A REVIEW OF AIRPORT CONCEPTS AND THEIR APPLICABILITY TO THE NEW LISBON AIRPORT PROCESS

REVISÃO DE CONCEITOS AEROPORTUÁRIOS E A SUA APLICABILIDADE AO PROCESSO DO NOVO AEROPORTO DE LISBOA

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ABSTRACT/RESUMO

Airports have been evolving since the 1930's and currently they tend to present considerable dimensions and higher versatility, producing significant impacts both at local and regional levels.

This paper aims to analyze several relevant aviation concepts that have emerged in the last decades, namely the Airport Region, the Airport City, the Airport Corridor, the Aerotropolis and the Airea, by assessing which concepts were well defined and were in practice implemented and which weren't. From the developed analysis, it was concluded that some of the referred concepts are well documented, namely the Airport City and the Airport Corridor and some aren't, namely the Airport Region, the Aerotropolis, and the Airea.

Also, on a more local relation, the New Airport of Lisbon's plans are compared with the same aviation concepts in the last fifty years, thus evaluating if the New Lisbon Airport (NLA) process was able to keep up with the modern aviation concepts. Two different degrees of coherence exist between these and the NLA planning process. Although in the 70s the NLA had a strong resemblance with the Airport Region, in the last two decades it was difficult to find a strong coherence between aviation concepts and the reviewed NLA's planning and technical documents.

Os aeroportos têm evoluído desde a década de 1930, sendo atualmente infraestruturas de considerável dimensão e grande versatilidade, capazes de produzir impactos significativos tanto a nível local como a nível regional.

Este artigo pretende analisar os principais conceitos aeroportuários que emergiram nas últimas décadas, avaliando os conceitos que são apenas produtos comerciais e de *marketing*, com pouca relação estabelecida com o desenvolvimento regional e as teorias de planeamento, e os conceitos que são verdadeiros fenómenos. Os conceitos aeroportuários analisados são: o Airport Region, o Airport City, o Airport Corridor, a Aerotropolis e a Airea. Foi concluído que alguns conceitos referidos têm aplicabilidade prática, designadamente o Airport City e o Airport Corridor, e os restantes não, designadamente a Airport Region, Aerotropolis e a Airea.

Numa perspetiva mais local, os planos do Novo Aeroporto de Lisboa são comparados com os mesmos conceitos aeroportuários nos últimos 50 anos, avaliando assim se o processo do Novo Aeroporto de Lisboa (NAL) foi capaz de se adequar aos conceitos aeroportuários modernos. Dois graus diferentes de coerência existem entre estes e o processo de planeamento do NAL. Apesar de, nos anos 70, o NAL ter uma forte semelhança com o Airport Region, nas últimas duas décadas foi difícil de observar uma forte coerência entre os conceitos aeroportuários e os documentos técnicos e de planeamento relacionados com o NAL.

Keywords: Airport City, Aerotropolis, New Lisbon Airport

Palavras-chave: Airport City, Aerotropolis, Novo Aeroporto de Lisboa

1. INTRODUCTION

Airports experienced a long evolution process throughout the 20th century. Some evolved from small and simple infrastructures, located on the outskirts of cities, to authentic extensive urbanized areas, integrated within the metropolitan regions.

As polarizing infrastructures, major airports became an influence for urban development and growth, a centerpiece on regional development and planning due to its territorial, social and economic impacts (Freestone, 2009; Freestone and Baker, 2011).

Despite today's importance and scale, from the beginning of the 20th century, and for about fifty years, airports were seen in a similar way as railway stations, a component of the transportation system, which should be installed in the outskirts of cities, to avoid potential threats, such as smoke pollution and operational hazards to the host cities (Freestone and Baker, 2011; Stevens et al., 2010).

Since its beginnings air transportation experienced significantly growth and during the latter part of the 1960s and 1970s, that tendency increased significantly, as air travel was getting easier and more affordable, and therefore, more accessible to the general population (Stevens et al., 2010). Aviation infrastructures also evolved, side-by-side with air travel transformations, evolving from simple transport infrastructures to much more complex and larger structures, and presently major airports have the capacity to accommodate great numbers of passengers and cargo and to compete for regional and international prominence (Freestone, 2009).

The higher capacity of airports along with the increased connectivity, and international accessibility that they provide made them, and their surrounding areas, attractive places for firm location, consequently, this led to greater impacts on their surrounding regions (Freestone and Baker, 2011). From the 1970s and throughout the 1980s, airports started to be managed as private businesses (several were privatized) to counter the natural cyclical business constrains or to maximize profits, airport managers started rapidly to diversify their revenue sources (Freestone and Baker, 2011). This trend led to significant transformations in the aviation world and in its commercial strategy and operations potentiating the emergence of modern aviation infrastructures (Poungias, 2009).

In the later part of the 1980s and through the 1990s, globalization accentuated the transformation of the airport as a potential centerpiece of an entire region while passengers, goods and services moving around the world through air transportation are steadily increasing, contributing more and more to reinforce the actual importance of airports (Kasarda, 2006a).

In the 1990s, globalization also reinforced the tendency of companies to locate their operations near airports – which started in late 1970s – where in the recent world economy, companies are more connected than ever and a product's quality and price are not enough for business success (Kasarda, 2001). In late 1990s, with the advent of internet and e-commerce, products started to be delivered more quickly and companies need to be flexible to attend the consumer's needs and demands in every part of the globe (Kasarda, 2001; Kasarda, 2006a).

Besides the changes in airport management and operations, massive transformations occurred inside and outside of airport's perimeters, where real estate in the airport vicinity (outside of the perimeter) was jointly developed by airport authorities and private entities (Freestone, 2009).

The involvement of airport authorities on the processes of urbanization and land-use changes meant that, in some cases, airports started to be a component, often a major one, of local and regional urban areas (Peneda, 2010). These new urban forms, directly related with the airports, originated different aviation concepts which differ from each other by the way they were planned, developed and structured.

This recent reality, where aviation infrastructures are a key component in the economical and urban regional development, was the leitmotiv of the present work which has the purpose of answering to two specific objectives: assessing which aviation concepts are well defined and were in practice implemented and which weren't and secondly, to evaluate if the New Lisbon Airport (NLA) process was able to keep with the same modern aviation concepts;

To achieve the first objective (presented in section 2), the following methodology will be applied: through a literature review the most important and common aviation concepts will be characterized and each aviation concept will be described according with the type of promoter (public/private), its relation with spatial planning instruments and its integration with the local and regional urbanization patterns. The characterization of the aviation concepts will also allow the delimitation of the field of research and establish the basis for a comparison between them and the NLA technical and spatial plans (which is related with the second objective of the work).

Regarding the second objective (presented and discussed in section 3), a comparison will be established between the aviation concepts' characteristics and the major technical and spatial plans related with the NLA. This will focus mainly on the integration with the local and regional urban structure, transportation sectorial plans and projects, and with the existence and coherence with planned residential, commercial, industrial/logistical developments in the vicinity of the airport.

Finally, in the conclusions, a summary and discussion of the main results explored along the text is presented.

2. AVIATION CONCEPTS

In order to identify the most important aviation concepts that are commonly referred since the 1970s and frame it's evolution with the NLA planning process, the literature related with these subjects was reviewed and the concepts to be considered and summarized on Frame 1 are the following: Airport Region, advanced by Roeseler (1971); Air-

port City advanced by Conway (1980); Airport Corridor advanced by Schaafsma et al. (2008); Aerotropolis advanced by Kasarda (1991); and Airea advanced by Schlaack (2010).

The concept of Airport Region considered here is the definition advanced by Roeseler (1971) and later described by Freestone and Baker (2011). The latter associates the Airport Region with the American concept of Airports in the Region, a national and regional top-down planning approach based on the work related with industry districts of the 1970s which consisted of a sum of commercial and industrial aviation concepts area on the fringe of the airport which also sheltered a residential community (Roeseler, 1971). There is a more modern version of the Airport Region concept, advanced by authors such as Schlaack (2010) or Stevens et al. (2010), where the concept of Airport Region is characterized by having an airport influencing an entire region. Here many commercial, industrial and logistical companies are directly and indirectly related with the airport. However, in the present work only the first definition will be considered, since it will be compared with the technical and spatial plans made for the NLA in the 1970s.

Regarding the Airport City (formulated in 1970s/1980s), its general definition corresponds to the immediate area around the runways, inside its traditional perimeter and is planned, developed and managed directly by public or private airport authorities. Normally it is composed by shopping malls, commercial offices, air cargo facilities, touristic, leisure, and health facilities, hotels and conference centers (Freestone and Baker, 2011; Schlaack, 2010).

The Airport Corridor (formulated in the 1980s/1990s) is a public and private planned infrastructure and its adjacent development with the presence of various stakeholders in its planning, development and management processes, like airport authorities, real estate developers and local and regional public institutions (Schlaack, 2010; Machedon, 2012). It creates an urban conurbation between the Airport City and the host city through the developing of residential, commercial, industrial, logistical and leisure areas, structured along highways and/or railways (Peneda, 2010). Although the development of Airport Corridors is a private-public combination of multiple stakeholders, public power still plays the fundamental role (Peneda et al., 2011).

The Aerotropolis (formulated in the 1990s) is composed by an Airport City as the center and as a key element of a larger area, occupied by business and logistic parks, retail complexes, industrial, technological and thematic parks, residential and commercial areas and entertainment facilities. All of them are distributed around the airport and structured by a fast and efficient transport network composed by rail systems, freeways, connected with major regional centers, like important cities or logistic and freight facilities (Kasarda, 2001; Charles et al., 2007). This concept has hybrid characteristics, since it assumes the existence of another related concept, the Airport City, which is integrated within a more encompassing regional structure. Although having similar features to the Airport Corridor, its form is different and broader, since it is autonomous from the host city, constitut-

ing a sort of an independent urban center. The Aerotropolis also started as an unplanned urban form arising from private initiative, and, despite some planned present examples (e.g. Incheon International Airport or Dubai World Central), there are no completed or mature totally publically-planned Aerotropolis today (Kasarda, 2001; Peneda et al., 2011);

Finally, the Airea is the most recent concept, and was defined by Schlaack (2010) to explain some airport related urban forms, exemplified by the author as the territory around Denver and Berlin-Brandenburg airports. It can be argued that the Airea is a mix between an Aerotropolis and an Airport Corridor, since its territorial development and relation with the airport is similar to the Aerotropolis, but instead of having a homogenous and continuous form, it is characterized by a dispersion of "islands" through the metropolitan area, and is organized in a polycentric way. As in the Airport Corridor this concept also considers the existence of public planning both at the regional and at local levels. Nevertheless its development is made by public and private developers, encompassing different scales of features, namely infrastructure and economic activities (Freestone and Baker, 2011; Schlaack, 2010; Machedon, 2012).

It can be said that the Airport Corridor and the Airea concepts consider both the participation of public and private entities in its planning and development processes having clearly originated distinct urban forms based and focused on the airport, although these urban forms are supposed to be integrated with the host city and with the metropolitan structure.

Related only with the Airea one can point the scarce of a thorough knowledge and discussion about the concept itself, since only some authors (Schlaack, 2010; Freestone and Baker, 2011; Machedon, 2012; Peneda, 2010) discussed it without going to much further beyond the initial definition advanced by Schlaack (2010).

Regarding the Airport City, it's not considered as a conventional urban phenomenon but more as a public and private-led commercial development with a relevant dimension because it focuses mainly in the area inside the airport perimeter and its closest vicinity.

Of all, the most controversial concept may be the Aerotropolis, since some authors enumerate some arguments against the validity of this concept, and contest the existence of airports that fit into its definition.

In particular, Stevens et al. (2010) considers its growth as "unsustainable", stating that existent Aerotropolis are sprawled types (Chicago and Dallas-Fort Worth) or are only applied theoretically in massive projects like Dubai World Central or Hong Kong's Chek Lap Kok. Still considers it as the "less successful as a normative model for regional greenfield airport development" (Stevens et al., 2010, 9).

Schaafsma (2010, 175) argues that the Aerotropolis cannot be considered yet as a true urban space, and Freestone (2009, 167, 172-173) continues by arguing that at the time most "Aerotropolis development [...] has been spontaneous and haphazard, and that to build sustainable communities airport urban planning should be fully integrated although

it's not a guarantee of success". It gives the example of a super-planned Aerotropolis, the Dubai Word Central as an extreme example of this kind of projects.

Peneda (2010, 65) states the inexistence of mature Aerotropolis purposefully planned, verifying that the recent Aerotropolis advances are spontaneously and driven by the private sector and markets. Furthermore, it states that the concept of Aerotropolis arose as "strictly business development model to be followed by the airport operator".

Finally, even Kasarda (Appold and Kasarda, 2006), despite being the most well-known advocate of the Aerotropolis, recognizes that planned Aerotropolis can only be seen in recent greenfield projects, like Hong Kong International Airport or the Incheon International Airport.

Some doubts have been raised towards the validity of the Aerotropolis' concept, mainly with the fact that the examples known and referred by authors are far away from what is commonly idealized about this aviation concepts development: on one hand, a spontaneous and unsustainable sprawled concept with little planning; and on the other hand, a large long-planned concept which until now doesn't have a truly successful and mature example. Anyway, both realities escape to the ideal conception promoted by Kasarda (1991) among others.

Regarding the Airport Region – 1970s concept – and its potential to originate a distinct urban phenomenon are difficult to assess due to the fact that its definition is more theoretical than real. Also, some issues arise with the Airea concept, not related with criticisms but partly with the lack of it, since as a recent concept, it wasn't still deeply scrutinized and therefore it's not possible to safely consider it as a definitely valid concept.

FRAME 1. CONCEPTS, FEATURES AND CHARACTERISTICS

Graphic Example	Concepts' Features	Planning and Developing
Airport Region (70s)		
	* An embryonic Aerotropolis from the 70's * A public planners view * Development of residential and industrial areas around the airport * Connected to host city and to main industrial and logistical sites by roads (highways and conventional roads) and conventional rail	* Top-down planning * Public authorities view * Public developers
Airport City		
	* Limited to the airport perimeter * Large supply of various services: commerce; public services; leisure and business spaces	* Privately and public developed and managed by airport authorities
Airport Corridor		
	* Developed on a corridor between the airport and the host city * Greater and more varied involvement of public on the infrastructure planning * Connected to host city and region by highways (express or not) and railway (express/high speed or not)	* Public-privately planned * Intervention of various stakeholders in cooperation: airport authorities; private developers; local and regional public institutions;
Aerotropolis		
	* Extrapolation of the Airport City to the surroundings of its perimeters * Replication of Airport City services, industrial, residential, thematic and logistical spaces * Features similar to Airport Corridor	* Unplanned to national and regional planed * Mix of developers: private; public; private and public
Airea		
	* A fragmented and dispersed developed area around the airport in a polycentric and metropolitan way * Features similar to Airport Corridor and Aerotropolis	* Regional and local planning * Private and public developers * Mix between private/public and small/large components

⬜ Airport; **A** - Airport City; ▨ Concept's area; ⬛ Host city

A complementary analysis was made in order to better seconding the arguments already stated along the current section for each aviation concept.

Therefore, in frames 2 and 3 the individual definition of the aviation concepts of each author considered on this work are summarized. The frames illustrate the communalities and differences of the definitions and examples advanced by the authors for each aviation concept. The Airport Region is not included since the definition chosen by the authors, referent to the 1970s decade, was already considered as more theoretical then practical.

A concept with common definitions, without any significant variations among authors should be analyzed with caution and similar care should be taken with concepts that have many different examples. The first issue may indicate a dependency on only one or two authors and the second could mean that the concept isn't still well defined, which could be a sign of inconsistency, since it is

too broad to allow a precise differentiation between airports with different characteristics.

The Airport City (see Frame 2) definition given by Güller and Güller (2003) and Kasarda (Kasarda, 2001) is the most quoted between other authors and the Amsterdam International Airport is the one that is used as an example. The similarity of definitions and common examples along with Schlaack's (2010:115) affirmation that "… almost every hub in the world" is an Airport City could be considered as a demonstration of this concept validity, or, in a more critical appreciation, the vagueness of the concept, which allows that almost all hubs could classified as an Airport City.

The same can be said about the Airport Corridor (see Frame 2) concept, defined by Schaafsma (2008), and commonly cited by several other authors with common examples being once again the Amsterdam International Airport – along with Zurich Airport – the most mentioned as being part of a corridor connecting the airport to the host city.

Regarding the Aerotropolis, Kasarda is undoubtedly almost the only author to explain this concept (see Frame 3), mainly due to his long work on the subject, being the Amsterdam International Airport once again often used as an example alongside with the Hong Kong International Airport, the Incheon International Airport and Dallas/Fort Worth International Airport (see Frame 3), beside other examples, showing a higher profusion of different examples when compared with the other concepts.

FRAME 2. AIRPORT CITY AND AIRPORT CORRIDOR EXAMPLES BY AUTHORS DEFINITIONS

Examples by Concepts	Definitions
Airport City	
* Athens International Airport; Düsseldorf International Airport (Poungias, 2009)	Provision of commercial services and infrastructures according to the client necessities and whishes
* «[...] almost every hub airport in the world» (Schlaack, 2010, 115)	The «area immediately surrounding the airport» with commercial and business activities (e.g. hotels) related to the airport
* Amsterdam Airport Schiphol; Singapore Changi Airport (Knippenberger, 2010)	Developments driven and planned by airport authority on the airport perimeter, constituted by shopping, working, meeting and entertainment venues
* Amsterdam Airport Schiphol; Dallas/Fort Worth International Airport; Frankfurt am Main Airport; Hong Kong International Airport; Incheon International Airport; Singapore Changi Airport (Peneda, 2010)	Commercialization of the airport with focus on the diversification of the revenues
* Amsterdam Airport Schiphol (Freestone, 2009)	Planned mixed-use developments on airport land by airport authority
Airport Corridor	
* Amsterdam Airport Schiphol (Schlaack, 2010)	Public planned infrastructures and developments structured on a road or rail buffer zone between the airport and the host city
* Amsterdam Airport Schiphol; Copenhagen Airport; Helsinki Airport; Kuala Lumpur International Airport; Rome Airport (Schaafsma et al., 2008)	Urban (U.S.) or industrial (Europe) developments located on a corridor between airport and city
* Amsterdam Airport Schiphol (Stevens et al., 2010)	A public-private cooperative agreement and planning for economic development on a determined area
* Copenhagen Airport; Denver International Airport; Zurich Airport (Peneda et al., 2011)	A planned and integrated sum of developments between the city and the airport, structured along a major surface infrastructure
* Zurich Airport (Freestone and Baker, 2011)	Coordinated provision of infrastructure and commercial development between airport and city CDB, by private developers and public infrastructure authorities
* Amsterdam Airport Schiphol (Machedon, 2012)	Coordinated provision of infrastructure and commercial development between the airport and city CBD by private developed and public infrastructure authorities framed on a mutual airport city development strategies and public private cooperation

Also, there are different definitions in relation with the exemplifications of concepts: the Amsterdam Airport is already well defined as a marked example of an Airport Corridor (Frame 2); the Hong Kong, Dubai World Central and the Incheon can be considered as the result of huge investments; Dallas/Fort Worth and Chicago exemplify the spontaneous and unplanned Aerotropolis. The addition of other different examples by Peneda (2010) and Freestone and Baker (2011) may also point to the existence of some inconsistency in relation of what is an Aerotropolis.

Finally, the Airea (see Frame 3) concept was recently formulated by Schlaack (2010) and so far, only her definition is quoted by other authors (Freestone and Baker, 2011, Machedon, 2012) to explain what an Airea is. The

references to Berlin-Brandenburg and Denver as examples of the Airea concept consist also of quotations of Schlaack (2010). Although well described, the existing literature about the Airea is still scarce and too recent, making it difficult to adequately evaluate the concept's applicability. Additional research may be needed for a better understanding of Airea concept and its adequacy to real cases.

As a conclusion, the aviation concepts Airport City and Airport Corridor can be considered as truly existing and well identified by a major part of the authors referred here.

The same cannot be said about Aerotropolis, some inconsistency exists on its definition, since some authors (Freestone, 2010; Peneda, 2010) point out the existence of Aerotropolises that were spontaneously formed. Also, others like Stevens et al. (2010) state that massive projects like the Dubai World Central or the Incheon Airport do not represent well this concept due to their dimension and because they are incomplete projects.

On the Airea concept, since all the definitions found are based on Schlaack (2010), this aviation concept should be the object of a deeper analysis before being considered as valid.

FRAME 3. AEROTROPOLIS AND AIREA EXAMPLES BY AUTHORS DEFINITIONS

Examples by Concepts	Definitions
Aerotropolis	
* Amsterdam Airport Schiphol; Hong Kong International Airport; Incheon International Airport (Kasarda, 2006a)	Development around the airport of multivariate activities and residential areas connected with the airport
* Hong Kong International Airport; Incheon International Airport (Schaafsma et al., 2008)	Sum of Airport City and Airport Corridors framed on a bigger regional project
* Chicago O'Hare International Airport; Dallas/Fort Worth International Airport; Dubai World Central; Hong Kong International Airport (Stevens et al., 2010)	Urban form focused on the airport being this a major regional/metropolitan agent with commercial and industrial activities and residential zones connected by high speed roads and rail
* Amsterdam Airport Schiphol; Chicago O'Hare International Airport; Dallas/Fort Worth International Airport; Frankfurt am Main Airport; Sãoo Paulo's Viracopos International Airport; Washington Dulles International (Peneda et al., 2011)	A sum of aviation concepts developments around the airport assuming an urban form with the Airport City as its core, with a mix of commercial and business activities and residential areas around the airport and structured by motorways
* Dubai World Central; Hong Kong International Airport; Incheon International Airport; Suvarnabhumi Airport (Freestone, 2009)	An area around the Airport City with aviation and non-aviation activities uses, like commercial, industrial and leisure activities and residential areas, all connected by motorway corridors
* Dallas/Fort Worth International Airport; Hong Kong International Airport; Incheon International Airport; Kuala Lumpur International Airport; Singapore Changi Airport; Suvarnabhumi Airport (Freestone and Baker, 2011)	An area with the Airport City at the epicenter and interconnected by dedicated motorways and high-speed rail linking outlying aviation oriented businesses, logistic parks, retail complexes, hotels, and free trade zones
* Dallas/Fort Worth International Airport (Machedon, 2012)	A low density airport-centered area, promoted by the private market with business orientation, with mixed jurisdiction. May be planned or unplanned
Airea	
* Berlin-Brandenburg; Denver International Airport (Peneda, 2010, Freestone and Baker, 2011, Machedon, 2012)	Fragmented and dispersed developments through the metropolitan area who are influenced by the airport or related to it; discrete spatial clusters of aviation concepts development on metropolitan sub region and promoted by the private market; discrete spatial cluster of airport in a polycentric urban form through a metropolitan sub region, promoted by private market resulting on multiplicity of economic development and marketing nodes with business orientation and framed by the regional planning

3. THE NEW LISBON AIRPORT PROCESS

3.1. EVOLUTION OF THE LOCATION CHOICE AND TECHNICAL PLANNING

The construction of a new airport to serve the city and region of Lisbon was, and still is, a tortuous process, with progresses and setbacks. The process of planning and designing the New Lisbon Airport (NLA) started more than 50 years ago. During this period, several different potential locations were considered and many technical plans and documents were produced along with the estimates of NLA's potential impacts on the region of Lisbon, which were studied on different regional master plans.

Sixteen years after the inauguration of the first Portuguese National Airport, in the northeastern part of the city of Lisbon (Portela de Sacavém), in 1942 – and presently still in operation – a new airport was already being considered by the Ministry of Public Works (Julião et al., 1988).

Only in 1969, did the Portuguese Government advanced with more concrete actions, with the creation of a temporary taskforce (GNAL – New Lisbon Airport Cabinet), with full powers, to develop the planning and construction of the New Lisbon Airport (NLA). Its powers included choosing the suitable location site. Rio Frio, on the River Tagus' south bank, was chosen as the first best location in 1972, after a comparison with other possible locations, namely Fonte da Telha, Portela de Sacavém, Montijo, Alcochete and Porto Alto (GNAL, 1972).

Although in the beginning of the planning stages the process advanced considerably, it was later interrupted for many years due to the first oil crisis, in 1973, and due to the 1974 Portuguese Carnation Revolution (Coutinho and Partidário, 2008) while the conclusions from the previous studies were set aside during the 1980s (DGTT, 1984, ANA, 1982). Besides this discontinuity, a new location was indicated as more suitable to host an airport, Ota, which is located about 50 kilometers north of Lisbon (ANA, 1985).

The process revival, now with Ota as the ideal site, was confirmed several years later by official studies (NAER, 1999a, NAER, 1999b, CA, 1999) promoted not by a taskforce but by a public company, the NAER – which officially confirmed Ota as the suitable location for the NLA (NAER, 1999a). In 2002, the Airport Director Plan for the Ota location (NAER, 2002) was concluded, but construction of the aviation infrastructure *per se* was delayed due to the high costs of the project.

Despite the delays, the NLA process appeared to be well underway, however everything changed again in 2008, with the publication of a study funded by the Portuguese Industrial Association (CIP, 2007) in which another new location, Alcochete – previously discarded on the 1972 study made by GNAL (1972) – was proposed and advanced as the most suitable location for NLA. The Portuguese Government, in 2008, influenced by this study (CIP, 2007) and by the public opinion (Marreiros and Gonçalves, 2013), confirmed Alcochete as the new official location (Conselho de Ministros, 2008a, Conselho de Ministros, 2008b), as indicated by the National Laboratory of Civil Engineering (LNEC) on a comparative study (LNEC, 2008) between Ota and Alcochete, which was mandated by the Portuguese Government.

However and once again, the NLA construction was halted due to financial constraints and then indefinitely postponed by the new Portuguese Government in 2011, situation that continues to the present day (Correia and Silva, 2013).

3.2. EVOLUTION OF THE REGIONAL PLANNING PROCESS

If the development process of the NLA was turbulent, the same can be said about the evolution of the Spatial Planning for the Lisbon region during the same period; although it was not marked by as many deviations and changes, it still had its share of advances and setbacks.

The first regional plan for the Lisbon region, the Lisbon Regional Master Plan, was elaborated during the first years of the 1960s (Ministério das Obras Públicas, 1964).

This plan considered Rio Frio as the location for the NLA, preceding and probably influencing the 1972 and the 1975 technical plans (GNAL, 1972; STC, 1975).

Despite the existence of this regional plan, the urban development of the region of Lisbon was marked by a non-planned exponential growth of Lisbon's periphery in the following 30 years of its creation, where illegal construction, lack of infrastructure and public facilities and the absence of an adequate overall plan created an unorganized and chaotic territory (STC, 1975; Soares, 2003).

There were attempts to adapt the spatial and regional planning processes to the existing reality in the way of a reform, conducted by the Ministry of Public Works in 1973 with the *Reform of the Lisbon Regional Master Plan* (Ministério das Obras Públicas, 1973a) and with the *Report about the Basis of the Reform of the Lisbon Regional Master Plan* (Ministério das Obras Públicas, 1973b), but there were no tangible results.

Only in 1992 a new regional plan was elaborated, but, once again, it wasn't enforced due to conflicts with the municipal master plans and with government's political choices (Soares, 2003). Only in 2002 (almost forty years after the original plan) a new regional master plan, the *Regional Spatial Planning of the Lisbon Metropolitan Area* (CCDR-LVT, 2002) PROTAML, was implemented. The relation established with the NLA was now different from the spatial plan of 1964, since it no longer dictated where the future location was going to be, but recognized an interconnection with the airport technical plans of the same period, appointing similar transportation and land use solutions.

Finally, in 2009, another regional master plan was completed, the *Regional Master Plan of Spatial Planning of the West Territory and Tagus' Valley* (CCDR-LVT, 2009) – PROTOVT, focusing in Northwestern area of Lisbon Metropolitan Region, which considered Alcochete as the NLA location in coherence with the PROTAML airport features.

3.3. COHERENCE BETWEEN CONCEPTS WITH NLA TECHNICAL AND REGIONAL MASTER PLANS

As seen on previous chapters, the five referred aviation concepts emerged in the last forty years, coinciding with the period of the NLA planning process. Assessing if the NLA technical plans and the regional master plans were able to keep up with aviation concepts could be helpful to future research on the relation between airport development and spatial planning in Portugal. Also, it could provide relevant policy insights, by stressing the relevance of the NLA as being more than a mere transportation infrastructure.

Due to all the setbacks in the NLA planning process, there aren't (publicly available at least) finished blueprints or master plans related with the effective construction of the NLA. Nevertheless, some available major technical plans can be largely related with final plans, and although they can be considered as dominantly conceptual, they still give a good idea of what was intended over the years. Thereby, the technical plans considered were the Coordination of the Planning and Construction and the Exploration of the New

Airport of Lisbon: Rio Frio of 1975, the Master Plan for Airport Conceptual Development of 2002 and the Study of Environmental Impact of the New Airport of Lisbon of 2010.

As referred, the development of the Lisbon regional master plans in the last forty years was intermittent, originating only two effective plans, the Lisbon Regional Master Plan of 1964 and the Regional Spatial Planning Plan of the Lisbon Metropolitan Area of 2002. Along with, the inclusion of a non-effective plan, the Reform of the Lisbon Regional Master Plan of 1973, was made with the intention of extending the amount of possible information and because the plan itself contains much valid information for the current case study.

To assess if the NLA technical plans and the regional master plans matched any aviation concept, a comparison between technical and spatial plans and concepts is established, which is resumed in Figure 1. The possible relations that can be established vary between low and high degrees of similarity, and they are based on two main components: the development of land-use and a large focus on the regional connectivity of all sorts of transport modes possible at the time.

Specifically, this comparison takes in account the planned management of land-use inside and outside of the airport operational area and the planned transport networks. The first component, land-use development and management, is considered to be more important as it is a more recent aviation approach and it's the key differentiator between the aviation concepts, contrarily to the transport networks which are always present in all concepts.

A relation of higher or lower degree of similarity is established between the single mention and the effective planning of land-use development and transport networks. The single mention of the components means that they are only briefly and shortly referenced, without detail and usually entailed on vague expressions. Contrary, the effective planning of such components means that a specific allocation of space and resources to a specific function is framed by clear guidelines. Hereupon, the degree of similarity is determined by a combination of this dichotomy with the components of land-use and transportation network as follows:
– The inexistence of similarities happens when the land-use component is not even mentioned;
– A low degree of similarity happens when there is only a mention to both components, or when only the planning of the transport networks is considered and land use is just mentioned;
– A high degree of similarity occurs when the transport network is just mentioned and the land-use planning is considered or when the planning of both components is explicit.

These relations of similarity connect the technical or the spatial plans with the concepts that they resemble most, although the majority of plans can only be resembled to one aviation concept. This is due to the fact that, despite the concepts have common features, they still present unique features which are deciding factors (e.g. their geographical distribution). Hence, choosing between Air-

port City or Airport Corridor, Aerotropolis and Airea is related with land development and management, which in the case of the Airport City only occurs inside the airport perimeter of operations.

In contrast, all latter three concepts consider land-use changes and management outside the airport perimeter of operations, distinguishing among themselves in turn, by their territorial distribution. On the Airport Corridor, an urban corridor must be effectively planned with the host city; on the Aerotropolis, a continuous stretch of land surrounding the airport must be planned; and on the Airea a discontinuous and fragmented stretch of land surrounding the airport must also be planned.

Finally, the Airport Region, as already explained is the only time-limited concept, being a good example of a typical theoretical top-down development approach which enables its comparison with older NLA and regional master plans.

However, due to theoretical characteristics of the Airport Region concept, the defined methodology will be relaxed when applied to it. Therefore, and only in this case, the mention of land-use in the technical and spatial plans along the mention or planning of the transportation network will be considered as having high degree of similarity.

The differences on the overall planning documents dating from different periods are easily distinguishable on Figure 1. The technical plan from 1975 advances proposals about the development of the airport's surrounding area. The regional plans from 1964 and 1973 advance proposals on more specific questions related with the airport and its transport connections.

By contrast, recent technical plans are circumscribed to the airport and its transport connections, and although the regional master plan of 2002 presents some considerations on the development of the surrounding region, it is only by a short mention and without effective planning.

In 1975, when Rio Frio was considered the most suitable location, a document entitled *The Coordination of the Planning and Construction and the Exploration of the New Airport of Lisbon: Rio Frio* (STC, 1975) was issued. In this document the coordination between the different NLA construction agents was discussed and analyzed, giving a clear idea of what was the view (even if only envisioned and not planned) for the NLA in Rio Frio.

Exceptionally, the technical plan of Rio Frio was considered with a high degree of similarity with the concept of Airport Region, however this similarity is mainly due to philosophy inherent to the NLA project, which is characterized by a top-down approach to develop a giant infrastructure able to shape the Lisbon metropolitan region (Freestone and Baker, 2011; STC, 1975), typical of the regional development theories of the time, and of which the Airport Region concept is a good theoretical example. Although considered as highly similar, this conclusion must be seen with caution, since all the equal features referred by the coordinator plan were not really planned, like the airport itself, but were only enunciated. They were no more than highly aggregated visions.

FIGURE 1. COHERENCE BETWEEN CONCEPTS AND NLA TECHNICAL AND REGIONAL MASTER PLANS

Spatial Plans	Concepts (epoch)	Technical Plans
Lisbon Regional Master Plan (1964) - Connections between the NLA and Lisbon by highways and conventional railway y **Reform of the Lisbon Regional Master Plan (1973)** - Plans to host 170 000 people on an Airport Community with industrial areas - Connections between the NLA and Lisbon by highways and conventional railway **Regional Spatial Planning Plan of the Lisbon Metropolitan Area (2002)** - Mention the necessity to establish connections between the NLA with Lisbon, regional ports, logistical plataforms by highways and by high speed railway - Mention the creation of spaces on NLA's nearby to host logistical, commercial and industrial activities and public services	**Airport Region** (1970s) **Airport City** (From 1970s/1980s) **Airport Corridor** (From 1970s/1980s) **Aerotropolis** (From 1990s) **Airea** (2000s)	**The Coordination of the Planning and Construction and the Exploration of the New Airport of Lisbon: Rio Frio (1975)** - Recognizes the need to constrain the area around the airport due to the problable installation of commercial and industrial activities in the area - Connection by highways and conventional railway to Lisbon and with main regional industrial sites - Creation of na Airport Community to house airport employees and other population along with the development of industrial and agricultural activities **Master Plan for Airport Conceptual Development (2002)** - Multi-modal airport connected to Lisbon and major regional locations by highways, major roads and conventional and high speed railway - Mention to the displacement of economic activities, jobs and residents to the NLA's nearby **Study of Environmental Impact of the New Airport of Lisbon (2010)** - Multi-modal airport connected to Lisbon and major regional points by highways, major roads and conventional and high speed railway - Mention to the potentiation of commercial spaces according to the current trends

——————— High degree of similarity

- - - - - - - Low degree of similarity

Twenty seven years later, in 2002, already with Ota as the defined location, the *Master Plan for Airport Conceptual Development* (NAER, 2002) was made. Unlike its predecessor, the regional components, with exception to the transport connections between the airport and the main urban areas, were not considered at all, probably because the document only was meant to direct and manage the construction of the airport, leaving the regional development for other institutions (CCDR-LVT, 2009).

There is a low degree of similarity between the NLA and any of the possible matching concepts, the Airport Corridor, the Aerotropolis and the Airea since it briefly mentions the possible shift of economic activities, jobs and residents to the NLA's proximity, without further specifications. This

document predicts this shift as a possible impact/outcome of the NLA's construction, but does not plan it, being impossible to know which specific concept is applied.

What is in fact planned are the transport networks, encompassing freeways, major roads and conventional and high speed railways. These features are associated with the three latter aviation concepts, and since there is no reference to the development of commercial areas inside the airport's area of operation, it cannot be related with the Airport City.

Regarding the last location selected, Alcochete, a comparison was made using the *Study of Environmental Impact of the New Lisbon Airport* of 2010 (NAER, 2010), from which a low degree of similarity with the Airport City was identified. There is an extensive planning of the transportation network – applicable to all concepts – but there is a brief reference to land development and management inside the airport's perimeter, the potentiation of commercial spaces, which can be related only with the Airport City, since also nothing is stated regarding outside the airport perimeter.

As a general conclusion we can state that, only during the 1970s it is possible to find a relevant level of coherence between the airport technical plans and the concepts of aviation infrastructures. However, on the coordination plan for Rio Frio (STC, 1975) only transport infrastructures were really planned. Regarding land use planning, only a handful of intentions were put forward, identical with the concept of Airport Region. Nonetheless, the high degree of similarity was given, since the concept of Airport Region presented here is only theoretical and shares a common approach of regional development, centered and organized by the state on a true top-down approach. The same rule will be applied ahead with the *Reform of the Lisbon Regional Master Plan* of 1973, being both the only exceptions to the methodology defined before due to the original statuses of the Airport Region concept.

The more recent documents about the NLA, the ones from 2002 (NAER, 2002) and 2010 (NAER, 2010), did not fully embrace the most recent aviation concepts; only tenuous connections with these exist, provided by a transportation network effectively planed but with only short references to land-use planning.

These different degrees of relations might be in line with the general paradigms of planning theory, as in the 1960s and 1970s planning and regional development paradigms assumed a more active and leading role of the public administration and in 1990s and 2000s its focus has shifted more to a more active role by the private sector.

As stated, the development of regional master plans for the Lisbon Metropolitan Area was also an unstable and discontinuous process with a large interval (almost fifty years) between the first plan (Ministério das Obras Públicas, 1964) and the second plan (CCDR-LVT, 2002). In 1964, the *Lisbon Regional Master Plan* (Ministério das Obras Públicas, 1964) considered Rio Frio as the most suitable location. Since it only had defined the landside transport connections, by rail and road, with Lisbon and its metropolitan area, no relation of similarity was established, as

it could be applied to all five aviation concepts. This plan only saw the new airport as just another element on the overall transportation system.

In 1973 the *Reform of the Lisbon Regional Master Plan* (Ministério das Obras Públicas, 1973a) (also presented in Figure 1) proposed some features with high degree of similarity with the Airport Region concept, especially due to the explanation of a thorough general idea regarding the land-use development, which included the construction of an Airport Community and the installation of commercial and industrial activities. Nonetheless, and although the high degree of similarity, this should also be viewed with caution since nothing *de facto* was really planned, as similar to what was described for the technical plan of 1975.

In 2002, a new regional master plan, the *Regional Spatial Plan of the Lisbon Metropolitan Area* (CCDR-LVT, 2002), presented a low degree of similarity with the Aerotropolis and the Airea concepts. The relation forged with both concepts was mainly related with the brief indication of a possible installation of commercial, industrial and logistical activities nearby the NLA. Proximity and activities locations automatically discard the Airport Corridor (the location was Ota, 40/50 km from Lisbon) and the Airport City (covers only the territory outside the airport limit). Besides the land-use components, it also mentions the necessity to build transport connections between the airport and the main regional urban centers. Both components are only mentioned and are framed on a broader logic according to which the airport is seen as an ideal infrastructure for regional social and economic development acting like an engine of development.

Officially, spatial plans for the Lisbon region have little similarity with the modern airport concepts, with the exception of the *Reform of the Lisbon Regional Master Plan* (Ministério das Obras Públicas, 1973a), which was never implemented.

Finally, Portuguese spatial plans usually had more similarity with airport concepts than the technical plans. This might be due to the clearly sectoral characteristics of the technical plans, which are more focused on the area inside the aiport perimeter, while the regional spatial plans are focused on the regional environment, where the airport is located. The coordination plan of 1975 (STC, 1975) is the exception.

This separation of responsibilities is corroborated by a series of technical plans (ANA, 1982; NAER, 1999b; NAER, 1999a; LNEC, 2008; STC, 1975; NAER, 2010) and by the PROTAML of 2002 (CCDR-LVT, 2002). At some point, all documents indicate the necessity to create a specific spatial plan or improve the existing ones – at regional and local level. These instruments should have the purpose of managing the area around the airport, accommodate the probable installation of new land-uses (industrial and commercial activities, residential developments and public infrastructures), in order to avoid or minimize unnecessary costs, urban constraints, environmental problems and lack of coordination with other major infrastructures.

4. CONCLUSIONS

The present work analyzed modern aviation concepts, taking into account the assessment of which ones were a valid reality and conceptually well-defined and which were not. Of the analyzed concepts, the Airport Region was considered to be related with a dated centralized top-down approach similar to what is presently an Aerotropolis. Although there are no examples of it, it was included to compare it with older technical and master plans of the NLA.

The Airport City and the Airport Corridor are well defined in the literature and there are some examples of them (e.g. Amsterdam Airport Schiphol, Zurich Airport or Denver International Airport). Regarding the Aerotropolis, it cannot be considered as a well-defined concept as its definition oscillates between two views: some authors (Freestone, 2010; Peneda 2010) state that the current Aerotropolis are the outcome of spontaneous and unplanned growth; and the full concept (greatly promoted by Kasarda) can only be seen on incomplete megalomaniac projects such as the Dubai World Central or the Incheon Airport (Stevens et al., 2010; Schaafsma, 2010). Either way, this dichotomy results on a profuse exemplification of the concept, in many cases showing incoherencies inside the two views and between them.

Lastly, the Airea is commonly well defined and commonly exemplified, however its definition and exemplification was based mainly on one author (Schlaack, 2010) and this fact, along with the novelty of the concept, implies some caution on the analysis of its applicability.

Finally, the comparison between the referred concepts with the NLA planning process showed that in the 1970s the technical and regional plans were coherent with the Airport Region concept, situation that changed during the 1990s and 2000s where the proposed infrastructure only minimally resembled the Airport City, the Airport Corridor, the Aerotropolis and the Airea. Also, besides the low degree of similarity between the NLA technical plan of 2002 with the Airport City concept, both the technical plan of 2010 and the regional master plan of 2002 had multiple relations (albeit weak) with the Airport Corridor, Aerotropolis and Airea from which was impossible to single out a unique relation between plans and concepts.

The low degree of similarity with modern aviation concepts shows that probably the NLA isn't meant to be as any one of the explained concepts or maybe its adherence to them would be made further on, since on latter plans there are some references to developing the area surrounding the airport.

Either way, it would be interesting to elaborate an analysis to assess if the NLA and the Lisbon Metropolitan Area have the potential to fit a modern airport-related concept like an Airport Corridor, Aerotropolis or Airea. If so, two key impacts would be worth assessing, namely the consequences of delaying its construction as a modern aviation concept and what would be the consequences of not planning it beforehand.

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