medium or large cities.

4. *Heavy rail*: Public transportation provided by rail companies. In this group we have included both airports with a rail station at the airport itself and those that offer short shuttle services or transfers (often for free or included in the rail ticket) to a nearby train station (less than 15 minutes away).

5. *High speed rail*: High speed trains services provided at a station located in or within the airport.

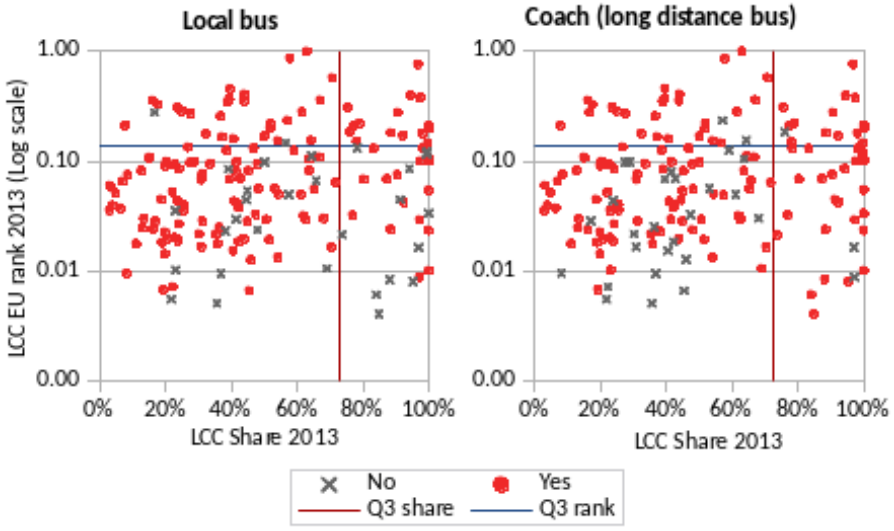

Figure 22: Bus-based surface transportation alternatives at sampled airports and LCC importance.

Figure 22 shows how the first two alternatives (i.e. those based on road access by bus)relate to the importance of LCCs. Most airports provide either local bus or coach services, irrespective of their focus on low-cost services. Most airports without local buses serve tourist destinations or are not located near cities. Only few airports do not provide neither buses nor coaches: Zakinthos (ZTH), Kefalonia (EFL) and Mikonos (JMK) in Greece, and Tirgu Mures (TGM) in Romania.

However, this level of aggregation can hide some specific characteristics for particular airports. Paris Beauvais (BVA) seems to be a good example where the success of the airport is especially linked to surface access. The airport is located in Tillé, 3.5 km northeast of Beauvais and 85 km north of Paris, and is accessible only by road (the nearest train station is in Beauvais). Since the arrival of Ryanair to the airport, back in 1997, the airport operator started a shuttle service to Paris.

In 2005 (last year with detailed data available), this coach service was used by 57.3% of the 1.8 million passengers that year. As it is included in the airport accounts, in 2005 the shuttle accounted for almost 13 million Euro of revenues, or about 49% of the total

revenues. Much more than the 3.5 M€ that the airport received for passenger, landing and handling fees the same year, 1.5 M€ of which reverted to Ryanair (Chambre Regionale des Comptes de Picardie, 2007). The Beauvais – Paris coach is still operated as a monopoly by the airport operator and its price in 2014 is 30% higher than in 2005.

Figure 23 shows the railway-based alternatives for surface access offered by the airports in the sample. The results are quite different from those with the bus-based alternatives, since fewer airports are able to secure investment for rail transportation. Following this line, de Neufville (2006) argued that planners should pay attention to airport access based on "rubber-tired, high occupancy vehicles", especially for airports with a higher focus on low-cost airlines.

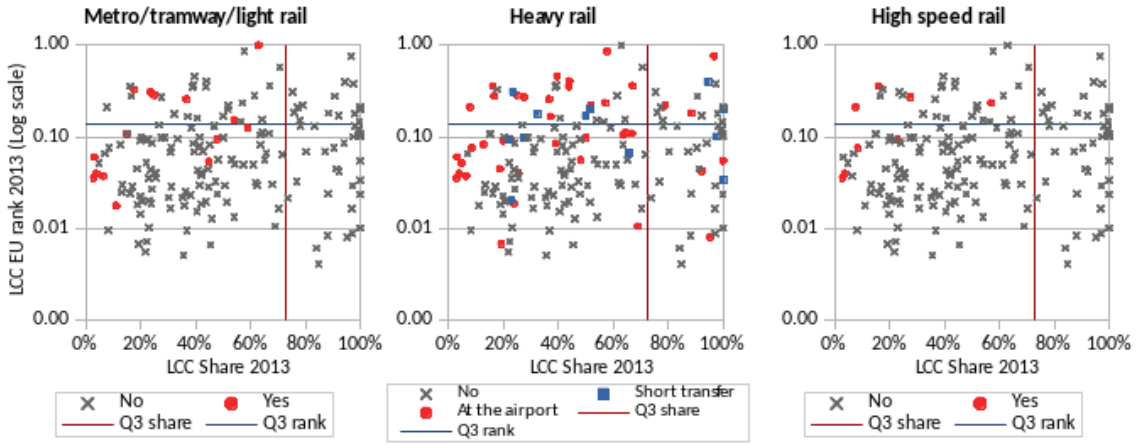

Figure 23: Railway-based surface transportation alternatives at sampled airports and LCC importance.

Only 15 airports in the sample had a rapid or semi-rapid frequent rail service (metro, tram or light rail). None of them had 'LCC share' above the upper quartile, but 6 of them had significant low-cost traffic at European level ('LCC EU rank' above upper quartile). 52 airports had a rail station at the airport premises (8 of which provided high speed rail service) or were connected by short transfers to a nearby train station. Three of these airports (London Stansted – STN, Berlin Schönefeld – SXF and Pisa – PSA) were actually above the upper quartile for both 'LCC share' and 'LCC EU rank'.

Other three airports with heavy rail services are also above the upper quartile for 'LCC share', although they are not as significant at European level: Glasgow Prestwick (PIK), London Southend (SEN) and Lublin (LUZ). Prestwick is actually the only airport in Scotland with a rail station and that is certainly a factor to enhance its competitive position. Traffic there, however, peaked in 2007 and has been in decline ever since. Lublin is a new airport in Eastern Poland with a surface railway station at the centre of its passenger building. Since its opening in December 2012 it has secured a number of routes from different airlines.

For Southend, the newest[11] of the major airports in the London MAS, the rail station seems to be in the core of its strategy. In fact, the station was built and is operated by the airport owner, being also one important source of revenue. The airport promotes surface accessibility and connectivity as its major advantages, with a dedicated rail station that is "100 paces from the terminal" and with "up to eight trains per hour into Central London" (London Southend Airport, n.d.).

5.3.4 Airport congestion

Airport congestion is measured indirectly through delays and capacity utilisation but it is difficult to find consistent, comparable and readily available data for all the airports in the sample. However, European airports are subject to IATA guidelines regarding airport slot coordination, which is a way of managing capacity in airports where it is constrained or limited. By this reasoning, only airports that are congested to some degree should be subject to coordination. We use IATA's slot coordination level as a proxy for the level of congestion at the airports under analysis. There are three levels of slot coordination (IATA, 2013):

1. *Level 1 – non-coordinated*: "airports where the capacity of the airport infrastructure is generally adequate to meet the demands of airport users at all times."
2. *Level 2 – facilitated*: "airports where there is potential for congestion during some periods (...) which can be resolved by voluntary cooperation between airlines."
3. *Level 3 - fully coordinated*: "airports where capacity providers have failed to develop sufficient infrastructure, or where governments have imposed conditions that make it impossible to meet demand."

In the sample, there are 65 airports in level 1, 36 in level 2 and 70 in level 3 (see Figure 24). A large majority of the 43 airports above the upper quartile for 'LCC EU rank' are either fully coordinated (29 airports in level 3) or facilitated airports (10 airports in level 2). Paris Beauvais (BVA), Brussels Charleroi (CRL), East Midlands (EMA) and Basel (MLH) are the only non-coordinated airports in this group. This finding appears to be counter-intuitive as congestion – in particular slot coordination – would make it more difficult for LCCs to enter the busier airports and would hinder high aircraft utilisation.

Nevertheless, slot coordination is a way to manage capacity to keep congestion at tolerable levels and avoid delays that disrupt the regular operations of the airlines. Coordinated airports have not necessarily assigned all available slots throughout the day;

11 It began major commercial operations in the modern era in spring 2012.

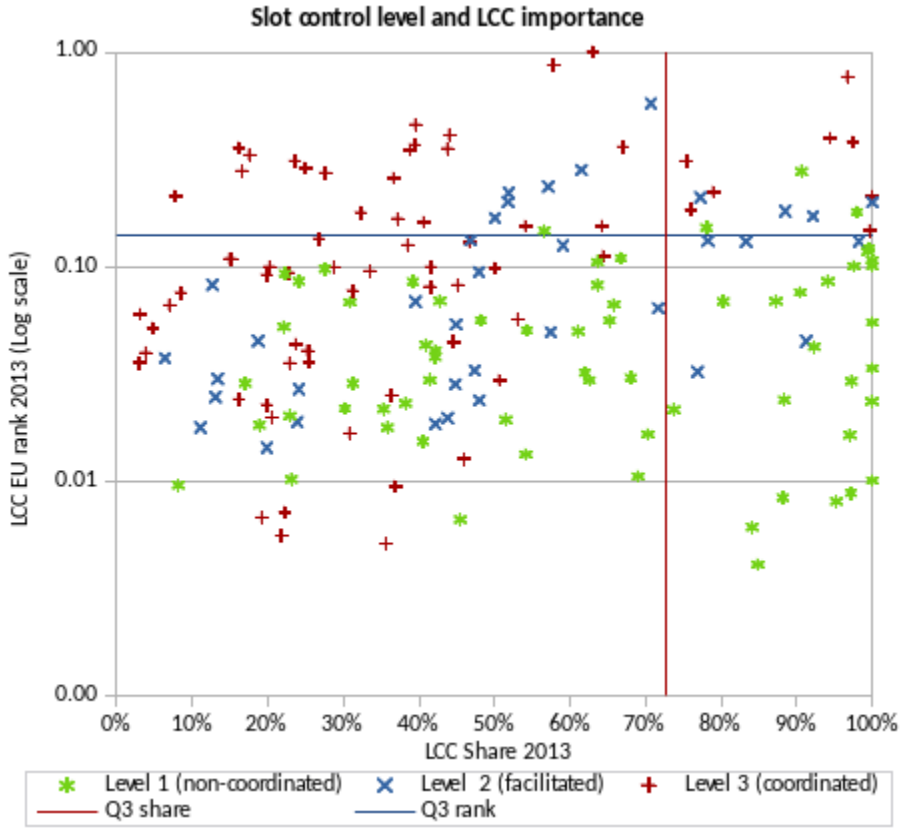

Figure 24: IATA slot control level, as a proxy for air side congestion, and the importance of LCCs at sampled airports.

in which case there would be room for new services from LCCs, particularly during non-peak periods.

Slot coordination is only related to the air side capacity of an airport, usually viewed as the capacity of the runway system in aircraft movements per unit of time (often one hour). Actual capacity in seats per hour depends on the size of the aircraft used by the airlines. LCCs tend to use a fleet of larger aircraft with dense configurations and high load factors, and therefore some “busy” airports may be willing to embrace LCCs in order to grow their passenger numbers without investing in additional facilities.

Moreover, as LCCs gain slots in coordinated airports, coordination schemes will in general prevent competition from potential new entrants. This might be particularly true in the cases where LCCs become the dominant carrier at airports that are effectively constrained in the air side (such as London Gatwick and Rome Ciampino). The convergence of airline business models (see Chapter 4) plays a major role in this aspect. LCCs going upmarket tend to look for higher yield passengers at busier airports, whilst legacy subsidiaries and charter descendants use the same airports where their parent/predecessors already owned slots.

On the other hand, 26 of the 43 airports above the upper quartile for 'LCC share' are non-coordinated. However, this figure includes 13 airports with less than 1 million

passengers in 2013. Therefore, even though LCCs have ample market share at these airports, the airports are too small to be significant in the European low-cost segment... at least until now. But some of them are in the market to compete and grow, like Charleroi in Belgium, or perish, like Forli in Italy.

5.3.5 Airport managerial strategies

LCCs in Europe have significantly contributed to an increase in airport competition (see section 3.5). It might thus be expected that managers take this new situation into account in defining strategies to promote their airports to airlines. We have analysed two strategies associated to airport marketing: airline incentives, and the presence of the airports on route network promotion websites (The Route Shop – www.therouteshop.com, in this case). In addition we have also investigated whether airports had a formal strategy formulation that is documented in publicly available sources.

i) Airline incentives

Airline incentive schemes have gained popularity among airport operators as a means to increase demand and extend their network of destinations (Malina et al., 2012). Warnock-Smith and Potter (2005) showed that "good aeronautical discounts" was an important factor in the LCC's choice of airports, but this practice is now widely adopted irrespective of the airport focus on low-cost traffic (Allroggen et al., 2013). We found 74 airports in our sample that openly publicise a formal scheme of incentives or special discounts to airlines (e.g. for route development), and a further 31 that agree to provide support or rebates (directly or through third parties) "on a case-by-case basis" or "at the discretion of the airport management".

There is no discernible pattern among the airports that implement incentive schemes when considering the relative importance of LCCs at the airport. Perhaps the only commonality is geographic, as Malina et al. (2012) pointed out: most Greek airports do not provide incentives (only Athens International Airport, the only public-private airport in Greece, offers an extensive incentive program), as well as a large proportion of Italian airports.

Spanish airports (which Malina et al. (2012) also found not to provide incentive programs) now offer incentives as AENA decided to implement a new program by the end of 2013. The British airports in the sample do not publish the specific conditions of their programs, but they have "played a key role in the introduction of formal, specific (long-term) contracts between the airport and downstream airline customers." (Starkie, 2008)

ii) The Route Shop

The Route Shop is an industry-specific website that allows airports to promote their route network opportunities (i.e. the destinations that could be served by an airport and are currently missing from their network) mainly for airline representatives to study. 96 of the airports in the sample publish their route development opportunities on the website. However, there is no clear correlation between this variable and those related to the importance of LCCs at the airport.

iii) Strategy

We have analysed whether there is a formal, public, and documented definition of the airport's strategy, but found only 16 such cases in the sample (11 of these airports had more than 15 million passengers in 2013). In none of these 16 airports 'LCC share' is above the upper quartile (London Gatwick has the higher LCC penetration – 57.8%, followed by Milan Malpensa – 43.8%). In most cases, their process of strategy formulation does not appear to be particularly linked to LCCs.

In the case of Gatwick (LGW) "the Company's strategy for the airport is to transform the passenger experience and improve efficiency for the airlines and the airport itself, thereby improving its competitiveness in the London airport market" (Gatwick Airport Limited, 2012). For the airlines, the focus of the airport strategy seems to be more on efficiency than in costs alone. Thus "understanding the airlines' goals" is crucial to help them grow at the airport, which is one of six strategic priorities for Gatwick. Commercial partnerships, in the form of long-term agreements with the airlines, are also crucial for this purpose, and the LCCs appear to be better prepared to engage in such contracts. In this sense, airlines such as easyJet or Norwegian have an strategy that aligns with the strategic focus of the airport. On the other hand, the airport strategy also aims at attaining the preference of the passengers independent of the carrier they choose.

5.3.6 Airport route network

Three variables describe the route network of the airports in the sample: whether the airport offers scheduled long haul (e.g. intercontinental) destinations; the total number of direct non-stop destinations available at the airport; and whether the largest carrier at the airport is one of the identified LCCs.

i) Long haul

Long-haul services are scarcely offered at airports with significant LCC penetration. Only 4, out of 43 airports that scored above the upper quartile for 'LCC share', offer at most 2 low frequency long-haul flights. This confirms the stronger focus of European LCCs on short to medium-haul routes.

ii) Non-stop destinations

The total number of destinations is mostly related to the airport size as, if the market exists, destinations will naturally be made available (bilateral agreements aside). In general terms, 37 airports from the sample offer 100 destinations or more. 16 of these airports are main or secondary hubs for a 'legacy' carrier (usually located in the capital of the country of registration). Only in 2 of these 37 airports LCCs have a market share above the upper quartile of the distribution: London Stansted (STN), the largest base of Ryanair; and Bristol (BRS), an important base for easyJet and Ryanair. Another 6 airports have an 'LCC share' above 50%: Barcelona (BCN), the main base of Vueling; Birmingham (BHX), the main base of Flybe; Cologne-Bonn (CGN), the main base of Germanwings; Edinburgh (EDI); London Gatwick (LGW), the main base of easyJet; and Istanbul Sabiha Gokcen (SAW), the main base of Pegasus.

iii) Largest carriers

Rather obviously, all the airports with an 'LCC share' above the upper quartile have an LCC as the largest carrier (see Figure 25). Perhaps more surprisingly, from the 43 airports where 'LCC EU rank' is above the upper quartile, 12 are not dominated by LCCs. Oslo Trop (TRF) is the airport where LCCs have the largest market share (66%) but where an LCC is not the single largest carrier. There, Widerøe offers 28% of the seats and Norwegian 26%, but if we consider the load factors, Norwegian would lead in terms of passengers. As Widerøe operates only smaller turboprops, it offers almost three times as much departures as Norwegian.

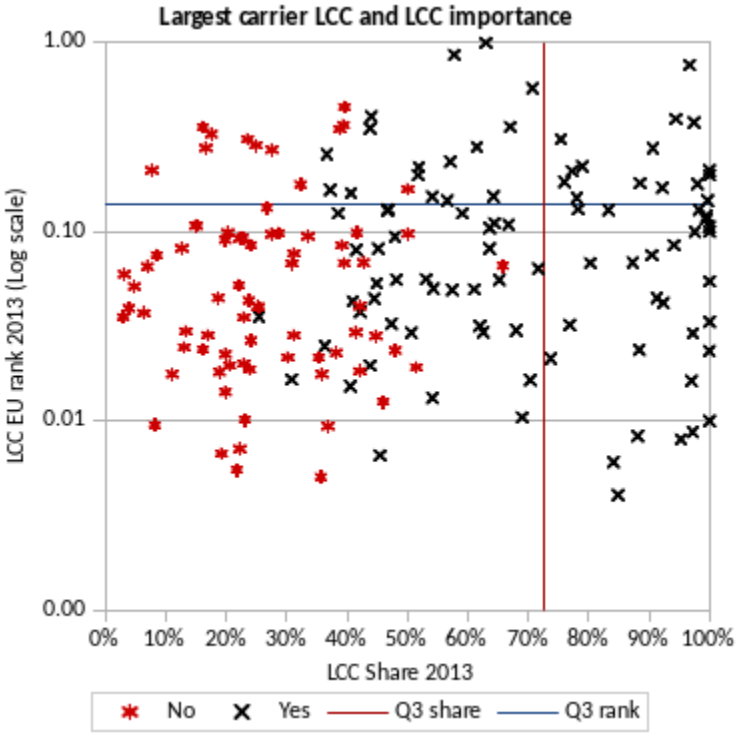

Figure 25: Sampled airports where an LCC is the largest carrier, and the importance of LCCs.

5.3.7 Airport financial conditions

Comparing airports in financial terms is not easy. We have looked at the proportion of aeronautical and non-aeronautical revenues, and whether the airport was profitable (in terms of net profit). However, in the sample we found data regarding non-aeronautical revenues for only 99 airports, and for 101 airports regarding net profits. For many of those airports, the figures concern the parent airport group companies, and not the individual airports. Moreover, financial data is not available for the same year in all cases, the definition of fiscal years may also differ and, it is obviously reported in the local currency of the airport operator. Therefore we consider these limitations do not allow for a fair comparison among airports, neither for an analysis of the relationship of this variable with the variables that measure the relative importance of LCCs.

i) Non-aero revenues

There is a great difference in the way airports report "other income", i.e. income coming from various activities or items (telecommunications, energy, consultancy, government grants, security or even ground handling, just to cite some examples) that affects the balance of aviation and non-aviation related revenues. In any case, from the data available, non-aeronautical revenues averaged 37%, ranging from as little as 15% in the case of Belgrade Airport (BEG) in 2012 to 71% for Kaunas Airport (KUN) in the same year. 11 airports reported 50% or more of their income from non-aviation activities.

ii) Profitability

As explained, the available data is not comparable and in many cases cannot be traced back to individual airports. Nevertheless, from the sample, 82 airports reported operating profits (most data is for 2011 or 2012) and 77 reported net profits.

5.3.8 Airport operational conditions

In what concerns operational processes at the airports, we have focused on *aircraft turnaround* as literature suggests that it is key for LCCs to have a quick performance on the ground as a way to increase aircraft utilisation and revenues (see section 2.4).

i) Turnaround time

We computed scheduled turnaround times using historical data from the aircraft tracking website Planefinder.net (Pinkfroot, n.d.) to identify the rotations performed by tracked aircraft during September 2013. Given the scope of the sample, we focused on turnarounds performed by 14 European airlines. Seven Full-Service Carriers, among the largest in Europe: Air Berlin, Air France, British Airways, Lufthansa, Iberia, KLM and Turkish Airlines. And seven Low-Cost Carriers, also among the largest in Europe: easyJet, Germanwings, Norwegian, Pegasus, Ryanair, Vueling and Wizz Air.

As turnaround times depend on aircraft size and these airlines have different fleets, and different aircraft types in the case of FSC fleets, we included only the rotations[12] performed with aircraft from the Airbus A320 and Boeing 737 families. In total, we were able to identify over 139,000 individual turnaround times performed by the 14 airlines during the whole month (see Table 11 for sample size per airline). We used the results to compare turnaround practices between airlines and turnaround performance at most of the airports in the sample.

Table 11: Valid turnarounds identified for each airline (out of one month of operations with A320 and B737 type aircraft).

Airline	Type	Computed turnarounds
Lufthansa	FSC	15,959
Air France	FSC	13,203
British Airways	FSC	10,706
Turkish Airlines	FSC	8,096
Air Berlin	FSC	8,061
KLM	FSC	5,610
Iberia	FSC	2,573
easyJet	LCC	24,044
Ryanair	LCC	23,985
Norwegian	LCC	8,899
Vueling	LCC	7,225
Germanwings	LCC	4,396
Pegasus	LCC	3,294
Wizz Air	LCC	3,294
Total turnarounds		139,345

Regarding the airlines, Figure 26 shows there is a clear difference in the turnaround times scheduled by LCCs and FSCs. The weighted average turnaround time (i.e. the average time considering sample size) for LCCs was of 37.4 minutes (standard deviation of 17.0 min). FSCs had a weighted average time of 58.0 min (standard deviation of 19.8 min). All LCCs were on average faster than FSCs and the standard deviations were similar, around 20 min, for all the airlines, yet easyJet was more regular (standard deviation of 15 min). Ryanair was on average the fastest airline on the ground, followed by easyJet. Turkish and KLM were the slowest.

The mode in Figure 26 indicates the scheduled turnaround that appears more often in the set of data for every airline (theoretically it is the value that is most likely to be sampled at random). This value may also represent how confident are airlines on their own efficiency and that of the airports they use. Clearly there are more nuances, for instance the need to align the schedules within a hub-and-spoke operation (especially for

12 A rotation is the sequence of flights (legs) scheduled in a given period of time (often, but not necessarily, a day for short-haul operations) for a particular aeroplane across the airline's destinations. For instance: in a day's rotation a given plane may depart its base at Paris Orly shortly before 7:00 am for a flight to Gran Canaria, then perform the flight back to Paris to depart again from the base at Orly to Lisbon and back to finish the day at Paris Orly around 11:00 pm. That plane will be parked at Orly for the night until the start of the next day's rotation. Following an exploratory analysis during one week, we considered different rotations if the aircraft stayed on the ground over 120 minutes.

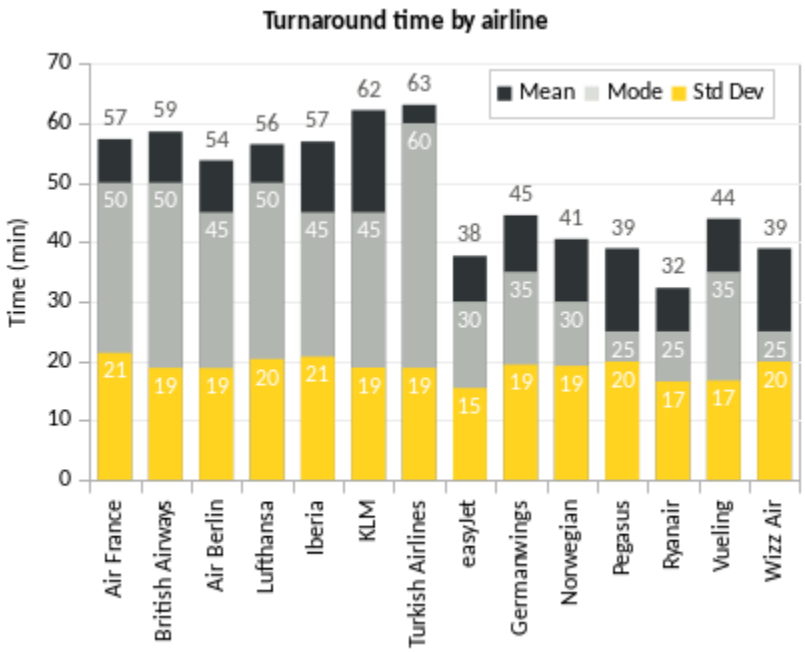

Figure 26: Average turnaround times by airline for all the rotations analysed.

FSCs), but we consider this is a good proxy. FSCs' most common turnarounds were 45 and 50 minutes, whilst for LCCs they were 25, 30 and 35 minutes.

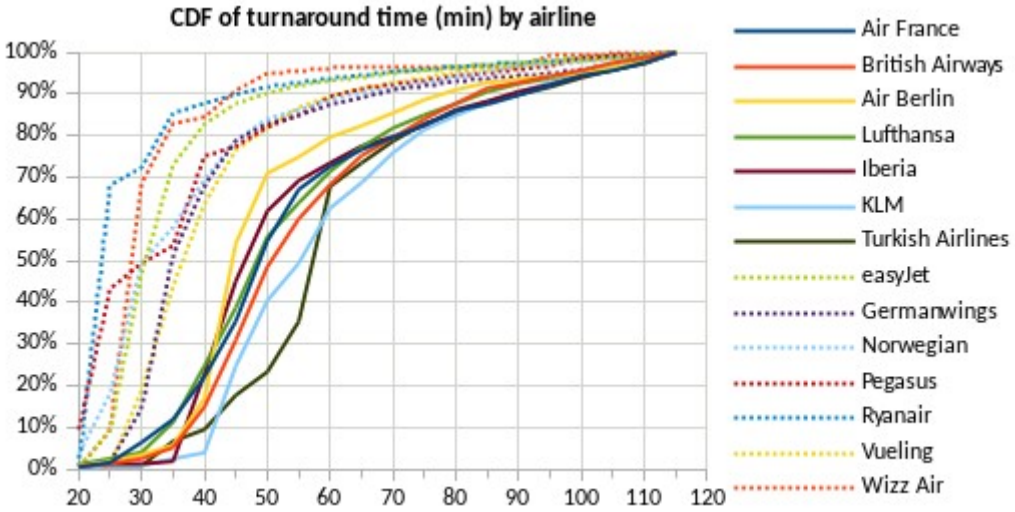

Figure 27: Cumulative Distribution Function of turnaround times by airline.

Figure 27 shows how turnaround times are distributed for the different carriers. All LCCs were able to perform at least 60% of their turnarounds in less than 40 min, whilst FSCs required one hour for the same level. Interestingly, Ryanair is the only airline that schedules most turnarounds at the mode value (67.5% of turnarounds at 25 min). EasyJet was the most regular with 74% of its turnarounds performed between 30 and 40 min. Air France and Lufthansa had a very similar performance and, in general, FSCs tend to schedule fewer turnarounds at the mode value.

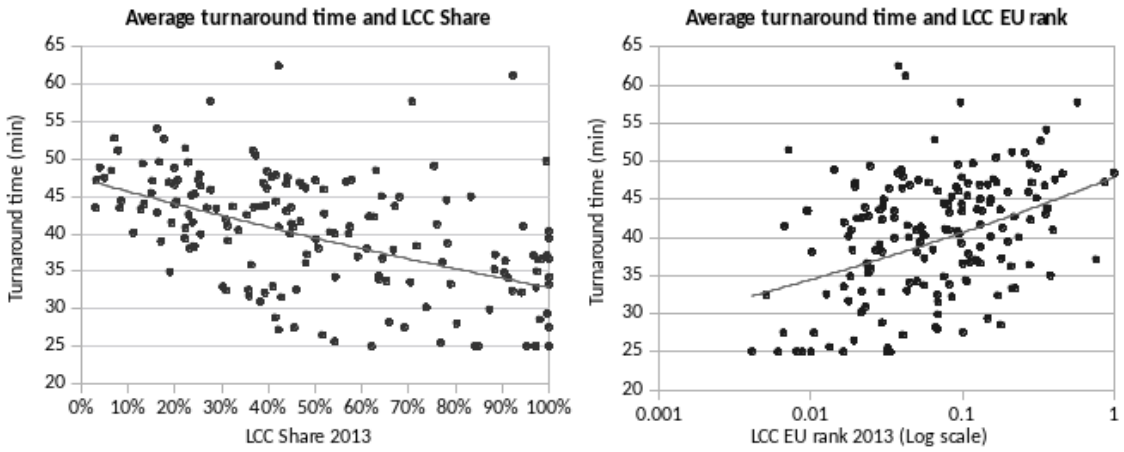

Figure 28: Average turnaround time for the 14 airlines analysed, in 168 of the 171 airports in the sample, and the importance of LCCs at the airport.

As for the performance at individual airports, Figure 28 shows the average turnaround times for all the airlines (out of the 14 selected for turnaround analysis) that operate in each of 168 airports in the sample[13]. Airports where LCCs have higher market share tend to reflect their quicker turnaround times (Figure 28 left). However, as the relevance of the airport for low-cost services at European level increases, the average turnaround time tends to increase (Figure 28 right).

This seems counter-intuitive, but in fact most of the airports that rank above the upper quartile for 'LCC EU rank' have an LCC market penetration that is below the upper quartile for 'LCC share' (see Figure 13), i.e. at many of those airports there are FSCs that are likely to perform slower aircraft turnarounds. Moreover, the behaviour of a given carrier may differ depending on the airport.

Figure 29 shows the average turnaround times per carrier at some selected airports. FSCs (left part of the figure) clearly perform slower turnarounds than LCCs (right part of the figure) at the same airports. But they also seem able to perform quicker turnarounds when not in their main airports. KLM, for instance, is the slowest at Amsterdam (AMS) and Iberia (IBE) is the slowest at Madrid (MAD), but they both perform much quicker in Venice (VCE).

LCCs also show some variability at different airports, and somehow follow a similar pattern. Vueling (VLG) is the slowest at its home in Barcelona (BCN), even slower than some FSCs; likewise easyJet (EZY) turns slower in Gatwick (LGW) and Luton (LTN) than in other airports; as Ryanair (RYR) does in Stansted (STN). This might be related with additional operations being performed at the bases, but we could not gather enough information to study this situation in more detail. The infrastructure offered at each airport might also play a role in such differences. Ryanair, for instance, turns quickly at

13 There were no valid rotations for the airlines analysed in the airports of Grenoble (GNB) in France, Timisoara (TSR) in Romania, and Zakinthos (ZTH) in Greece.

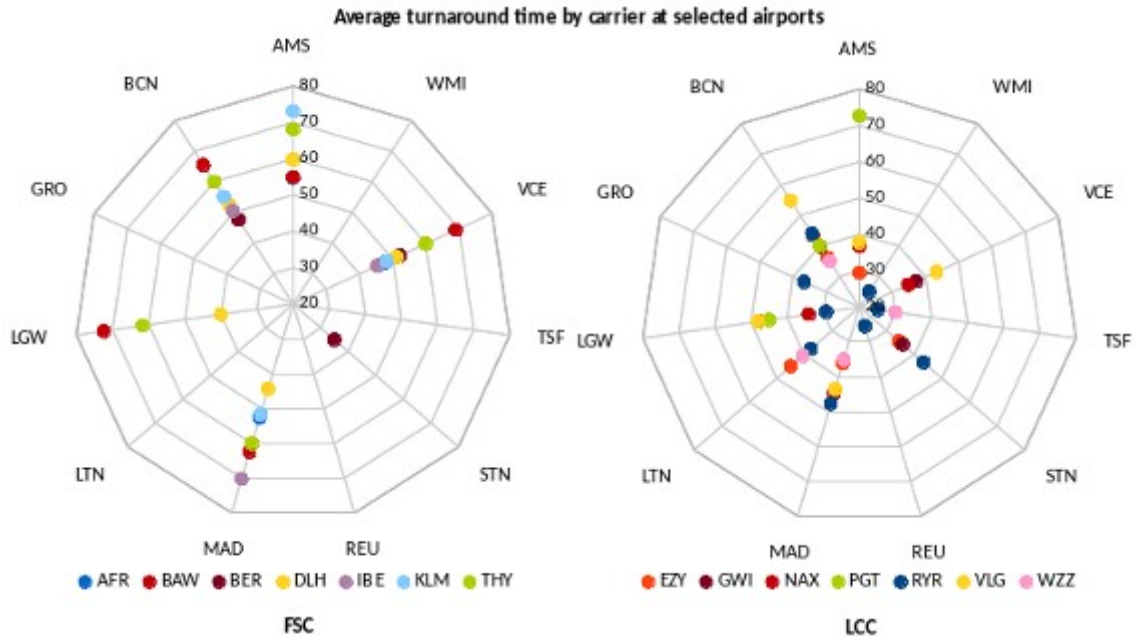

Figure 29: Average turnaround time by carrier at some airports. Left - FSCs: AFR: Air France, BAW: British Airways, BER: Air Berlin, DLH: Lufthansa, IBE: Iberia, KLM: KLM, THY: Turkish Airlines. Right – LCCs: EZY: easyJet, GWI: Germanwings, NAX: Norwegian, PGT: Pegasus, RYR: Ryanair, VLG: Vueling, WZZ: Wizz Air.

Barcelona Reus (REU), Venice Treviso (TSF) and Warsaw Modlin (WMI), all of them single-runway airports with simple facilities; but turns much slower in Madrid (MAD) and Barcelona (BCN).

Yet, beyond infrastructure, the operational strategy of the carriers seems even more important. EasyJet (EZY), for instance, performs very quick turnarounds (29 minutes on average) at Amsterdam Schiphol (AMS), an airport with a rather complex runway system, and quicker than Ryanair (RYR) in Barcelona (BCN) and Madrid (MAD), where Wizz Air (WZZ) also turns quickly compared to all the other carriers.

In fact, there are some specific aspects that require further study and cannot be approached in a comprehensive way within the scope of this work and with the available data. For instance, the way the turnaround differs for aircraft that are based at a given airport, and, more importantly, whether the actual turnaround times differ from the scheduled ones.

5.4 Capabilities of European 'low-cost airports'

The analysis in the previous section shows it is quite difficult and possibly irrelevant to define a set of precise characteristics to distinguish airports that are 'low-cost' from those that are not. The point is there is no single element that could be considered essential or indispensable for an airport to guarantee (or to prevent) low-cost services, at least in what concerns airport infrastructure.

Over 20 years have passed since the inception of the low-cost model in Europe. At this point, airlines and airports seem able to trade off some of the original elements of their business models to pursue growth. Indeed, the attitude of airport managers towards LCCs is crucial for the development of current trends. The way managers execute their intended strategy or implement business models clearly determines the way they consider airline partners. And it is precisely in the airport-airline interaction that trade-offs are made. In fact, this could help understand the recent moves of Ryanair in Lisbon, Rome Fiumicino and Brussels Zaventem, airports that the airline previously had avoided.

In general terms, even though LCCs clearly dominate at some airports, many other airports with lower LCC penetration generate many more low-cost passengers to the European aviation market. Our approach, that focused not only on the relative importance of LCCs at individual airports, but also on the relative importance of individual airports in the European low-cost segment, highlights this finding. This shows that, as the segment matures and evolves, LCCs impact most major and secondary airports in Europe. And, given that the market is usually larger at major airports, this impact is, for scale reasons, as important as the impact airlines had before on smaller airports.

This said, the paradigm for airport planning and design can be challenged at all airports. To set a new paradigm it is crucial to consider the ascendency of LCCs, the differences among them, and the way they use airports. Even if it is not possible to strictly differentiate 'low cost' from other airports, it is worth considering particular developments on those airports in which LCCs are somehow consolidated.

There are 28 airports in our sample at which LCCs have a market share over 72.7%, or above the upper quartile for 'LCC share' (i.e. they handle almost exclusively low-cost traffic); 28 other airports that appear above the upper quartile for 'LCC EU rank' (i.e. they handle a significant majority of the European low-cost traffic); and 15 additional airports that score above both quartiles (i.e. they are dominated by LCCs and have a relevant participation in the low-cost segment at European level). This last group could be regarded as “the most low cost airports” in Europe (although they are not the top 15 airports for LCC seats offered in Europe).

If we match these groups of airports with the LCCs that use them (in 2013), correspondingly grouped as described in Table 6 ('originals', charter descendants and legacy subsidiaries), as in Figure 30, we find interesting trends:

1. airports in the top 25% for 'LCC share' are particularly attached to the 'originals' LCC, especially Ryanair (FR) and Wizz Air (W6);

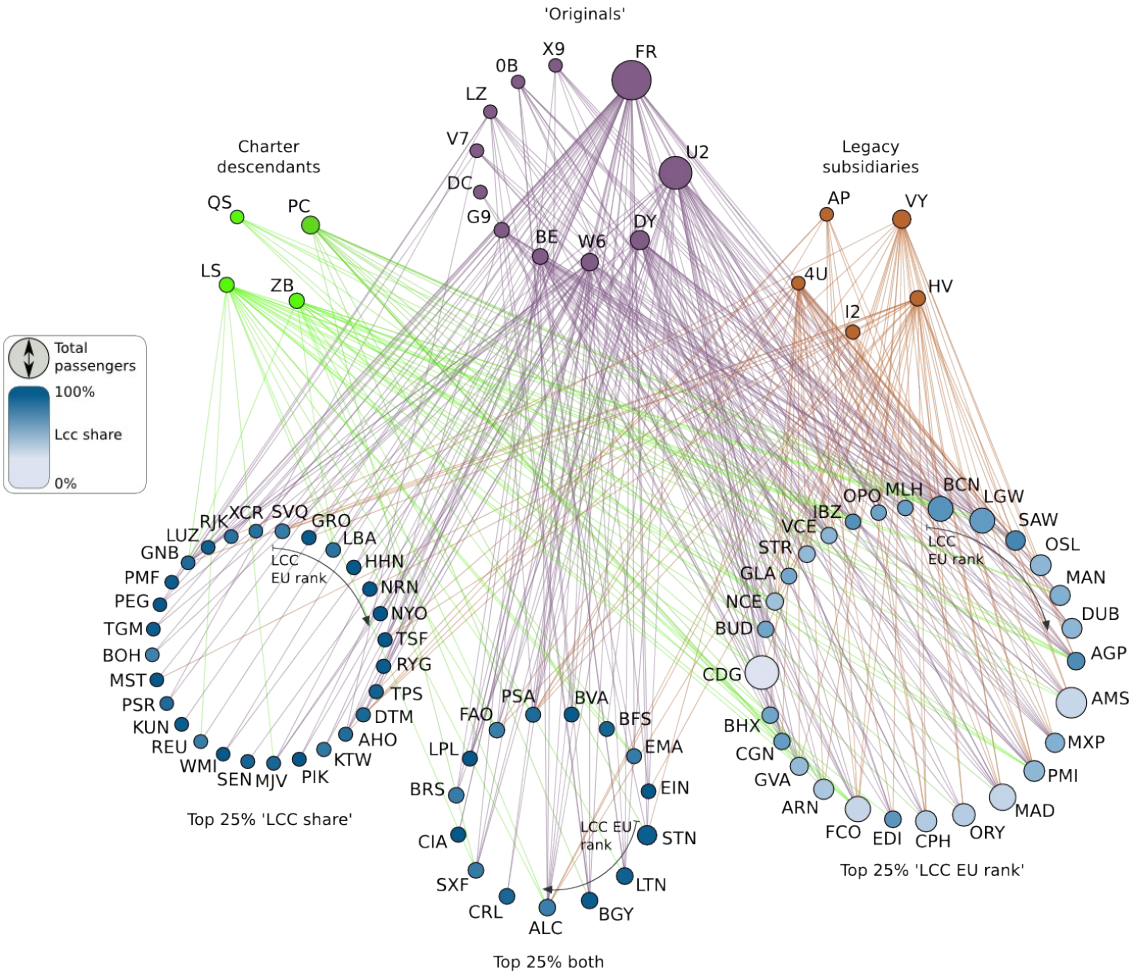

Figure 30: LCCs (top) serving the airports ranked above the upper quartile for 'LCC share' (bottom left), 'LCC EU rank' (bottom right) and for both variables (bottom centre), in 2013.

2. 'legacy subsidiaries' LCC are particularly attached to the airports in the top 25% for 'LCC EU rank' (which are also amongst the largest airports in the sample), as well as 'charter descendants';

3. airports in the top 25% for both variables are more linked to the 'originals', but mainly to the most originals of them – Ryanair (FR), easyJet (U2) and Wizz Air (W6);

4. easyJet (U2) and Norwegian (DY), known for their hybridisation, serve most of the airports in the top 25% for 'LCC EU rank', whilst Ryanair (FR) is present in only half of them, but it serves all airports in the top 25% for 'LCC share'.

Looking at the recent evolution of these airports, as in Table 12, reveals another interesting perspective. Total seats offered in the 15 “most low-cost” airports (those above the upper quartile for both variables) increased 56% between 2004 and 2013, and the number of seats offered by LCCs grew 73% over the same period, but LCCs were already consolidated in these airports by 2004 and their market share grew only 8.8 percent points (pp). For the airports in the top 25% by 'LCC EU rank' (not including the previous

15) the overall growth of seats offered in the same period was 24%, but the growth of LCC seats reached 229% and the market share of LCCs rose 22.1 pp. The airports in the top 25% by 'LCC share' (again not including the first 15) experienced an overall growth rate of 70%, also between 2004 and 2013, but contrary to the first group, LCCs were not as consolidated in 2004 and their market share grew 28.7 pp.

Table 12: Evolution of LCC capacity between 2004 and 2013 in the airports above the upper quartile for 'LCC share' and 'LCC EU rank'.

Airport group	Average LCC Share 2004	Average LCC Share 2013	Average growth (all carriers)	Average growth (LCCs)
15 airports above upper quartile for 'LCC share' and 'LCC EU rank'	81.0%	89.8%	56.2%	73.2%
28 airports above upper quartile for 'LCC EU rank'	13.3%	35.4%	23.8%	228.9%
28 airports above upper quartile for 'LCC share'	63.5%	92.2%	70.1%	147.0%

These trends suggest some general dynamics for each group of airports, although all airports in every group may not match the general trend[14]:

1. those airports in the top 25% for both variables (i.e. the “most low cost” ones) were able to attract LCC growth early on. Or in other words, they were the 'originals' (on the airport side) that shared the risk to explore the segment and were generally rewarded with long-lasting relationships with the initial LCCs;
2. those airports in the top 25% for 'LCC EU rank' were 'legacy' airports in which, at first, 'legacy' carriers reacted to market developments in the low-cost segment and established the bases for their LCC subsidiaries; and then the airports themselves reacted as well (also enticed by competition from the airports in the previous group) by more actively attracting other LCCs, initially those with a more hybrid proposition;
3. those airports in the top 25% for 'LCC share' are mostly smaller regional airports that, encouraged by the first group, saw an opportunity to pursue growth by actively catering for LCCs, particularly those most attached to the original low-cost model.

5.4.1 Desirable attributes for a (low cost) airport

All things considered, there are three aspects that appear to be especially interesting for airports to embrace low-cost services: to provide (or allow) quick aircraft turnaround times; to charge low (aeronautical) fees; and to provide access to low fares for passengers. Yet, in practical terms, these aspects are useful to any type of airline.

14 The next chapter explores and expands these dynamics in more detail with specific data for a selection of case studies.

Quick aircraft turnaround helps airlines increase aircraft utilisation. Nonetheless, the performance of the turnaround process depends on several actors with different priorities: more importantly, the airline itself, but also the air traffic control (in all phases: en-route, approach, tower, ground), ground agents, airport operations and even the passengers. The role of the airport, as the stage where these actors meet, is to encourage a smooth coordination between them. Moreover, additional effort should be made to:

1. minimise aircraft waiting time by optimising resources and processes (particularly those related to the runway system) in order to avoid hold patterns, reduce taxiing, and guarantee gate and runway availability;
2. allow an efficient (dis)embarking process by – whenever possible and desired by the airline allowing on-foot (dis)embarking or using transporters or jet bridges to optimise hold queues;
3. provide an efficient handling process when the airport is also the handler;
4. provide incentives for quick turnarounds by offering time-based discounts (lower fees if the aircraft turns in less than 30 minutes, for instance) or extra fees (if the turnaround takes longer than 30 minutes, for instance).

Low (aeronautical) fees ultimately help airlines keep a low cost structure. Reductions in published airport fees is not the only way to tackle this issue. It is also possible to:

1. provide performance–based discounts through route development incentives and discount schemes for traffic stimulation on existing routes;
2. establish common objectives and understanding regarding charges, services and infrastructure development on specific airport-airline long-term agreements;
3. offer differentiated pricing (time- or facilities-based) and simplified fees/charges structure.

Finally, airports should not focus exclusively on the needs of the airlines. It is also important to provide access to low fares so that passengers can be attracted. In fact, many airports already do this by exploring alternatives in order to:

1. increase the number of destinations reachable directly (non-stop) from the airport;
2. provide adequate connections with ground transportation (e.g., coach-air travel) and cheap parking;
3. enlarge the business scope of the airport, i.e. put back the “frills” with services targeted at passengers;

4. use social media, and on-line and off-line marketing, to provide potential passengers with the adequate information.

5.5 Summary

The airports that LCCs use in Europe have such diverse characteristics that some of the elements traditionally considered in the literature to identify 'low cost airports' may not be essential for actual low-cost operations. This chapter argued that it is not practical neither useful to sharply distinguish between two types of airports ("low cost" and "not low cost"). Such classification is less relevant if we take into account the changing attitude of airport management towards LCCs and the existence of flexibility to adapt to changing requirements and keep up with the evolution of airline business models. These two aspects are even more important in the cases where infrastructure is already built, for instance when LCCs move to the bigger airports.

LCCs evolve and they do not behave as they did when they were start-ups, and therefore it may not be reasonable to state that LCCs *need only* a particular kind of infrastructure. Alternatively, airports and airlines may agree on some trade-offs to explore market opportunities. In this sense, we have proposed (in general terms) three interventions that might be desirable for airports targeting at LCCs but that are, in fact, applicable to any airport: to provide (or allow) quick aircraft turnaround times; to ultimately charge low (aeronautical) fees; and to provide access to low fares for passengers. We have also described various ways to contribute for the implementation of these ideas.

The study presented in this chapter was based on a transversal analysis for the situation of airports and LCCs in 2013. A more dynamic (i.e. longitudinal) analysis is crucial to better understand how airports and airlines adapt to market developments. The next chapter presents a quantitative research on the evolution of the low-cost segment in a set of European airports, along with a conceptual model to generalise the findings.

6 Dynamic evolution of airports

The previous chapter provides a snapshot of the current state of European airports in terms of the low-cost segment. But a dynamic analysis is necessary to understand the impact of LCCs on airports, in strategic terms. Therefore this chapter presents a longitudinal analysis designed to identify relevant trends in the evolution of some airports, and an attempt to generalise the results.

The analysis is primarily based on airline capacity (available seats) data, from the Innovata database (IATA, n.d.) aggregated for the years 2004, 2008, 2012 and 2013. In the case of Spanish airports we have also used the data provided by AENA Aeropuertos, the airport operator, in terms of passengers per airline for every year between 2005 to 2013 (AENA, 2014). In the case of British airports, we complemented capacity information with passenger traffic data, aggregated at the airport level (i.e. not by carrier) between 1998 and 2013 (CAA, 2014).

6.1 Case studies

The measures of relative importance of LCCs that guided the analysis in the previous chapter ('LCC share' and 'LCC EU rank') provide a starting point for the selection of a second sample of airports to be used in further case studies. Table 13 shows the top 20 airports in Europe in terms of LCC seats in 2013 (i.e. those that rank the highest for 'LCC EU rank'). In 5 of these airports the market share of LCCs is above the upper quartile of the sample distribution ('LCC share' above 72.7%). In addition, most of these airports (16 out of 20) belong to a Multi-Airport System (MAS) in which there is one or more airports with a significant proportion of LCC services.

Considering all the airports in these Multi-Airport Systems, and the 4 additional airports that (as Table 13 shows) do not belong to a MAS, we selected a second sample that

contains 42 airports (see Table 14). The fact that most of these airports belong to a MAS is quite useful for the analysis with airports where LCCs have had different levels of consolidation during the time frame considered in the study.

Table 13: Top 20 airports in the sample by 'LCC EU rank' in 2013.

Rank	Airport	LCC Seats	Non-LCC seats	LCC EU rank	LCC share	MAS	Airports in the MAS with LCC share above the upper quartile (72.7%)
1	BCN	13,815,371	8,113,052	1.00	63%	YES	GRO, REU
2	LGW	11,944,131	8,726,448	0.86	58%	YES	STN, LTN, SEN
3	STN	10,528,169	360,262	0.76	**97%**	YES	STN, LTN, SEN
4	SAW	7,938,035	3,287,782	0.57	71%	YES	
5	OSL	6,318,552	9,645,007	0.46	40%	YES	RYG
6	MAN	5,635,331	7,160,270	0.41	44%	YES	LPL, LBA
7	LTN	5,470,035	322,546	0.40	**94%**	YES	STN, LTN, SEN
8	BGY	5,237,927	139,048	0.38	**97%**	YES	
9	DUB	5,082,701	7,808,861	0.37	39%	NO	
10	AGP	4,972,711	2,445,424	0.36	67%	NO	
11	AMS	4,935,170	25,583,377	0.36	16%	YES	EIN
12	MXP	4,882,400	6,261,598	0.35	44%	YES	BGY
13	PMI	4,823,954	7,588,499	0.35	39%	NO	
14	MAD	4,550,378	21,335,025	0.33	18%	NO	
15	ORY	4,267,430	13,840,985	0.31	24%	YES	BVA, XCR
16	ALC	4,265,473	1,391,481	0.31	**75%**	YES*	MJV
17	CPH	3,960,907	11,904,071	0.29	25%	YES	
18	EDI	3,889,613	2,434,101	0.28	62%	YES	PIK
19	FCO	3,841,415	19,241,519	0.28	17%	YES	CIA
20	CRL	3,832,317	395,658	0.28	**91%**	YES	

* Regional MAS

Table 14: Airports selected for detailed dynamic analysis.

IATA Code	Airport	MAS
ALC	Alicante (Elche)	Alicante
MJV	Murcia San Javier	Alicante
AMS	Schiphol	Amsterdam
EIN	Eindhoven	Amsterdam
RTM	Rotterdam	Amsterdam
BCN	El Prat	Barcelona
GRO	Gerona	Barcelona
REU	Reus	Barcelona
BRU	Brussels Zaventem	Brussels
CRL	Charleroi	Brussels
CPH	Copenhagen (Kastrup)	Copenhagen
MMX	Malmo	Copenhagen
EDI	Edinburgh	Glasgow
GLA	Glasgow Intl	Glasgow
PIK	Prestwick	Glasgow
IST	Ataturk	Istanbul
SAW	Sabiha Gokcen	Istanbul
LCY	London City	London
LGW	Gatwick	London
LHR	Heathrow	London
LTN	Luton	London

IATA Code	Airport	MAS
SEN	Southend	London
STN	Stansted	London
LBA	Leeds Bradford	Manchester
LPL	Liverpool	Manchester
MAN	Manchester (Ringway)	Manchester
BGY	Bergamo	Milan
LIN	Linate	Milan
MXP	Malpensa	Milan
OSL	Oslo (Gardermoen)	Oslo
RYG	Rygge	Oslo
TRF	Torp (Sandefjord)	Oslo
BVA	Beauvais	Paris
CDG	Charles de Gaulle	Paris
ORY	Orly	Paris
XCR	Vatry	Paris
CIA	Ciampino	Rome
FCO	Fiumicino	Rome
AGP	Malaga (Costa del Sol)	-
DUB	Dublin	-
MAD	Madrid Barajas	-
PMI	Palma de Mallorca	-

The following sections describe the evolution of traffic at these airports with a particular focus on the low-cost segment. Moreover, for every case, we have also analysed

major developments related to infrastructure expansion and, to the extent allowed by publicly available information, we have studied airline decisions or events that impacted the airports (such as bankruptcies, mergers, change of strategy focus, start-ups, bases, etc.). Also, the airports have been grouped by MAS, in order to allow an easy analysis of the impacts that events in one airport may have on the other airports of the MAS.

6.1.1 Alicante MAS

Alicante is located in the Costa Blanca along the Spanish Mediterranean coast, making it a popular destination for tourists in Europe. The MAS is formed by Alicante Elche (ALC) and Murcia San Javier (MJV) airports. ALC is 9 km southwest of Alicante and it is the main airport serving the city. MJV is a military base that also serves civilian traffic, 27 km southeast of the city of Murcia and 85 km southwest of ALC, and conveniently located next to the Costa Calida (the coast in the region of Murcia, next to Alicante). As a matter of fact there is a third brand new airport that could belong to the MAS, the Region de Murcia International Airport (RMU), but it has not been used at all since construction ended in 2012 (this is obviously an interesting issue to analyse).

Air traffic in the region is highly linked to tourism, and both airports have been developed as a result of the increase in the number of tourists. ALC has been the main airport for Alicante since 1967. MJV opened to civilian traffic around the same time, yet it was only in the 1990's that its traffic became significant, after a passenger building opened. In recent times, traffic at these airports has been significantly affected by the economic recession in Spain, as Figure 31 shows.

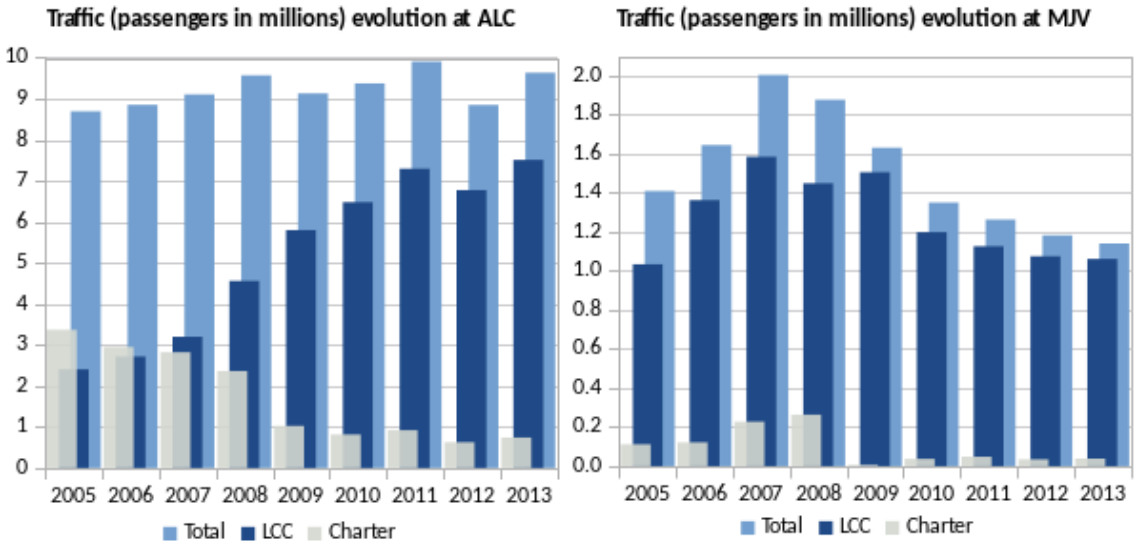

Figure 31: Traffic evolution at Alicante MAS. Left: Alicante Airport. Right: Murcia San Javier Airport. Source: AENA.

At ALC, LCCs have gradually replaced charters as the main airlines, but total traffic has not grown dramatically. EasyJet was, for some time, the main carrier at the airport (see

Figure 32) after acquiring Go (an LCC spin-off of British Airways) in 2002 and taking over its operations, including the routes at ALC, since 2003. Yet the growth of LCCs at the airport became more expressive when Ryanair started flying there in 2007 and after having opened a base there in November that year. Although total traffic fell in 2009 due to the economic downturn, Ryanair continued to grow until a dispute with the airport operator over the use of jet bridges in 2011-2012 (Illescas, 2012).

According to media reports, the airline threatened to reduce its operations drastically because it considered the use of jet bridges expensive, unnecessary and inefficient. Indeed, the airline had over one million passengers less in 2012 than in 2011. Yet at other Spanish airports also operated by AENA Ryanair uses jet bridges regularly without disruptions. In the end, traffic recovered overall in 2013, including over 300,000 more passengers for Ryanair.

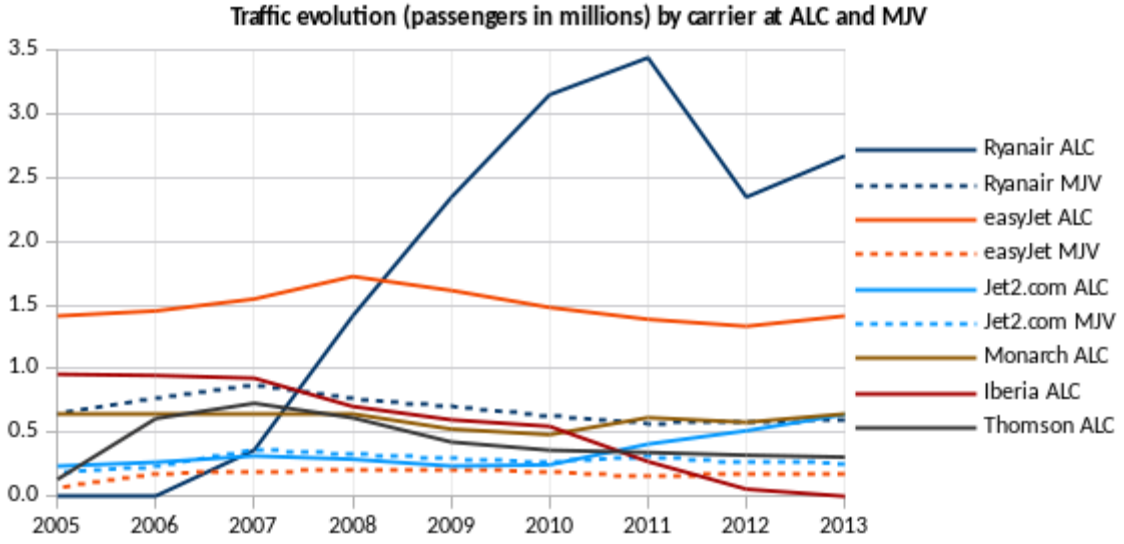

Figure 32: Traffic evolution of the main carriers at Alicante MAS. Source: AENA.

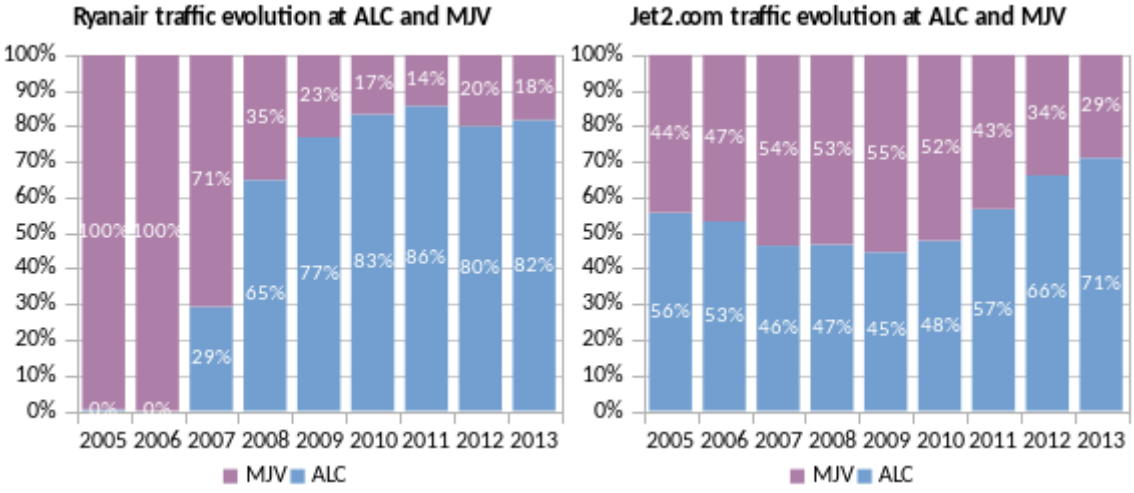

Figure 33: Evolution of airport market share for Ryanair (left) and Jet2.com (right) traffic in Alicante MAS. Source: AENA.

The dispute arose in 2011 when the airport operator opened a brand new passenger building with an associated apron and with a taxiway expansion. The New Terminal Area, in which all 15 contact positions have boarding bridges, made old terminals 1 and 2 redundant. All airlines use the new terminal as it alone provides capacity for 20 million passengers per year, the double of the traffic in 2011. Iberia, the major 'legacy' airline during most of the airport's life, completely abandoned the airport by 2013, transferring some of its flights to Iberia Express in 2012 and 2013, but these services were also withdrawn afterwards.

At MJV traffic is even more dependant on LCCs. Ryanair, Jet2.com and easyJet were the main carriers along the period of analysis (see Figure 32). Traffic was growing until 2007 when Ryanair decided to concentrate its growth in ALC, which it did not serve previously (see Figure 33 left). Traffic for the other airlines remained more or less stable but Jet2.com also decided to grow more at ALC after the new passenger building opened (see Figure 33 right). The passenger building at MJV was also expanded in 2004 and again in 2006 to accommodate traffic growth. In addition, a new runway devoted exclusively to military operations opened in 2011.

6.1.2 Amsterdam MAS

Amsterdam MAS is composed by Amsterdam Schiphol (AMS), Eindhoven (EIN) and Rotterdam (RTM) airports. Being the fourth largest airport in Europe in terms of passengers (51.5 million in 2013), AMS is by far the biggest airport in the MAS and also the main airport serving the city and the country (see Figure 34 and Figure 35 left). Moreover, about 40% of the traffic at AMS is transfer passengers and the airport caters especially to

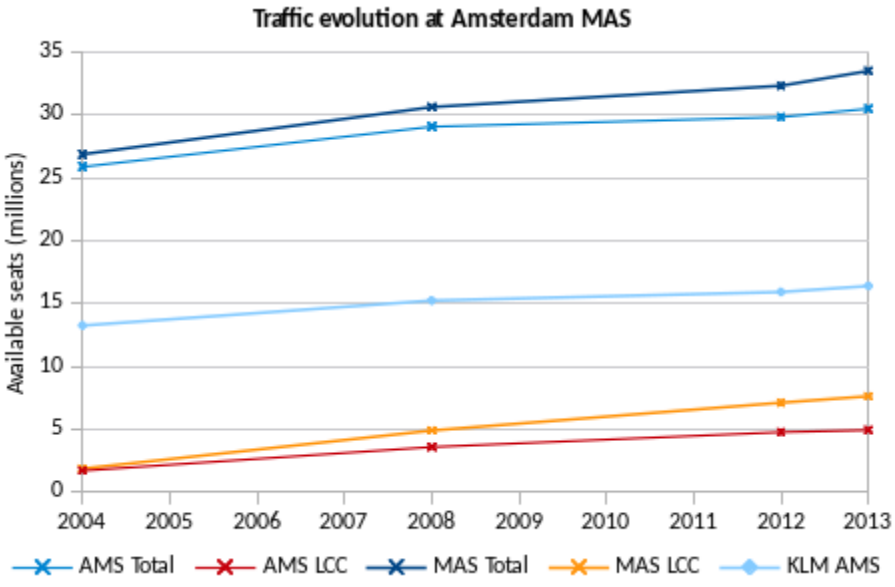

Figure 34: Total and LCC capacity evolution at Amsterdam MAS and Amsterdam Schiphol (AMS). Source: Innovata.

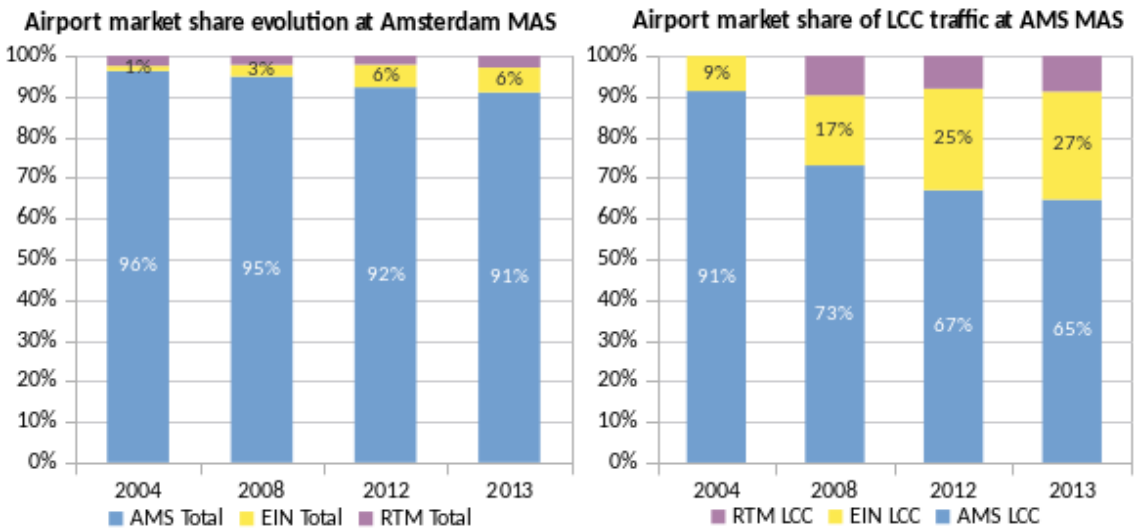

Figure 35: Airport market share of total (left) and low-cost (right) traffic at Amsterdam MAS. Source: Innovata.

this group of travellers (ANNA.aero, 2011b; Schiphol Group, 2013). For this reason KLM is also by far the largest carrier in the MAS, even if it currently operates only at AMS.

AMS also concentrates most of the LCC traffic in the MAS. In total, the market share of LCCs in the MAS grew from 7% to 23% between 2004 and 2013, whilst at AMS it grew only from 7% to 16% during the same period. Thus the share of other airports in this segment has increased considerably during the last decade (see Figure 35 right). The strength of AMS in this segment is largely due to the operations of Transavia Holland (the LCC spin-off of KLM) and easyJet. However (as Table 6 shows) Transavia is considered an LCC only from 2005 onwards as before it was dedicated to charter services only.

In November 2005 AMS opened a new area in its passenger building, named pier H (for non-Schengen flights) or pier M (for intra-Schengen flights), developed particularly for LCCs. EasyJet remains the main user of pier H/M and also the largest LCC at AMS and the second largest in the MAS, as Figure 36 shows. Transavia, which does not use the 'low-cost'

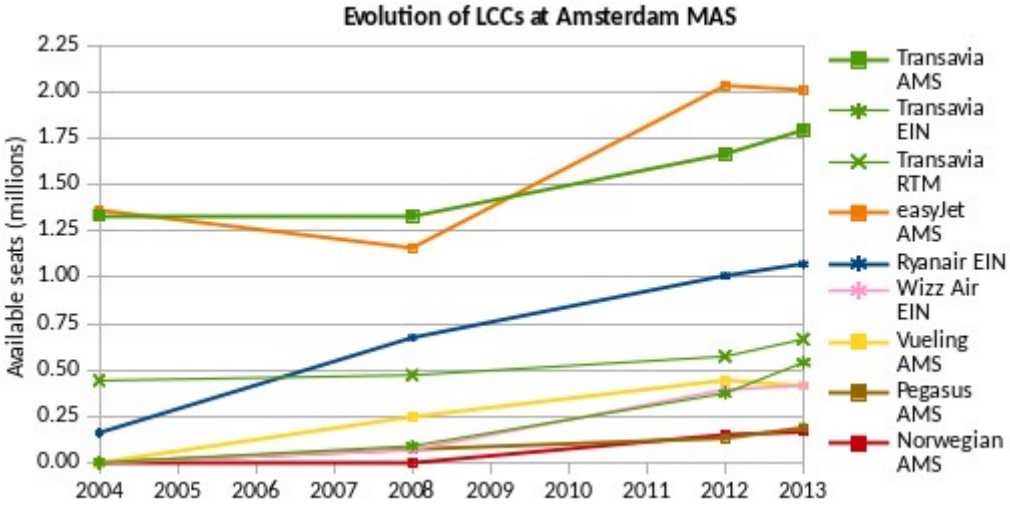

Figure 36: Capacity evolution for the major LCCs at Amsterdam MAS. Source: Innovata.

pier, was mainly focused on charter traffic at AMS and RTM but it has grown at EIN since it has become a LCC (see Figure 36 and Figure 37).

RTM has not had any significant development in terms of infrastructure. Transavia has been for long the major operator at the airport. Moreover, a business service to London (both to Heathrow and London City) is the second largest contributor to traffic at the airport, this service being operated by KLM, Air France and now British Airways. Expansion opportunities at RTM are limited, however.

EIN, on the contrary, has been redeveloped with a stronger focus on LCCs. In 2003 a new passenger building with capacity for 1.5 million passengers per year opened. Ryanair started operating at EIN in April 2002 and has been responsible for a considerable proportion of the airport growth. The airline established a base at EIN in April 2013. Transavia also grew significantly during the same period and it is now the second largest carrier at the airport. To face such growth, EIN opened a terminal expansion in June 2013 with an upgraded capacity of 5 million passengers per year.

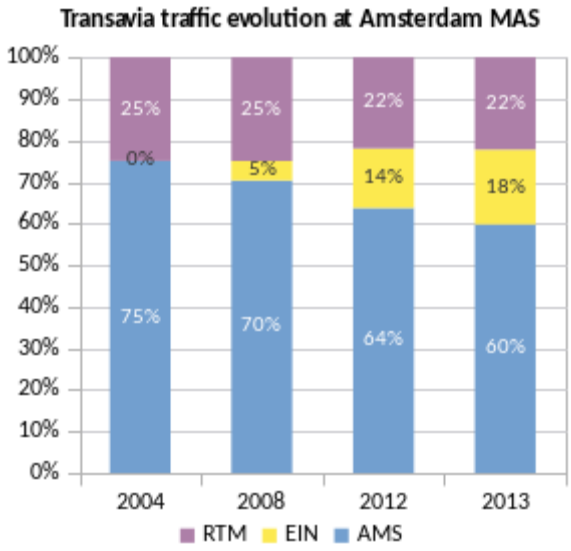

Figure 37: Evolution of airport market share for Transavia at Amsterdam MAS. Source: Innovata.

The Schiphol Group holds majority interests in all of the three airports in the Amsterdam MAS, along with a fourth airport (Lelystad) that currently serves general aviation only. The strategy of the company clearly aims at maintaining the hub focus at AMS in close cooperation with KLM and other members of the Sky Team alliance, whilst developing the other airports for regional, point-to-point and leisure traffic (Schiphol Group, 2013). Yet, as AMS still has around 60% of origin/destination traffic, LCCs have been keen to remain at the airport and accounted for over 16% of the capacity in 2013.

6.1.3 Barcelona MAS

Barcelona MAS includes Barcelona El Prat (BCN), the main airport located 12 km of the city centre; Girona (GRO), located 100 km away from Barcelona but right in the Costa Brava coast and near the Pyrenees; and Reus (REU), a former military base 95 km southeast of Barcelona and in the Costa Dorada coast. AENA controls the three airports.

Traffic in the entire MAS peaked in 2007 with almost 39 million passengers but was reduced drastically until 2009. In 2007 Barcelona (BCN) – Madrid (MAD) was the busiest route in the world with 971 flights per week in both directions (OAG, 2007). But as the AVE high speed rail line between the two cities opened in February 2008, the air shuttle was gradually adjusted to the new situation. On top of this, the economic performance of Spain also contributed to a reduction in traffic at that time. Overall, BCN was the most affected, as traffic in GRO and REU continued to grow until 2009 (see Figure 38). In September 2010 Ryanair opened a base at BCN and the picture changed altogether.

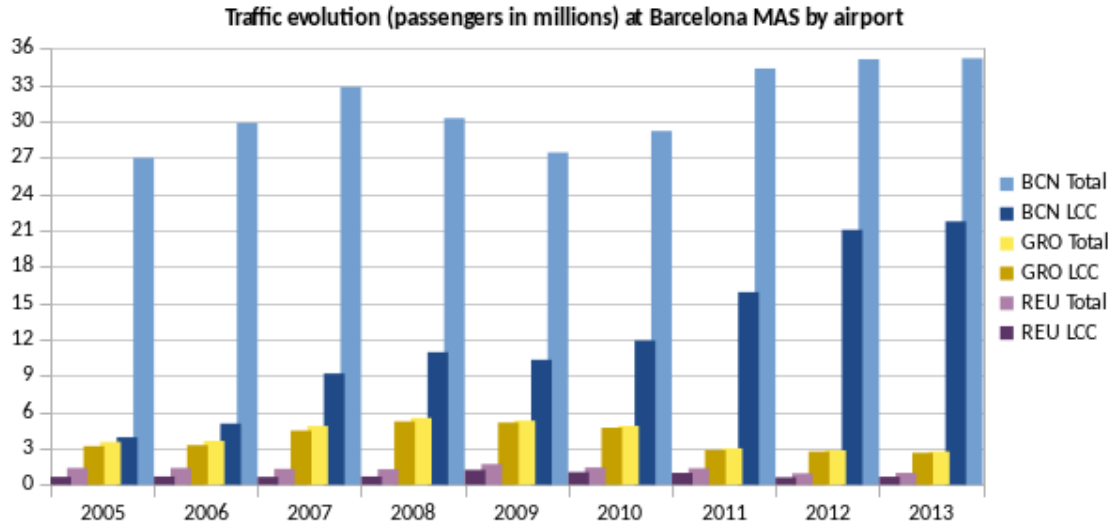

Figure 38: Evolution of total and LCC traffic at Barcelona MAS. Source: AENA.

Ryanair first entered the Spanish market with services to Girona (GRO) in December 2002. The airport was upgraded to a base for the carrier in February 2004 and the LCC has been responsible for almost the entire traffic ever since (see Figure 39). Likewise, Ryanair started flying to REU in the early 2000's. They opened a base there in October 2008, and after this the airline delivered over 60% of the airport passengers. When Ryanair started operations in BCN with a base in September 2010, traffic at REU and GRO decreased and eventually the base at REU was abandoned in 2011 and the base at GRO was downsized the same year. In 2012, the LCC became the second largest operator at BCN with 12% market share. Despite the shifts, Ryanair traffic in the MAS always grew between 2005 and 2012 but in 2013 the airline transported almost 1 million passengers less in BCN alone, compared to the previous year.

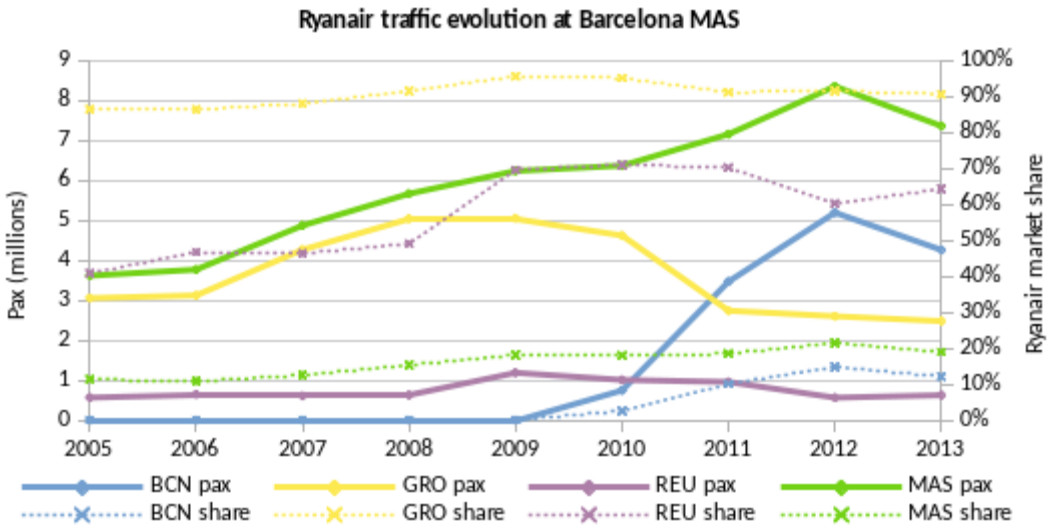

Figure 39: Traffic and market share of Ryanair at each airport of the Barcelona MAS. Source: AENA.

The growth (and decline) of the secondary airports in the Barcelona MAS is highly intertwined with the developments of Ryanair. At GRO, however, the infrastructure was already in place before Ryanair arrived and no major expansions happened during the period of analysis. At REU the airport operator upgraded terminal facilities three times. A new arrivals building opened in 2005, a new check-in building that connected the arrivals and departures terminals opened in 2008, and a new boarding area opened in 2010. Likewise, the apron was expanded in 2009 to offer more aircraft stands. There were plans for an entire new terminal but they did not seem to go ahead. Both REU and GRO have strong seasonal demand patterns. At REU, Ryanair is the only airline currently operating all year round services. At GRO, Ryanair is joined by Wizz Air in this sense.

At the main airport of Barcelona (El Prat), apart from Ryanair, the history of LCCs is particularly linked to the success of Vueling. It started as an independent LCC in 2004 but it expanded significantly after merging with Clickair (an LCC sponsored and partly owned by Iberia) in July 2009. In that year Vueling became the largest carrier at BCN and then the airline almost tripled its traffic from 4.95 million passengers in 2009 to 12.17 million in 2013 (see Figure 40). After the merger with Clickair, Iberia took a stake in Vueling and then, in April 2013, International Airlines Group (the holding of British Airways and Iberia) took over Vueling entirely.

The recent rise of LCCs at BCN is also related to the fall of the major 'legacy' carriers at the airport, as Figure 40 shows. Iberia practically abandoned the airport after transferring most of its Barcelona network to the short-lived LCC spin-off Clickair in October 2006. Iberia then focused on its hub development at Madrid and remained only with the shuttle “air bridge” to Barcelona. Air Nostrum, operating regional flights on behalf of Iberia, also reduced drastically the number of passengers. Spanair, the flag carrier of Catalonia, went

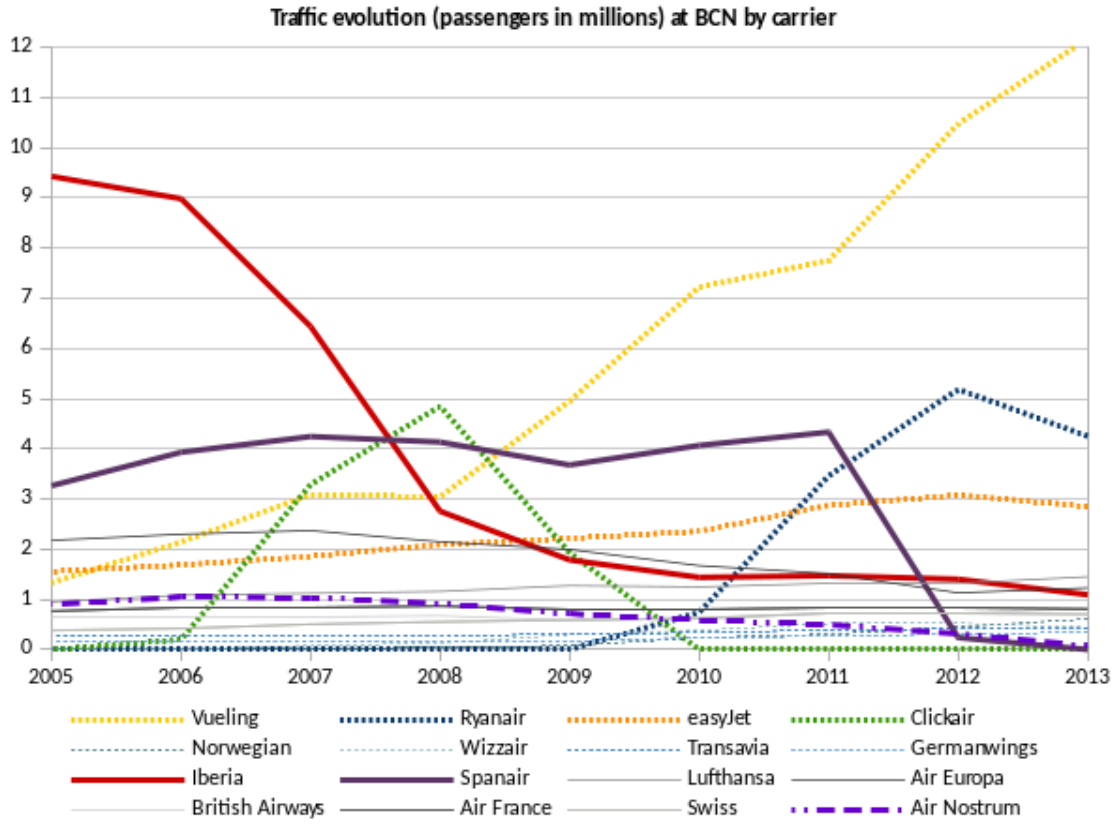

Figure 40: Total passenger traffic at Barcelona El Prat Airport (BCN) by carrier. Source: AENA.

bankrupt and ceased operations in January 2012, leaving ample room for LCCs to take on its passengers. Air Europa also reduced its services to focus growth at Madrid.

These developments helped strengthen the position of BCN in the MAS both in total traffic and in the low-cost segment, as Figure 41 shows. Besides the decision of the airlines (in particular the relocation of Ryanair across the three airports and the rapid expansion of Vueling), there is another break point in the path for Barcelona El Prat becoming the

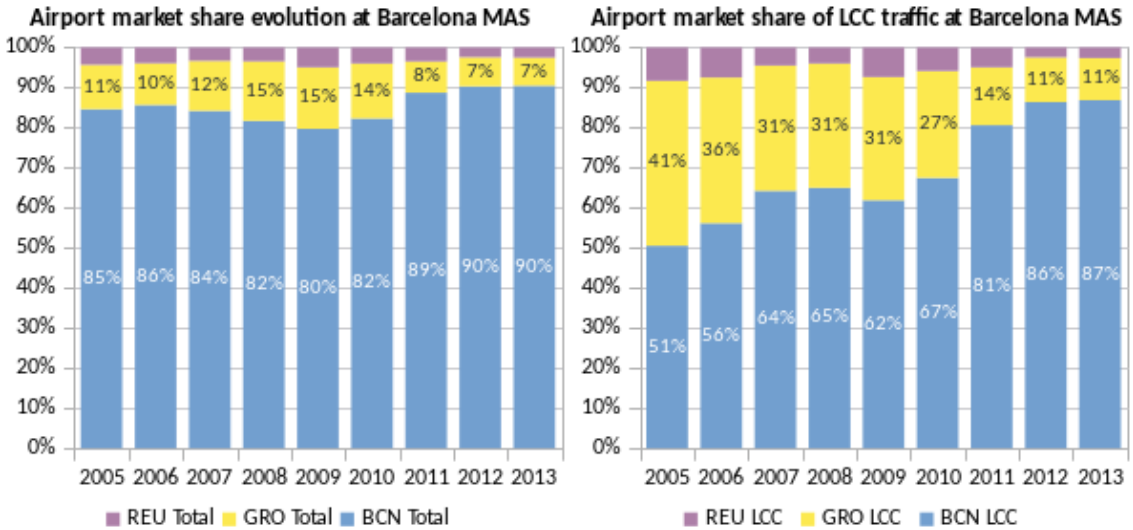

Figure 41: Airport market share of total (left) and low-cost (right) traffic at Barcelona MAS. Source: Innovata.

largest airport in Europe in terms of LCC capacity in 2013. In June 2009 a brand new "Terminal 1" opened at the airport.

BCN had been considerably expanded for the Olympics in the city in 1992. A second wave of significant capacity expansions started in 1999 with the implementation of the so-called "Plan Barcelona" by AENA, the airport operator. In 2003 terminals A and B were expanded to improve boarding, baggage claim and retail areas. In September 2004 a new runway opened, the third for the airport. In 2007 it was the turn for a new building to connect terminals A and B and improve check-in area, followed by an expansion of terminal C in 2008.

Then, in 2009 the new 1.2 billion Euro Terminal 1 offered 540,000 m^2 more to the passenger building and 600,000 m^2 in new aprons. This building alone has a capacity for 30 million passengers per year, increasing total capacity to 55 millions. The former terminals A, B, C were re-branded "Terminal 2" and remained practically empty immediately after the new terminal opening. This created an opportunity for LCCs to use the spare capacity.

In fact, apart from Vueling (the main user of the new Terminal 1), all other LCCs use terminals 2B and 2C (the latter is only used by easyJet). Terminal 2A has been closed in the meantime. Moreover, the dismal of Spanair further increased the growth of LCCs at the airport. The new Terminal 1 also provided an opportunity for Vueling to grow with a differentiated product that is more up-scale than that of other LCCs, whilst indicating that the airline is less willing to use 'low-cost' facilities (Airport Business, 2014).

6.1.4 Brussels MAS

Brussels MAS includes Brussels Zaventem (BRU), the main airport located 11 km northeast of the Belgian capital, and Brussels South Charleroi (CRL) 46 km south of Brussels. Brussels MAS is a good example of the expansion of the LCC model in continental Europe, in particular as a platform for the growth of Ryanair.

Figure 42 shows that total traffic in the MAS grew continuously between 2004 and 2013. From 2008, however, all the growth is only due to Charleroi. The main Brussels airport first suffered the bankruptcy of the Belgian flag carrier, Sabena, in 2001. By then BRU hosted Virgin Express, an LCC founded by the Virgin group in 1996. In 2006 Virgin Express merged with SN Brussels, the replacement of Sabena, to form the current Brussels Airlines and reduced the market share of LCCs at BRU. At the same time, BRU experienced strong competition from CRL, almost exclusively devoted to LCCs.

Charleroi became one of the first four Ryanair destinations in continental Europe in 1997. The airport also became a model for the emergence of secondary airports in Europe

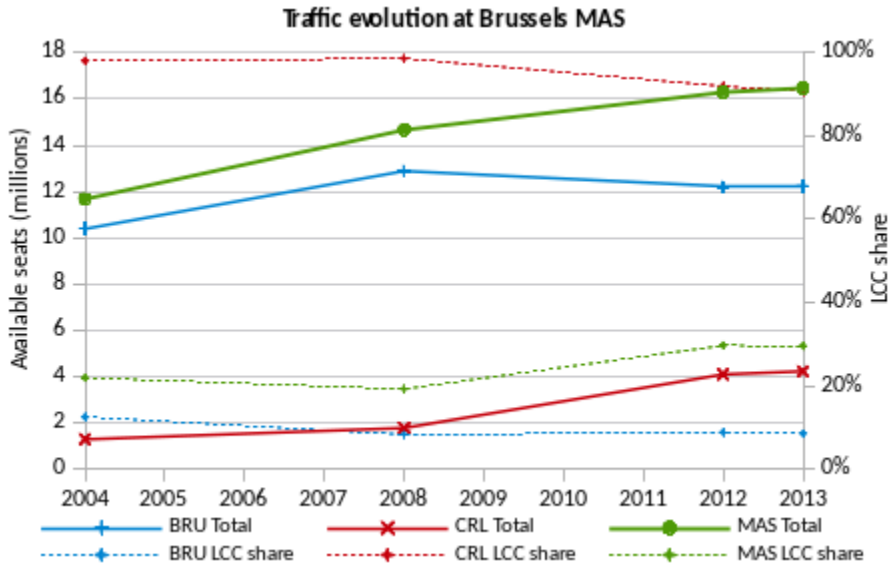

Figure 42: Evolution of available capacity at Brussels MAS. Source: Innovata.

to explore the boom of LCCs. It is popular with scholars and practitioners, and often appears on the media for the long-standing disputes about the subsidies that Ryanair received from the Walloon government for its establishment Charleroi.

Ryanair used Charleroi as its first base in continental Europe in April 2001 following an agreement with the Walloon government that granted special discounts and financial support to the company (Barbot, 2006). Traffic grew from 200 000 passengers in 1997 to 2 millions in 2004 when Wizz Air started serving the airport as well. As a consequence, the airport operator built a new terminal and apron that entered into service in January 2008 with a theoretical capacity of 5 million passengers per year and an investment of 125 million Euros. CRL kept growing and in 2013 it handled 6.8 million passengers.

Over this time, Charleroi has grown to take one quarter of the total market, and almost 80% of the low-cost segment, in the Brussels MAS as Figure 43 shows. To compete

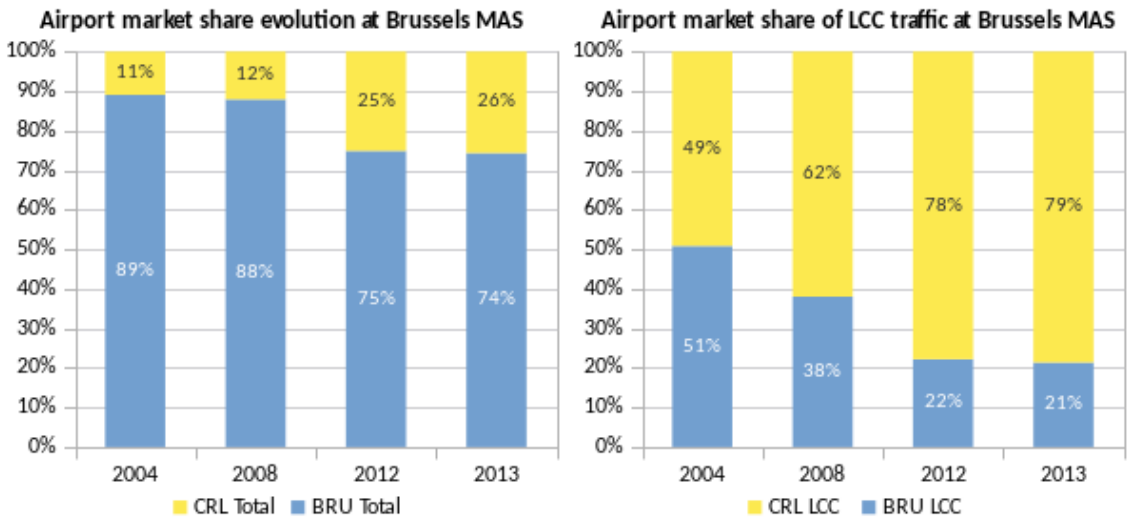

Figure 43: Airport market share of total (left) and low-cost (right) capacity at Brussels MAS. Source: Innovata.

for LCCs, Brussels Zaventem (BRU) had announced the development of a "low-cost pier" by the end of 2007 but it abandoned this plan in March 2011 (Airport Business, 2008; Brussels Airport, 2011). In the meantime, Ryanair became the second largest airline in the MAS behind Brussels Airlines, as Figure 44 shows. This picture may change even more in the short-term as Ryanair and Vueling entered BRU in 2014.

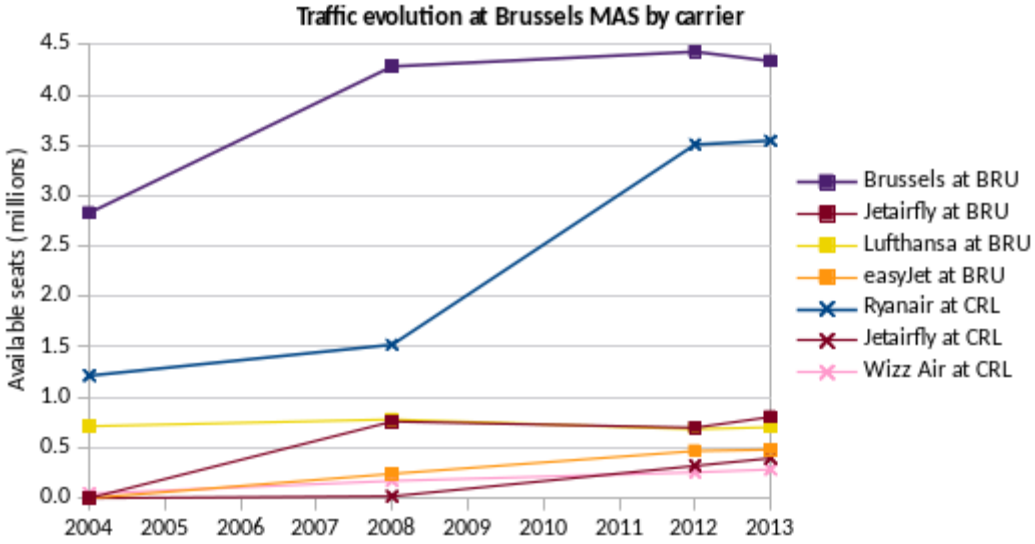

Figure 44: Evolution of available capacity of major carriers at Brussels MAS (SN Brussels is included as "Brussels at BRU" in 2004). Source: Innovata.

Moreover, the strong position that CRL has gained in the low-cost segments might be challenged as well. In fact, the airport has been targeting other carriers and the dominance of Ryanair has decreased from 95% of seats provided in 2004 to 84% in 2013, whilst Jetairfly, a charter airline, reached 9% in 2013.

6.1.5 Copenhagen MAS

Copenhagen MAS is formed by Copenhagen Airport Kastrup (CPH) 8 km south of the city centre, and Malmo Airport (MMX) across the Oresund strait in Sweden, 28 km east of Malmo and 55 km away from Copenhagen. As Figure 45 shows CPH clearly dominates total and low-cost traffic in the MAS. MMX serves as a regional airport for Sweden with regular flights to Stockholm and, to a lesser degree, as an alternative to Copenhagen.

Wizz Air has served MMX continuously, and by 2013 it was the third largest carrier (after SAS and Malmo Aviation) with 17% of the seats offered. Ryanair, has never operated in CPH, having suspended all services to MMX between autumn 2007 and summer 2011, and currently operates only seasonal flights. LCC traffic at CPH is mostly represented by Norwegian and easyJet and their growth was rather moderate in the airport after 2008, in spite of service reductions from SAS and the bankruptcy of Cimber (Air/Sterling) in 2012 (see Figure 46).

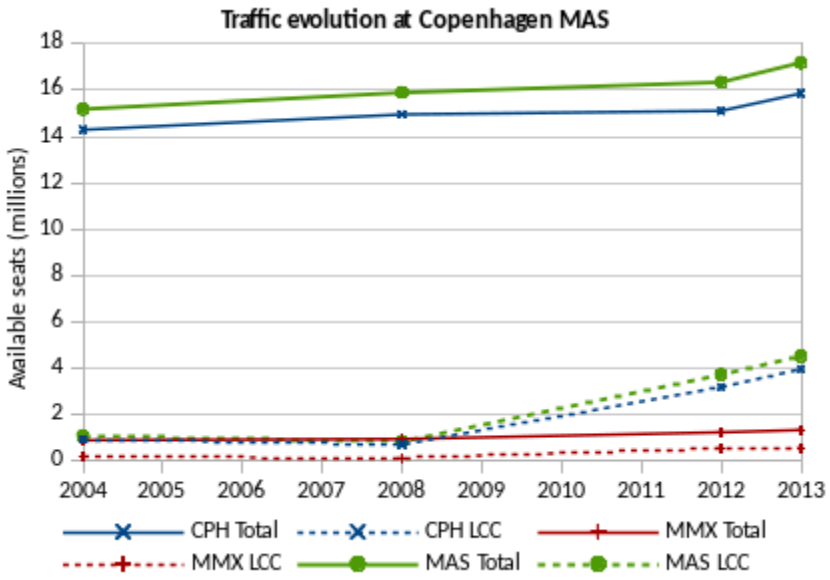

Figure 45: Evolution of available capacity at Copenhagen MAS. Source: Innovata.

The market share of LCCs at CPH grew rapidly in the last few years from 6.5% in 2004 to 25% in 2013. Most of the growth is due to the establishment of a major base of Norwegian after the bankruptcy of Sterling Airlines in 2008. The same year the airport operator announced the creation of a dedicated "low-cost terminal" – CPH Go, a low-cost pier in one of the passenger buildings opened in October 2010. Although Norwegian does not use the facilities, easyJet took the opportunity to grow and become the third largest carrier at CPH, with over 800,000 seats offered in 2013.

6.1.6 Glasgow MAS

Glasgow MAS includes three airports in Scotland: Glasgow International (GLA), the main airport for the city of Glasgow; Edinburgh Airport (EDI), the main airport of the

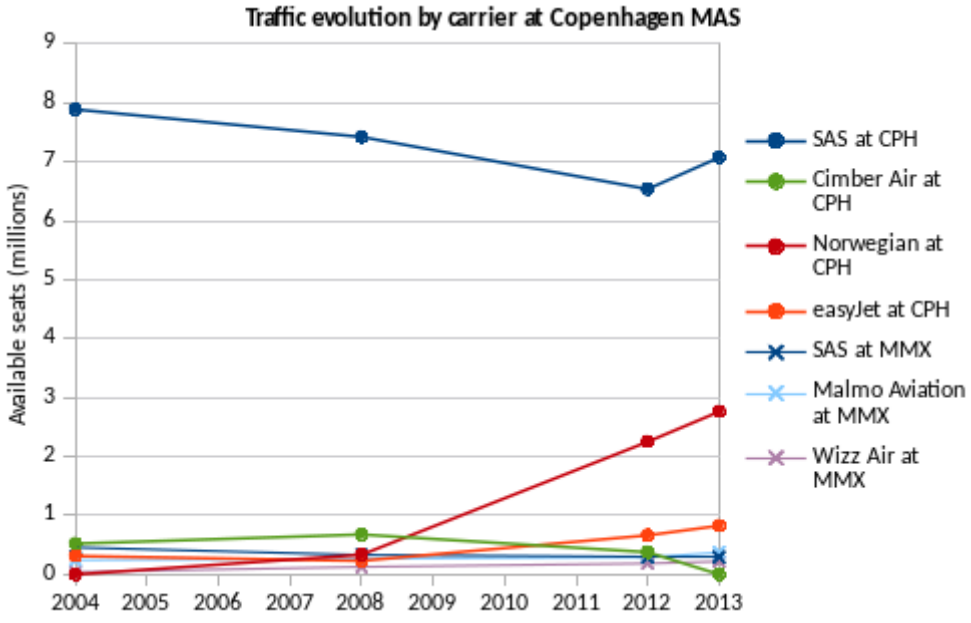

Figure 46: Evolution of available capacity for the major carriers at Copenhagen MAS. Source: Innovata.

Scottish capital and 62 km east of Glasgow; and Glasgow Prestwick (PIK), a mixed military and civil airport used for cargo, aircraft maintenance and pilot training and passenger services 51 km west of Glasgow. As Figure 47 shows, GLA used to be the largest of the three airports in terms of total passengers, but EDI overtook it in 2007. Traffic at PIK was booming in the 2000's but decreased drastically since 2009.

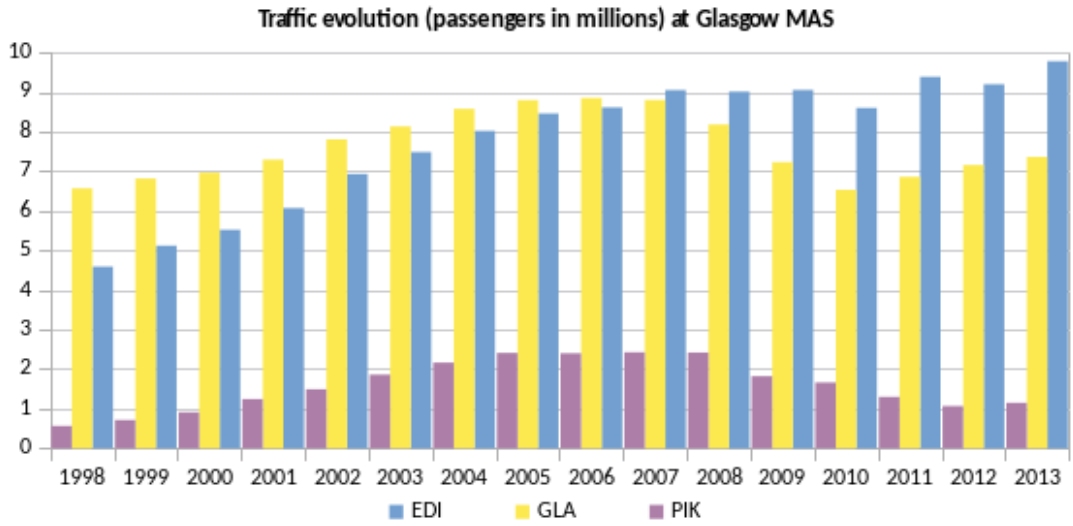

Figure 47: Traffic evolution at Glasgow MAS. Source: UK CAA.

From the 1960's to the 1980's, due to regulation, Prestwick was the transatlantic gateway to Scotland. Following BAA's privatisation by the end of the 1980's the role of the three airports in the Glasgow area was rearranged. Transatlantic flights were transferred to Glasgow International, Prestwick was sold to private investors, and Edinburgh, which was mainly a military airport then, was redeveloped. GLA then became the main gateway to Scotland, EDI increased the direct destinations and PIK became a secondary airport mostly for low-cost services. In this arrangement, as Figure 48 shows, EDI attracted most of the low-cost traffic in the MAS whilst PIK – despite having only LCCs for passenger

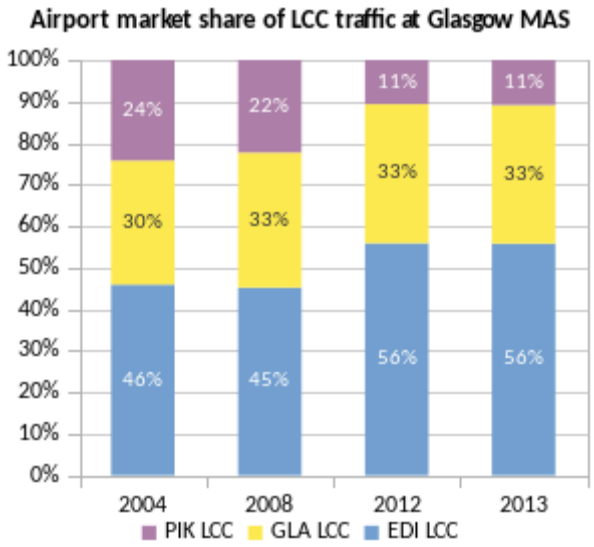

Figure 48: Market share of the airports at the Glasgow MAS in the low-cost segment. Source: Innovata.

services – could not retain more than a quarter of the LCC traffic and its share has been declining.

Once PIK had been sold by BAA, the new investors opened a railway station in 1994 and saw Ryanair starting services as it expanded its Ireland-UK market. With the growth in passenger numbers, the terminal was refurbished in April 2005. Passengers peaked in 2008 at 2.4 millions and then declined to 1 million in 2012 and recovered to 1.1 millions in 2013. In November 2013, the airport was bought by the Scottish government from its private owners, who were at the moment considering to close it. Ryanair remains the only passenger airline at PIK and, despite the fall in traffic, it uses it as a major maintenance base.

In recent years, traffic increase at EDI made it the largest airport in the MAS, and its infrastructure has been expanding accordingly. A new "South East Pier" opened 6 boarding gates in 2006. The main passenger building was also extended with a new departure lounge in 2010. Another major renewal and expansion started in 2013, including an access by tram that opened in May 2014. In the meantime, BAA was forced to sell the airport in June 2012. It was acquired by GIP, the owners of both London Gatwick and London City.

GLA also implemented significant upgrades during the period of analysis. First, a new facility dubbed "Terminal 2" opened in 2004. This is a departures-only building that provides check-in and baggage handling. Then a major expansion of terminal 1, including a centralised security screening area, opened in December 2008.

The way the major carriers in the MAS assign traffic also impacted the position of the airports. From Figure 49, we can see that British Airways was the largest airline by 2004 both at EDI and GLA, and also in the MAS. EasyJet had a strong presence in the same

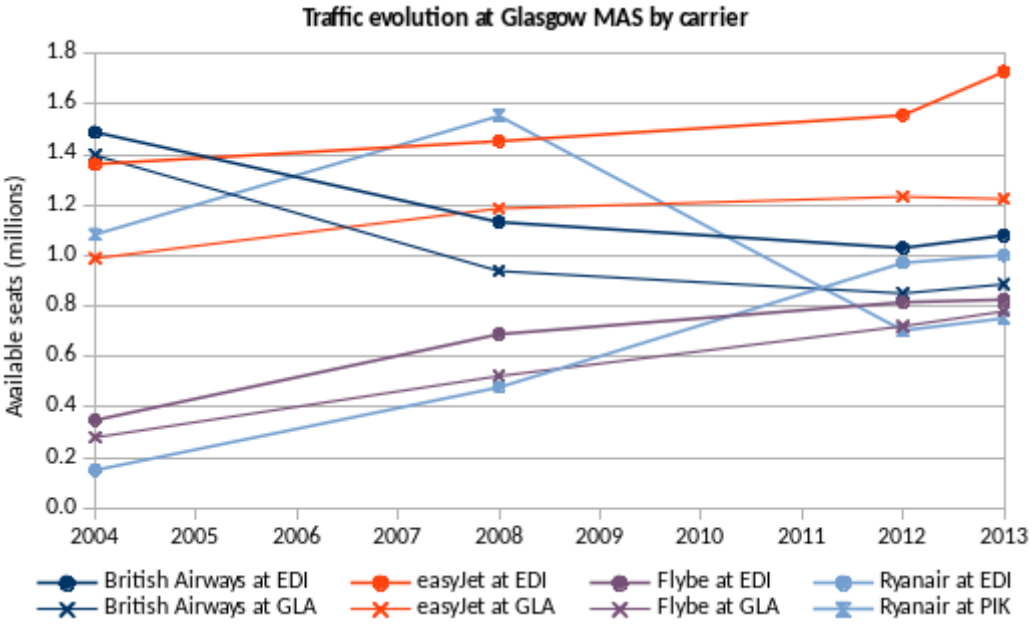

Figure 49: Available capacity of major carriers at Glasgow MAS. Source: Innovata.

airports and Ryanair was mainly operating at PIK, but it also operated at EDI. British Airways lost market share, mainly to Ryanair and Flybe. The four airlines are more concentrated at EDI, as of 2013, this meaning Ryanair transferred a large proportion of its traffic from PIK. EasyJet is now the largest operator in the MAS and at each of the two airports it serves (EDI and GLA). Flybe capacity is almost equally distributed between EDI and GLA.

6.1.7 Istanbul MAS

Istanbul MAS is composed by the main Istanbul Ataturk Airport (IST) in the European side of the city, 24 km west of the centre, and by Sabiha Gokcen International Airport (SAW) in the Asian part, 35 km southeast of the city centre. As Figure 50 shows, the evolution of both airports is closely related to the development of the two largest airlines in Turkey: Turkish, the flag carrier, and Pegasus, the major LCC.

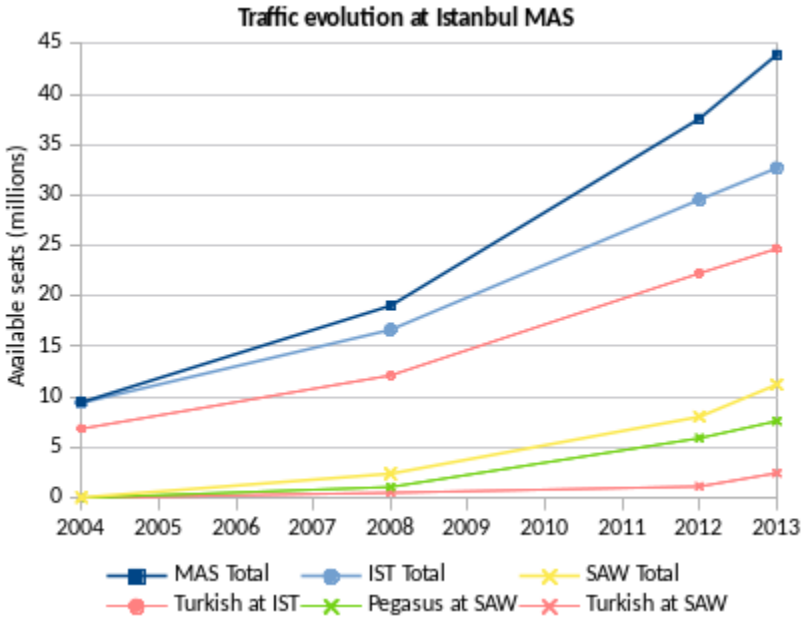

Figure 50: Evolution of available capacity of major carriers at Istanbul MAS. Source: Innovata.

At IST, a new international terminal with capacity for 20 million annual passengers opened in 2000. TAV, the company that built the international terminal, won a concession to operate the entire airport and take responsibility for its long-term development in June 2005. Since then, an expansion of the international terminal in December 2010 increased total capacity to 45.5 million passengers per year. The growth of the airport has accommodated the growth of Turkish Airlines, that increased its market share (in terms of seats) at IST from 72.7% in 2004 to 75.6% in 2013 and more than tripled its capacity in the same period.

SAW opened as a greenfield development in 2001 with the aim of relieving congestion at IST. Two terminals provided annual capacity for 3.5 million passengers, yet the airport

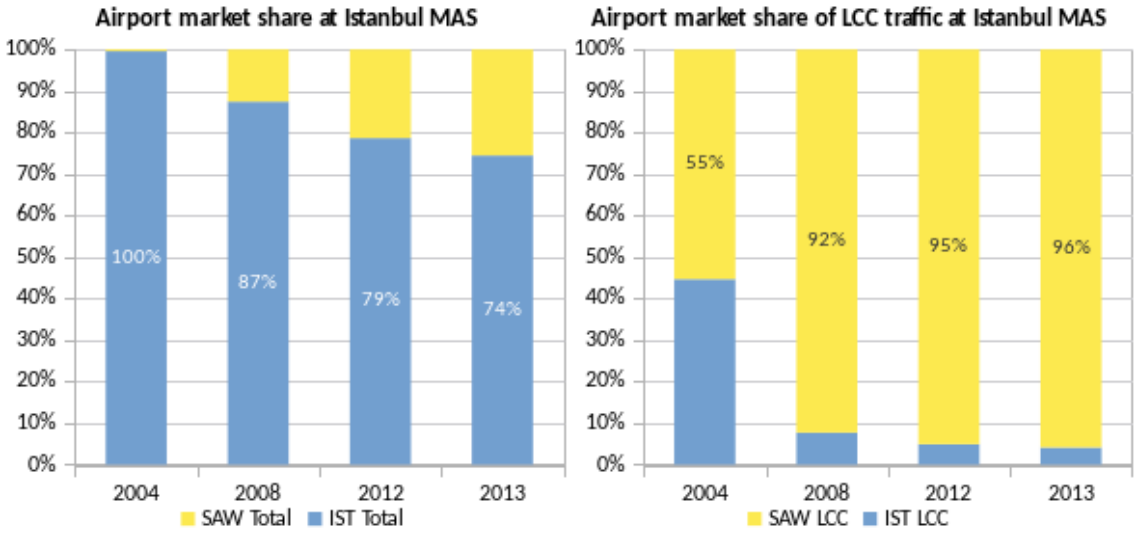

Figure 51: Airport market share of total (left) and low-cost (right) traffic at Istanbul MAS. Source: Innovata.

was almost empty until Pegasus shifted its business model towards an LCC proposition and adopted SAW as its main base in 2005. A tender in 2007 granted ISG (Istanbul Sabiha Gökçen International Airport Investment Development and Operation Inc.) the rights to operate and expand the airport for 20 years from May 2008. In October 2009 the new private operator opened a new terminal (and associated apron and land-side infrastructure) with a capacity of 25 million annual passengers.

The growth of Pegasus at SAW, from a little over 1 million seats provided in 2008 to 7.6 million seats in 2013, also enticed the growth of other LCCs that could not find room at IST[15]. As Figure 51 shows, SAW has taken 26% of market share in the MAS and it handled 96% of LCC traffic in 2013. The market share of LCCs at SAW was 78% in 2012 and decreased to 71% in 2013 when Turkish Airlines based aircraft there to serve part of the traffic that does not need to connect at its hub in IST.

Despite the strong consolidation of LCC services at SAW[16] the airport's CEO considers they “are not a low-cost airport but a full service airport embracing a full range of airlines and passenger profiles with [their] services(...). Airport charges are similar, though possibly a little cheaper than at Atatürk” (ANNA.aero, 2013b). Having this in mind, it is possible that slot availability at SAW was more important for LCCs than other considerations related to specific infrastructure or airport fees. In fact, this may be an important issue as Istanbul gets ready to build a third airport (expected to be finished before the end of the decade) that may free capacity at the existing airports.

15 Market share of LCCs at IST has not been above 1.1% in the period of analysis (2004 – 2013) and almost all of it comes from Pegasus as well.

16 Sabiha Gokcen was, from the sample analysed in chapter 5, the fourth largest “European” airport in terms of total LCC seats in 2013.

6.1.8 London MAS

The London metropolitan area is served by six major airports forming the largest MAS in the world, in terms of passengers. Traffic in the MAS peaked in 2007 with 139.9 million passengers, shrinking to 127.2 millions in 2010, and growing again to 139.7 millions in 2013. As Figure 52 shows, the largest airport is Heathrow (LHR), handling 52% of the total traffic in the MAS in 2013 more than the double of the second largest airport – Gatwick (LGW). The other significant airports in the MAS are London City (LCY), Stansted (STN), Luton (LTN) and Southend (SEN).

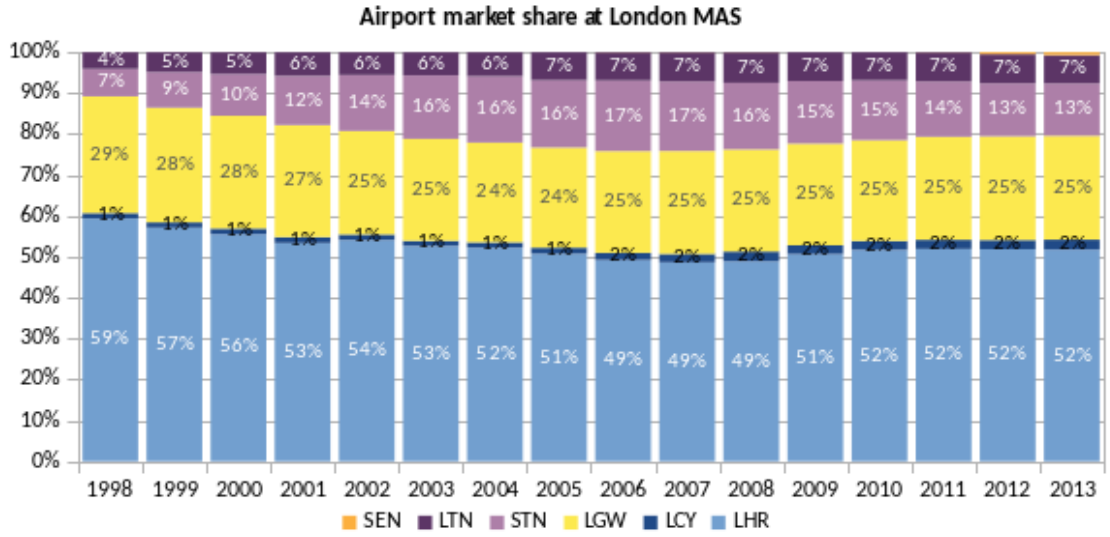

Figure 52: Evolution of airport market share at London MAS. Source: UK CAA.

Heathrow, as many other major airports, is in an almost permanent state of construction. The major expansions that happened at LHR during the period of analysis included: the opening of the eastern extension at Terminal 1 in 2005; a new pier for Terminal 3 to handle the Airbus A380 in 2006; and the brand new £4.2 billion Terminal 5 in March 2008. Also, a new Terminal 2, on the site of the original Terminal 2, opened in June 2014. In the meantime, plans for a third runway and a new terminal were approved in 2009 but cancelled in 2010.

LHR is the main hub for British Airways, that clearly dominates the airport with almost seven times more traffic than the second largest carrier – Virgin Atlantic (see Figure 53). LHR is also a stronghold for 'legacy' FSCs, and LCCs have little expression at the airport with less than 2% of the total seats in 2013, as Figure 54 shows. In absolute numbers that is equivalent to 473,000 seats, an all-time high but less than total LCC seats at Southend (SEN) in the same year. The only LCCs currently operating at LHR are Germanwings (part of Lufthansa, the third largest carrier at the airport) and Vueling (part of IAG, which also controls British Airways and Iberia).

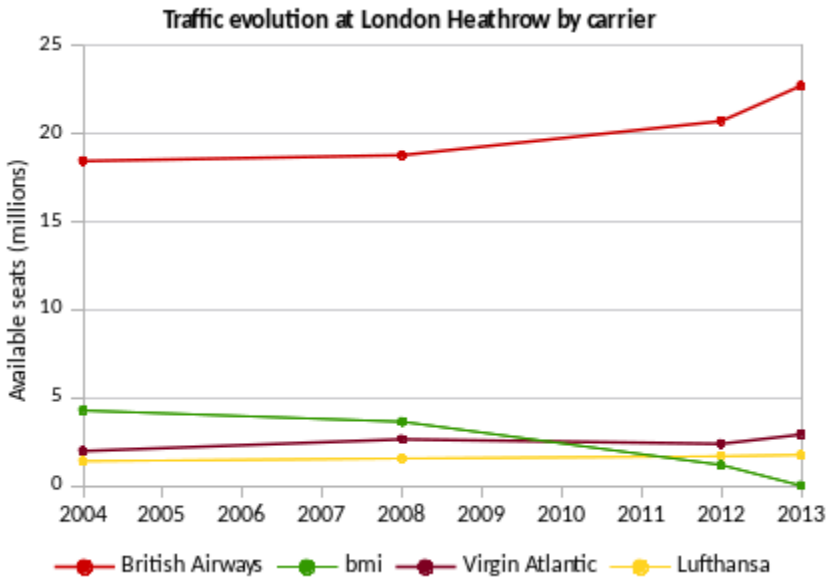

Figure 53: Evolution of available capacity for the major carriers at London Heathrow. Source: Innovata.

Gatwick (LGW), on the contrary, has seen a substantive growth in the low-cost segment and by 2013 it had 41% of the total LCC traffic in the MAS, up from only 18% in 2004 (see Figure 54). LGW became not only the biggest airport in terms of LCC capacity in the London MAS in 2013, but also the second biggest in Europe after Barcelona El Prat (see Chapter 5). The consolidation of LCCs at LGW is more consistent after BAA PLC was forced to sell the airport for the sake of competition and it was acquired by GIP in December 2009. Such consolidation is largely due to easyJet, which became the largest carrier at LGW in 2008, as Figure 55 shows.

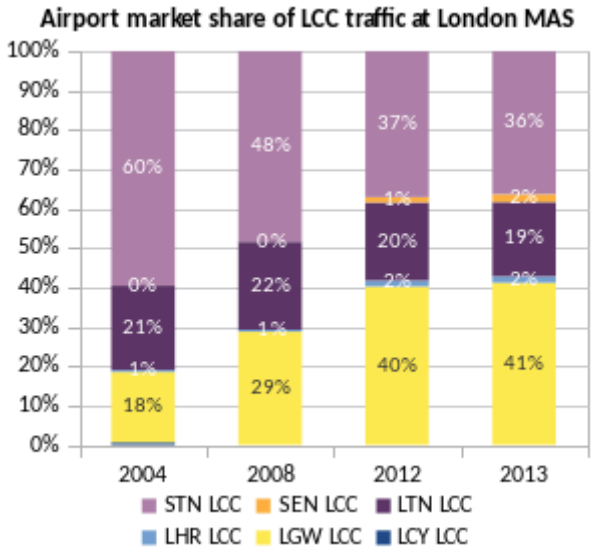

Figure 54: Airport market share of low-cost traffic in the London MAS. Source: Innovata.

EasyJet began its history at Luton (LTN) but it expanded considerably to other London airports with a series of acquisitions of rival airlines. Although easyJet started flying to LGW in December 1999 and opened a base there in 2002, taking over GB Airways in early

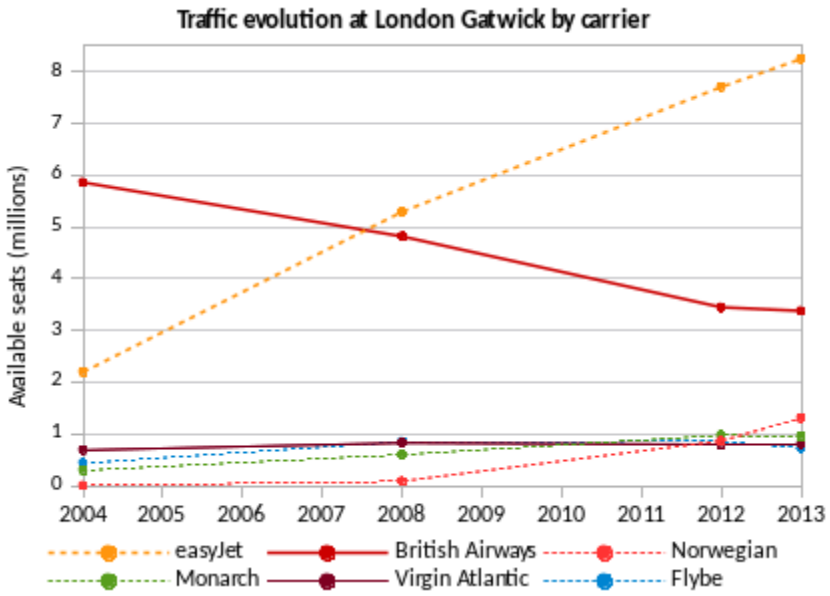

Figure 55: Evolution of available capacity for the major carriers at London Gatwick. Source: Innovata.

2008 gave the carrier more slots and a solid position at the airport that has been expanded ever since, to become the largest base in the airline's network. The major development regarding airport infrastructure for the period of analysis was the new “Pier 6” (including the famous air bridge over a taxiway) in 2005. The airport also implemented different renovations and expansions of both terminals North and South.

In 2010, following the change in ownership, Gatwick started implementing a new strategy summarised in their ambition “to compete to grow and become London's airport of choice” (Gatwick Airport Limited, 2013, 2012). Two of the strategic priorities set by Gatwick relate to enhance passenger experience and to increase efficiency in air-side operations, along with commercial agreements, to help airlines grow. In line with these concerns, the airport has implemented *six sigma* techniques to improve processes leading to efficient and on-time operations. Operational efficiency is considered to be crucial for LCCs using the airport, yet the Gatwick strategy also aims at attracting new long-haul traffic. As for the passengers, the airport aims at offering the same high level of service to all of them, regardless of the airline they use.

Such changes in the management perspective have allowed easyJet and other LCCs, particularly Norwegian, to effectively grow at LGW and counteract the effect of the reduction in capacity of British airways, as Figure 55 highlights. In fact, the growth of easyJet at LGW has significantly reduced the proportion of the airline's services at other airports in the MAS, especially Stansted (see Figure 56). Moreover, in 2013 easyJet reached an agreement with Flybe to acquire all of their slots in Gatwick from 2014. Flybe, in turn, moved to London City (LCY), also owned by GIP, the same owners of Gatwick. This would start LCC services at LCY that hosted no LCCs before.

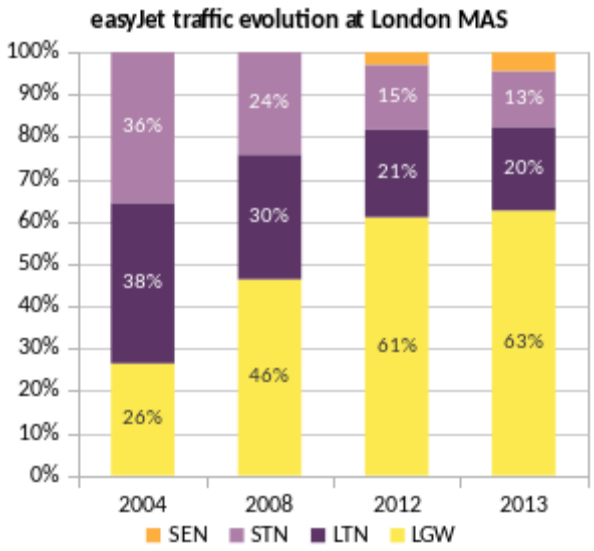

Figure 56: Distribution of easyJet capacity at London MAS airports. Source: Innovata.

After acquiring Go from British Airways in 2002 easyJet also gained a base at Stansted (STN). The airport, however, has been much more crucial for the development of Ryanair, by far the largest operator at STN over its recent history (see Figure 57). During the second half of the previous century, STN was largely used by charter carriers. The airport was redeveloped in the 1980's as an alternative to congestion at LHR and LGW.

The renovated STN opened in 1991 featuring a signature architect (Norman Foster) design, with a railway station and satellite terminals connected with an automated people mover. Despite these characteristics, usually not associated to 'low cost airports', STN quickly became the preferred airport for LCCs. As Figure 54 shows, STN had 60% of London's LCC traffic in 2004, down to 36% in 2013 due to the developments at LGW described above. STN provides ample capacity, estimated at 35 million passengers per year (ANNA.aero, 2013c). An expansion and renovation of the arrivals area in the main

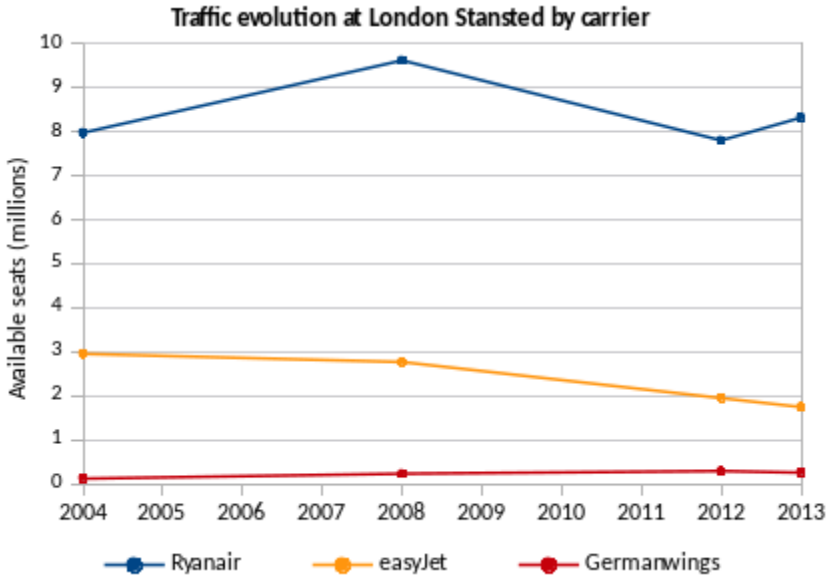

Figure 57: Evolution of available capacity for the major carriers at London Stansted. Source: Innovata.

passenger building opened in December 2008. In March 2009, the Competition Commission ruled that BAA should sell both LGW and STN. STN was sold only in February 2013 when Manchester Airports Group (MAG) took control of the airport.

Ryanair started using STN in 1991 when the new facilities were in place. It transferred its main London base from Luton and created the largest base for the airline when choosing STN for its European expansion from 1997 onwards. After 2008, Ryanair's traffic declined significantly at STN (see Figure 57) due to a dispute with the previous owner, BAA, over airport charges. In September 2013 the airline signed an agreement with the new owners, MAG, to grow steadily in the next ten years. EasyJet traffic also declined at STN with the growth at LGW (yet MAG also signed an agreement with the airline in 2013).

Luton (LTN), as STN, has been traditionally devoted to the low-cost segment in the London MAS, as Table 15 shows. Luton history for commercial aviation is also linked to the rise of charter airlines in the second half of the 20th Century. Then, in 1986, Ryanair started services from Ireland but, as mentioned before, moved to STN in 1991. LTN returned to growth by hosting the birth of easyJet in late 1995, this coinciding with a major renewal of airport infrastructure between 1992 and 1996. In 1998 the Luton Borough Council granted a concession for a private consortium for airport operation, management and development, for 30 years.

In 1999 LTN opened a new passenger building and a railway station located 1.8 km from the terminal. In 2005, the passenger building was expanded and renovated. As Figure 58 shows, easyJet shifted its growth strategy to LGW and declined traffic at LTN, yet it still is the largest operator at the airport where its headquarters are located. Ryanair also rationalised capacity after 2008 but did not grow in other London airports. Wizz Air, on the contrary, has made of Luton one of its most important airports although it is not a formal base. In fact it became the second largest airline at LTN.

Table 15: Evolution of market share of LCCs at London MAS. Source: Innovata.

Airport	2004	2008	2012	2013
London City (LCY)	6.9%	0.0%	0.0%	0.0%
Gatwick (LGW)	24.7%	38.0%	55.3%	57.8%
Heathrow (LHR)	0.2%	0.3%	0.9%	1.0%
Luton (LTN)	96.0%	94.4%	94.7%	94.4%
Southend (SEN)	0.0%	100.0%	85.3%	92.3%
Stansted (STN)	91.6%	90.2%	96.0%	96.7%
MAS	24.2%	29.3%	32.4%	33.0%

Southend (SEN) is the newest addition to the London MAS. Stobart Group acquired the airport in 2008 and redeveloped its infrastructure to provide regular commercial service. First, a new control tower and a railway station adjacent to the passenger building (still under construction by then) opened in 2011. A runway extension and a new terminal

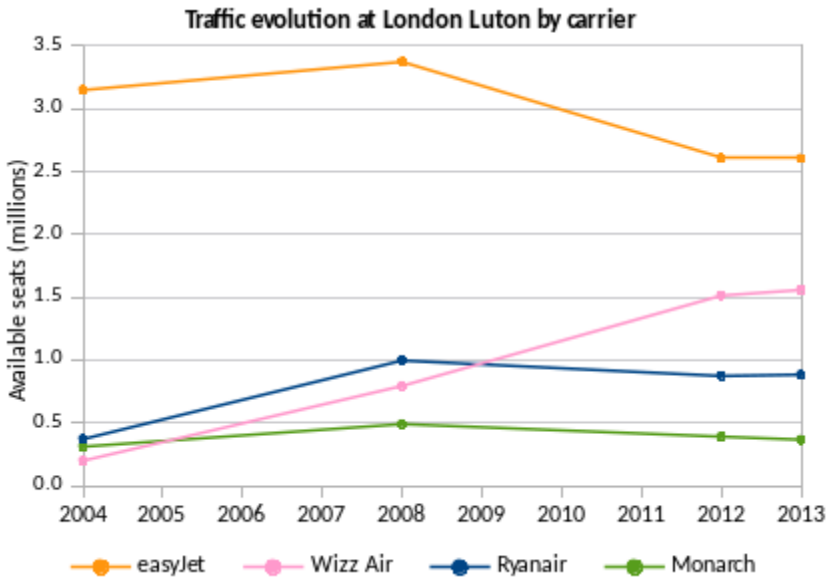

Figure 58: Evolution of available capacity for the major carriers at London Luton. Source: Innovata.

opened in March 2012, on time for the opening of an easyJet base in April that year. Aer Lingus also started operations in May 2012 but its flights (operated by Stobart Air, an airline partially owned by the airport owners) are to be franchised for Flybe from 2014.

According to the owners, SEN was redeveloped with cost-effectiveness in mind. Moreover, their position in the competitive London MAS is strongly based on a quick access to/from London through the dedicated railway station (see section 5.3.3 item v), on simple and fast facilities for passengers, and on short taxiing times and slot availability for airlines (London Southend Airport, n.d.). Following this strategy, the passenger building was further expanded and the second phase opened in April 2014.

6.1.9 Manchester MAS

The MAS at Manchester includes the main Manchester (Ringway) Airport (MAN) and the airports of the nearby cities of Liverpool (LPL) and Leeds (LBA). Manchester Airport is the largest in the UK outside the London area, and thus more than the double of the size of LPL and LBA in terms of passengers. LPL is the main airport for the city of Liverpool but it is located 53 km east of Manchester centre. LBA serves both Leeds and Bradford and it is located about 70 km northeast of Manchester.

Figure 59 shows that traffic at MAN peaked in 2006 with 22.4 million passengers that year, fell to 17.7 millions in 2010, almost the same level of 1999, and then grew again to 20.7 millions in 2013. On the other hand, LPL overcame LBA as the second largest airport in the MAS in 2000 and peaked in 2007 with 5.5 million passengers. In the last two years traffic fell to 4.2 millions as MAN recovered. LBA has had a less dramatic but more consistent growth and more than doubled its passengers from 1.4 millions in 1998 to 3.3 in 2013.

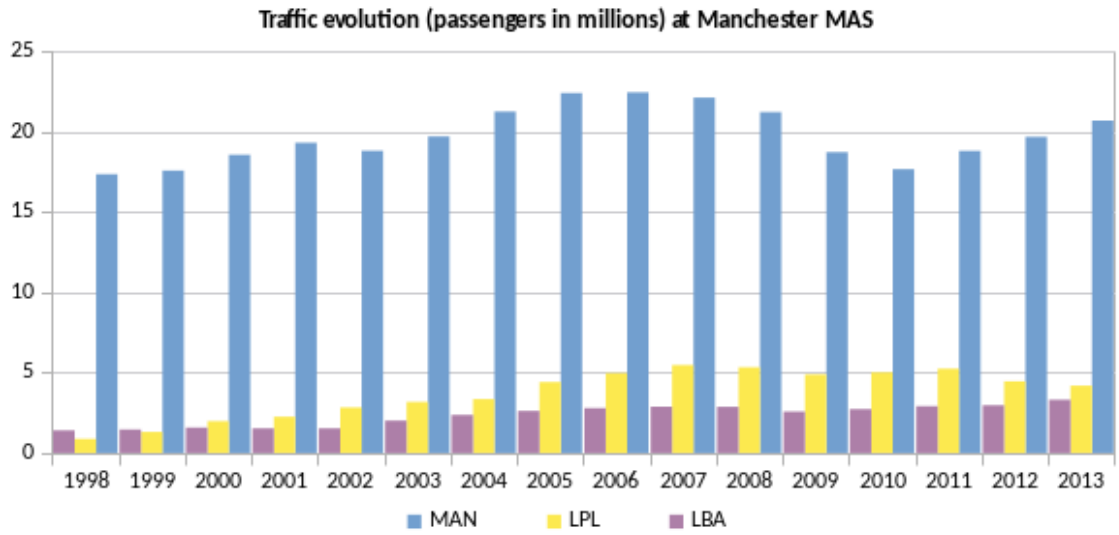

Figure 59: Traffic evolution at Manchester MAS. Source: UK CAA.

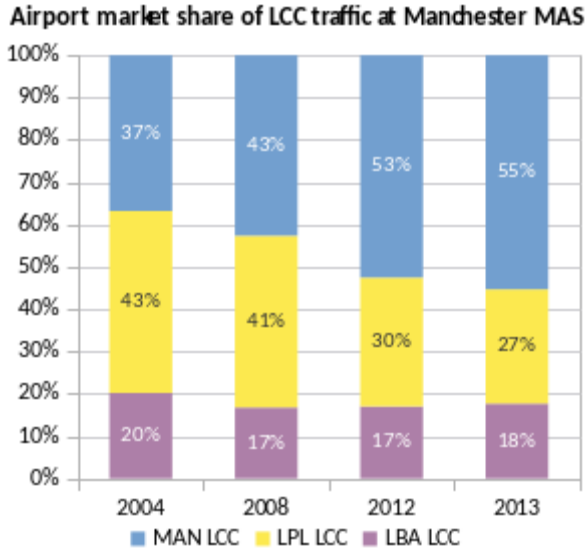

Figure 60: Airport market share of low-cost traffic in the Manchester MAS. Source: Innovata.

Low-cost traffic in the Manchester MAS has been always in the rise between 2004 and 2013, influenced by the growth at the secondary airports and by the efforts of MAN to attract LCCs. As Figure 60 shows, the share of MAN in low-cost traffic has grown to 55% in 2013, mostly at the expense of LPL.

At MAN the largest 'legacy' carriers downsized their operations during the same period. British Airways cut almost 1.9 million seats and bmi shrunk until bankruptcy in October 2012, whilst LCCs like Ryanair, easyJet, Flybe, Monarch and Jet2.com significantly increased their offer (see Figure 61). As in other airports, the acquisition of GB Airways by easyJet gave the airline slots and existing operations at MAN. Ryanair also opened a base at the airport in 2011, this making it the largest carrier in the airport.

In the meantime, MAN was implementing expansion programs that saw a new runway open in February 2001, a public transport interchange (mainly a railway station) in 2004, and improvements across the three terminals in July 2009. Manchester Airports Group

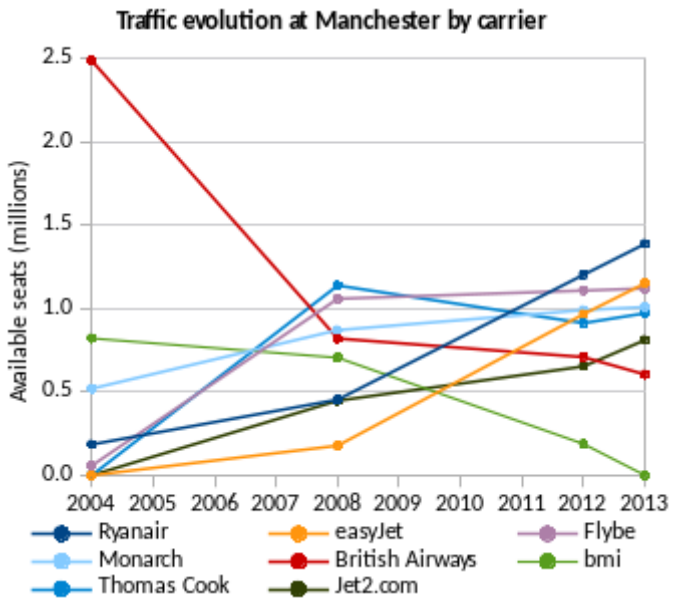

Figure 61: Evolution of available capacity for the major carriers at Manchester Airport. Source: Innovata.

runs MAN but, despite its name, it does not operate the other airports in the MAS (the group owns East Midlands, Bournemouth and London Stansted).

Liverpool (LPL) is, like London Luton, part of the early history of easyJet. It became the airline's second base in the UK in late 1997. LPL was privatised early in the 1990's and in 1997 was acquired by an infrastructure investor, Peel Group. To cater for the growth in passengers a new terminal opened in 2002. Then, in November 2004, Ryanair announced the opening of a base at LPL to join easyJet. Since then, the two airlines compete head to head to be the largest carrier at the airport, as Figure 62 shows. However, Ryanair decided to grow more at MAN after opening a base there in 2011.

Leeds Bradford Airport (LBA) also follows the development of an LCC. Jet2.com, a spin-off of a former freight and charter carrier (Channel Express), was launched at LBA in

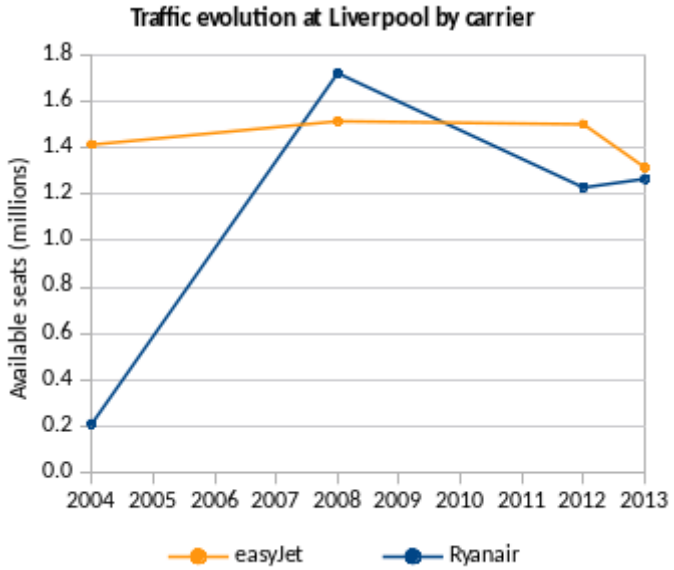

Figure 62: Evolution of available capacity for the major carriers at Liverpool Airport. Source: Innovata.

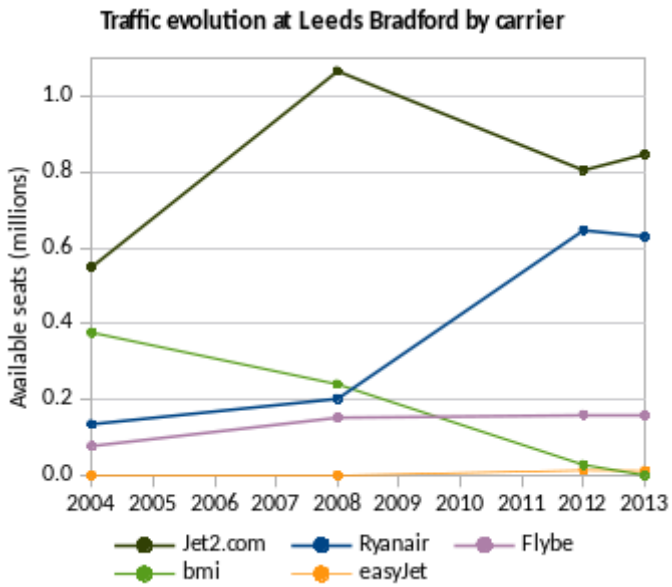

Figure 63: Evolution of available capacity for the major carriers at Leeds Bradford Airport. Source: Innovata.

February 2003. The airline has been the largest at LBA ever since (see Figure 63). The airport was then privatised in 2007 but no major infrastructure developments have been implemented. In 2010 Ryanair opened a base at LBA that attained half the size of its bases in the other two airports in the MAS.

It should finally be noted that, as Figure 64 shows, the diversification of Ryanair into the three airports in the Manchester MAS made it the largest airline in the MAS. Likewise, the expansion of easyJet at MAN, whilst keeping its base in LPL increased its position in the metropolitan area, as Jet2.com at MAN and LBA. Clearly, the reduction in capacity by British Airways has facilitated the consolidation of the low-cost segment in the region.

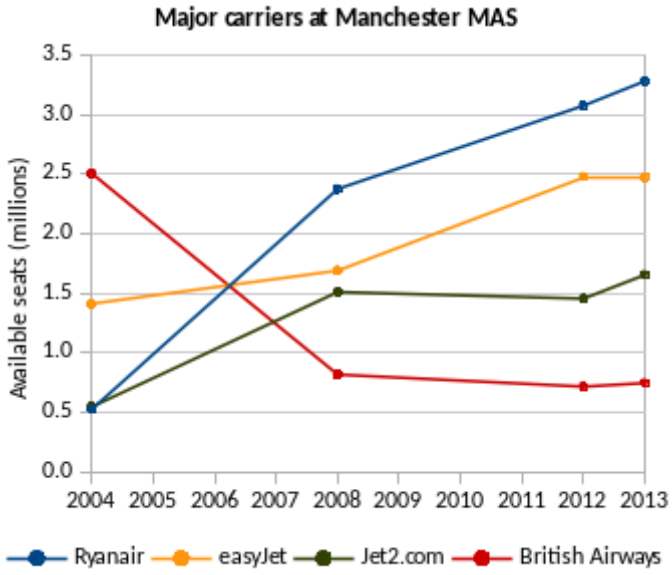

Figure 64: Evolution of available capacity for the major carriers at Manchester MAS. Source: Innovata.

6.1.10 Milan MAS

The Milan metropolitan area, the most populous in Italy, is served by three major airports: Malpensa (MXP), Linate (LIN) and Bergamo (BGY). Linate was the main airport for the city of Milan before the opening of Malpensa, currently the major airport, 40 km northwest from the city centre. Bergamo is located in Orio al Serio, 45 km east of Milan. SEA Milano owns and operates MXP and LIN and holds 31% of the shares in BGY operator SACBO.

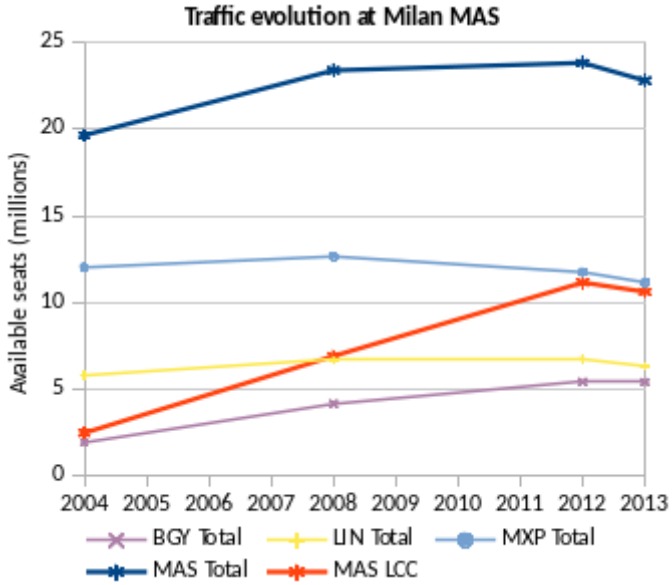

Figure 65: Evolution of available capacity at Milan MAS. Source: Innovata.

As Figure 65 shows, BGY has grown consistently over the previous decade, sustaining the traffic level in the MAS, as traffic at MXP has actually declined and at LIN it has been more or less stable. Indeed, BGY has achieved a total market share of 24% and handles most of the low-cost traffic in the MAS, although MXP has been growing considerably in the segment, as Figure 66 illustrates.

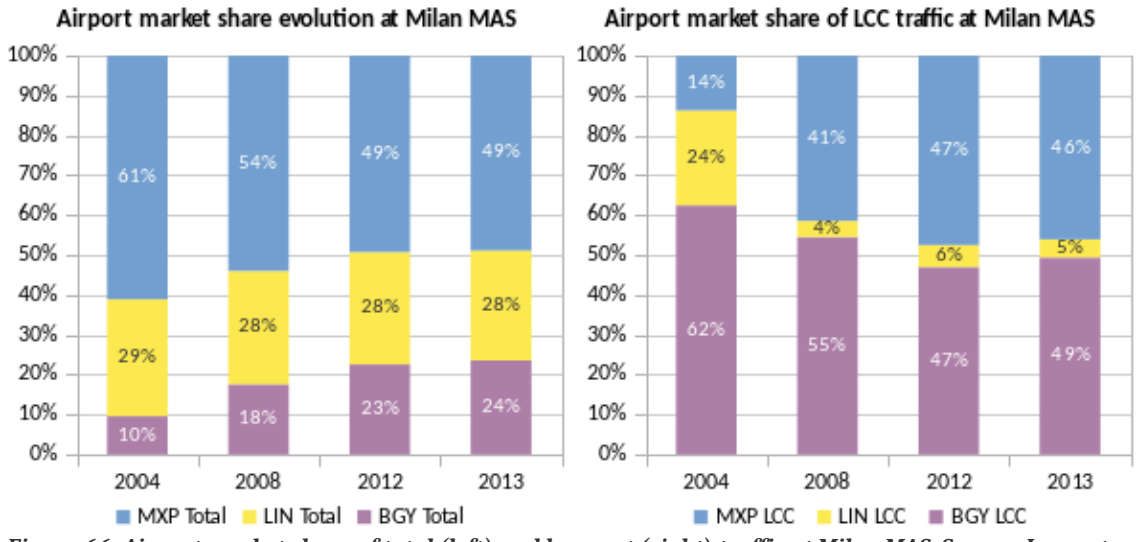

Figure 66: Airport market share of total (left) and low-cost (right) traffic at Milan MAS. Source: Innovata.

LIN, the airport that is closer to Milan centre, was due to reduce its services significantly[17] after a complete renovation of MXP in 1998. Nevertheless, this downscaling was never performed and LIN continues in operation, mostly for short-haul domestic and intra-European routes. Alitalia continues as the largest operator at the airport and, despite easyJet's long-standing services at LIN, the market share of LCCs has been consistently below 10% for the last decade.

MXP, on the other hand, was entirely renovated as part of the "Malpensa 2000" plan to develop a major hub in the region. The first phase of the planned renovations was concluded in October 1998, when the new Terminal 1 entered into service. Shortly afterwards Alitalia established its main hub at the airport but it moved back to Rome Fiumicino in 2008 (this explaining the strong fall in Alitalia's traffic, as shown in Figure 67). In 2006 the airport operator reorganised the scope of the terminals and devoted the old Terminal 2 for low-cost flights.

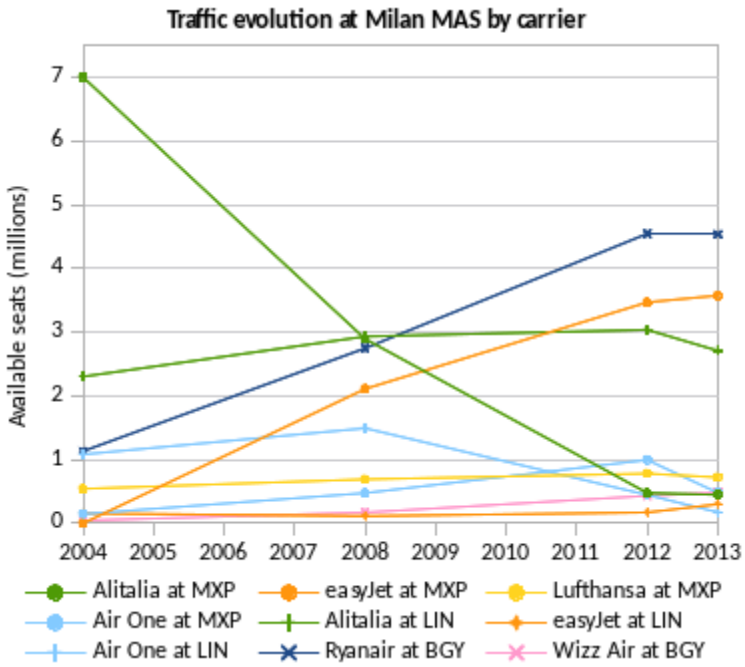

Figure 67: Evolution of available capacity for major carriers at Milan MAS. Source: Innovata.

EasyJet was using MXP since September 2005 and, after the reorganisation, it opened a base there in March 2006. It is the only user of Terminal 2 at MXP and the airport is currently the second biggest base for the airline, in terms of available seats, after London Gatwick and followed closely by Geneva. It is by far the largest airline at the airport, trying to fill the void left by Alitalia (see Figure 67 and Figure 68).

In 2009 Lufthansa created an Italian subsidiary (Lufthansa Italy) that used MXP as a hub, but the separated airline was terminated in October 2011 and operations transferred back to the parent company. Still, by 2013 Lufthansa was the second largest operator at

17 The original intention was to close it for all traffic except a shuttle service to Rome.

MXP following the downsizing of Air One (see Figure 67). The airport has been catering for other airlines to establish long-haul operations. In January 2013 it opened a new satellite for Terminal 1.

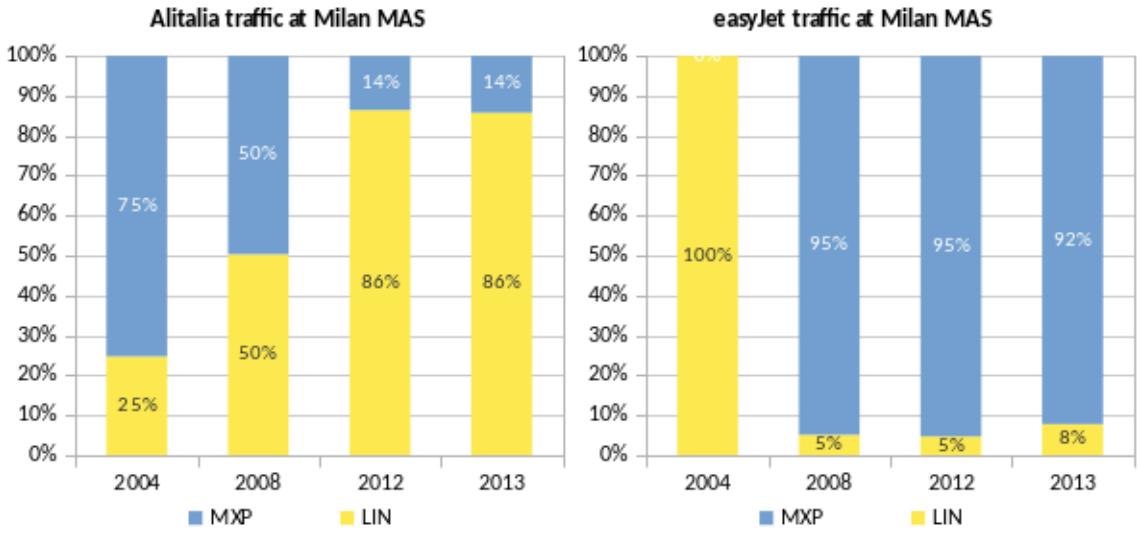

Figure 68: Distribution of capacity for Alitalia and easyJet between Malpensa (MXP) and Linate (LIN) airports. Source: Innovata.

The success at Bergamo, that went from the sixteenth largest Italian airport in terms of passengers in 2002 to the fourth in 2013, is closely related to the ascendency of Ryanair in the European, and particularly in the Italian market. The airline started flying to BGY in early 2002 and opened a base in February 2003. Traffic at the airport grew continuously ever since and it became, by 2013, the third biggest base for Ryanair, behind London Stansted and Dublin, and the biggest in continental Europe, ahead of Brussels Charleroi and Rome Ciampino. Such growth also allowed Ryanair to become the largest carrier in the Milan MAS despite an equally strong growth of easyJet (Figure 69).

To cope with this fast growth SACBO, the operator at BGY, implemented an extension of the parking lots and an improvement of aviation equipment in 2005; a refurbishment

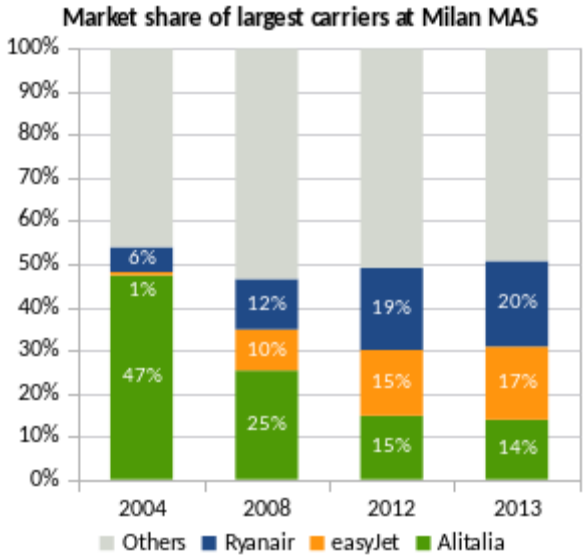

Figure 69: Market share of Alitalia, easyJet and Ryanair at Milan MAS (all airports). Source: Innovata.

for the check-in area and the baggage handling system in 2007; an extension and renewal of departures area in 2009; and a terminal expansion with increased boarding gates and commercial space air-side in March 2010. The latter is part of a 200 million Euro investment plan that, besides terminal expansion and renovation (including retail areas and two VIP lounges), includes apron expansion, runway renovation and new parking spaces.

The airport management considers Bergamo does not, currently, match a traditional “low-cost style”, although it definitively caters especially for LCCs. It has a good, long-lasting, even “friendly” relation with Ryanair (that accounts for around 85% of the seats provided at BGY) and recently renewed a long-term agreement with the airline to cooperate until 2022. Nevertheless, the airport is also interested in attracting other carriers, particularly from extra-European markets, and has been offering new destinations with seasonal charter services.

An important advantage for BGY, and one they consider gives them bargaining power to negotiate with airlines, is the strong catchment area. The airport is located in a region with a large population and with a significant concentration of wealth, but also a considerable number of companies that generate about 22% of Italy's GDP (Mentasti, 2013) and important migrant flows. With this characteristics the area is a traffic generator that enhances the position of the airlines, Ryanair in particular, to negotiate incentives at other airports served from BGY.

BGY also explores cargo activities as a way to improve revenues. It leases a cargo terminal to DHL, which does its own handling and operates most flights during the night. This setting brings cargo revenues at reduced marginal costs for the airport operator and little disruption to the day operations of passenger carriers (some charters also operate during the night).

The recent investments at BGY aim at improving passenger experience and level of service. The current and planned expansions to the passenger building take the airport another step away from the traditional notion of 'low cost airports' by introducing premium services like fast-track security and VIP lounges (paid for by the passengers directly to the airport), extensive retail areas in the second floor of the terminal and a more modern look. The airport operator argues that understanding and accomplishing the real requirements of LCCs in terms of punctuality, efficiency, and operational policies is more important to achieve a successful relationship with the airlines.

6.1.11 Oslo MAS

Oslo MAS includes: Oslo Airport Gardermoen (OSL), the main airport for the Norwegian capital, 35 km northeast of the city; MossRygge (RYG), an air force base 60 km south of Oslo; and Sandefjord Torp (TRF), a regional airport 118 km southwest of Oslo. OSL opened in October 1998 and the old Oslo Airport Fornebu, located within the city, closed immediately and was dismantled. The location of the new main airport was inconvenient for the regions to the south and west of the city, creating opportunities for new airports to emerge. TRF, that had new facilities in place in the 1990's, was the first to attract regional airlines and LCCs. RYG is a rather new development, at least for civilian use, having opened for commercial traffic in October 2007.

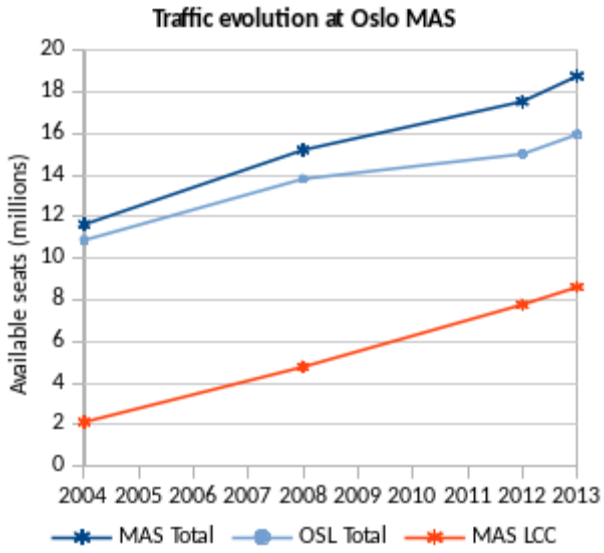

Figure 70: Evolution of available capacity at Oslo MAS. Source: Innovata.

Traffic in the MAS grew steadily during the last decade fuelled by the growth in low-cost traffic, as Figure 70 shows. OSL is by far the largest airport in the MAS for both total

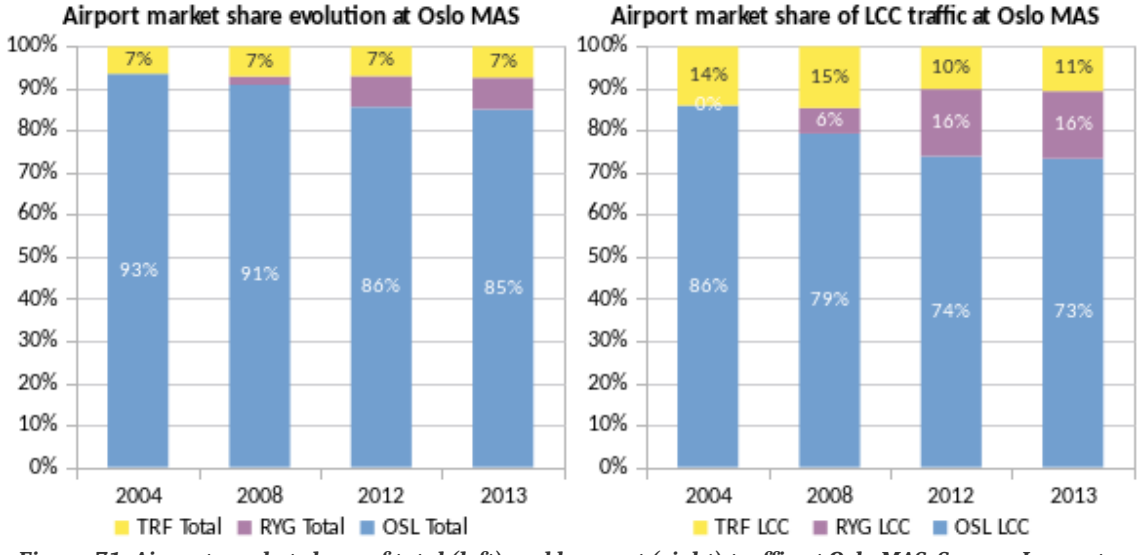

Figure 71: Airport market share of total (left) and low-cost (right) traffic at Oslo MAS. Source: Innovata.

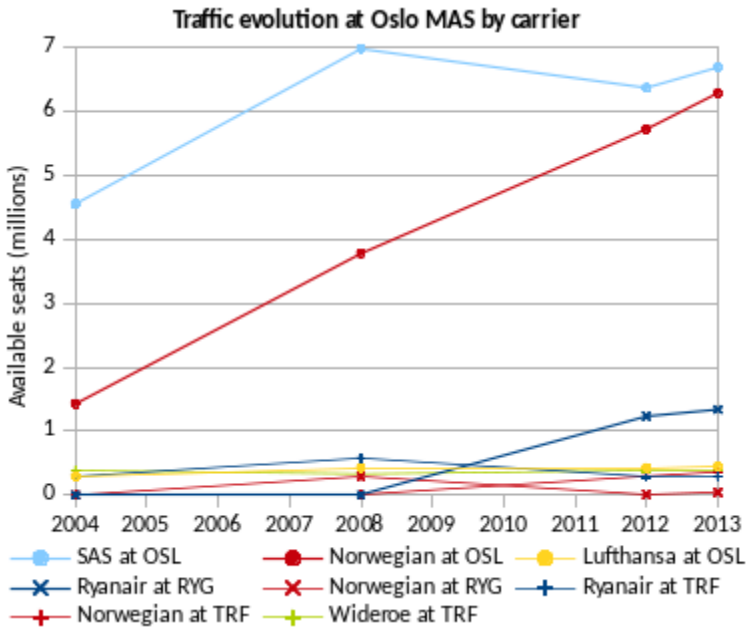

Figure 72: Evolution of available capacity for major carriers at Oslo MAS. Source: Innovata.

and LCC traffic, yet RYG has taken a visible market share, especially in the low-cost segment (Figure 71). The strength of OSL for low-cost traffic is greatly influenced by the development of Norwegian, for which the airport is the largest base.

OSL is currently expanding the main terminal of the airport. It opened "Pier South" in 2012, intended as a temporary extension to keep capacity during construction works. For the first part of the 2000's both Norwegian and SAS grew dramatically at OSL. In the last five years, however, Norwegian almost reached the size of SAS as SAS shrank its operations after 2008 (see Figure 72). Indeed, including the operations of Norwegian at the three airports, the two airlines deploy the same capacity in the MAS, as Figure 73 shows. During the same period, Ryanair grew and became the third largest operator in the MAS, without using the main airport (see Figure 73).

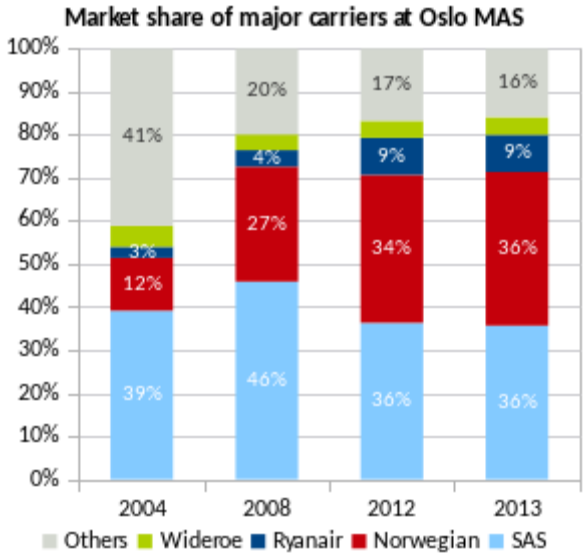

Figure 73: Market share of the largest carriers at Oslo MAS (all airports). Source: Innovata.

Ryanair first flew to Oslo in November 1997 using TRF, before the opening of OSL. At RYG, the civilian sector of the airport, fostered by private investors, opened by the end of 2007 and in February 2008 Norwegian established a base there. But after Ryanair transferred part of the traffic at TRF to a new base in RYG in March 2010, Norwegian did the opposite and terminated most of its services at RYG by the end of 2012, opening more services at TRF (see Figure 72). Wideroe remains a regular user at TRF where a terminal expansion is due to open in 2014.

6.1.12 Paris MAS

The Pairs metropolitan area forms the second largest aviation market in Europe after London. The Paris MAS includes four commercial airports: Charles de Gaulle (CDG), the main hub for Air France and the second busiest European airport in terms of passengers, located 25 km northeast of Paris; Orly (ORY), located 13 km south of central Paris, that was the main airport for the city before CDG; Beauvais-Tillé (BVA), an airport devoted to LCCs 85 km north of Paris; and Vatry (XCR), a new development, 147 km away of Paris.

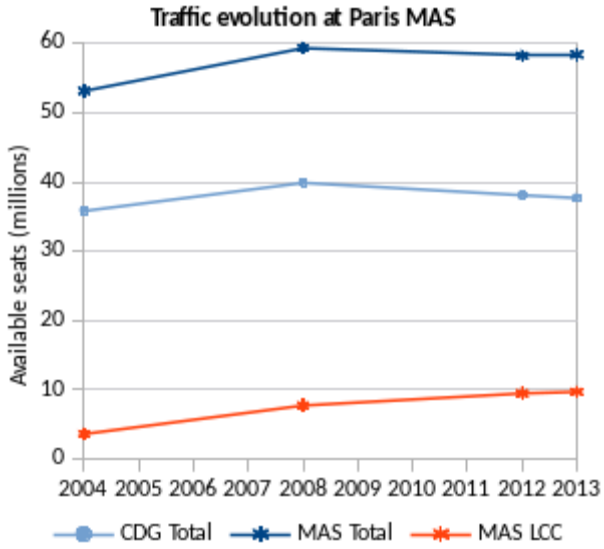

Figure 74: Evolution of available capacity at Paris MAS. Source: Innovata.

Figure 74 shows that total traffic (available seats) in the MAS has declined since 2008 but LCC traffic has grown continuously over the past decade. As Figure 75 (left) shows, CDG is the largest airport in the MAS and its market share decreased only 2%, this decrease being compensated by the growth at BVA. Despite being a major 'legacy' airport, CDG also takes a sizeable share in low-cost traffic, which is dominated by ORY (see Figure 75 right). Conversely, XCR, redeveloped to focus on cargo in 2000 and with a new passenger building to cater for LCCs opened in 2004, has not been able to secure significant traffic in either segment.

CDG has been in constant expansion during the period of analysis. The airport opened in 1974 with a single Terminal 1 featuring a particular circular design connected

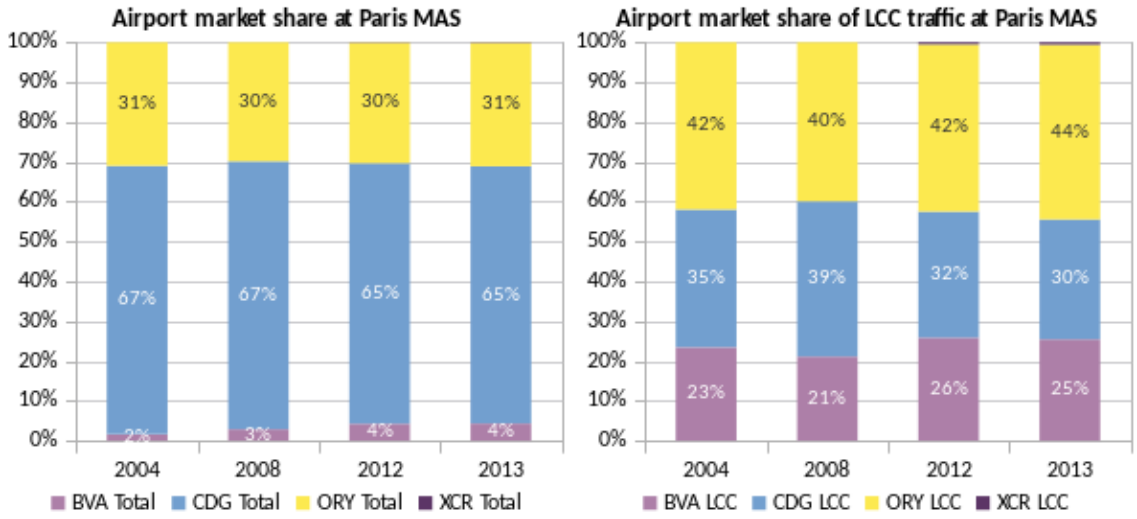

Figure 75: Airport market share of total (left) and low-cost (right) traffic at Paris MAS. Source: Innovata.

underground to seven triangular satellite buildings. Terminal 2 is in fact composed by 9 different buildings, and has been built and expanded by phases. Terminal 2E opened in 2003 but part of its boarding dock collapsed and reopened only in 2008. An automated people mover that connects the different terminals (except 2G), train stations and parking lots – CDGVAL – opened in 2007. By the end of the same year the first satellite of terminal 2E (called Satellite 3 or Hall L) opened. Then terminal 2G, dedicated to regional flights in small aircraft opened in 2008. The oldest Terminal 1 was renovated in 2009. Finally, a connecting building between terminals 2A and 2C opened in March 2012 and the second satellite terminal for Terminal 2E (Satellite 4 or Hall M) opened in June 2012.

Such gradual deployment of capacity, along with the four parallel runways available, make enough room for different airlines. Terminal 3 is frequently referred as 'low-cost' mainly due to its simple facilities (especially compared to the other buildings). Terminal 3 is used mainly by charters and some LCCs (see Table 10), is not used by easyJet, the second largest carrier at CDG far behind Air France (see Figure 76). Although CDG was the sixth largest base for easyJet in 2013, the airline also uses ORY where it is the second largest carrier behind Air France too.

ORY, operated by Aéroports de Paris as CDG, was the main airport for Paris before CDG. Infrastructure development has been more limited during the period of analysis. A renovated Hall 2 in Terminal Ouest (West) opened in April 2006 whilst renovations in Terminal Sud (South) opened between 2007 and 2008. Access via tramway (line T7 that connects with metro line 7 in South Paris) opened in November 2013. ORY has been focusing more on short and medium-haul non-hub traffic. Thus a series of LCCs have expanded at the airport. Besides easyJet, this is also the case of Vueling and Transavia France (the low-cost subsidiary of Air France).

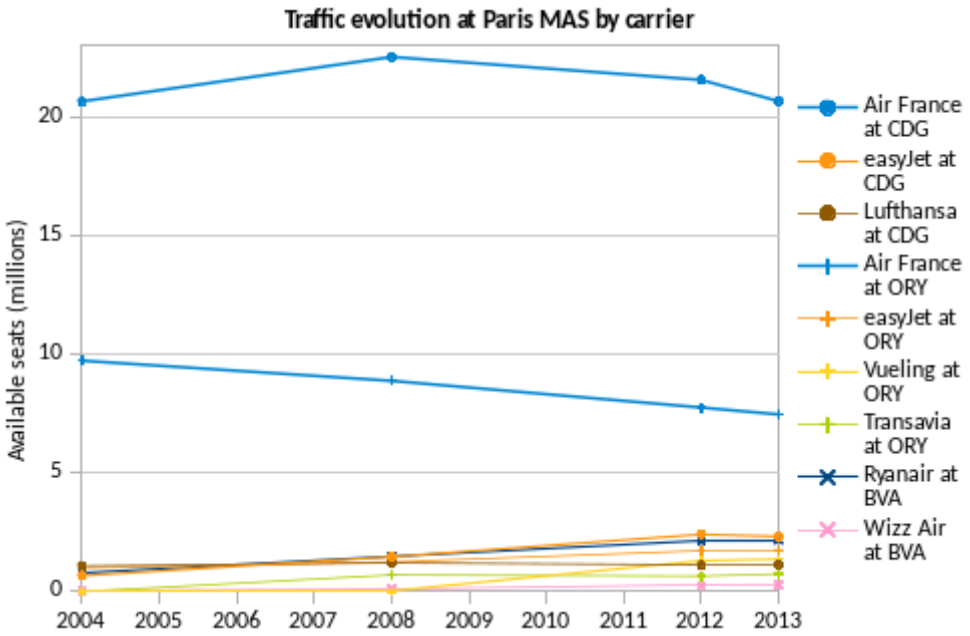

Figure 76: Evolution of available capacity for major carriers at Paris MAS. Source: Innovata.

Beauvais (BVA), originally used by the military until the 1950's, was redeveloped as a civilian regional airport. A passenger building, current Terminal 1, opened in 1979. Yet it was more recently that the airport became significant in terms of passenger traffic. Beauvais, along with Charleroi and Stockholm Skavsta and Oslo Torp, was among the first airports in continental Europe to take advantage of the expansion of Ryanair. The LCC started services from Dublin in May 1997 and low-cost traffic has grown consistently ever since. A new sparse passenger building, Terminal 2, opened in December 2010 to accommodate this growth.

Although Ryanair clearly dominates the airport (it offered 92% of the seats in 2004 and 88% in 2013), BVA managed to attract other airlines, particularly Wizz Air (that accounted for 11% of the seats in 2013). Despite handling over 3.9 million passengers in 2013, BVA is not a formal base for any airline hence there are no aircraft overnight at the airport. This keeps the costs for the airport operator low as it is able to close after the last departures at 23:30 and reopen only for the first arrivals and departures at 06:30.

6.1.13 Rome MAS

The MAS of Rome includes the main Rome Fiumicino airport (FCO), the busiest airport in Italy, located 35 km southwest of the city centre, and Rome Ciampino (CIA), the former main airport of the city 12 km southeast of central Rome. FCO opened in the 1960's because there was no space available to expand CIA, that remained open mostly for charters and general aviation.

Fiumicino (FCO) is clearly the largest airport in the MAS, as shown in Figure 77. Although the capacity offered by the airlines has receded after 2008, passenger numbers

have actually increased to 36.2 millions in 2013 (compared to 34.8 in 2008). This situation can be explained by the growth of LCCs that already saturate CIA, but have been expanding at FCO and usually operate with higher load factors. As Figure 78 shows, easyJet transferred all its flights from CIA to FCO around 2008, and Vueling also established a significant presence at the airport. At the same time, Air One reduced its offer after merging with Alitalia. Infrastructure development during this period was not significant, only Terminal 5 – offering departures to US and Israel in some airlines – opened in 2008.

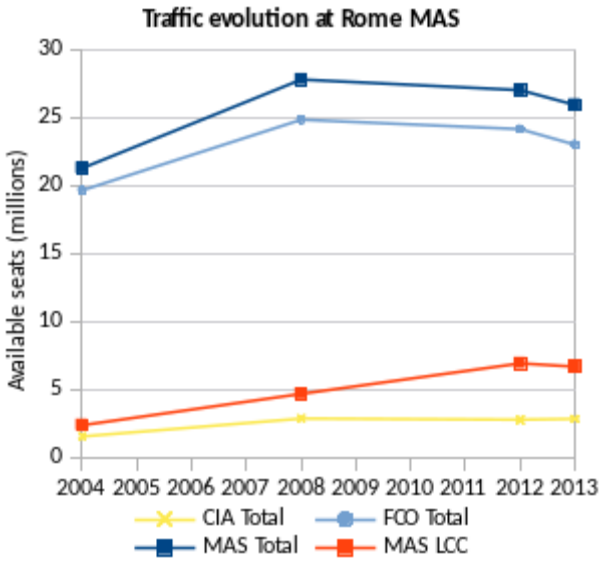

Figure 77: Evolution of available capacity at Rome MAS. Source: Innovata.

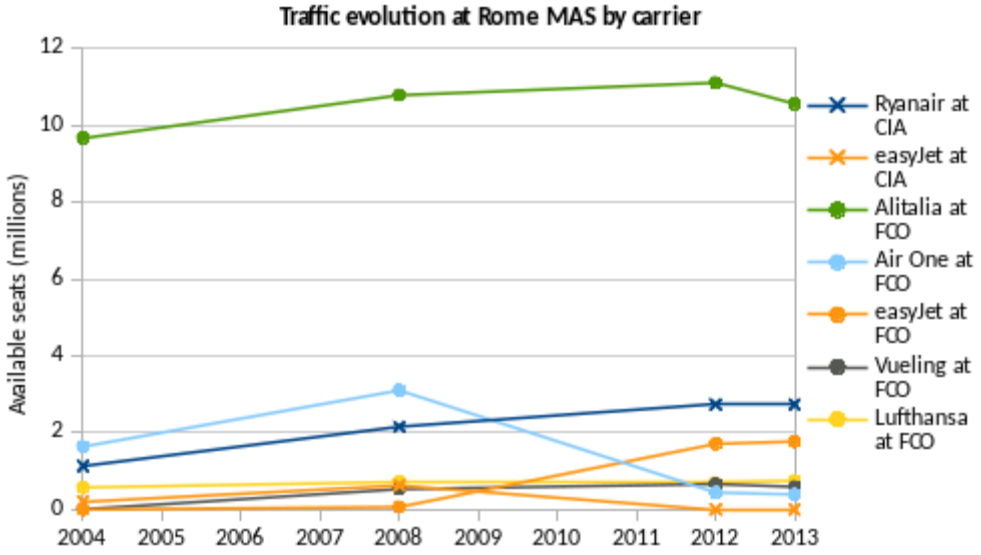

Figure 78: Evolution of available capacity for major carriers at Rome MAS. Source: Innovata.

Ciampino (CIA) reached its maximum capacity and can hardly handle more than 5 million annual passengers. Nevertheless, the airport had almost 5.4 million passengers in 2007 but then the Italian civil aviation authority, ENAC, capped the number of flights per day allowed at CIA, to control noise. Given these limitations, LCCs have diverted to FCO

during the last years, and the main airport now handles more low-cost traffic than CIA (see Figure 79).

Ryanair, based at CIA since 2004, offered over 93% of total seats at the airport. Wizz Air, the only other airline at CIA also operates at FCO. Even Ryanair opened a base at FCO by the end of 2013, coinciding with the planned growth of easyJet and Vueling at the airport (CAPA Centre for Aviation, 2014d).

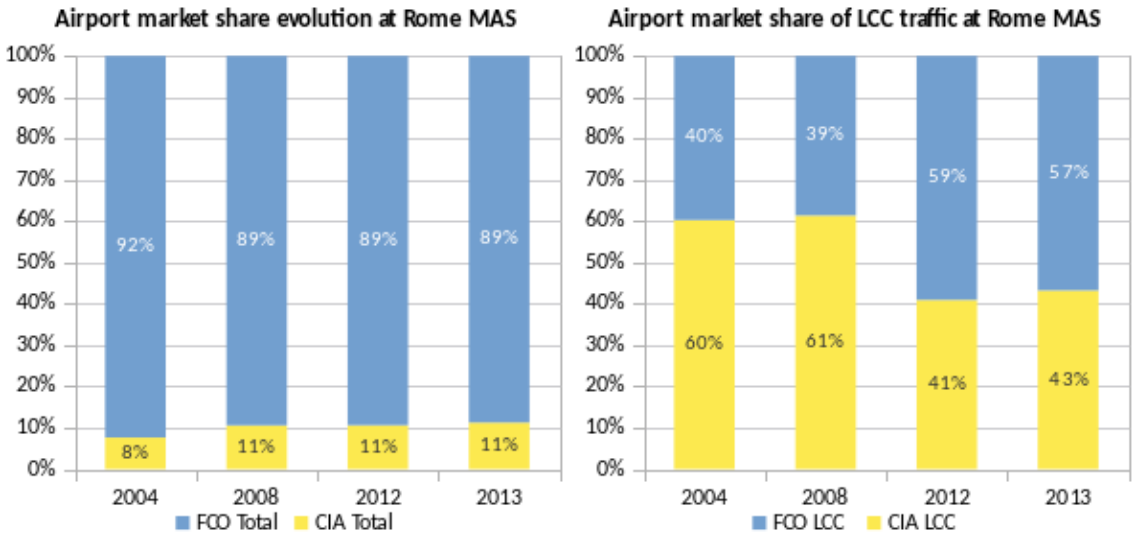

Figure 79: Airport market share of total (left) and low-cost (right) traffic at Rome MAS. Source: Innovata.

6.1.14 Malaga Airport

Malaga Airport (AGP) is located 8 km away of Malaga, in the Mediterranean Costa del Sol, one of the most important tourist destinations in the south coast of Spain. As Figure 80 shows, the total traffic at AGP fluctuated around 12 million passengers per year between 2005 and 2013. Nevertheless, the market share of LCCs grew steadily and they now dominate the airport with over two thirds of the market.

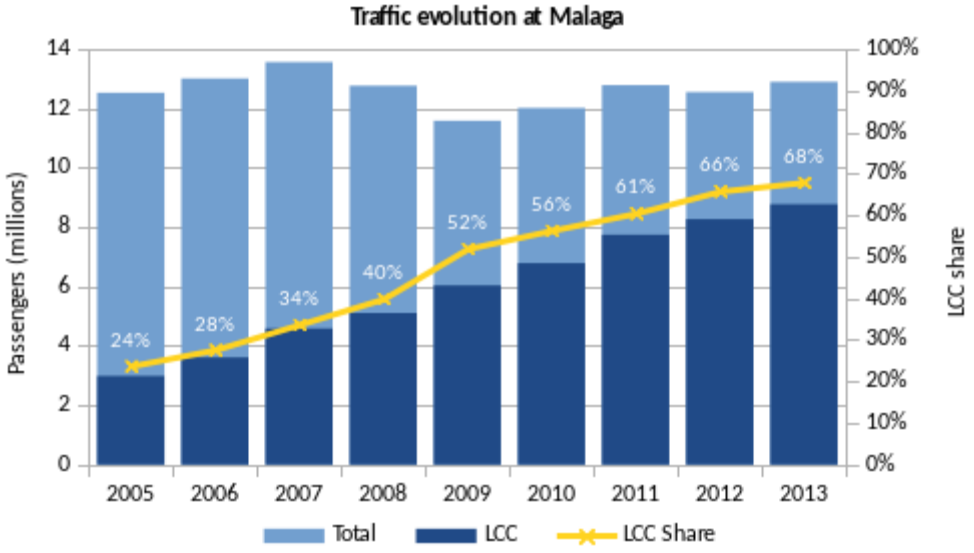

Figure 80: Evolution of passenger traffic and the market share of LCCs at Malaga Airport. Source: AENA.

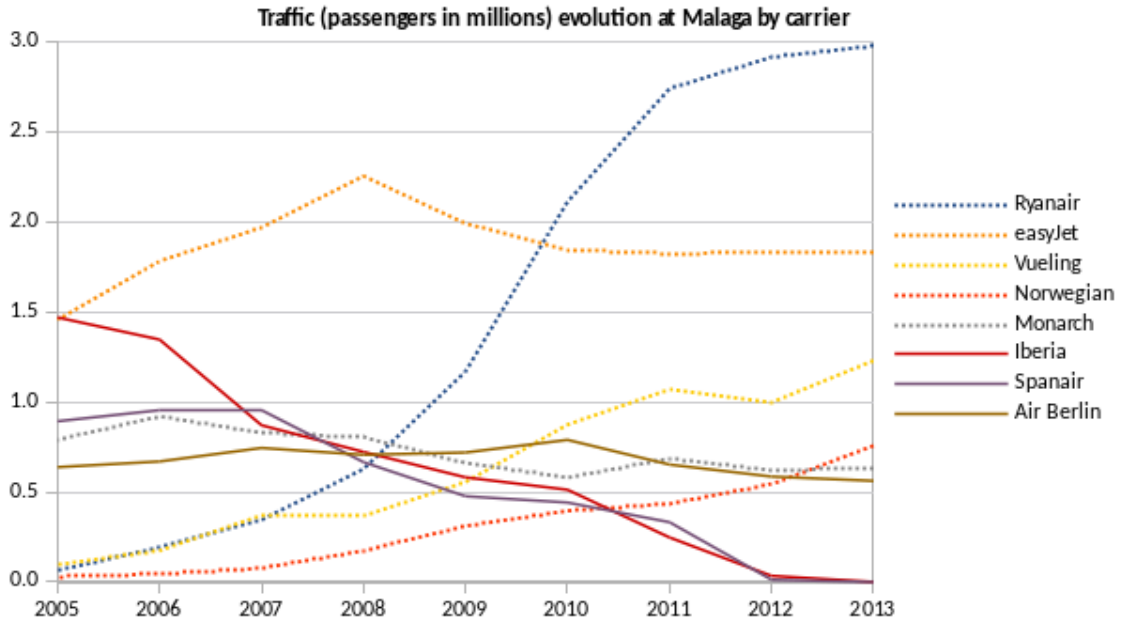

Figure 81: Evolution of traffic for the largest carriers at Malaga Airport. Source: AENA.

Indeed, as shown in Figure 81, most LCCs have grown at Malaga (AGP), especially over the last five years as 'legacies' Iberia and Spanair abandoned the airport. EasyJet took the lead but reduced some services after 2009. Ryanair opened a base at AGP in June 2010 and became the largest carrier since then. Vueling, now the third largest operator, inherited the base that Clickair had established in 2007 after the merger of the two airlines. Norwegian also opened a base at AGP in 2012, and subsequently increased its own traffic. Air Berlin remains the largest FSC at AGP, with traffic more or less stable.

Despite the lack of extensive traffic growth, the airport experienced significant infrastructure investments during the period of analysis. A new 410 million Euro passenger building, Terminal 3, opened in March 2010 to increase peak capacity. Terminal 2 was then merged with the new building, and Terminal 1 was closed. Following the new terminal, a railway station opened in September 2010. Then, a new runway opened in 2012, along with a new apron and corresponding taxiways.

6.1.15 Dublin Airport

Dublin (DUB) is the largest airport in Ireland in terms of passengers. It is also the location of Ryanair headquarters and part of the airline's history, almost since its beginning when it was still a FSC. Ryanair first flew out of DUB in 1986 before becoming a LCC in 1990. Traffic at DUB grew considerably during the 1990's and 2000's until 2008, along with the market share of LCCs (see Figure 82). Passenger numbers then fell sharply in 2009 and 2010 due to the Irish financial recession and a drastic cut in Ryanair's capacity (see Figure 83).

The main passenger building, Terminal 1, expanded considerably during the 1990's. As traffic growth continued, a new “Pier D” for Terminal 1 opened in October 2007. This pier, that lacks air bridges to board aircraft, is used for all Ryanair flights since its opening. By 2008, Ryanair was the largest user at DUB (see Figure 83) and strongly opposed the development of a new passenger building (Terminal 2) that they deemed not cost efficient (Ryanair, 2007). Despite this opposition, Terminal 2 went ahead and opened in November 2010 amid financial crisis in Ireland and the Euro zone. Both Ryanair and Aer Lingus had reduced their services but there was an important recovery in 2013.

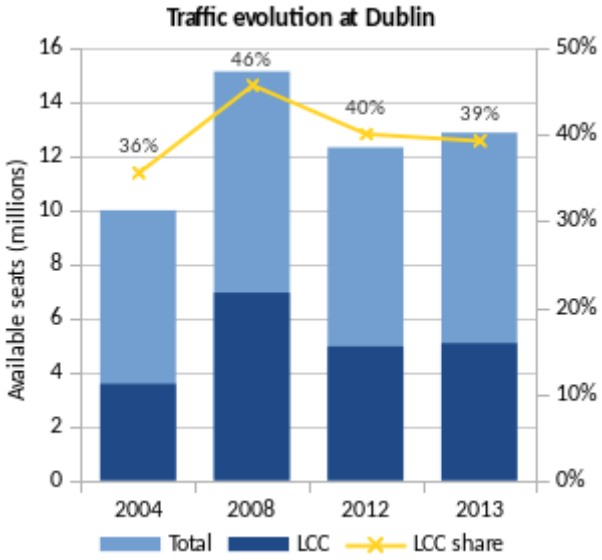

Figure 82: Evolution of passenger traffic and the market share of LCCs at Dublin Airport. Source: Innovata.

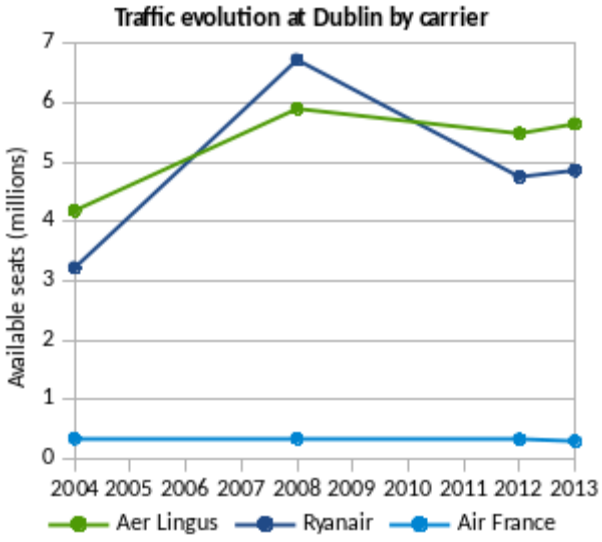

Figure 83: Evolution of available capacity provided by the major carriers at Dublin Airport. Source: Innovata.

The strong position of Ryanair at DUB, that encouraged significant cost reductions in the Irish flag carrier, Aer Lingus (ANNA.aero, 2008), kept other LCCs away from the airport. In 2013 Ryanair offered 37.7% of the total seats at DUB, very close to the total LCC share at 39.4%. This pattern repeated for the period of analysis and, in fact, Ryanair and

Aer Lingus offered 82% of the total capacity at DUB in 2013, leaving little room for other airlines to consolidate.

6.1.16 Madrid Airport

Madrid Barajas (MAD) is the airport serving the Spanish capital city. The airport was subject to extensive investments in capacity expansion between 1998, when a new runway opened, and 2006 during the implementation of the "Plan Barajas" program by AENA. The plan aimed at alleviating congestion in terminals 1, 2 and 3, and at providing better infrastructure for the hub of Iberia, the Spanish flag carrier.

The plan was completed in February 2006 with the opening of the new Terminal T4, along with the satellite 4S (connected by an underground automated people mover to T4), two new runways, and associated aprons and taxiways, and the supporting systems for baggage handling and traffic control. The new terminals provided additional capacity for 35 million passengers per year, doubling the total capacity at MAD to 70 millions. Iberia and its One World allies became the main users of the new terminals.

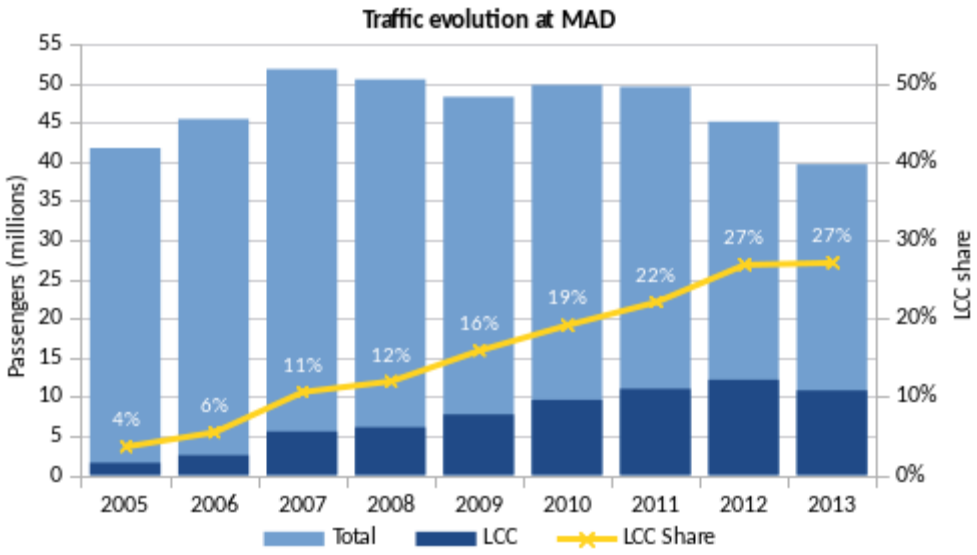

Figure 84: Evolution of passenger traffic and the market share of LCCs at Madrid Airport. Source: AENA.

As Figure 84 shows, traffic grew for another two years after infrastructure expansions but then decreased considerably. In 2013 MAD handled 39.7 million passengers, less than the 41.8 millions in 2005 prior to renovations. This let the airport with extensive capacity available that was largely taken by LCCs. Indeed, the low-cost segment grew from just 4% in 2005 to 27% in 2013 mostly using the old terminals 1 and 2 (except for Vueling and Iberia Express more recently).

The opening of the high speed train line between Madrid and Barcelona in February 2008 also impacted traffic at the airport, particularly for Iberia (see Figure 85). On top of that, the weak economic situation of both the country and Iberia by the end of the decade,

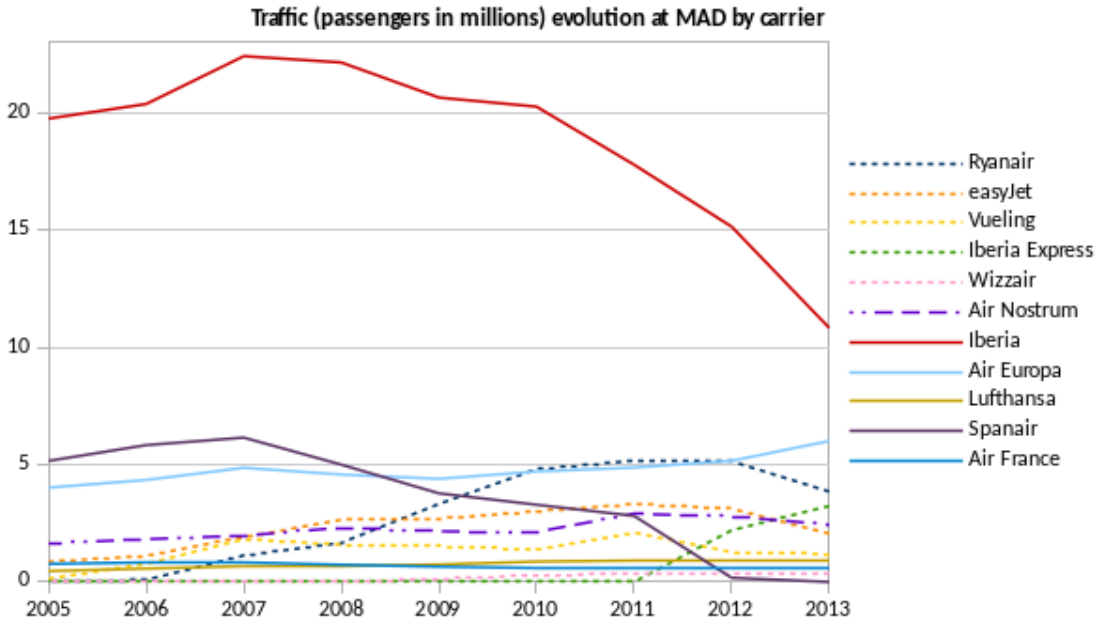

Figure 85: Traffic evolution of largest carriers at Madrid Airport. Source: AENA.

hampered traffic development. Ryanair and easyJet, operating at MAD since the end of the 1990's, were quick to take advantage of available capacity. Ryanair opened a base in November 2006 and easyJet followed in February 2007.

Nevertheless, as AENA increased airport fees in 2012, Ryanair downsized operations at MAD and easyJet dismantled its base in the winter 2012/2013 season. Iberia, on the other hand, responded to the intense competition by creating yet another in-house LCC (Iberia Express this time) and assigning more feeding for the hub to its regional franchisee Air Nostrum. Overall, adding up the market share of Iberia, Iberia Express and Air Nostrum, these airlines were responsible for 41% of the passengers in 2013, 10% less than Iberia and Air Nostrum in 2005 (see Figure 86). Air Europa, in the meantime, took the opportunity of a weaker Iberia to grow and make of MAD its hub as well.

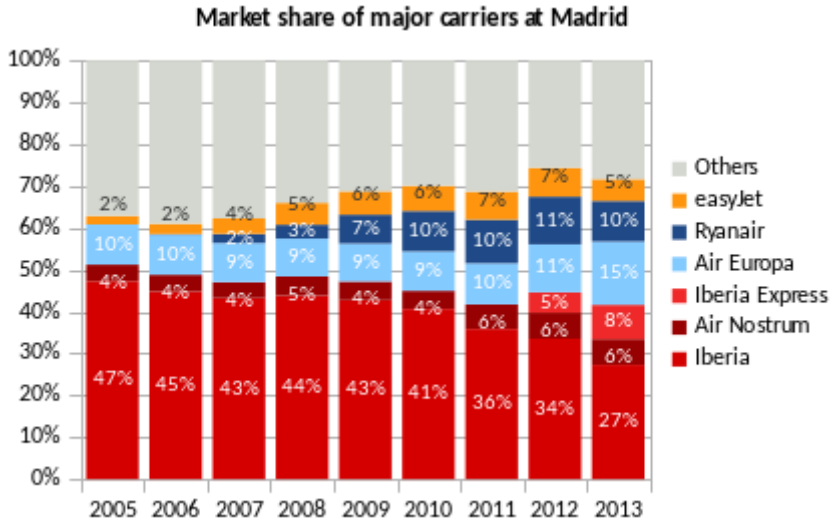

Figure 86: Evolution of the market share of major airlines at Madrid Barajas. Source: AENA.

6.1.17 Palma de Mallorca Airport

Palma de Mallorca Airport (PMI), located in the largest of the Balearic Islands, is the third largest in Spain, with over 20 million passengers per year. PMI is home of Air Europa headquarters and it is the second largest airport for the airline, after its Madrid hub. PMI also serves as a hub for intra-European flights of Air Berlin and it is the third largest airport for the airline.

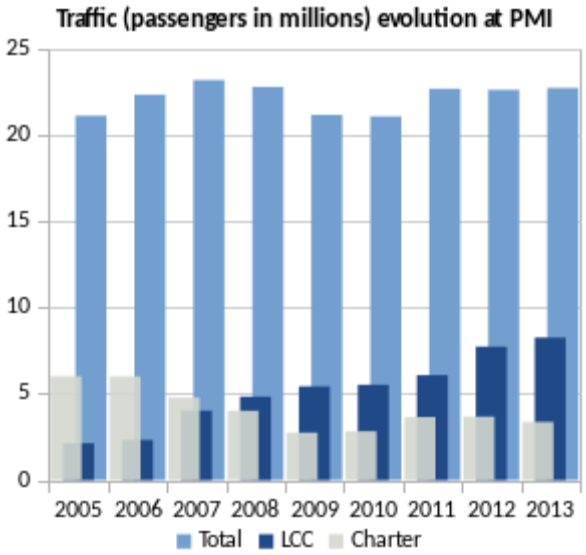

Figure 87: Evolution of passenger traffic at Palma de Mallorca Airport. Source: AENA.

PMI concentrates regional traffic between the different islands in the Balearic archipelago. A passenger building, "Module B", opened in 2003 to handle inter-island traffic exclusively. But PMI is mainly a major tourist destination in the Spanish Mediterranean. As a consequence, charter traffic was considerable at the airport and more important than low-cost traffic before 2008 (see Figure 87). Due to the influx of tourists, the airport is subject to significant seasonality and another passenger building, "Module A", is used only during the summer periods. LCCs have gradually replaced charters from 2008 onwards. Total traffic fluctuated around 22.5 million annual passengers during the last decade.

Air Berlin, which followed a more low-cost model during late 1990's and early 2000's, connects some traffic at PMI. To facilitate this kind of hub operations, the airport operator expanded and refurbished the "Module C" concourse in 2011. As Figure 88 shows, Air Berlin is the largest carrier at PMI. The reduction in traffic in 2011 was due to the assignment of routes to Niki, another airline of the Air Berlin group, hence the traffic level for the group has remained stable after several years of continuous growth.

Some charter airlines are still strong at PMI, such as Condor and Thomson. LCCs are mainly represented by easyJet and Ryanair. The latter started using the airport in 2007 and

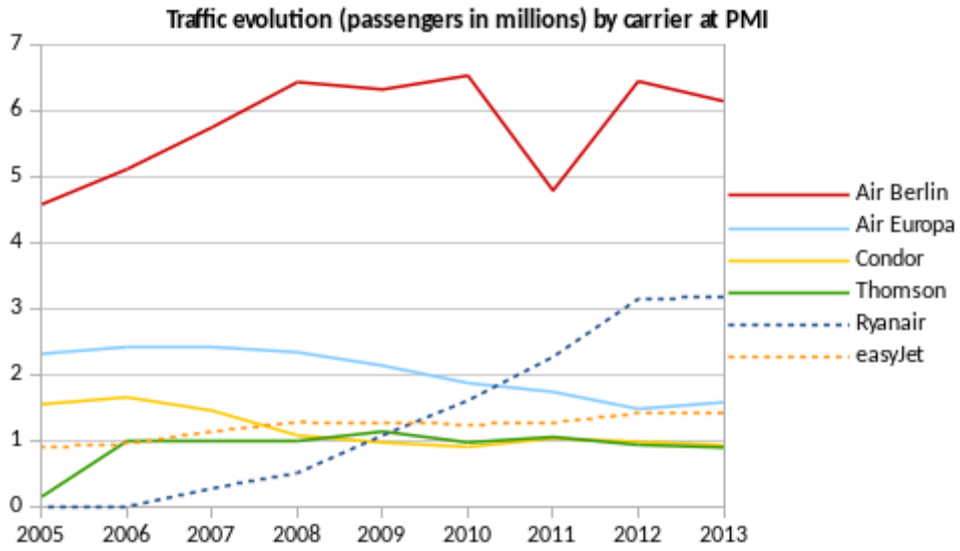

Figure 88: Traffic evolution of largest carriers at Palma de Mallorca Airport. Source: AENA.

kept growing to become the second largest operator. In 2012, Ryanair opened a base at PMI.

6.2 Dynamic evolution of airports

Based on the findings of the multiple cases presented above, and inspired by the work of Bonnefoy (2008) on the evolution of Multi-Airport Systems in metropolitan regions, this section presents a conceptual model that aims at understanding the impact of LCCs in the evolution of European airports. First we identify generic patterns for traffic development, then we describe how the mechanisms that generate those patterns dynamically interact in order to redefine the airport systems in what concerns the distribution of low-cost traffic.

6.2.1 Patterns of low-cost traffic evolution at European airports

Despite the particular characteristics that make every case unique, we have identified four generic mechanisms that trigger different patterns of traffic evolution in the airports involved. Table 16 gives examples of each case.

i) Capacity expansion at primary airports

The first mechanism relates to the implementation of a major capacity expansion at a primary[18] (or at the only) airport in the system. In this case low-cost traffic is typically promoted because the airport is unable to attract the foreseen growth in non-LCC traffic that has apparently justified the expansion (see Figure 89). Given that additional capacity can only be deployed in lump sums, some airports invest in large expansions, based on long-term forecasts that are highly uncertain. When investments are realised (typically 2

18 Bonnefoy (2008) considers primary airports those that handle over 20% of total traffic in a Multi-Airport System (secondary airports thus handle 20% or less). In the case of systems with a single airport this is naturally considered a primary one.

to 6 years after construction started depending on the scale of the project, and 5 to 15 years after planning – i.e. forecasting – started) external conditions that affect demand are different (as in the case of Spanish airports in which most major expansions opened in the middle of the economic recession).

Table 16: Mechanisms of low-cost traffic evolution in airport systems.

Capacity expansion at primary airports	New/emerged primary airports	New/emerged secondary airports	Market disruptions
	Examples from the case studies:		
Madrid (MAD), Barcelona (BCN), Alicante (ALC), Edinburgh (EDI), Milan Malpensa (MXP), Malaga (AGP), Paris Charles de Gaulle (CDG), Amsterdam (AMS), Palma de Mallorca (PMI)	Primary airports unable to attract non-low-cost traffic: Istanbul Sabiha Gokcen (SAW), London Stansted (STN), (Eindhoven, EIN, to a lesser extent as it was developed mainly with charter and LCCs in mind) Primary airports fostering LCCs at new/emerged secondary or former primary airports: Oslo (OSL), Rome Fiumicino (FCO), Paris Charles de Gaulle (CDG)	Murcia San Javier (MJV), Girona (GRO), Reus (REU), Charleroi (CRL), Prestwick (PIK), Luton (LTN), Southend (SEN), Liverpool (LPL), Bergamo (BGY), Oslo Rygge (RYG), Beauvais (BVA), Paris Vatry (XCR)	Alicante (ALC), Rotterdam (RTM), Barcelona (BCN), Brussels (BRU), Copenhagen (CPH), Oslo (OSL), Glasgow (GLA), Edinburgh (EDI), Gatwick (LGW), Manchester (MAN), Milan Malpensa (MXP), Paris Orly (ORY), Madrid (MAD), Dublin (DUB), Malaga (AGP), Palma de Mallorca (PMI)
	Other examples not in the case studies:		
Lisbon (LIS), Porto (OPO)	Athens (ATH), Lublin (LUZ), Berlin Brandenburg (BER, catering to all kinds of traffic, whenever opens)	Warsaw Modlin (WMI), Frankfurt Hahn (HHN), Munich Memmingen (FMM), Grenoble (GNB)	Budapest (BUD), Cologne-Bonn (CGN), Düsseldorf (DUS)

If expected demand does not occur, unused facilities with high fixed costs become a burden for the airport operator. LCCs (and in particular the largest European LCCs) have large fleets that can be deployed quickly and flexibly (crew and single-type aircraft are readily available across many bases) to stimulate demand with low fares and occupy the emerging empty space. This pattern is more visible when capacity was added by building new separate terminals. The old terminal(s) either close, possibly creating congestion in the new buildings, or attract LCCs.

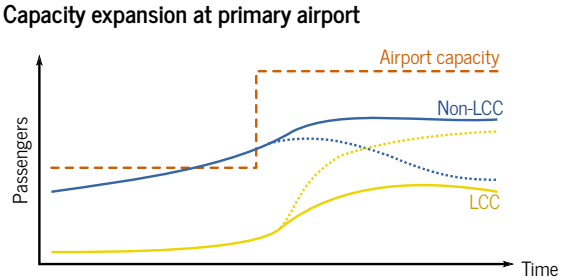

Figure 89: Typical traffic patterns at a primary airport before and after considerable capacity expansion.

If demand for traditional airlines effectively grow but not at the expected rate, the marginal cost of providing capacity for LCCs is much lower than before the expansion, when the airport was more congested. In this case LCCs can also thrive at the airport by exploring new markets with higher yields.

ii) New/emerged primary airports

The second mechanism involves the emergence of a new primary airport in the region, not necessarily a greenfield project as major redevelopment of former facilities can also be considered. When, in a given airport system, a new primary airport is built (or an existing airport is extensively redeveloped to become a primary airport), there are typically two patterns of evolution according to whether the new/emerged airport is able to capture traffic or not (see Figure 90).

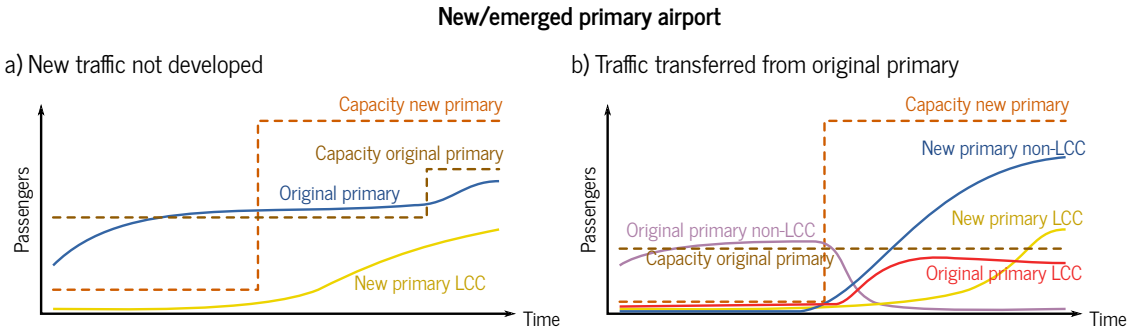

Figure 90: Typical traffic patterns when a new or redeveloped primary airport emerge.

In the first case (Figure 90 left) the new airport opens, the old one is not closed, and its traffic is not forced to transfer to the new location. As traffic does not materialise in the new facilities, the airport operator needs to increase revenues to balance high fixed costs and LCCs become a natural option for the airport to foster growth. In the meantime, capacity at the original primary airport may be increased to cope with congestion. Eventually, some LCCs may operate from the original primary airport as well, especially through acquisitions or mergers, whilst some non-LCC carriers may also use the new/emerged airport, especially foreign FSCs or charters.

London Stansted (STN) and Istanbul Sabiha Gokcen (SAW) are the best examples of this pattern. Built to alleviate congestion in other primary airports, STN and SAW only grew to prominence when LCCs started regular services.

In the second case (Figure 90 right) traffic is transferred from the original primary airport to the new development, but the old airport is not dismantled. Eventually, low-cost traffic may develop almost exclusively in the original primary airport (which can become a secondary one if traffic at the new primary grows considerably) but limited to the available capacity. When capacity is reached, the airport is not expanded (usually there is no space to do it, this being the reason for the new development) and some LCCs can go to the new/emerged primary airport to continue growing. The Rome MAS illustrates this case very well. Fiumicino (FCO) was built to replace Ciampino (CIA) as the main airport, after some years empty CIA turned a secondary airport for LCCs but then most LCCs started expanding at FCO.

It may also happen that the original primary airport gets closed and dismantled (as in Oslo or as it is planned for Berlin). The new airport can be designed with different types of traffic in mind and thus allow space for the growth of LCCs. Moreover, especially when the new location becomes inconvenient for some travellers (as in the case of Oslo), the new primary airport can foster the (re)development of secondary airports that mainly target LCCs.

Sometimes the new primary airport does not capture any traffic at all. Montreal Mirabel Airport is perhaps the most renowned case, but it is out of the geographical scope of this dissertation. Examples in Europe are not uncommon though: the 1.1 billion Euro Ciudad Real Airport (intended to be South Madrid Airport) opened in December 2008 and closed in 2012 with less than 100 000 passengers over that period; the Region de Murcia International Airport, also in Spain, has not seen its first passenger despite construction ended in 2012; opening of Berlin Brandenburg has been severely delayed and it is not expected to happen soon.

iii) New/emerged secondary airports

The third mechanism relates to the emergence of a new, or existing but underused, secondary airport in the region served by an existing primary airport. In this case the emerging airport typically attracts mostly low-cost traffic (see Figure 91). In many cases, secondary airports accompanied the expansion of LCCs and their developers provided incentives or better opportunities to capture that market (as in Charleroi, Luton, Liverpool, Bergamo, Beauvais, for instance). For start-up LCCs, these airports offered a lower cost but also lacked congestion and had simple layouts that favoured streamlined efficient operations.

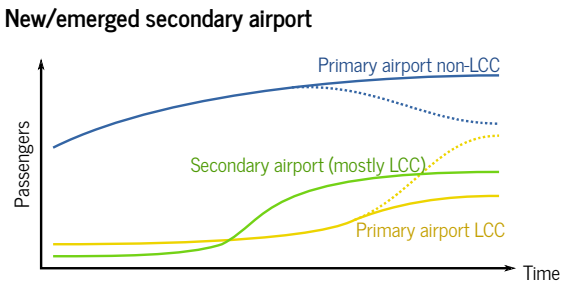

Figure 91: Typical traffic patterns when a new or redeveloped secondary airport emerge.

Yet emerged secondary airports can also foster the growth of LCCs at the primary airport mainly by raising awareness of competition between airlines and between airports. Thus, as Figure 91 shows, low-cost traffic at the primary airport may become more important than at the secondary airport, particularly when LCCs with a more hybrid proposition come to the primary airport. In addition, if non-LCC carriers cannot sustain

competition from their low-cost counterpart, the significance of LCC traffic at the primary airport can also increase as these airlines downsize their operations.

Secondary airports may also fail to attract traffic, thus facing closure or downscaling, transferring part of their LCC traffic to primary airports (or to other secondary airports). Paris Vatry (XCR), for instance, has not been able to establish significant operations since its redevelopment. Forli Airport, in Italy, went bankrupt in 2013 and most flights moved to Rimini and Bologna nearby. Hamburg Lubeck, although it has not closed and still handles LCC traffic from Wizz Air, also filed for bankruptcy in early 2014 as it lost most services from Ryanair. Beja Airport, located in between Lisbon and the Algarve in Portugal, opened in 2011 aiming at attracting LCCs but has not attracted any regular scheduled operator to date.

iv) Market disruptions

The fourth mechanism involves the occurrence of market disruptions at a given primary or secondary airport affecting either the airlines that use the airports or the airports themselves. Market disruptions imply changes in the traffic mix of the airport system that are not directly related to changes in the infrastructure. These disruptions include new LCC start-ups, changes in the commercial focus of a major airline (from FSC or charter to LCC, or vice versa, for instance) at the airport, or of the airport itself (due to change in ownership or management); bankruptcy or downscaling of a major airline (de-hubbing, for instance); and mergers or acquisitions.

Figure 92 shows the typical traffic pattern that leads to strengthened position of LCCs at an airport after market disruptions. The overall growth of LCCs in Europe increased competition with traditional 'legacy' and charter carriers, and this in turn added pressure for these airlines to control their costs and, in many cases, to restructure and concentrate their operations. For many small regional airports this meant that LCCs were the only viable alternative to sustain traffic. Other major airports (see Table 16) changed their attitude towards LCCs as the airlines they were used to serve gradually (or suddenly in some cases) vanished or transformed themselves.

As Figure 92 illustrates, typically LCCs are keen to (and the airports are also keen to have LCCs) substitute the void left by 'legacy' carriers that went bankrupt. Moreover,

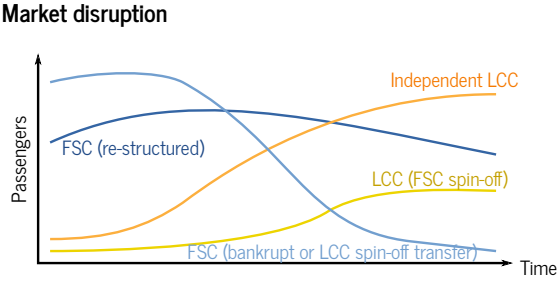

Figure 92: Typical traffic patterns after market disruptions.

'legacy' carriers may replace themselves with their in-house LCC subsidiaries to focus on their hubs for long-haul traffic. The major independent LCCs (Ryanair, easyJet, Norwegian, Vueling before IAG acquisition, or Wizz Air, for instance) usually gain larger market shares because they have larger fleets and better financial positions to fund expansion.

6.2.2 Conceptual model for dynamic airport evolution

The different mechanisms described above may also appear in several combinations, normally accelerating or increasing the impact of low-cost traffic evolution at the airports. Figure 93 shows a conceptual model that describes the dynamic evolution of airports, and aids in the analysis of the interactions between the different mechanisms and the resulting infrastructure. These interactions produce a given dynamic state for an airport system in what concerns the development of low-cost traffic.

The model presents seven states that can be reached from an initial state. In this initial state, the airport system is composed of an original primary airport in which low-cost traffic is not relevant (not necessarily a single airport. London, for instance, had Heathrow and Gatwick before the development of Luton, Stansted, City and Southend). The states are defined by the infrastructure (i.e. airports) included in the system and the significance of low-cost traffic in each case. The transitions between states are triggered by the mechanisms described above.

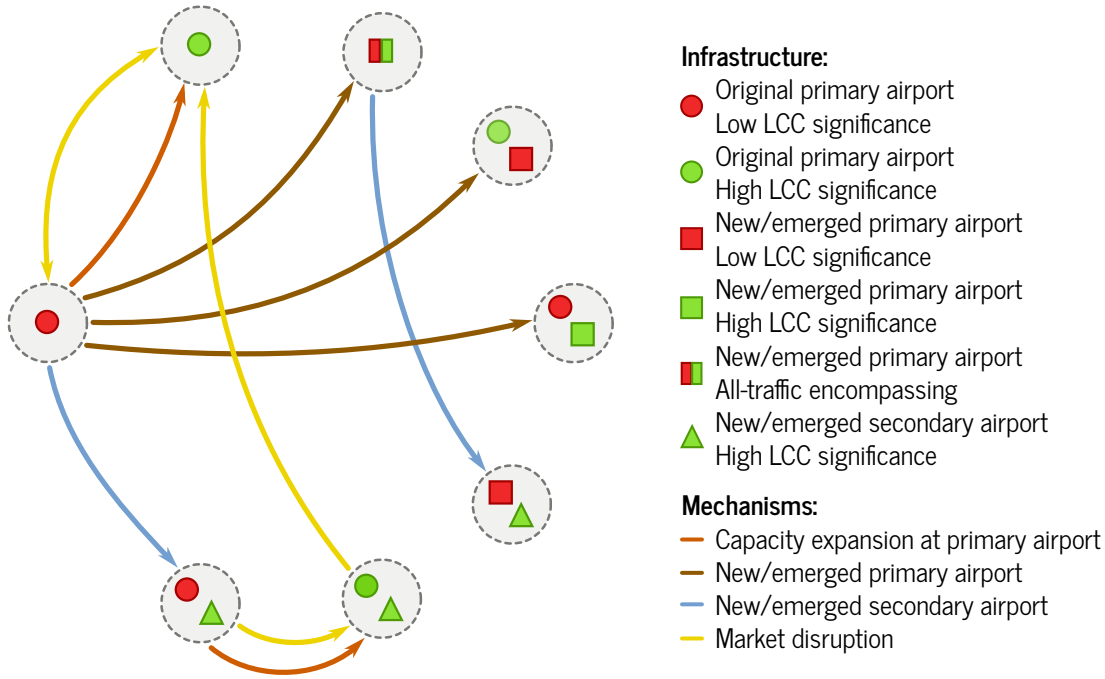

Figure 93: Conceptualisation of the dynamic evolution for airports with regards to low-cost traffic.

The system can go back to the initial state if the mechanisms, market disruption in particular, trigger such feedback. Alternatively, any new state can be considered as an initial state for the future evolution of the system according to the development of the

market conditions and the regulatory environment that is uncertain. Perhaps the most likely transition from any state with more than one airport is related to closing airports to concentrate all traffic segments in a single airport (as in Berlin, whenever the new airport opens).

Likewise, the most likely transition from a state involving one airport is the expansion of the airport system by developing emergent airports possibly focused on a given type of traffic (not necessarily low-cost, as airline business models may evolve in different directions in the long-term).

6.3 Summary

LCCs in Europe have significantly impacted both major and secondary airports. The way airport systems react to the ascendency of LCCs determines the evolution of the system. By analysing historical traffic and the key recent events that affected the evolution of 42 airports, 38 of them part of Multi-Airport Systems, this chapter proposed a conceptual model to help understanding the dynamic evolution of airports. The model identifies four mechanisms that can produce different states related to the infrastructure of the airport system and the traffic patterns.

The mechanisms that trigger the transitions in the airport systems are related to the development of physical infrastructure but also to changing market conditions for airlines and airports. This finding highlights the need for a new paradigm in airport strategic development that incorporates the planning and design of infrastructure, along with the definition of a corresponding business strategy. Encompassing infrastructure and business plans, airport planners and managers can aim at guaranteeing the long-term sustainability of an airport. This will be the subject for the next chapter.

7 Airport strategic planning

Master plans have been and remain the norm in airport planning and designing (de Neufville and Odoni, 2003). Usually, master plans forecast a future demand level and type of traffic, and aim at preparing airport infrastructure to deal with that assumed future. Yet, as the case studies presented in the previous chapter clearly show, even in the short term, the traffic amount and mix can change considerably, especially when LCCs emerge at or withdraw from the airports. In addition, master plans do not deal with the possibility that airport managers can somehow shape the future, by defining the characteristics of their product.

In the context of the remarkable LCC ascendency, the airport industry has been significantly reshaped as we have discussed along this dissertation. These changes provide new opportunities for airports to explore alternative approaches to the way they conduct business. In this chapter we propose an integrated framework to facilitate airport strategic planning, by articulating the main elements and findings of the previous chapters.

This framework, referred as the *[New] Airport Business Network*, aims at providing a tool for strategic planning intended to be applicable to any airport. Nevertheless, it is important to bear in mind that airports differ in location, size and governance, among other aspects that impact the planning process. Hence, despite the generalisation proposed, for specific cases “the airport strategic planning process must be tailored to each airport to account for its individual characteristics” (ACRP, 2010).

7.1 Stakeholder involvement

Airport strategic planning should explicitly take into account the fact that the airport product is provided and influenced by several different actors. Section 3.1 grouped airport stakeholders according to their influence in airport activities. This section describes how

the stakeholders interact to provide a seamless airport product, and how they should be integrated into the planning process.

Jarach (2001) proposed market relations (business to business, and business to consumer) between some airport stakeholders to characterise the interactions that generate a range of value propositions that satisfy customer requirements. We expand this notion to describe how the airport stakeholders form a network of relationships (see Figure 94). The airport management, representing the airport as a firm (i.e. not merely an infrastructure provider), is in the core of the network. This means managers play a crucial role in articulating all the other stakeholders and bringing together their different interests to create a seamless airport product. The stakeholders are linked to each other according to the following three types of relationships: business to business; business to consumer; or planning influence.

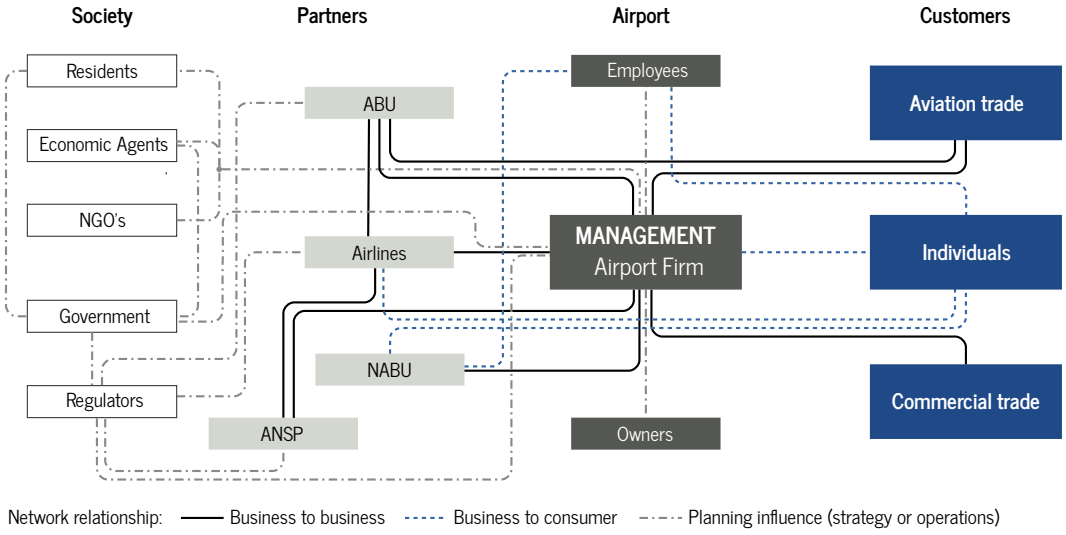

Figure 94: Network relationships between the stakeholders involved in the airport business (NGOs: Non-Governmental Organisations; ABU: Aeronautical Business Units; NABU: Non-Aeronautical Business Units; ANSP: Air Navigation Service Provider).

7.1.1 Business to business relationships

Business to business (B2B) relationships are mediated by commercial interests between companies, often associated to maximise profit. In B2B relationships the companies mutually interact to provide integrated or complementary products or services to final customers. In the network of stakeholders, the Airport Firm establishes B2B connections with Airlines, Aeronautical and Non-Aeronautical Business Units (ABU and NABU respectively in Figure 94), and Air Navigation Service Providers (ANSP), all the entities being partners in the airport business. Similarly, B2B relationships exist between the Airport Firm and the Aviation trade and Commercial trade groups of customers (see section 3.2 for details on airport customers).

Airlines were traditionally perceived as the main airport customer. Yet in the current context, a B2B relationship between the airport firm and the airlines implies a closer cooperation to foster business in both sides, and a better understanding of the real requirements of airlines in terms of infrastructure and operations. Long term commercial agreements between airlines, particularly LCCs, and airports make the idea of cooperation for mutual benefit more explicit and critical. These agreements also reduce airports uncertainty in planning infrastructure investments.

Airlines also follow a B2B relationship with the Aeronautical Business Units, which in turn can offer their services directly to other corporate customers in the Aviation trade group. Although some airlines perform related aeronautical activities (especially ground handling) themselves or through subsidiaries, they often subcontract companies that are part of the Aeronautical Business Units. This is particularly true for LCCs in the European context.

Aeronautical Business Units can also be part of the airport operator, but it is increasingly common to have different providers at the same airport, partly due to liberalisation in the ground handling industry. Thus the Airport Firm is linked to the Aeronautical Business Units and to the Aviation trade customers through a B2B relationship as well. The airport must guarantee airlines have access to competitive services and a sufficiently attractive business environment for the aeronautical units, whilst fulfilling all applicable regulations. For planning purposes, the B2B relationship between the Aeronautical Business Units and the Airport Firm should also contribute to an efficient use of the infrastructure.

Like the aeronautical counterpart, Non-Aeronautical Business Units (e.g. retail stores) can be part of the airport operator but are usually third-party companies. Thus there is a B2B relationship between these units and the Airport Firm. Other non-aviation related services can be offered by the airport directly to customers in the Commercial trade group, also following a B2B approach.

Finally, there are B2B relationships between Air Navigation Service Providers and the Airlines, as direct users, and also with the Airport Firm, as user of ground traffic control and as the interface between ground and air traffic, to ensure efficient and on-time operations. Moreover, ANSPs can also become the link between different airports to ensure the reliability and safety of the entire airport network, as it is the case of the implementation of Airport Collaborative Decision Making initiatives (Eurocontrol, 2012).

7.1.2 Business to consumer relationships

In Business to Consumer (B2C) relationships stakeholders aim to provide/acquire a product or service for final consumption. In this case profit maximisation is not the main goal for any of the parties. The Airport Firm follows a B2C approach to offer the products and services of the interest of the Individuals customer group. Some of these products are not directly produced by the airport but result from the B2B interactions described above. In this sense, Individuals are also connected to Airlines and Non-Aeronautical Business Units through B2C relationships.

Similarly, Non-Aeronautical Business Units can offer their products and services directly to the employees of the airport and to the different companies settled in the airport site. In addition, airport employees represent the airport interests, being its public, visible face, when offering the airport product to the Individuals customer group. For planning purposes this is important because it means that employees are in charge of translating the airport strategy to day-to-day activities.

7.1.3 Planning influence

The stakeholders that are less involved in defining specific airport activities (i.e. those in the Society group in Figure 94) can be, nonetheless, very influential in the planning process. These stakeholders are in some way linked to the Airport Firm and to other stakeholders, by non-business relationships that are not directly mediated by commercial interests (such as profit maximization). At the same time, airport activities can influence the perception that these stakeholders have of the airport.

The influence on the airport business can be positive or negative, and have a strategic or operational impact. For instance, local residents affected by noise can dictate operational changes that affect airport capacity, such as curfews or limits to runway utilisation. In contrast, local governments can support the airport to foster development in the region. On the other hand, changes in regulation, concerning security measures for instance, can significantly influence the development of airport infrastructure or equipment.

It is therefore important that the Airport Firm keeps a constant communication with all relevant stakeholders in this group, to ensure they actively contribute for the definition of the airport strategy. Feedback mechanisms should be implemented in airport planning, whilst development plans should be exposed directly to the affected parties, to minimise harmful impact and maximise benefits.

7.2 Airport differentiation and strategic focus

Differentiation lies in the core of strategy definition. Organisations trade-off among factors that define a unique position within their markets (Porter, 1996). Similarly, airports can establish a set of differentiation factors, as a way to enable a successful strategy in a rather competitive environment. The differentiation factors would, in principle, attract specific airport customers, but given the particular characteristics of the airport industry, it is common that different customer segments use the same airports. Indeed, chapters 4 to 6 showed how LCCs use a diverse range of airports. For this reason, we have considered differentiation factors that can be targeted at particular customers, within the three main customer groups defined in section 3.2.

These differentiation factors can then be implemented into the six service packages that were defined in section 3.3 as the airport product. The service packages are consumed by one or more of the customer groups. The extent to which an airport implements the service packages and the way the differentiation factors are embedded into those packages determines a given strategic focus for the airport. Section 3.4 covered six generic approaches to the airport business that can be translated into strategic focuses.

Figure 95 summarises the factors identified as possible sources of differentiation for airports. These factors are linked to specific customer segments at whom the strategies that implement each (or a combination) of the factors may be targeted. These sub-groups are contained in the three main customer groups for the airport service packages.

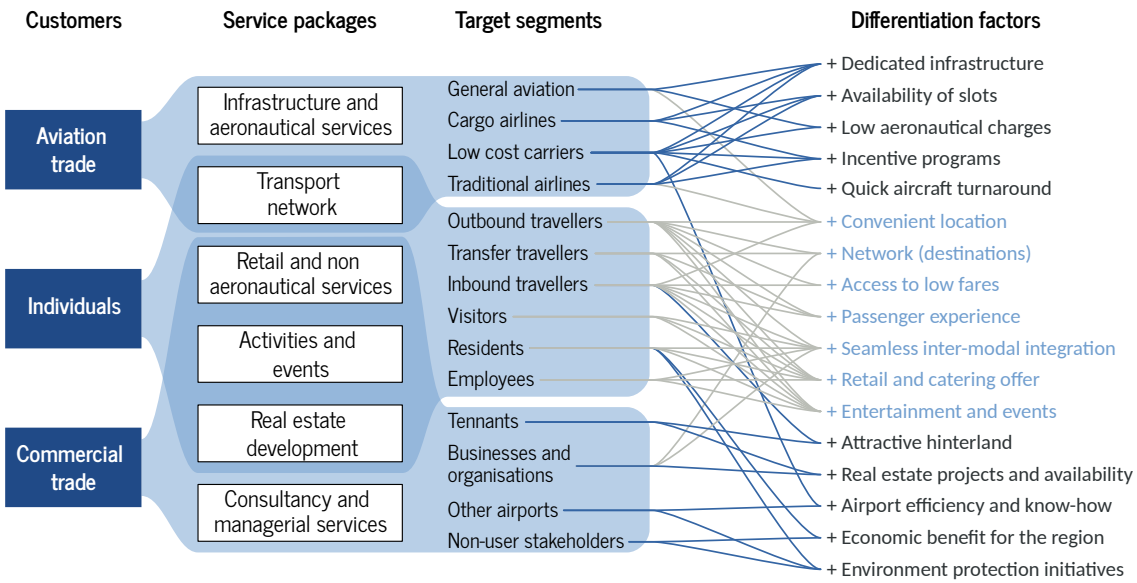

Figure 95: Differentiation factors for airports and the customers they are targeted at.

7.2.1 Factors mainly targeted at aviation trade customers

Dedicated infrastructure can be attractive for commercial airlines and general aviation users. This may include exclusive terminals, parking stands, boarding gates or check-in

areas in the passenger buildings. Dedicated infrastructure can be targeted at airlines willing to gain visibility, improve branding or influence airport planning by becoming, in relative terms, large carriers at the airport. Infrastructure may also be used to separate market segments with dedicated areas, for instance for low-cost carriers (e.g. Kuala Lumpur Airport in Malaysia), freight integrators (e.g. Memphis International Airport in the United States), or premium passengers (e.g. Lufthansa's First Class Terminal at Frankfurt Airport in Germany).

Availability of slots is quite important for airport growth and is targeted specifically at commercial airlines (cargo and passengers). This is one of the advantages of smaller airports, when attracting low-cost airlines (Barret, 2000), but any airport willing to establish a competitive position must provide available capacity to accommodate the desired increase in traffic. Besides spare capacity, it is crucial to provide slots at attractive times, but some LCCs may be keen to schedule flights off-peaks in more congested airports, not only to circumvent congestion but also because the current methods to allocate slots usually favour incumbent airlines that already have the right to use them (Belobaba et al., 2009).

Low aeronautical charges, as discussed in section 5.4.1, can be targeted at LCCs, but also to general aviation users that do not necessarily derive a profit from their activities. The implications of low aeronautical charges as the sole differentiation factor are discussed in more detail in section 7.2.5, but clearly this may not be the only way to attract price-conscious airlines.

Airports may implement strategies that include *incentive programs* to support route development of commercial airlines (including cargo), and then attract more customers to the airport. Secondary airports established incentive programs to attract LCCs, but nowadays these programs are widely used by different airports, and diverse types of airlines benefit from discounts or support in the light of these programs.

Quick aircraft turnaround is another factor particularly targeted at LCCs to help them improve aircraft utilisation. Although the duration of the turnaround is the main responsibility of the airline and its selected handler, airports can advertise this as a factor of differentiation when they are able to provide short taxiing times and efficient procedures at the stand and boarding gate (besides other measures discussed in section 5.4.1).

7.2.2 Factors mainly targeted at individual customers

A *convenient location* of the airport site can be targeted at outbound and inbound travellers, but also at general aviation users that want to have their aircraft easily

accessible, and at traditional airlines that want to promote location as an advantage for their passengers. The convenience obviously differs according to the location of the airport relative to the actual origin of passengers, or according to the location of the airport where the flight ends, relative to the passenger final destination. Previous research highlights access time and cost, and level of service (flight frequency, timetable and flying time) as key aspects that determine traveller's choice of departure airport (Hess and Polak, 2006; Lian and Rønnevik, 2011).

In this sense, *network provision (destinations)* is also a crucial factor for airport competitiveness. A wider network (offered through improved connectivity or non-stop destinations), in combination with adequate frequencies and timetables, can significantly expand the airport's catchment area. The network of destinations may be targeted at outbound and transfer travellers (as well as travel agents and tour operators), and to businesses and organisations located in or around the airport.

The *access to low fares* for passengers, strongly linked to the presence of LCCs, may differentiate airports by providing the cheapest alternative for outbound and inbound travellers. Strategies that implement this objective as a key differentiation factor must include elements to attract the airlines that provide the low fares, and to market these fares to the passengers, as section 5.4.1 describes. It also helps if ground transportation offers competitive fares too, as passengers normally would consider the full price for their trips, obviously including all components.

The overall *passenger experience* at the airport can be targeted at all travellers. This includes the level of service (mainly space and waiting time) during all airport processes, particularly check-in, security controls and baggage claim; but also the cleanliness and availability of facilities (e.g. lounges, Wi-Fi, or showers), airport way-finding, aircraft-to-curb time, walking times inside the buildings, or even the convenience offered by the possibility to avoid transfers.

Seamless inter-modal integration is also a key differentiation factor that may be targeted at outbound and inbound travellers, visitors, residents, employees and businesses and organisations. Inter-modal integration may require specific infrastructure for shifting between the modes, but also coordinated services such as air-rail, air-cruise, or air-bus that provide seamless origin to destination travelling.

All customers in the Individuals group can be lured with a proper *retail and catering offer* and *entertainment and events.* This differentiation factors aim at encouraging travellers to enjoy the airport as a place to be at, and not only to pass by. Retail and catering can be tailored to the specific segments (e.g. business or low-cost travellers) or even to seasonal patterns (summer or winter trips), whilst entertainment activities and

events may include airport tours, viewing terraces, concerts, sport tournaments and so on, depending on the characteristics of the buildings and available space.

7.2.3 Factors mainly targeted at commercial trade customers

An *attractive hinterland* is a factor based on the promotion of the airport or its hinterland as a destination. This factor is targeted mainly at inbound travellers and tenants, and may be explored in terms of tourism in the region where the airport is located, or in terms of the opportunities created by real estate developments around the airport (for instance, the centre for quick surgeries in The Circle project at Zurich Airport, to attract "medical tourists"). In this sense, *real estate projects and availability* can be targeted at tenants, businesses and organisations willing to invest in the airport hinterland either to locate their offices or to develop their own productive projects.

Another factor, *airport efficiency and know-how*, is related to the airport firm's performance and goodwill. Airports with a reputation of good performance have an advantage when targeting other airports to provide business and engineering consulting and managerial services. Efficient airports may also target this factor at LCCs that require operational efficiency to guarantee high aircraft utilisation.

Finally, taking advantage of the growing development around airports, two additional differentiation factors are related to the side benefits produced by an airport *economic benefit for the region* and by *environmental protection initiatives*. Strategies to explore positive impacts can be targeted at local residents to gain their support; at other airports interested in implementing similar initiatives; and at non-user stakeholders also to gain their support for airport activities.

7.2.4 Airport strategic focus

Section 3.4 introduced six business approaches that airport managers can pursue according to the extent to which the airport implements each one of the six service packages presented in section 3.3: public utility provider (in association with the infrastructure and aeronautical services package), multi-modal interface (with the transport network package), commercially oriented (with the retail and non-aeronautical services package), consumer oriented (with the activities and events package), airport city (with the real estate development package), and global business (with the consultancy and managerial services package). Each of such approaches characterises a generic strategic focus to define the airport strategy.

A strategy canvas presents the offering level (vertical axis) of different competing factors (horizontal axis) that buyers in an industry receive according to the value proposition resulting from the strategy of a given company or companies (Kim and

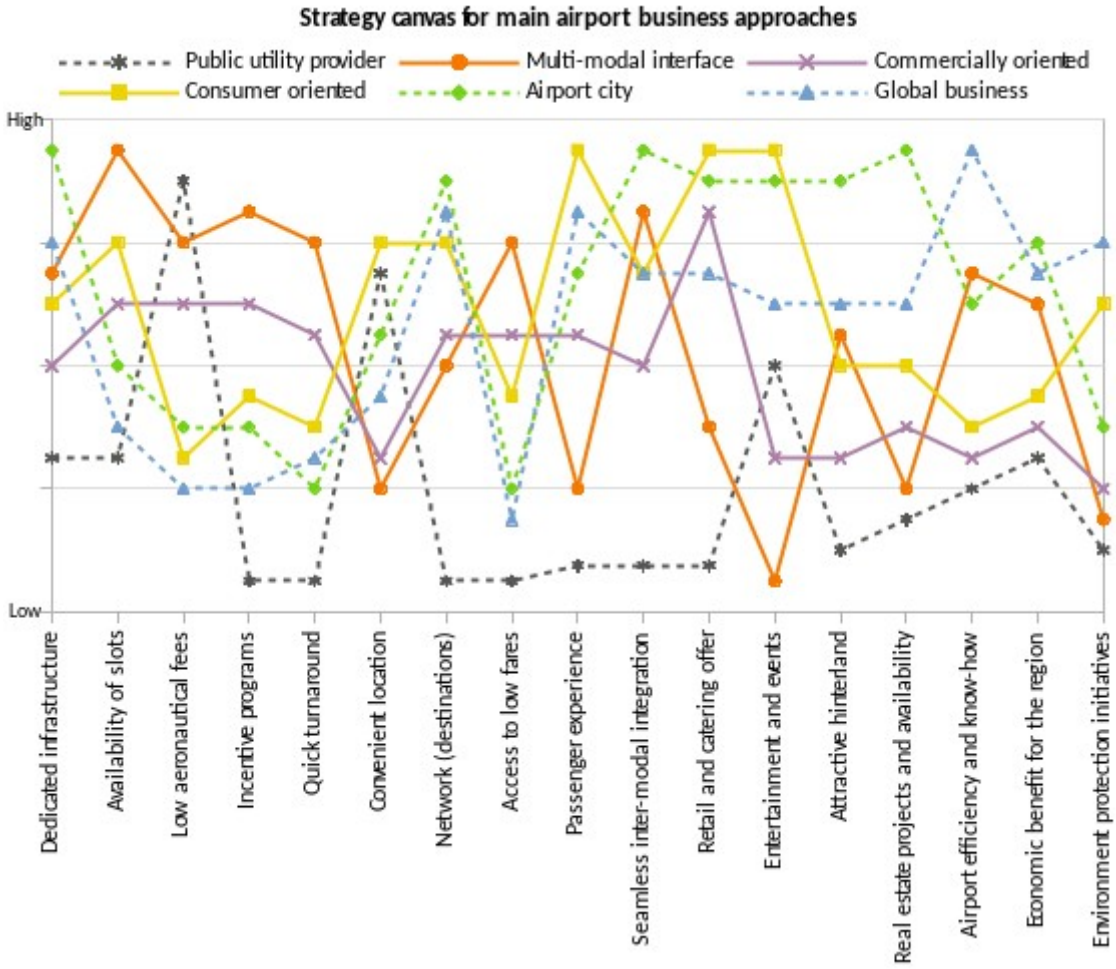

Figure 96: Strategy canvas for generic airport strategic focus.

Mauborgne, 2005). Figure 96 shows a strategy canvas for the six generic airport strategic focuses and the offering level for each of the differentiation factors identified in the previous section. This element may aid managers in defining a unique position for the airport.

The specific strategic focus of a particular airport must be decided by the management team in accordance to the intended offering levels for the differentiation factors. This decision is naturally influenced by the characteristics of the airport site and must be aligned with decisions on infrastructure investment. Moreover, given the uniqueness of every airport, managers can identify other differentiation factors that are more relevant for their particular situation, as well as modify or eliminate the others accordingly.

7.2.5 Airport cost leadership

Given the particular focus of this dissertation on low-cost airlines and airports, the use of cost leadership as a standalone strategy is analysed in more detail. Before the growth of LCCs, airport charges normally accounted for a small proportion of air fares charged to passengers (European Commission, 2002). In a regulated market that

prevented airline competition, a 'cost-plus' environment generated inefficiencies along the business chain (de Neufville, 2008). As a consequence, airport fees were not a relevant factor for competition in the industry.

Economic liberalisation creates a completely different operational environment. Price competition between airlines leads to lower costs that are passed on to passengers. In this context, aeronautical charges gain relevance as a source of competitive advantage and airports advertise them to attract airlines, LCCs in particular.

As a result of the discount scheme for airport charges implemented by Aer Rianta (now Dublin Airport Authority), traffic at the Dublin airport doubled between 1993 and 1998 and congestion also rose significantly. Ryanair sought further discounts to promote new routes to mainland Europe. Unsuccessful, the airline shifted its route development to London Stansted. This provides evidence for how "in a competitive airport environment airport managers will have to engage in price negotiations with airlines rather than present a fixed set of charges on a take it or leave it basis" (Barret, 2000).

Indeed, when regulation on single or dual till approaches allows it, airports offer reduced fees to increase the number of passengers, and non-aeronautical revenues, expecting a higher general profitability. However, when aeronautical charges are reduced, "there is a need to ensure adequate retail facilities are in place to generate commercial revenue" (Francis et al., 2003). Otherwise, there is no opportunity to compensate for the loss of income in the aeronautical side.

Competition through aeronautical charges may not always enhance welfare in the case of Multi-Airport Systems (Forsyth, 2010). When competition occurs between a major airport and a secondary one located nearby, and the major airport has spare capacity, the marginal cost of handling extra flights there may be much lower than the cost for the secondary airport. Consequently, the allocation of new services to the secondary airport would result in higher overall costs and less general welfare. Price competition from the smaller airport could act as an incentive for the major airport to improve efficiency and eventually encourage airlines to move from the secondary to the main airport.

Conversely, low airport fees may be so "successful" that they could lead to significant congestion problems. In the long run, the strategy may put the airport in a less competitive position as the level of service decreases and congestion increases (Graham, 2010). Therefore cost leadership strategies must be closely linked to infrastructure planning, pursuing the achievement of common goals.

In addition, regardless of the weight of airport charges in their overall costs, airlines do obviously consider all costs incurred when operating at an airport. Accordingly, the

framework we propose in this work aims at supporting the formulation of strategies that consider multiple elements required to create advantages for airports in current competitive environments, not just to guarantee cost leadership.

7.3 The [New] Airport Business Network

The *[New] Airport Business Network* (see Figure 97) is an integrated framework proposed by this research to aid airport managers in the pursuit of differentiation in their strategic planning process. The framework articulates the different elements described in this chapter around the airport customers and the corresponding service packages (i.e. the airport product). The resulting framework is useful to identify the most relevant stakeholders that are involved in the implementation of the desired strategic focus for the airport.

Some of the network relationships between the airport stakeholders (to the left in Figure 97) have been simplified from the more detailed description presented in section 7.1. This is intended to emphasise the role of the airport management team as a mediator between all the stakeholders, to harmonise their different interests towards the accomplishment of the same strategic objectives. Also, the influence relationship between the owners and the airport management has been highlighted as the one where such broad strategic objectives are defined, not necessarily imposed by the owners but mutually agreed in accordance with the requirements and interests of all the stakeholders. Likewise, the influence relationship between airport management and employees is highlighted as the one where strategy communication occurs to ensure that all customers perceive the intended strategy in an adequate manner.

This tool is intended to be an integrated approach to provide planners and managers with a big picture of the airport position in a competitive environment. In this sense, the [New] Airport Business Network associates the following elements: the value proposition that results from the intended airport strategy; the specific factors that need to be strengthened in accordance with the value proposition; the target customers to which the strategy is most attractive; the service packages that need to be implemented in accordance with the selected differentiation factors; the generic customer groups that have an interest in the packages as a product to acquire; and, finally, the relevant stakeholders that participate in the provision of the specific product that materialises the intended strategy.

Another feature of the proposed integrated framework is that it allows to incorporate infrastructure development plans into the process of strategy definition. This ensures that airport planners and managers align the development of physical facilities with the goals

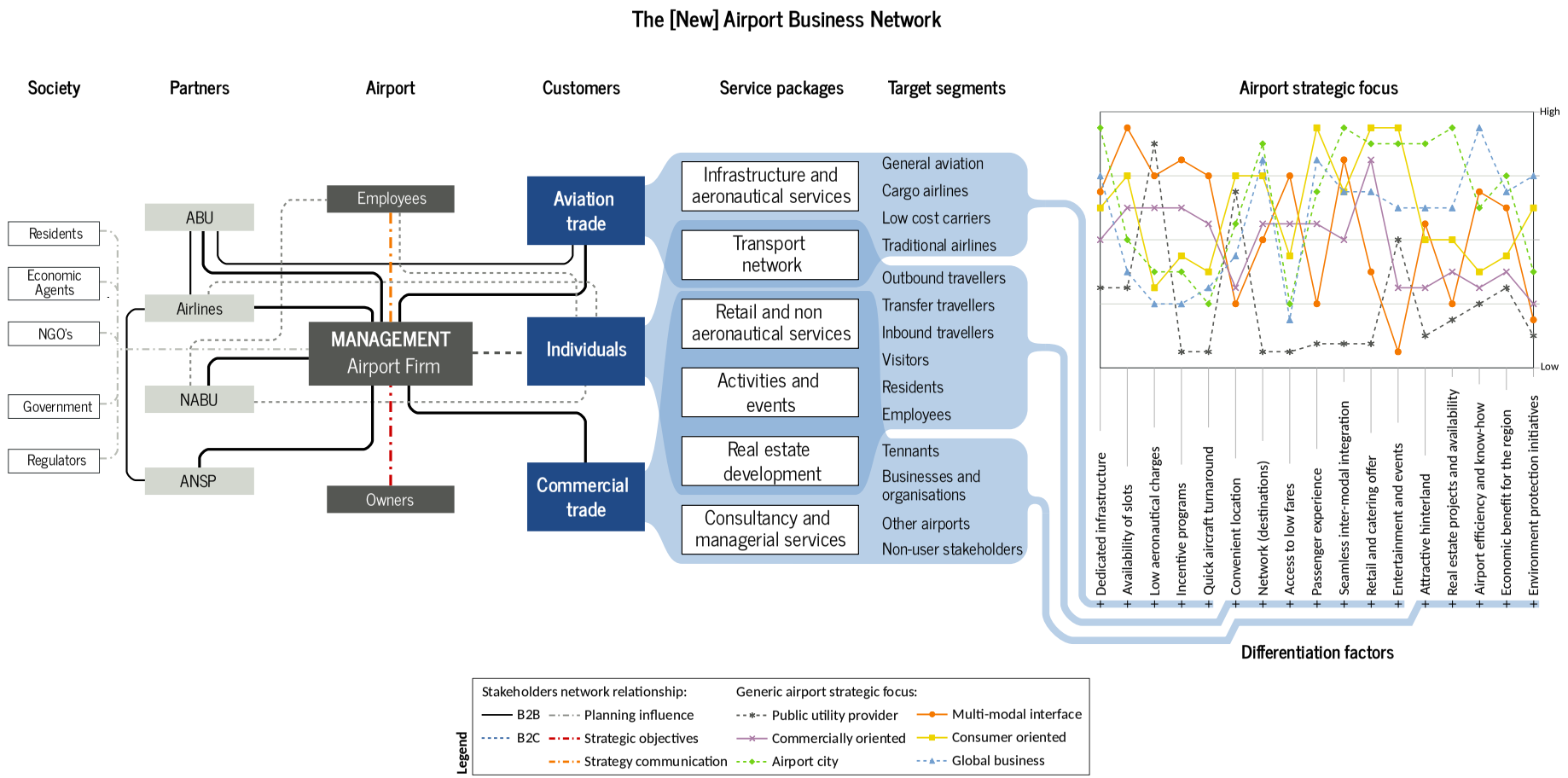

Figure 97: The [New] Airport Business Network, a tool for airport strategic planning.

of their intended business strategy. In specific terms, airport infrastructure is incorporated within the first five service packages.

Each of these service packages (*infrastructure and aeronautical services, transport network, retail and non aeronautical services, activities and events*, and *real estate development*) can be associated to specific facilities in accordance to the offering level selected for the differentiation factors, and for existing airports, these factors can be selected in line with the characteristics of the current facilities. The essential point is that both infrastructure and strategy should match to support the success of the airport. The use of this integrated framework was validated by applying it to a case study, as presented in section 7.5.

7.4 Flexibility and strategic adaptation

The definition of a strategy can obviously help in shaping the future of an airport, in terms of its infrastructure and traffic. However, external events that are not controlled by airport management can still occur and affect the position of the airport. Likely events, but not necessarily predictable, include changes in regulation that modify the standard procedures for airport activities and, more often, market changes affecting the airlines. In this case, new airlines can start service at the airport, or existing airlines can either disappear or evolve towards a different business model.

New airline with new business models can challenge airport operations if their requirements differ substantially. Airlines withdrawing service can severely affect the sustainability of the airport business. In both cases, strategic planning for the airport should allow for the necessary adaptations to prevent undesirable outcomes or take advantage of new opportunities. In the first case, *flexibility* may be valuable in order to allow the airport to host the new entrants. In the second case, strategic adaptation may be valuable to quickly restore service.

During the last decade, in the European context, most of these unexpected events associated to airlines were related either to the emergence and expansion of an LCC, or to the bankruptcy or downsizing of a FSC. In most cases, these changes led LCCs to use the same facilities previously developed for traditional airlines. Often, this situation implied adaptations for the operations of LCCs (see Table 17 for some examples), as well as a shift in the attitude of airport managers towards this type of airlines.

Conversely, airports can also adapt to the evolution in the business model of LCCs towards a more hybrid product. Some airports (Milan Bergamo notably) increased retail areas to profit from passenger growth and also introduced premium services such as VIP lounges or fast-track for security lines.

Table 17: Examples of airport adaptations to LCC operations.

Adaptation	Description
"Bus gates" used as "walking gates"	Some airports provided "bus gates" to access remote stands, usually for smaller aircraft used by regional carriers. The use of these gates changed to allow walking access to aircraft in adjacent stands. Some airports (Brussels Charleroi, for instance) feature covered walkways to access more distant stands.
Converted use of jet bridges (holding queues)	At airports featuring jet bridges connected to fixed walkways that separate inbound and outbound flows (Porto, for instance), LCCs can use the outbound section to hold the queue of boarding passengers and start aircraft boarding shortly after the disembarking process has finished in order to reduce turnaround times.
No use of jet bridges	At airports featuring jet bridges connected to fixed walkways with direct access to the stand via stairs (Wroclaw, for instance), airlines can avoid the use of jet bridges and board/disembark the aircraft using both doors.

Airports that have built new facilities with LCCs in mind favoured some flexible alternatives such as shared-use space and modular buildings. Shared-use space is mainly used to provide common pre-boarding rooms where passengers mingle before gate numbers are announced closer to departure in smaller, spare areas. Modular buildings are used in particular to allow for "swing gates" that feature passport control booths, for international flights[19], located closer to the gates. Airports that have built new facilities but did not anticipate the growth in the low-cost segment, have mostly been forced to close part of their old facilities to reduce operating costs.

In general, these adaptations emerged more as a necessity due to external disruptions and less as a concious (or at least documented) decision of airport managers to implement flexibility. The idea of an airport strategic planning process is to incorporate adaptability. Thus airport infrastructure can cope with unforeseen changes whilst airport strategy can take on new opportunities as markets develop and evolve.

7.5 The case of Lelystad Airport in the Amsterdam Multi-Airport System

Amsterdam Schiphol (AMS) is the main airport in the Netherlands. It was the fourth busiest airport in Europe, in 2013, in terms of passenger traffic. AMS is also the main hub for KLM, which provided 54% of the seats available at the airport in 2013, and a major airport for the SkyTeam alliance, whose members – including KLM – are responsible for 70% of the airport traffic. Its role as a hub, called "Mainport" by airport management, is central to the airport strategy, especially considering the small size of the domestic market in the Netherlands (Schiphol Group, 2013).

For environmental reasons, the capacity at AMS is limited to 510,000 air traffic movements per year. In 2013 there were 425,565 movements at the airport, 83% of the imposed cap. The Schiphol Group, the airport owner and operator, would like to support the "Mainport" strategy by redistributing non-hub related traffic to other airports in the

19 Out of the Schengen space in the European context

Netherlands in order to relieve capacity at Schiphol. The preferred alternative is to redevelop the Lelystad Airport (LEY) to attract "flights to European cities and regions, with focus on tourist destinations", "in order to accommodate selective growth at AMS" (Schiphol Group, 2014a).

Lelystad is the largest airport for general aviation traffic in the Netherlands. It is located 56 km from central Amsterdam, about 45 minutes by car to the east. The airport is wholly owned by the Schiphol Group, which also owns the Rotterdam airport (RTM) and a 51% stake in the Eindhoven airport (EIN), both in the Amsterdam Multi-Airport System (see Figure 98).

Figure 98: Location of Lelystad (LEY) and the other airports in the Amsterdam MAS: Schiphol (AMS), Rotterdam (RTM) and Eindhoven (EIN).

The strategic planning for the case of Lelystad appears as an interesting opportunity to apply the framework developed in this work (as presented in the current chapter) – the *[New] Airport Business Network*. The airport will need to change its infrastructure in order to accommodate larger aircraft and passenger processing and will therefore require a corresponding strategy to attract the specific type of traffic, as planners and managers desire. In addition, the converted airport would operate in a very competitive environment and thus requiring a differentiated position within the Amsterdam MAS in order to be attractive for both airlines and passengers.

7.5.1 Lelystad Airport within the MAS

The Lelystad airport has a main asphalt runway with 1,250 m in length and a grass runway with 430 m. It is used only by general aviation aircraft, including helicopters, with110,000 air transport movements in 2013. The airport also hosts an aviation museum. The runway is too short for larger commercial aircraft and there is no apron able to handle them either.

In relation to Eindhoven (and also to Groningen, in the northeast of the Netherlands, and Maastricht in the south), Lelystad is considerably closer to Amsterdam and thus better located to serve as a secondary airport for the city. In terms of distance, the Lelystad airport is also closer to Amsterdam than the Rotterdam airport, but considering available connections travel time is not very different.

The ambition to divert short-haul non-hub traffic, "with focus on tourism destinations", to Lelystad implies a stronger focus on the airlines that are able to deliver such type of traffic. Over the past years LCCs in Europe have focused on short-haul point-to-point leisure traffic, although more recently they have been targeting business travellers more actively, and some of them even offer interline connectivity using simple hub structures. This means the development at Lelystad should consider the evolution of this segment in other airports in the MAS, with which it may compete.

Section 6.1.2 already covered the evolution of the Amsterdam MAS in terms of traffic and airport development. In recent years Eindhoven grew to become the second largest in the MAS, with a particular focus on low-cost traffic. Rotterdam is mainly used by Transavia, the low-cost arm of Air France-KLM, for leisure traffic. And despite its main role as a hub, LCCs at Schiphol reached 16% of market share in 2013 supported by the growth of easyJet (the second largest carrier after KLM) and Transavia.

7.5.2 Lelystad Airport Business Network

i) Strategic focus for Lelystad Airport

In order to become an attractive alternative, Lelystad must develop a differentiated position that enables the airport to capture the intended traffic. Whether that traffic is actually diverting from Amsterdam Schiphol (such that it frees capacity for the "Mainport") is not entirely certain. The fact that in this case the three current airports in the MAS, plus Lelystad, share ownership could facilitate the coordination of the airport strategies to accomplish a global objective for the MAS. Yet the airport operator is not able to force airlines to move from one airport to the other, nor to restrain any airline willing to use any of the airports (slot considerations aside).

Indeed the Schiphol Group recognises this situation and proposes specialisation and marketing to attract different target segments for each airport (Schiphol Group, 2014b). Thus Lelystad should have a strategic focus that differentiates it from the other airports in the MAS, especially from Rotterdam and Eindhoven that also serve non-hub related traffic. Considering the differentiation factors introduced in section 7.2, Figure 99 shows the strategic focus for the airports in the MAS using a strategy canvas.

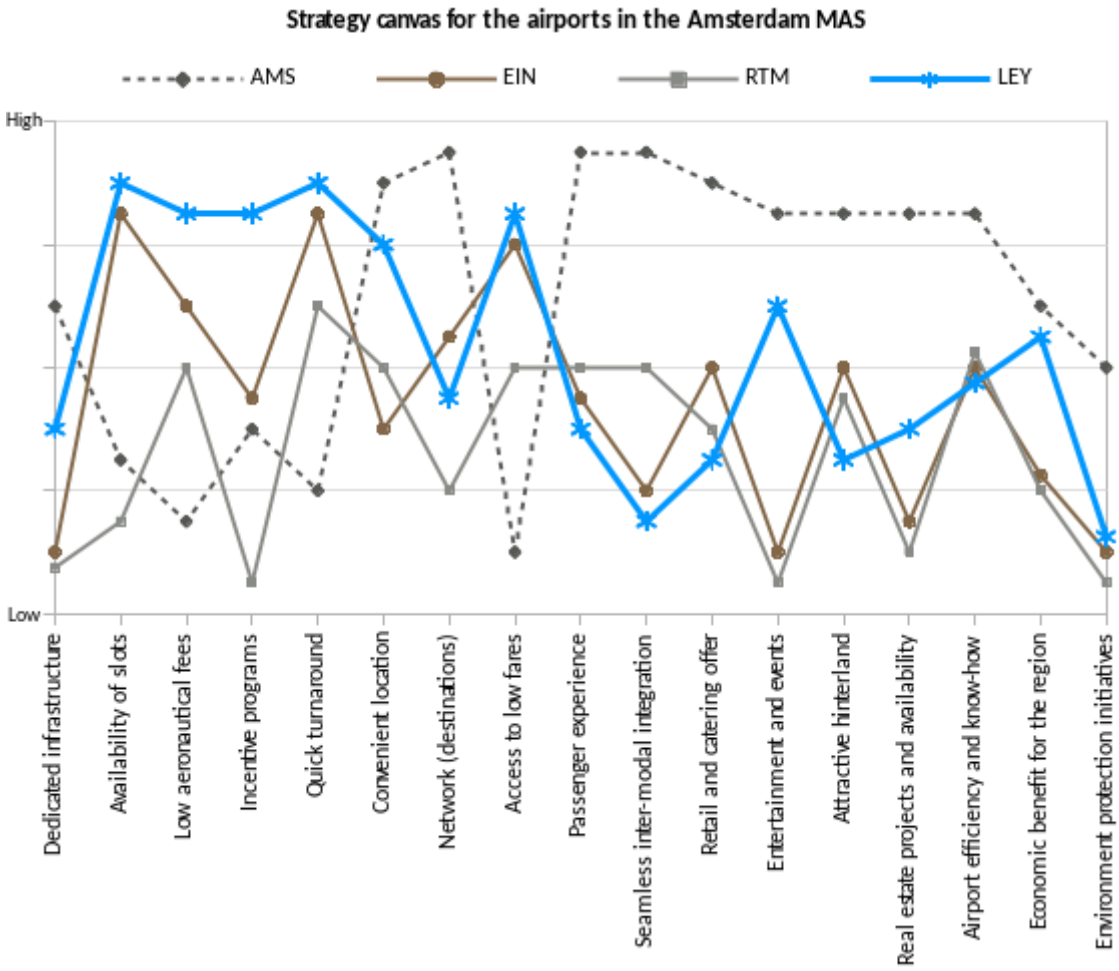

Figure 99: Offering level of the differentiation factors according to the value proposition of each airport in the Amsterdam MAS: Amsterdam Schiphol (AMS), Eindhoven (EIN), Rotterdam (RTM) and Lelystad (LEY).

For Amsterdam Schiphol (AMS), Eindhoven (EIN) and Rotterdam (RTM) the value curves reflect the current offering according to the characteristics and strategy of each airport. The strategy for AMS resembles a combination of the Airport city and Global business approaches, whilst EIN and RTM combine elements from Multi-modal interface and Commercially oriented airports. Based on these observations, we propose a value curve that reflects a differentiated position for Lelystad (LEY).

Figure 99 suggests the differentiation factors that should be integrated into the airport strategy: *availability of slots; quick aircraft turnaround; low aeronautical charges and incentive programs,* for customers in the aviation trade group; *access to low fares, convenient location, and entertainment and events*, for individuals; and *economic benefit for the region*, particularly targeted at non-user stakeholders.

ii) Target segments

The specific implementation of the differentiation factors and their impact on the airport strategy and infrastructure can be analysed with the [New] Airport Business Network illustrated in Figure 100 for the case of Lelystad. The factors highlighted above

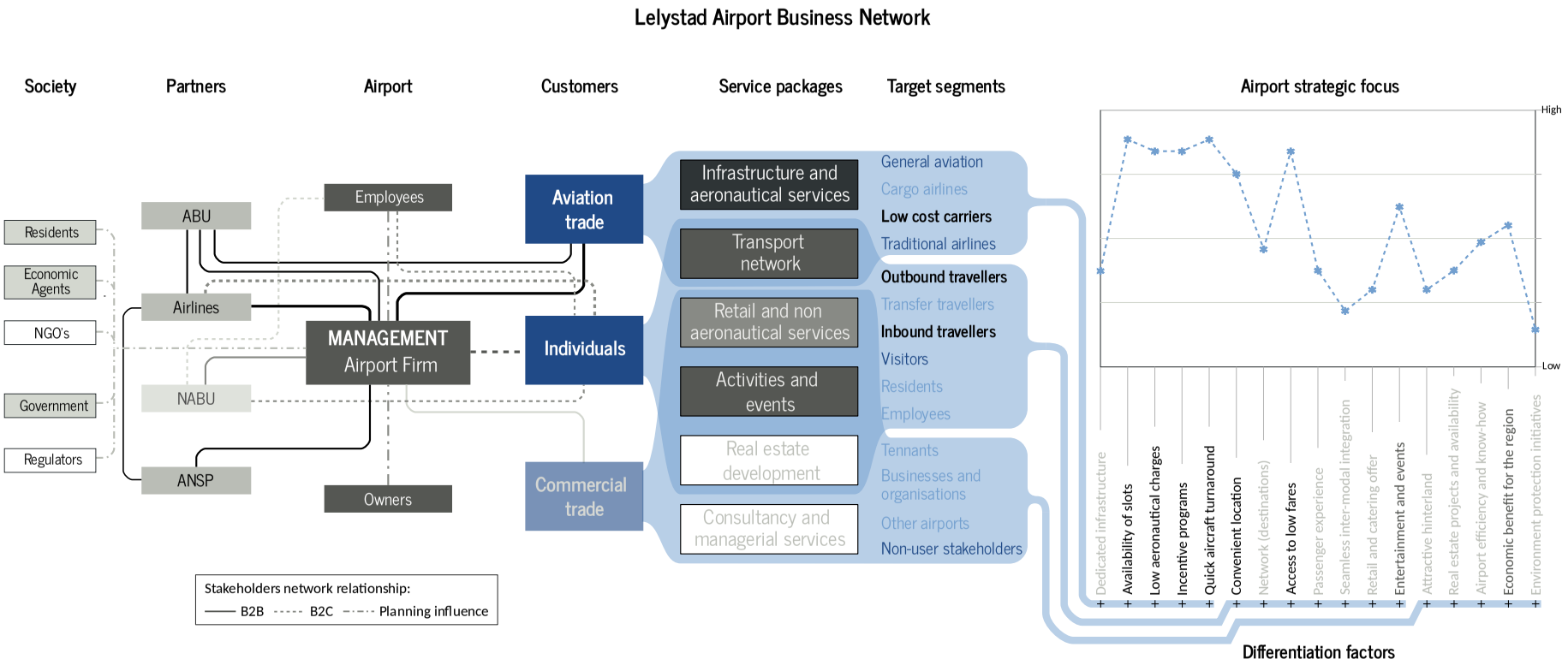

Figure 100: The Lelystad Airport Business Network.

can be targeted with more emphasis in the case: of *low-cost carriers*, *outbound travellers* and *inbound travellers*; and to a lesser extent to *general aviation* users, *traditional carriers* (i.e. non LCCs), *visitors* and *non-user stakeholders* (such as the government and local residents).

At the beginning of the redevelopment of Lelystad as a commercial airport, it is crucial to attract airlines and passengers so that the airport becomes a viable alternative. Necessarily, airlines must come first providing the scheduled destinations that, in turn, will attract passengers. LCCs are more likely to come first since they usually have large fleets that can be easily deployed to different airports and many of them have aircraft orders to expand their fleets in the coming years (Schiphol Group, 2014b). Moreover, LCCs are more keen than other airlines to explore new markets as are able to stimulate demand by setting lower fares.

In order to attract airlines, especially LCCs, Lelystad would need to provide the following differentiation factors: *availability of slots; low aeronautical charges; incentive programs;* and *quick aircraft turnaround*. Available slots are crucial for airlines to start new services at times that match their network configuration and are attractive to passengers. At Lelystad the availability of slots can be hampered by the intense general aviation traffic and the possible conflicts with air traffic in approach and departure trajectories at Schiphol. Both aspects need to be considered for Lelystad during the planning phase in order to ensure safety and complementarity for commercial and general aviation without interfering with operations at Schiphol, especially at peak times.

As for low aeronautical charges, the investments at Lelystad must be carefully studied and crafted to avoid unnecessary expenditures, that airlines would not be willing to pay. At the same time, the airport can explore non-aeronautical revenues to ensure it can maintain fees that are lower than those in the other airports in the MAS. In addition, incentive programs can entice airlines to develop the intended destinations and market segments whilst sharing the risk of starting new services. These programs must be carefully designed not to affect the position of Schiphol Airport in terms of hub-related traffic(considering both airports are owned by the same organisation).

Regarding short aircraft turnaround times, Lelystad development should encourage and exploit the advantages of a compact, single-runway airport site. This would minimise taxiing times which, in turn, help airlines reduce fuel costs. Also, air traffic must be adequately managed to avoid holding patterns and delays.

In order to attract passengers Lelystad can take advantage of its more convenient location, in comparison to other airports in the Netherlands, as an alternative to Schiphol for the Amsterdam region. The challenge for the airport is to explore that advantage in

association with the *access to low fares* as a differentiation factor. Especially because Rotterdam and Eindhoven currently provide a number of interesting alternatives for surface access.

To a lesser extent, at least in the initial stage of redevelopment, Lelystad can take advantage of the presence of general aviation and the in-site museum to explore *entertainment and events* as a differentiation factor to attract visitors (that could buy non-aeronautical services) and enthusiast travellers. Similarly, the airport can use the expected growth in employment and economic benefits for the region to leverage support from non-user stakeholders.

iii) Service packages and airport infrastructure

As Figure 100 highlights, in order to explore the differentiation factors described above, the Lelystad airport should focus on the implementation of the following service packages: *infrastructure and aeronautical services; transport network;* and, to a lesser extent, *activities and events,* and *retail and non-aeronautical services*. There is no doubt that *infrastructure and aeronautical services* is the most important in the initial stage of redevelopment because the current conditions do not allow for commercial service with the types of narrow-body aircraft that are expected. In the design and development of the infrastructure it is crucial to take into account that *low aeronautical charges* and *quick aircraft turnaround* are desired differentiation factors.

In what concerns air side development, Lelystad would require a runway extension to allow for the operation of narrow-body aircraft to serve the intended destination markets. The Schiphol Group (Schiphol Group, 2014c) estimates that a runway with a total Take-Off Distance Available (TODA) of 2,700 m (composed of 2,100 m of Landing Distance Available – LDA – and two Runway Safety Areas – RESA – of 300 m at each end of the runway) is sufficient for intra-European flights and even for more distant leisure destinations such as the Canary Islands or Morocco. This extension can be accommodated within the current boundaries of the airport and using the existing runway.

A new apron is also required, and it is estimated in an initial stage to be able accommodate up to four stands for code C aircraft (such as Boeing 737 or Airbus A320) in the northeast corner of the airport site. In addition, a new parallel taxiway is required to connect the runway with the new platform. To minimise runway occupancy times, thus favouring the mix of commercial and general aviation without affecting capacity, and support short turnaround times, the taxiway can extend up to two thirds of the runway length in the initial stage of development.

A new passenger building can be developed next to the new platform, along with the associated infrastructure for parking and public transport. Given the uncertainty about

traffic development, a small passenger building with appropriate space to expand is preferable. The official preliminary plans (Schiphol Group, 2014c) estimate a “start-up” phase that includes a terminal with a capacity of around 1.5 million annual passengers.

The specific characteristics of the building has not yet been designed, but it should take into account the desired target customer segments, as well as the intention to provide low aeronautical charges. Recent developments at London Southend and Warsaw Modlin (Figure 101) are examples of simple, inexpensive buildings that provide adequate levels of service for the passengers and enough space for a matching retail and catering offer.

Figure 101: Public areas inside Warsaw Modlin passenger building as of January 2014 (more retail and catering spaces have been added in the second floor as of September 2014).

It is crucial to implement *flexibility* in the design of the passenger building to allow for expansion should the commercial airport succeed, or for a change in use if required. In case commercial operations do not become successful, the passenger building should be able to be converted to a terminal for executive aviation, or to office space for fixed-base operators, thus adapting the airport strategy towards general aviation again.

The second service package in terms of importance for the desired strategy at Lelystad is the *transport network*. An air transport network (set of destinations) would attract travellers (directly or via tour operators or travel agencies) but only after airlines decide to establish operations. A surface transport network is essential to allow passengers to have access to the low fares offered by the targeted airlines. De Neufville (2006) suggested that road-base transportation is in general more flexible and minimises the necessary investment. Indeed, in line with common practice at other European airports, Lelystad could implement (by itself or through partners) a bus network that connects the airport at least with central Amsterdam and with Lelystad train station.

As stated before, the *activities and events* service package can be in direct connection with the existing aviation museum to attract visitors. In addition, the *retail and non*

aeronautical services package must be aligned with the intended segments in the *individuals* customer group. In the future, the airport could explore opportunities in *real estate development*, but the *consultancy and managerial services* package is better implemented within the parent company, Schiphol Group.

iv) Relevant stakeholders

As Figure 100 shows, in order to market the airport strategy with the elements described so far, it is important to focus on the *aviation trade* and *individuals* groups of customers. And in order to successfully implement the elements of the strategy it is crucial to work in close collaboration with *airlines*, *aeronautical business units* and, given the particular characteristics of the air space around Lelystad, with the *air navigation service provider*.

Regarding airlines, as discussed above, it is foreseeable that the main users of the redeveloped airport, at first at least, would be current LCCs. In this sense, a permanent communication should be established with their representatives to integrate their concerns into the airport design. It is also important to bear in mind that other airlines may oppose these development plans, as they may be perceived as introducing more competition. Planners must evaluate carefully how Lelystad could impact the strategy intended for Schiphol.

In this sense, easyJet and Transavia, the largest low-cost operators at Schiphol, might be unwilling to transfer their operations to Lelystad because they have already gained an important market position and a significant customer base at the main airport. Moreover, as Transavia started performing some flights in code-share with its parent KLM (Schiphol Group, 2014d), part of its traffic can actually be considered hub-related and thus not desirable to be diverted to Lelystad.

Under these conditions, it might be more likely for Lelystad to attract growth in the point-to-point leisure travel segment than actually capture current traffic from Amsterdam Schiphol. It is also likely that Lelystad could divert part of the current traffic at Eindhoven or other surrounding airports (Maastricht, Groningen, Weeze) from airlines that do not serve Schiphol. The case of London Southend could provide some insights in this respect and might be valuable to study it in more detail.

In addition, as Lelystad is not likely to start commercial operations before 2018, it is important to follow different current market trends as well. Other airlines could become an interesting target for Lelystad in the future, but might not be evident today. For instance regional airlines that have a lower cost structure than competitors and have the flexibility to serve thinner markets, as it is the case of Flybe and Volotea currently.

Concerning the other stakeholders, it is important for Lelystad to ensure a close cooperation with the *aeronautical business units* in order to offer an environment that matches the desired low aeronautical charges and quick aircraft turnaround. Moreover, in partnership with the *aeronautical units* the airport can explore technological developments that translate into cost and emission savings for the airlines and the airport itself, such as electric Automated Guided Vehicles instead of the traditional fuel powered tugs, to move aircraft at the stands and hangars.

It is also important to study in detail the impact of commercial services at Lelystad in air traffic management and the ways to articulate these services with current general aviation traffic or, alternatively, the likelihood of diverting part of this traffic to other regional airports. Similarly, the entire planning process must especially consider feedback from local residents, economic agents and the government as it is also highlighted in the developed framework (see Figure 100).

7.6 Summary

The traditional approach to airport planning (master plans) focuses only in infrastructure development and does not allow managers to be proactive in defining a strategy that could shape the future of their airports. Master plans also hamper adaptability to changing market conditions, which have been heavily influenced by the ascendency of LCCs. This chapter presented an integrated framework for airport strategic planning, the *[New] Airport Business Network*, which complements existing methods of infrastructure development.

Airports, as organisations in other industries, should be able to define a unique position that differentiate them among competitors before their target customers. The framework we presented is based on a set of differentiation factors that align with the intended strategic focus of airport planners or managers. The strategic focus reflects the value proposition offered by the airport in accordance to the particular characteristics of the airport site. Similarly, for new developments, the characteristics of the airport product (including the attributes of airport infrastructure) should reflect the intended strategic focus.

As the airport product is in fact delivered by a diverse array of actors, the [New] Airport Business Network also allows planners and managers to identify the most relevant stakeholders in order to materialise a given airport strategy. However, considering the specificities of different airport sites, the process of airport strategic planning must be tailored to each particular case.

This chapter also presented the case of the Lelystad airport in order to illustrate the application of the proposed framework. The framework provided a tool to select a strategic focus that differentiates Lelystad from other airports in the Amsterdam Multi-Airport System. Although it is not intended as an exhaustive representation of the entire planning process, the example aimed at helping decision makers in defining the features of the airport to achieve the goal of relieving capacity at Amsterdam Schiphol to strengthen its competitiveness as a major hub.

8 Conclusions

The liberalisation of the air transport market in Europe introduced new relevant dynamics in the airport industry. In recent decades, airports evolved from infrastructure providers in a monopolistic context, to commercially oriented enterprises, in a competitive environment. Airports nowadays are multi-service firms that interact with a network of stakeholders to deliver a set of service packages (as the airport product) to different groups of customers.

A liberalised market also provided the proper ground for LCCs to proliferate. Initially, smaller regional airports took a clear advantage of the expansion of LCCs, thus becoming major players in the industry. The academic literature in this area has shaped the notion of 'low cost airports'; a notion that did not follow the enormous evolution of the low-cost segment, being too much rooted in the initial phase of LCC consolidation.

Yet the airports that LCCs use in Europe have such diverse characteristics that the elements traditionally considered in the literature to identify 'low cost airports' may not be, in practice, essential for low-cost operations. As the low-cost segment matures and LCCs move to larger airports, it may be impractical to distinguish between two types of airports ("low cost" and "not low cost").

Our analysis found three attributes that may be desirable for airports targeting at LCCs but they are, in fact, applicable to any airport: to provide (or allow) quick aircraft turnaround time; to ultimately charge low (aeronautical) fees; and to provide access to low fares for passengers. Moreover, existing infrastructure can be mediated by the attitude of airport management towards LCCs and by flexibility to adapt to changing requirements, thus keeping up with the evolution of airline business models.

The extent to which LCCs evolve and consolidate in an airport system is related to the development of physical infrastructure (through capacity expansion or the

development/emergence of new primary or secondary airports) but also to changing market conditions for airlines and airports. A new paradigm in airport strategic development is required in order to benefit from the opportunities presented by these dynamics. Our research argues that such paradigm should incorporate the planning and design of infrastructure and the definition of a matching business strategy.

In fact, the traditional approach to airport planning, master plans, focuses only in infrastructure development and does not allow managers to be proactive in defining a strategy that could shape the future of their airports. Airports, as organisations in other industries, should be able to define a unique position for their target customers to differentiate them from competitors.

8.1 Research contributions

This dissertation argues that the ascendency of LCCs has been in the core of significant changes in the aviation industry, and that those changes impacted significantly the way airports face strategic planning. The experience of Europe has clearly shown the impact on the airports that LCCs use in the continent. Then, building upon the findings, the dissertation proposes a framework to support the process of airport strategic planning by integrating infrastructure development and strategy formulation.

8.1.1 Contributions to research

Our research presents an updated review of the airport business in the current context. It proposes novel perspectives regarding airport stakeholders, airport customers, the airport product, and six generic approaches that, in general terms, identify the strategic focus that airports follow nowadays. It also argues in favour of the existence of competition between airports and summarises different areas in which they compete.

In addition, using a mixed methodology, this dissertation have analysed the impact of LCCs for a large sample of European airports. No other study had been so comprehensive and detailed in collecting and analysing information at this scale. Our analysis expands the traditional notion of 'low cost airports' by considering the airports that LCCs actually use nowadays. It also contributes to the field by compiling a significant amount of evidence and data that was not previously organised in a single study.

We also propose a conceptual model for the dynamic evolution of airports that can be further developed as a formal model to aid decision making in future scenarios. The conceptual model identified four mechanisms that trigger different traffic patterns, particularly in what concerns the low-cost segment. These mechanisms are associated to infrastructure expansion and to market disruptions.

8.1.2 Contributions to practice

We expect our research can help airport planners and managers, and practitioners in general, to better understand the context of the industry in a liberalised competitive environment. Moreover, we have compiled extensive data and performed systematic analyses that can be used to support airport benchmarking.

More importantly, our research proposes a novel framework that complements existent methods for airport strategic planning. This framework aims at facilitating the design of a differentiation strategy that delivers a unique position for an airport in a rather competitive market. It also helps planners and managers to identify the most relevant stakeholders, to ensure that the strategy can be materialised. In addition, we have developed a short case study that demonstrates the applicability of the framework.

8.2 Research questions revisited

This dissertation followed two main research questions focusing on the process of airport strategic planning and on the impact that LCCs have on that planning process. In order to summarise the main outcomes of the research, this section revisits the questions to provide a concise answer in each case. The answers offer a quick reference, rather than a replacement for the detailed analysis presented along the dissertation, as Table 18 relates.

Table 18: Sections of the dissertation where research questions are addressed in detail.

Research question	Addressed in detail in
Question 1	Chapter 7 and Chapter 3
Question 2.1	Chapter 5 and section 5.3.3
Question 2.2	Chapter 4, sections 4.3 and 4.4, Chapter 5 and Chapter 6
Question 2.3	Chapter 6 and Chapter 7
Question 2.4	Chapter 7, Chapter 5 and Chapter 6

8.2.1 Question 1

How should European airports design strategies to deal with the increased uncertainty produced by the liberalisation of the airline/airport industry and the ascendency of LCCs?

The rise of LCCs significantly increased competition between airlines and created a more volatile environment for airports. In a liberalised context, airlines are free to start and drop routes at will from/to whichever airport they deem convenient. Thus airports are more likely to be affected by decisions made by airlines in relation to abandoning, downsizing or growing operations.

Liberalisation in Europe have also contributed to increase competition between airports. To thrive in a competitive environment airports should design strategies to define a unique position before their customers. In order to identify the value proposition that

delivers such unique position, airport planners or managers should identify a set of differentiation factors that match a given strategic focus for the airport. It is paramount that the strategy that implements the differentiation factors is aligned with available or planned infrastructure, and vice versa.

This dissertation has presented an integrated framework to support planners and managers in this process. The *[New] Airport Business Network* allows them first to select the most appropriate differentiation factors according to the characteristics of the airport site, the intended strategic focus and the target customers; then the service packages (that an airport offers as its product) that need to be implemented in order to ensure that the airport can effectively deploy the differentiation factors; and finally the stakeholders that are involved in the provision of the service packages to the airport customers.

In designing their strategies, airport planners and managers should tailor the elements of the proposed framework to the particular features of each case. Moreover, taking uncertainty into account, they must include flexibility in the definition of the specific characteristics of the service packages (especially those involving physical infrastructure) and allow for strategic adaptation in case market conditions change drastically. In this sense, the proposed framework can complement traditional approaches for airport planning and design.

8.2.2 Question 2

In what way have LCCs influenced airport strategic planning?

In particular:

i) Question 2.1

To what extent have European airports implemented low-cost facilities?

14 airports in Europe market specific facilities for the use of LCCs. These facilities include separate passenger buildings (i.e. terminals), and piers or concourses within existing terminals. Only in two cases (Copenhagen and Bordeaux) the low-cost facilities were purpose-built from scratch. In other 5 cases (Amsterdam, Lyon, Marseille, Bremen and Tampere) they were redeveloped specifically with LCCs in mind. In the remaining cases the facilities came to be marketed as 'low-cost' only after a change in the main users.

In all these 14 airports there are LCCs that do not use the low-cost facilities (notably Vueling that only uses the “low-cost terminal” at Paris Charles de Gaulle) and in many of them there are other users (particularly charter and regional airlines).

In recent years, few airports in Europe have been built or redeveloped especially for LCCs (certainly Warsaw Modlin and Oslo Rygge; and to a lesser extent London Southend,

Eindhoven and Lublin). Others were built expecting to attract mainly LCCs but have not been able to secure significant traffic (e.g. Vatry in France, Beja in Portugal, and also Ciudad Real and Region de Murcia in Spain). But the most renowned cases of "low cost airports" are regional airports with modest passenger buildings that accompanied the initial development of the (now) major LCCs (e.g. Milan Bergamo, London Luton, Brussels Charleroi, Liverpool, Paris Beauvais and Frankfurt Hahn).

ii) Question 2.2

To what extent do LCCs operating in Europe use airport facilities developed for traditional airlines?

The five European airports with the largest capacity (available seats) deployed by LCCs in 2013 were not originally developed with LCCs in mind: Barcelona, London Gatwick, London Stansted, Istanbul Sabiha Gokcen and Oslo. This pattern is replicated in the majority of the airports that concentrate most of low-cost services in Europe. This means that, besides the cases mentioned in the previous question, LCCs have expanded in Europe using airports that, for the most part, had facilities developed for traditional airlines.

The ascendency of LCCs in Europe is evident in small regional or secondary airports in metropolitan areas, as it is also in the largest ones. In 2013, LCCs had a market share above 25% in 129 airports out of 171 studied in detail in this dissertation. Yet 6 airports (Amsterdam, Madrid, Paris Orly, Rome Fiumicino, Copenhagen and Paris Charles de Gaulle), in which the market share of LCCs was below this level, significantly contributed to low-cost traffic at European level.

iii) Question 2.3

Is the implementation of low-cost facilities setting new standards for airport design? If so, in what ways?

From the previous answers, we can state that specific low-cost facilities are not as widespread as the use of regular facilities by LCCs in airports that do not feature "low-cost terminals". The ascendency of LCCs in Europe may have increased awareness of airport charges as a relevant element in a competitive environment. This encourages airports to consider more carefully the feasibility of expansion projects and to take more into account the perspective of airlines on the development of new facilities. Likewise, the design of passenger buildings now tends to allocate more space for non-aeronautical activities to increase revenues, even in airports with a stronger focus on LCCs.

Passengers travelling in LCCs usually take fewer bags and perform on-line check-in before arriving to the airport. This reduces the space required for check-in counters. In

addition, as LCCs tend to perform quicker aircraft turnarounds in comparison with FSCs, other airport processes need to be streamlined in order to be performed quicker too. In the end, the total space required for passenger processing diminishes. Airports may consider this aspect when designing new facilities or refurbishing old ones, as LCCs are able to process more passengers per gate in a given period of time.

The ascendency of LCCs has certainly made all airlines more cost aware, and airports must respond accordingly. Some new airports have been developed with this in mind, allowing for less space per passenger but more efficient processes, along with less walking time to access gates and aircraft (e.g. Warsaw Modlin, Lublin, London Southend). The design of the passenger building at Berlin Brandenburg[20] includes a pier that allows for walking access to the aircraft and reduces the cost in deploying jet bridges.

Many other projects of airport expansion in Europe have gone ahead following more traditional design standards. Dublin, Barcelona, Heathrow, Alicante and Malaga have examples of new terminals in a more classical design (i.e. unique architectural monuments). The traditional planing process for new infrastructure usually takes too long to accommodate market developments that occur in shorter periods. Therefore, several forms of flexibility have been implemented even in some of these projects as well. The use of open shared-use spaces within passenger buildings and modularity is increasingly popular in airport design.

Concerning air side facilities, there are no particular changes associated to the rise of LCCs. LCCs use the same aircraft as other airlines and are bound by the same safety regulations and procedures. Smaller regional airports that became visible thanks to LCCs may feature a rather simple air side with a single apron located near a single runway, but this is more related to their size and it is a common characteristic at many European airports. Also, LCCs have large operations at airports with more intricate runway and taxiway systems such as Paris Charles de Gaulle, Amsterdam Schiphol or Madrid Barajas.

iv) Question 2.4

Is the establishment of LCCs in existing facilities setting new guidelines for airport strategy? If so, in what ways?

LCCs in Europe extensively use existing facilities that were not designed specifically for this type of operations. The ascendency of LCCs has contributed to change the attitude of airport managers towards these airlines. In order to develop traffic, some airports have explicitly developed strategies in which LCCs play a relevant role (e.g. London Gatwick).

20 This is currently the only major development of a new airport in Europe, along with a new Istanbul airport, as new developments in London and Lisbon have not taken off.

Even if the strategies are not as explicit or documented, many European airports have embraced LCCs to pursue mutual growth.

LCCs were first lured by some airports with incentive programs for route development. Although many LCCs continue to benefit from this kind of programs due to the flexibility they have to deploy their fleet, airport incentives are increasingly common in Europe and are available to any type of airline. In many cases airports and airlines have entered into long-term agreements that set common objectives and incentives for 5 to 10 years.

In line with the previous answers, airports have also adapted their infrastructure and processes for the use of LCCs. Notably, they have converted previous “bus gates” to boarding gates that allow for walking access to the aircraft in adjacent stands. However, this research work claims that in their strategic planning airports should allow for flexible designs and strategic adaptation to cope not only with the ascendency of LCCs but also with any future market developments not foreseeable at present.

8.3 Limitations of the research

As the geographical scope of this dissertation is bound to Europe some of the outcomes of the analysis may not be entirely generalisable for airports worldwide. Specific regulation and organisational settings may influence airport development in different ways. The process of liberalisation in Europe is different from other processes in the world, particularly in the sense that it is transnational. In addition, the level of maturity of the low-cost segment in Europe is higher than in other regions. The combination of these aspects may result in different outcomes for other locations.

Nevertheless, we have used the geographical scope to provide examples from which more general, interesting insights can be derived. We have taken the context into account in our analysis, when necessary, and we consider the findings can be used to set up possible scenarios in other regions with similar developments.

Moreover, given the number of airports that we have studied in detail, and the large amount of variables that we have analysed for each airport, part of the quantitative exploration was restricted to a transversal approach. Thus the analysis presented in chapter 5 is mainly based in data collected for the year 2013, except for financial parameters for which up to date information was not available. For this reason, financial information was not considered representative enough to draw conclusive insights.

Naturally, the information used to build our database may have changed after data collection. To minimise negative effects in the analysis, we pointed out when the changes that we were aware of were considered relevant. In addition the dynamic analysis

presented in chapter 6 also aimed at identifying more stable patterns with multi-annual data.

8.4 Future work

There are three topics in which we consider our research could be further developed in a natural and useful way. The first one is the analysis on aircraft turnaround times. We have identified a source of reliable data and a possible methodology for the analysis, but more research is required to explore the topic to its full potential. It could be interesting to analyse actual turnaround times instead of scheduled ones. Likewise, there are more nuances to investigate within the turnaround practices of each airline, in particular how these practices differ between based and non-based aircraft (considering that the turnaround time at hubs and bases may tend to be longer than at other airports).

The second topic concerns the development of a formal model for the dynamic evolution of airport systems. We consider that our conceptual model could be usefully explored by using system dynamics methodologies. A more formal model might prove valuable for traffic forecasting considering uncertainty, as well as for evaluating the viability and desirability of new airports in a given region.

Finally, the third topic relates to the application of the *[New] Airport Business Network* as a framework for airport strategic planning. We have studied the case of Lelystad to illustrate the application of the framework but more work is required to test our propositions. First, a more comprehensive and detailed application to the case of Lelystad would surely be quite useful. Then the application to other different cases would nurture the framework and enhance its practical utility.

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