



# Life In-Between Flows: A Study on Airport Cities and Changing Trends in Metropolitan Areas

*Akışlar Arasındaki Yaşam: Havaalanı Şehirleri ve Metropoliten Alanlarda Değişen Eğilimler Üzerine Bir Çalışma*

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## ABSTRACT

Globalization efforts, socioeconomic concerns shaping cities, the integration of innovative technologies into planning strategies, and attempts to deal with increasing populations have added a “new breath” to planning concepts. Airport cities could be defined as examples of postmodern cities in metropolitan areas in which the airport (with its related departments) is centered as a focal point and other facilities encircle the airport hub up to 30 kms outward in a mutualistic manner. Considering the crucial role of airports in the 21<sup>st</sup>-century globalized world; travel activities such as international connections, business contacts, congresses, accommodation, and so forth should take place in a short time with easy access. Airport cities can provide all these elements without the need to go to the metropolitan city center and generate a new potential for the reconstruction and development of metropolitan areas. This study aims to investigate the basic information about airport cities with their spatial structure, components, general characteristics, environmental and economic impacts, and critical contributions to metropolitan areas through a theoretical framework. The study consists of three main stages in the framework of qualitative methods, such as data collection, comparison, and evaluation: (I) introduction and theoretical investigation of airport cities with their historical background, key concepts and characteristics, effects on the environment, and their role in sustainability; (II) inquiry into the theoretical knowledge through a case study (Stockholm–Arlanda Airport City); (III) and discussions on the potentials, possible impacts, and stimulating dynamics of airport cities regarding the future of metropolitan areas.

**Keywords:** *Airport city; metropolitan areas; new settlement concepts; postmodernism; Stockholm.*

## ÖZ

*Küreselleşme girişimleri, şehirlerin geleceğini belirleyen sosyo-ekonomik kaygılar, inovasyon teknolojilerinin planlama stratejilerine entegrasyonu ve sürekli artan nüfus ile mücadele gibi güncel olgular; planlama yaklaşımlarına yeni bakış açılarının getirilmesine olanak sağlamıştır. Post-modern bir “yerleşim konsepti” olarak tanımlanan havaalanı şehirleri; merkezinde havaalanı birimleri ve bu merkez odağı 30 kilometre boyunca çevreleyen, doğrudan ilişki içinde olduğu diğer donatılar ve yerleşim birimleri ile özellikle metropoliten alanların çeper noktalarında yeni ve farklı yerleşme kurgularının ortaya çıkmasına örnek oluşturmaktadır. Havaalanı noktalarından uluslararası transferlere, gününbirlik kongre-iş toplantılarına, alışveriş noktalarına ve konaklama birimlerine kısa sürede ve kolay erişebilir olma ihtiyacı; 21. yüzyıl küreselleşen dünya koşullarında havaalanlarının metropoller içindeki rolünü daha da güçlendirmiştir. Bu bağlamda havaalanı şehirleri, şehir merkezine gitmeyi gerektirmeden tüm ihtiyaçların giderilebileceği, kompakt, kendi kendine yetebilen potansiyel gelişme alanları olarak tanımlanabilmektedir. Bu çalışmanın amacı; havaalanı şehirlerinin temel kurgusu, mekânsal düzeni ve bileşenleri, çevresel ve ekonomik etkileri ile metropoliten alanlar üzerindeki olumlu ve olumsuz etkilerini teorik bir çerçevede inceleyerek metropoliten gelişim dinamiklerinde değişen eğilimler hakkında çıkarımlar yapmaktır. Çalışma; veri toplama, karşılaştırma ve değerlendirme gibi kalitatif yöntemleri esas olarak üç temel etapta kurgulanmıştır: (I) Havaalanı şehirlerinin oluşumu, tarihsel gelişim süreci, temel karakteristik özellikleri ve çevresel/ekolojik sürdürülebilirlik üzerindeki etkilerinin kavramsal okuması, (II) Elde edilen kavramsal bulguların Stockholm - Arlanda Havaalanı Şehri örneklem alanı üzerinden irdelenmesi, (III) Havaalanı şehirlerinin metropoliten alanların geleceğine dair potansiyelleri ve olası etkilerinin tartışılması.*

**Anahtar sözcükler:** *Havaalanı şehri; metropoliten alanlar; yeni yerleşme konseptleri; post-modernizm; Stockholm.*

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## Introduction

As an inevitable consequence of the rapid growth of large cities, developments in technology and investments in transportation facilities, new metropolitan area-related terms, and new settlement concepts began to occur, particularly from the beginning of the 21<sup>st</sup> century. Generally, the growth of cities shifts the core activities of cities to peripheral/suburban areas and pushes both physical and socioeconomic flows to the outskirts, resulting in the development of satellite towns connected with the central city by several transportation hubs and routes. Moreover, new settlement concepts formed around a particular function also began to evolve as new forms of urbanization, such as “edge cities”<sup>1</sup> developed around a shopping mall or office complex and “transit-oriented developments (TODs)”<sup>2</sup> constructed as walking-scale suburban developments around public transport hubs.<sup>3</sup>

An airport city (later aerotropolis) can be classified as a huge-scale version of a TOD in which the walking-scale concept is partially discarded by focusing on a very important and complicated transport hub: airports. The approach was developed after the rapid expansion of “airport-linked commercial facilities”: Travelers and locals can reach many business facilities, places for knowledge exchange, shopping, eating, accommodation, and entertainment without going more than 15 minutes from the airport building. With the implementation of this concept, a new urban form emerges and stretches up to 30 kms outward from the airport.<sup>4</sup> Diagrammatically, functions are distinctively distributed in three circular, nested regions in a typical airport city layout: (I) The center is the airport and related transportation hubs; (II) the inner circle may contain retail and entertainment areas, hotels, offices, business parks, industrial parks, technology parks, manufacturing and trade areas, and so forth; (III) and the outer circle contains mixed-use residential areas. This diagrammatic layout may vary depending on the physical and socioeconomic dynamics of settlements, but the main idea is based on generating self-sufficient metropolitan development that can integrate both local and international economic connections and provide a great level of comfort to its temporary or permanent users.

This study aims to understand the dynamics of a new metropolitan area-related airport city concept and investigate its components and characteristics, as well as its physical, environmental, and economic impacts on metropolitan areas. Within the context of this study, the airport city concept involves globalization efforts in the world, changes in transportation technology, and the evolution of contemporary planning and design strategies

through qualitative methods based on data collection, comparison, and evaluation. For the theoretical framework of the study, we examined, in detail, (I) the historical evolution of metropolitan transportation systems; (II) key concepts, components, and characteristics of airport cities; (III) their effect on both the physical and social environment; and (IV) their role on sustainability and economic emancipation. For the second part, we investigated these conceptual findings through the lens of one of the most important airport cities in Europe—Stockholm (Arlanda) Airport City, which is considered as a gateway to Scandinavia; it was converted into an airport city as a result of a series of planning studies. In the final part of this study, the major and minor issues, potentials, and their impacts on metropolitan areas are discussed to understand future scenarios for airport cities better.

## Study of Airport Cities in Metropolitan Areas

A metropolitan area can be defined in more than one way: It can be a region where more than one city or country, even with rural areas in the area, are accepted as metropolitanized, or it can correspond exactly with the borders of a city, having effects on its surroundings in several ways. On the contrary, it can be an area mostly in the part of the central city (or a few neighborhoods) that follows the rules of metropolitan planning. Furthermore, a metropolitan area can be a megacity, global city, metropolis, cosmopolis, megalopolis, and so forth. Experts have used many methods to define a metropolitan area, such as population size, the volume of economic, cultural, and political activities, or the exchange of both goods and user groups. The basis of how to define a metropolitan area and what to call it remains a complicated issue, but scholars continue to develop new concepts in this area. Today, airport cities are recognized as “gateways to the metropolitan economics.”<sup>5</sup> In addition, aviation activities are analogically simulated with digital Internet systems, or the “physical Internet,” as referred to by John D. Kasarda, the leading developer of the aerotropolis concept. Kasarda coined this term due to similarities such as the transmission of people and products through aviation and data and information through the digital Internet, along with aviation networks as electronic networks, hub airports as routers, and firms/workers as computers/workstations.<sup>6</sup> In this context, it can be argued that there is a consistent relationship between the development processes of metropolitan regions and aviation facilities, and the development of aviation networks has many impacts not only on the physical structure of metropolitan regions but also results in the creation of important hubs within the global network system.

<sup>1</sup> Garreau, 1991.

<sup>3</sup> Calthorpe 1993.

<sup>2</sup> Kelbaugh 1989.

<sup>4</sup> Kasarda and Lindsay, 2011.

<sup>5</sup> Roost and Volgman, 2013.

<sup>6</sup> Kasarda, 2019.

### Evolution of Airport Cities with Advances in Transportation Technology

As rapid development indicators of cities, “transportation technologies” have always played an active role in metropolitan processes throughout history. A city or an area, as a living organism, tends to sustain its basics in relation to changing dynamics. It adapts, harmonizes, rearranges, and finally produces something new, known as the “form of the city” in the field of urban planning. Transportation facilities constitute one of those changing dynamics. It is clear that new inventions and innovations in transportation technology impact the status of the city and increase the inhabitants’ mobility.

The motors and motivations of a city have been intertwined with the evolution of transportation facilities. The first outstanding step in this evolution was the “first car” produced in a factory in the United States in 1913. Afterward, cities became decentralized with the increasing mobility of city inhabitants. Some functions related to metropolitan areas were moved to less developed regions with many economic opportunities. Cities reflected this innovation through the reconstruction of streets, widening conventional pedestrian ways for vehicular traffic, increased prices of accessible land, and so on. In this phase, airports were also decentralized and moved to the outskirts with its additional land uses, such as for accommodation and many other facilities.<sup>7</sup>

Second, trains have facilitated the mobilization of both people and goods. Distant cities were integrated via railways, and with an increase in in-migration rates of metropolitan areas, cities were reconcentrated. People from less developed or rural regions moved to cities to seek job opportunities, education, and so forth. Metropolitan areas became places where miles of new railways were constructed to connect with other distant regions. The integration of railway and vehicular transport is one of the features that characterized metropolitan areas.

Third, the integration of multiple transportation modes in metropolitan areas was revitalized with the invention of airplanes. Cities became poly-centralized after the introduction of airplanes as a transport mode. New development areas began to form around airports as a result of many opportunities this mode of transport offered,<sup>8</sup> including non-aviation facilities such as trade areas, soft industrial parks, and service stations for health and dining, as well as art, exhibitions, and leisure activities. Planning practices also evolved in the postwar era in such a way that once an airport was constructed, several service areas were also constructed to increase income related to these non-aviation activities in addition to the income

volume generated by the airport itself.<sup>9</sup> Today, cities are connected through aviation: An estimated 41,820 airports existed in 2016, and U.S. cities have the highest number of airports in the world. In addition, about eight developed airport cities exist in Europe, and airports in metropolitan areas have undergone rapid enhancements.

### Characteristics of Airport Cities

In airport cities, the core economic activities rely on airport-related dynamics, and both highly technological initiatives and knowledge-based economies are clearly distinguishable. The prioritized economic activities tend to occur in the central part of the city where the airport is located. The airport’s surrounding areas attract substantial development (including residential), so land prices become relatively high in these areas due to changing social patterns and increased accessibility to the city center. Moreover, TODs, which emerge from “the practice of creating vibrant, walkable, mixed-use communities surrounding transit stations,”<sup>10</sup> are formed within the city around the airport. In TODs, all the transportation facilities operate in conjunction to allow people to reach the center easily. Around the subcenters of TODs, many residential zones and other types of land are located within walking distance to the hub.

In the context of the evolution of cities and the development of transportation systems, an airport city is connected not only to aviation but also to railway and road systems. An airport city exhibits the features of a polycentric city from a global perspective. Three main types of public transport (air, rail, and road) are integrated with each other to form continuous transport lines across states, nations, and continents. In this regard, socially, an airport city does not belong to any state or nation.

The structural border of an airport city is not stable in time either since it depends on passenger flows and volume of use. The “expandable” character of the airport city derives from the temporary or removable parts of construction and design of interior spaces that can adapt to changing programs, thus enabling it to expand easily.<sup>11</sup>

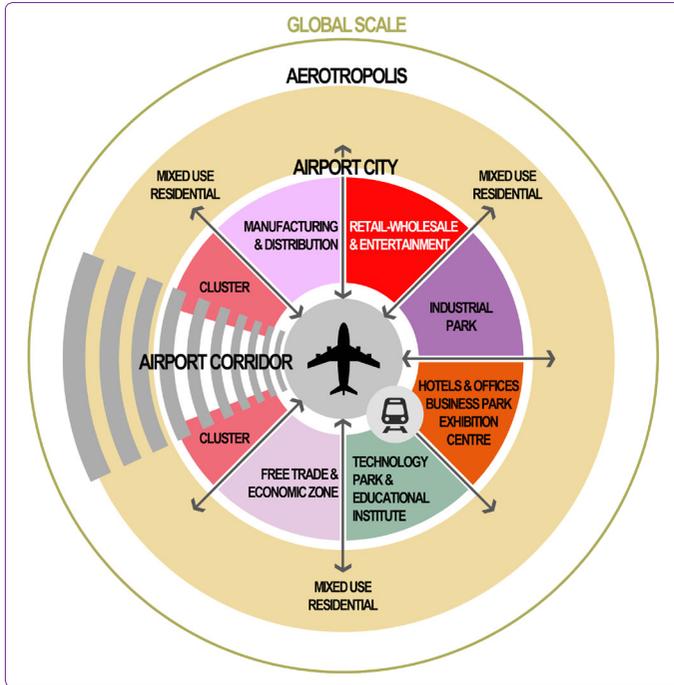
### Components of Airport Cities

Airport cities share some common characteristics and components all over the world (Fig. 1). (I) A “central metropolis” has the highest proportion of commercial activities in the center of the city. Hotels, office and retail complexes, recreation facilities, conference and exhibition centers, logistics and free-trade zones, and time-sensitive goods-processing facilities are the main elements of this region. Luxury residences might be located in this zone as well, together with mixed-use land-planning strategies. (II) An “airport corridor” starts from the airport itself and creates a connection between other clusters in the airport

<sup>7</sup> Chandu, 2017: 386. <sup>8</sup> Freestone and Baker, 2011. <sup>9</sup> Chandu, 2017: 374.

<sup>10</sup> Transit-oriented Development Advances, n.d.

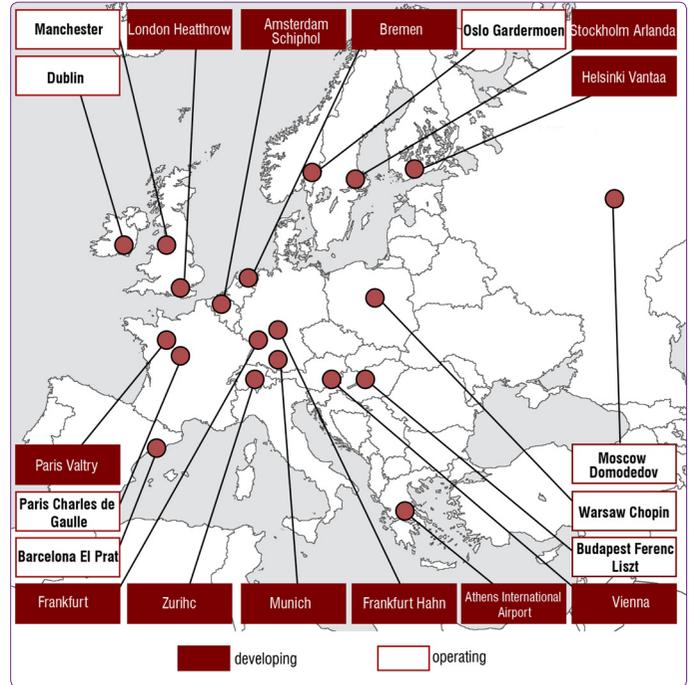
<sup>11</sup> Chandu, 2017: 376.



**Figure 1.** General diagram and components of airport cities (developed from Yigitcanlar et al., 2008).

city. Airport corridors constitute an attractive point for the headquarters of firms, international companies' service centers, and so forth, and they may serve as an innovation valley as well.<sup>12</sup> (III) A "logistics center" is also located close to the airport to benefit from the low cost of transporting goods from there. (IV) If airport cities are connected continuously on a global scale, and if it is clear that a global scale metropolitan area can be identified based on this connection, then the term "aerotropolis" is applied to recognize the area.<sup>13</sup> Furthermore, an aerotropolis may contain numerous residential and urban service areas.

Airport cities are not always planned from scratch and built on unconstructed or natural environments. Usually, they are shaped through the "alteration/evolution of existing city airports."<sup>14</sup> At present, almost all city airports in Europe constitute an airport city and include a central metropolis, airport corridors, and an aerotropolis. To illustrate, during the establishment of the European Union, which has no borders or diplomatic procedures to restrict the mobility of goods and people, many airports were constructed in the 1980s and onward. Today, European people can easily move throughout the continent via air travel (Fig. 2). Moreover, many historical cities still exist in Europe; in this regard, it is impossible to reshape the city of Paris around Paris Charles de Gaulle, for instance. Nevertheless, remembering that the city is a living organism that adapts to new notions with time, we can assume that Paris is occasionally exemplified with the airport city concept derived from a city airport,



**Figure 2.** Airport cities in Europe, 2017 (reproduced from www.globalairportcities.com).

Charles de Gaulle, due to the attempts of airport-centered spatial development strategies and projects, such as new urban transportation network proposals, an airport corridor, and several large-scale urban projects, even if a huge success has not been achieved.<sup>15</sup>

Yet, examples exist of airport cities planned from scratch through the reclamation of unstructured areas or the transformation of natural environments. One of the most striking examples is Songdo-dong International Business District in South Korea, originally designed as a smart city, along with the aerotropolis of Incheon Airport (ICN), built from scratch on 6 km<sup>2</sup> of dried sea area.<sup>16</sup> Although it was designed as an independent project at a later period, a new "airport city" was produced to serve as an annex to the mainland for a literally isolated international airport on an island (also without any hinterland zone) connected by a bridge. However, its components do not have the characteristic features that an airport city should possess. Arguably, Istanbul could be seen as having a city airport, but it does not fully exhibit the features of an airport city. However, some dynamics have changed since the beginning of the construction of a third airport in the northern part of Istanbul. One of the largest benefits of that project is its potential to create an airport city for Istanbul through the construction of new settlement areas, trade facilities, hotels, and office centers associated with the new airport connected to a canal (Fig. 3). If we consider that no built environment exists in the northern part of the area, the

<sup>12</sup> Kasioumi, 2015.

<sup>13</sup> Yigitcanlar et al., 2008.

<sup>14</sup> Kasarda, 2013.

<sup>15</sup> Kasioumi, 2015.

<sup>16</sup> Klühspies, 2015.



**Figure 3.** The location of Istanbul 3<sup>rd</sup> Airport and Airport City in master plan (adopted from Environmental Impact Assessment Report, 2013 and local real estate development offices) and one of the draft logos and project proposals for Istanbul Airport City (retrieved April 1, 2018 from <https://www.finarkurumsal.com/assets/03markalama/IstanbulAirportCity.html>).

city around the third airport of Istanbul will constitute an airport city planned from scratch and built by transforming the unstructured natural environment.

### Environmental Effects of Airport Cities

An airport city can either be built from scratch or adapted from a city airport, but it is clear that it has some detrimental effects on the natural and manmade environment. Establishing an airport city on a non-built or natural environment entails the demolition of endogenous natural values of the area. For example, the total number of demolished trees on the construction site of a third airport city in Istanbul is about 657,000 according to the Environmental Assessment Report; in addition, it has been reported that the Black Sea contains 15,000 m<sup>2</sup> of construction-related materials.<sup>17</sup> Furthermore, the hinterland could be affected negatively by an airport city. Such negative impacts come from the huge construction sites required for landing, roads, and other urban infrastructure sites, which increase the temperature due to the high heating capacity of artificial construction elements in comparison to natural surfaces and greenery. This regionally increased temperature could be associated with climate change as well.

### Air Pollution and Noise

The greatest environmental impact of an airport on

neighborhoods is the effect of sound, otherwise known as “noise pollution.” Airport noise is measured and mapped via noise contours (noise maps). The estimated decibel levels in areas close to an airport are very problematic. Many researchers have found that airport noise has a negative effect on property values,<sup>18</sup> and the central metropolis (the area most affected by sound pollution) has the most valuable land for any kind of development. These two contrasting situations in the central metropolis must be balanced somehow, as seen in European cities today. The best solutions to achieve this balance involve architectural studies and applications, such as innovations in building materials, sound insulation systems, and noise barriers to reduce noise pollution both in airports and nearby areas.

Furthermore, airport cities may suffer from air pollution as a result of particles that airplanes create and disseminate during air travel. Moreover, existing studies outline many indirect effects of air pollution on the health of inhabitants.<sup>19</sup> The relation between aircraft noise and hypertension implies that the noise might be a critical risk factor for cardiovascular disease. Moreover, it has effects on people’s daily routines and activities: There is clear evidence that sleep patterns and concentration are disrupted, and the quality of life and health is reduced by air pollution in general.

As mentioned before, airport cities have detrimental effects on nature. More optimistically, an airport city improves the environment by means of a decreased carbon effect due to the use of innovation and information technologies as leading sectors in airport cities. To illustrate, the economic activities in an airport city often involve innovation and information technologies, as they rely on access to the rest of the world. In contrast, airport cities tend not to adopt certain economic activities (such as hard industrial production) as a development strategy. If the carbon effect of airplanes is disregarded in the central metropolis, the economic activities in the airport corridor are very close to being carbon neutral, as soft industries leave a smaller carbon footprint compared to hard industries.

### Social and Structural Effects

Apart from the natural environment, airport cities have some social and structural features that are unprecedented in other conventional kinds of city development. Instead, of evaluating these effects as negative or positive, it is more meaningful to evaluate them as “motivations” and “demotivations.”<sup>20</sup> In the following section, airport cities are divided into two categories: those that motivate and those that demotivate new developments in the metropolitan city (Table 1).

<sup>17</sup> Istanbul 3<sup>rd</sup> Airport Environmental Impact Assessment Report, 2013.

<sup>18</sup> Conventz and Thierstein, 2014. <sup>19</sup> Evrard et al., 2017. <sup>20</sup> Peneda et al., 2011.

**Table 1.** Motivations and Demotivations of Airport Cities (developed from Peneda M., Reis, V. D., & Macario, M. R., 2011)

Demotivations for metropolitan planning	Motivations for metropolitan planning
High exchange rates within the population	Lower land prices, particularly mixed-use (service)
High migration net gains (foreign and national)	Lower business tax
Restriction of future settlement	High share of productive industries

As airport cities are spaces with flows of different kinds, user characteristics are always in flux; thus, the demographics of the inhabitants do not remain static. Similarly, the social patterns in airport cities constantly change, particularly in the central metropolis. In this regard, it is somewhat problematic to identify for whom the airport city is being planned. In addition, an airport city does not belong to any state or nation because of its borderless nature from a global perspective. Therefore, a variety of responsible actors and stakeholders from nations and international states should be included in the planning process of an airport city. This issue may lead to the generation of an international planning crisis even for a small airport city.

Furthermore, as airport cities are determined by TODs, they have a definite capacity that cannot sustain TODs when exceeded. In cases of capacity overflow, airport cities become another form of city area.

Regarding the motivations behind new developments, an airport city motivates new services due to low land prices and low initial costs. The application of lower taxes on airport corridors is another significant point for attracting new development, particularly those related to innovative technologies. As the 21<sup>st</sup> century is determined by the power of knowledge-based economies, these motivations could lead to the generation of super-developed regions on the planet.

### Achieving Sustainability in Airport Cities

Specialists have created a set of approaches outlining how to make airport cities more sustainable around the world.<sup>21</sup> Applying the following strategies in airport cities could solve common negative natural, structural, and social effects. The three distinct phases or levels are as follows.

- Economic emancipation is related to the increased effort in coordinating economic development in airport areas. The cluster economies of labor pooling and sharing, knowledge spillovers, and input sharing play important roles in this phase. Furthermore, the emancipation of the economy requires developing the appropriate tools for achieving visibility through

a critical mass and going upmarket to attain a more valuable economic profile. In this respect, the governance issue is significant, considering the responsible bodies in governance systems, in developing accurate tools and satisfying the economic needs of those involved.

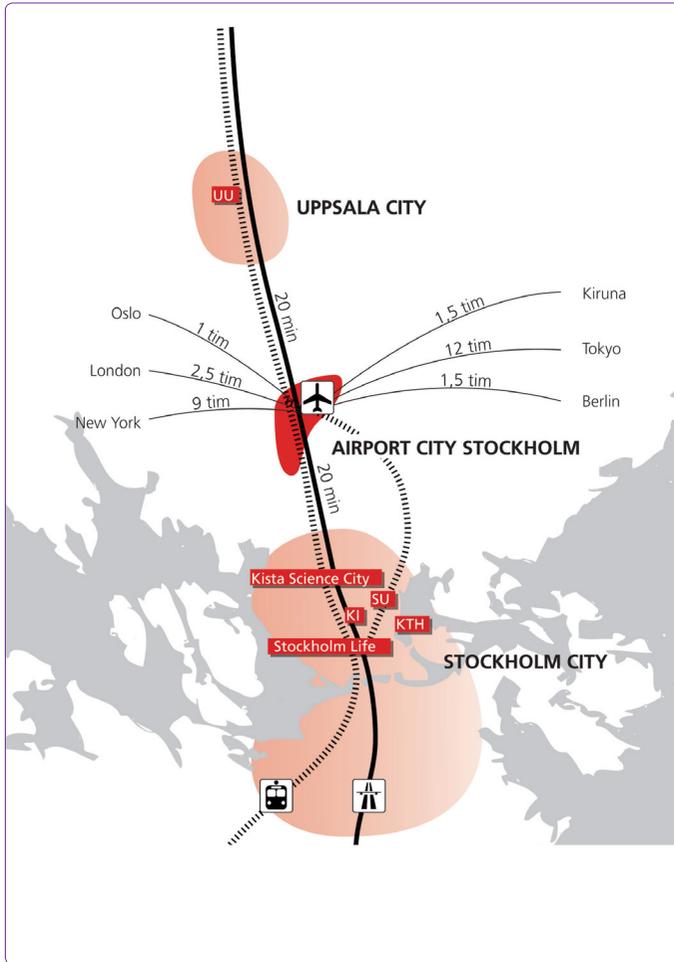
- A shift in approach, i.e., from quantitative to qualitative, concerns the design of airport cities considering “the volume of connectivity rather than the volume of passengers” and “the frequency of international connections rather than steady growth of passenger volumes.”<sup>22</sup> Particularly for social sustainability, the matter of success relies on the personal well-being of each user, rather than the ratio of those who are satisfied throughout the total population. The absence of exclusion of marginal groups and minorities is the fundamental motivation for the quality approach.
- Urban emancipation, as a final phase, involves the airport corridor, which refers to the consolidation of a unified urban environment that has resulted from a continuous sprawl from the airport to the city. The transportation lines between consolidated spaces, green lands divided for undisturbed access between these spaces, and transition areas become significant for an emancipated urban atmosphere. This continuity can only be managed with planning, governance, and design implemented together. Master planning attributes, transparent governance systems, and comprehensive design methodologies are the key notions for sustained urban environments. This phase regulates three components of sustainability: socioeconomic, natural, and artificial environments.

### Urban Metamorphosis: The Case of Arlanda Airport City (Stockholm)

Stockholm is the capital city of Sweden, a member state of the European Union since 1995 located within the Schengen Area. The City of Stockholm includes 14 separate islands located between the Baltic Sea and Malaren; the city’s consists of areas with histories that stretch back to

<sup>21</sup> Conventz and Thierstein, 2014.

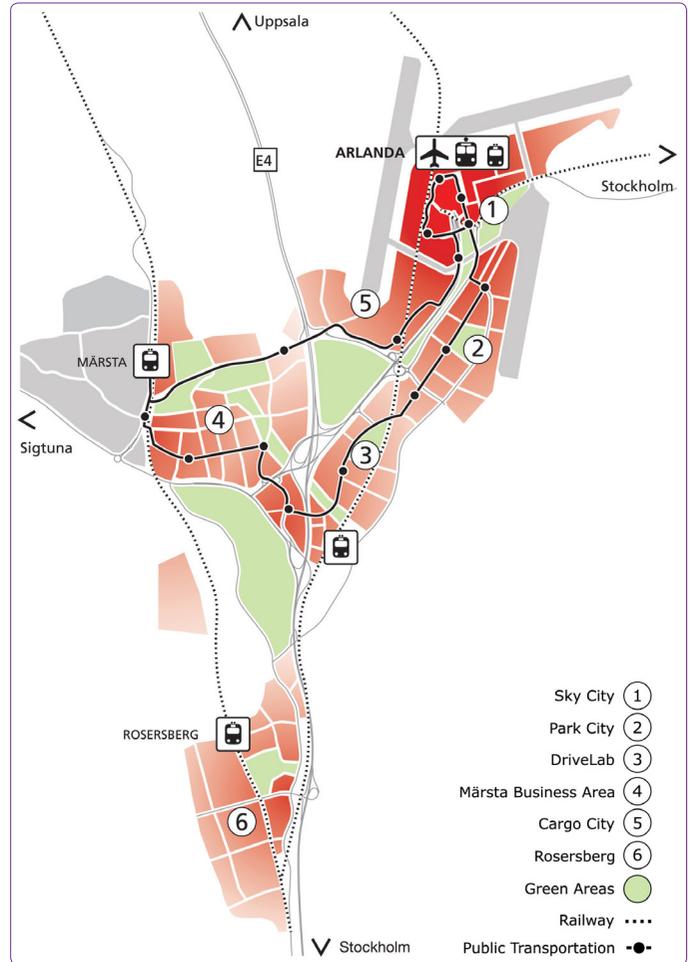
<sup>22</sup> Conventz and Thierstein, 2014.



**Figure 4.** Location of Stockholm Airport City with City Linkages (Furuto, 2013).

ancient times with many well-preserved historical towns, but it features super high-tech innovation valleys as well. The importance of Stockholm as an airport city derives from its generation process, including planning efforts, sustainable cases in management and operation, and its rapid success in providing accessible opportunities both for the inhabitants of the city and the temporary users from around the world.

There are four airports in Stockholm: Bromma, Vasteras, Skavsta, and Arlanda. Arlanda Airport was constructed in 1954 between Stockholm’s historic city center and the Uppsala region on unconstructed land. In 1960, the first scheduled flight was completed to New York, and new roads and railways were constructed to connect the city center with Uppsala, which emerged as an undesirable example of urban planning. However, the story of Arlanda Airport City does not start until the unprecedented population growth was experienced around Arlanda Airport in Sigtuna Municipality beginning in the 2000s. In 2010, actors from the state, the local municipality, and a private real estate company organized a competition to create an urban

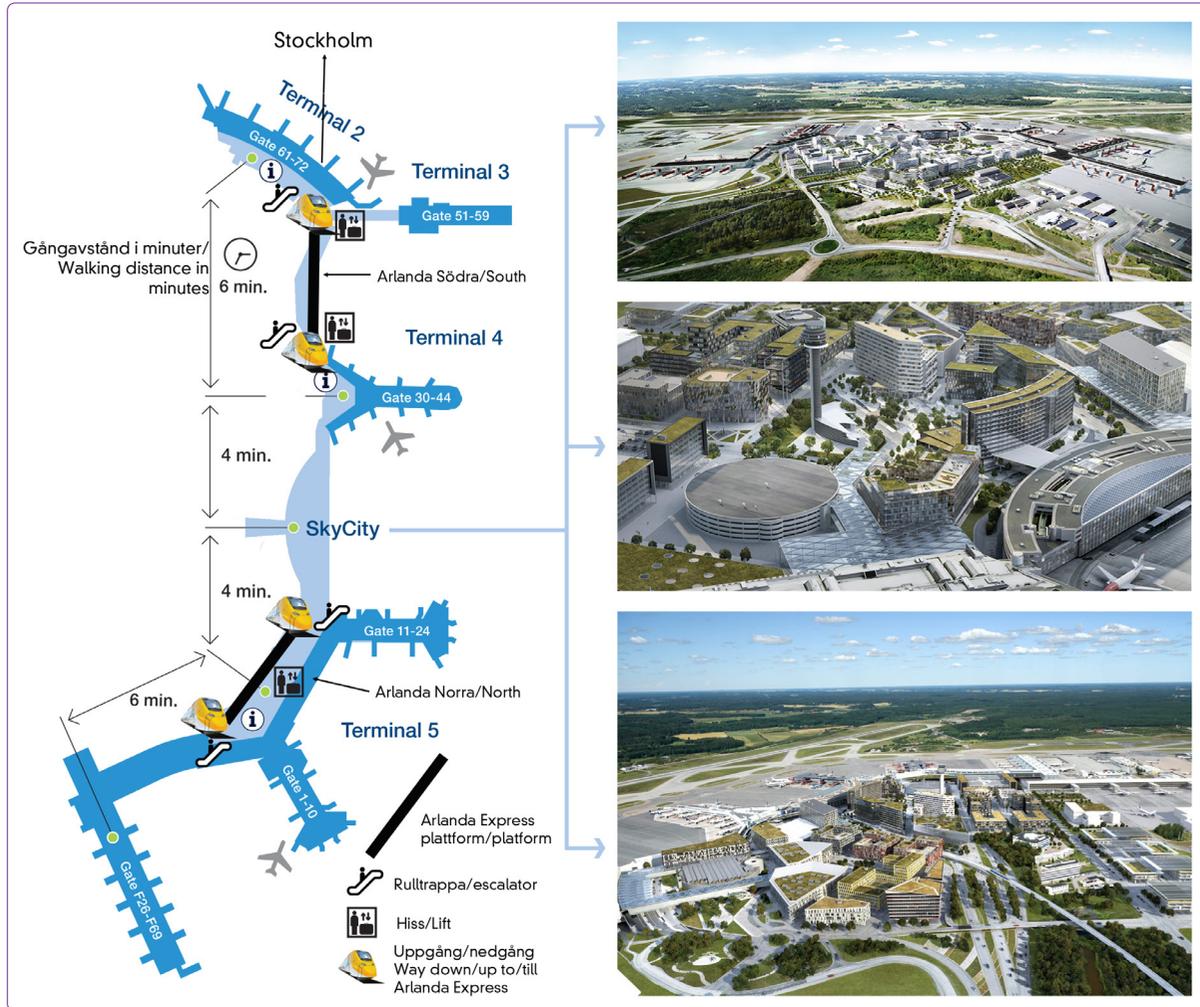


**Figure 5.** Stockholm Airport City Master Plan (Furuto, 2013).

design plan and urban development strategy for the so-called Stockholm–Arlanda Airport City (Fig. 4).

### A City Made of Six: The Characteristics of Arlanda Airport City

In 2013, the project was prepared with many radical proposals regarding the common characteristics of an airport city. It offers six urban districts assigned for special land uses and design strategies (Fig. 5). (I) First, Sky City plays the role of a central metropolis where the airport is located and an urban downtown is taken under control (Fig. 6). (II) Park City close to the airport is organized around many recreational facilities for inhabitants downtown. In addition, it has land available for future development and urban land maximization, so the central land is not limited, and the TOD can sustain itself in the long term. (III) DriveLab next to the highway along the Arlanda corridor was specially designed to supply the required infrastructure for hard innovative sectors. Many firms could cluster in the district to benefit from sources of agglomeration economies of labor market pooling, input/output sharing, and knowledge spillover. (IV) Another district is the Märsta Business Area, which was designed as a logistics center to cater to light



**Figure 6.** Spatial layout and computer based illustrations of Sky City (retrieved from Stockholm Arlanda Airport Masterplan Report, 2017).

industries and craftspeople. (V) Cargo City, close to the airport's terminal, is primarily designated as a professional cargo area for logistics, as well as for residential use. (VI) Finally, Rosersberg is the furthest city from the airport, specifically intended to be the most environmentally friendly logistics center with warehouses and large parking lots.<sup>23</sup>

Arlanda Airport is neither similar to Paris Charles de Gaulle (built in the city center in historic times and transformed from a city airport) nor to Istanbul's third airport (treated an investment opportunity for national growth). Rather, Arlanda is an example of urban metamorphosis, as a transformed urban environment for an upgraded urban experience, a regenerated urban character with both local and national significance, and the designers considered new urban planning trends in response to changing dynamics.

### Environmental Way of Thinking

Arlanda is not an ordinary airport since it incorporates today's postmodern urban planning approaches; it plays crucial roles at both the local and regional levels from administration to application. In this context, the Stockholm Airport City project represents several opportunities to think of and evaluate an airport city with pros and cons.

### Zero-carbon Attributes in Stockholm

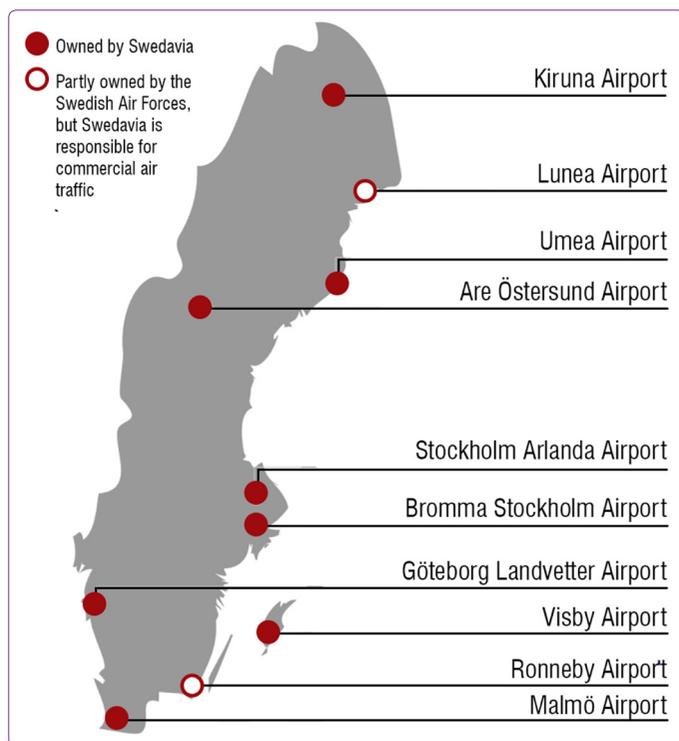
Stockholm Airport City has one outstanding feature: its diminishingly small environmental effects on its surroundings. Arlanda and nine other airports in Sweden are operated by a public corporation, Swedavia, established in 2010 (Fig. 7). The aim of the organization is "to become climate neutral," the main driver behind its action planning.<sup>24</sup> Moreover, it is noted that the organization hopes to achieve zero-carbon emissions by 2020 for all airports. It is important to note that the

<sup>23</sup> Furuto, 2013.

<sup>24</sup> OECD, 2013, p. 109.

**Table 2.** Carbon Footprint (kilotons of CO<sub>2</sub>) (reproduced from Swedavia’s Annual and Sustainability Report, 2017, p. 47)

Airport	Air traffic emissions in the landing and takeoff cycle	Passenger’s ground transport to and from the airports	Swedavia’s own operations	Total
Bromma Stockholm Airport	18	3	0.1	22
Göteborg Landvetter Airport	48	29	0.2	77
Kiruna Airport	2	1	0.2	4
Lulea Airport	9	6	0.0	15
Malmo Airport	21	17	0.2	38
Ronneby Airport	2	1	0.0	3
Stockholm–Arlanda Airport	235	103	0.9	340
Umea Airport	8	6	0.2	15
Visby Airport	3	1	0.2	4
Are Östersund Airport	4	2	0.0	6
Total	352	170	0.0	0
Percentage Change 2016–2017	4.7%	2.9%	–30.3%	3.9%



**Figure 7.** Ten Airports in Sweden (reproduced from Swedavia Annual and Sustainability Report, 2016).

zero-carbon concept here is based on the operational meaning of the airport and thus excludes the carbon generated by airplanes taking off and landing; yet, it should also be mentioned the organization has made some other efforts to diminish these negative effects. In 2017, Swedavia was awarded for its success in making easy-to-use renewable fuel, as described in the Airports Sustainability Declaration.<sup>25</sup> Furthermore, the emission of

<sup>25</sup> Swedavia’s Annual and Sustainability Report, 2016–2017.

carbon has always affected regional climate conditions, natural resources, the habitats of fauna and flora, and the sustainability of those natural values.

The organization is one of the significant bodies responsible for developing solutions, particularly for reducing emissions of greenhouse gases and water and noise pollution. Its main motivation involves providing green solutions, as well as making innovative decisions on the local and regional levels. From a local perspective, many examples exist of organizations successfully overcoming these challenges. The OECD reported that the level of carbon emissions decreased by about 60% compared to the previous levels over seven years in all 10 airports through Swedavia’s initiatives. This decrease also happened due to Arlanda Airport’s passenger volume and air traffic (Table 2). As mentioned above, the organization aims to achieve zero-carbon emissions by 2020 for all airports.

Swedavia has implemented many policies and applications to conserve natural habitats and the environment. Environmental and energy policy not only deals with steps to decrease the carbon footprint or to improve energy efficiency but also to set fundamental rules about management systems and sectoral decisions to ensure environmentally friendly tasks in the future.

However, if we consider Swedavia’s regional initiatives, the success is not as clear as at the local level. For instance, the firm faces difficulties resulting from challenges in the management of urban land. For the development of new theoretical solutions, there are problematic issues regarding pursuing suitable business opportunities through practical steps, and this situation is definitely not unprecedented. For instance, land is always subject to the level of collaboration among many stakeholders for mutual benefits.

**Table 3.** Projected Direct Economic Contribution of Stockholm Airport City Project (reproduced from Airport City Stockholm: An Assessment of Current and Future Economic Contributions, 2014, p. 23)

	2012	2030	Average annual growth rate (% per annum)
Employment	20,466	50,000	5.1%
Turnover (million SEK)	38	135	7.2%
Employee income (million SEK)	10	31	6.7%
Gross value added (million SEK)	13	46	7.2%
Turnover per employee	1,874	2,692	2.0%
Income per employee	467	614	1.5%
Gross value added per employee	648	923	2.0%



**Figure 8.** Investment in Stockholm Airport City by year (reproduced from Swedavia’s Annual and Sustainability Report, 2017).

### Who Wins in Stockholm?

Stockholm Airport City is a project that offers economic benefits and opportunities for economic growth. Its contribution to regional growth is characterized by employment opportunities and international connectivity to global platforms in business. As a result of the projected service sector increase, Stockholm has caught the attention of many employees not only from Sigtuna and Uppsala but also from many neighborhoods.

Moreover, even in 2012, when Stockholm Airport City was not a complicated project yet, the organization stated that each job created in Stockholm Airport City would contribute to the generation of 5.2 employment opportunities in regional economies. In addition, if Stockholm Airport City accomplishes its goal of increasing employment by 2030, it will have increased the current employment level by 2.5 times and the gross value added by 3.5 times compared to the present<sup>26</sup> (Table 3).

As one of the key factors, airport cities facilitate international trade and foreign investment through the integration of global economies with aviation. Many

<sup>26</sup> Airport city Stockholm: An assessment of current and future economic contributions, 2014, p.3.

<sup>27</sup> Airport city Stockholm: An assessment of current and future economic contributions, 2014, p.25.

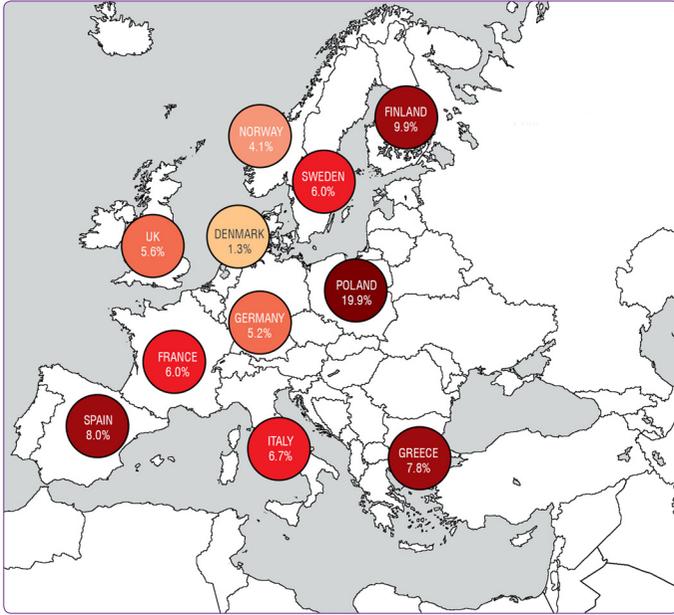
investment projects have either been completed or are planned to be completed in the coming years. Today, DriveLab and Cargo City are initial focus points for investment opportunities for many investors all over the world, and in this context, many other applications, such as Candy Crush and Minecraft, are subjected to new generations. The Stockholm Airport City Master Plan indicates that the capacity expansion of investment opportunities contributes 13 billion Swedish krona (SEK) to the national economy (Fig. 8). Moreover, it is expected to contribute 7 billion SEK in the first period of planned contribution until 2023.<sup>27</sup>

### Sustainable Applications Prioritizing Users

For more sustainable applications from theory to practice, Swedavia has identified many phases. First, for the airport service area where Sky City is located, the main factor driving sustainability is the customer-



**Figure 9.** Sustainable Management Strategies (reproduced from Swedavia’s Annual and Sustainability Report, 2017).



**Figure 10.** Passenger Trends in Europe (reproduced from Swedavia’s Annual and Sustainability Report, 2017).

oriented approach (Fig. 9). This approach is based on the idea that all activities revolve around customer satisfaction—not only at present but also in future scenarios. Remembering that sustainability is expressed by the management of resources without damaging the rights of future generations, the structure of Swedavia’s “customer orientation” could be evaluated as a successful example. In terms of prioritizing quality instead of quantity, the steps taken toward sustainability are most successful when the passengers/employees of the airport and inhabitants of residential areas express increasing satisfaction, as opposed to when other meaningless numbers increase (Fig. 10). The basic method for employing such a user-oriented approach relies upon a management system developed by Swedavia based on inclusion and diversity. Furthermore, organizations can understand the customer/user in many ways, such as analyses of the passenger cycle with different possible customer experiences. The importance of a user-prioritized management system could be evaluated by determining how an airport city sustains itself unless increasing passenger trends in aviation are exhibited in regional approaches.

Moreover, Swedavia defined a set of targets to ensure sustainability, and they can be categorized into four leading actions for definite time periods: (I) reaching 85% in customer/passenger satisfaction by 2025, an increase of 10% compared to 2017; (II) increasing engaged leaders and employees by 75% until 2020, a 10% increase compared to 2018; (III) supplying a 6% return on capital, an increase of 4.6 compared to 2018; and (IV) ensuring

zero-CO2 emissions by 2020, a reduction of 1305 tons compared to 2018. Of course, the steps are not limited to these phases, and they branch into many targets to lead to a more sustainable Airport City for Stockholm in terms social development, environmental concerns, and economics with major strategies regarding commercial and operational excellence, increased capacity, engaging culture, and responsibility for society and people.

**Conclusion: Sky is the Limit**

Airport cities are the newest interpretation of postmodern urban formations through the evolutionary process of metropolitan areas. They are built with centralizing aviation facilities and shape the related functional areas nearby, such as commercial zones, business centers, accommodation units, recreational and entertainment areas, industry and technology parks, mixed-use residential areas, and so forth. Moreover, they have many features, such as airport corridors, unique logistics units, and institutional areas. Whatever their potentials and disadvantages many be, many large metropolitan areas today are characterized by at least one airport city, and many other cities are attempting to compete globally with new developing airport cities all over the world. The major advantage of airport cities is that they generate a new subcenter, which expands 30 km outward from the airport and is fully supported by public transportation (a version of a TOD); thus, temporary or permanent users of the airport cities can circulate, accommodate, eat, find entertainment, shop, gather together, and participate in many other activities within a 15-minute movement cycle around the airport complex. In particular, passengers transferring flights do not need to travel to the city center since they can easily meet their needs nearby. Therefore, metropolitan area dynamics and both physical and socioeconomic behaviors also change due to the compact and self-contained structures of airport cities: They create a new center of attraction in metropolitan areas and become specific instruments that can guide the further development dynamics of metropolitan cities, as well as serve as important gateways for cities or regions in the globalizing world. Due to this widespread trend, many airport cities have emerged around remarkable airports, particularly in Europe. Some existing airports have been converted into airport cities, while others have been recently planned as an airport city or an aerotropolis from their inception, such as in Asia, the United States, and Africa, adapting to their city’s position in the global system.

One city competing with the world’s well-known metropolitan areas and also strengthening its identity in global platforms is Stockholm–Arlanda Airport City. It is neither a city airport nor a city built from scratch; rather,

it has been branded as an airport city as a development strategy to overcome the problems Stockholm currently faces. In addition, the role of city and regional planning in the structure and development of the airport city's identity is significant. The city is planned through five sectors with dedicated roles (i.e., urban core, green infrastructure, technical infrastructure, logistical center, and urban periphery). Since 2014, a number of efforts by Swedavia, the local administration, and real estate developers, as well as other measures they have proposed, have led to positive outcomes. The superposition of urban transformation, urban regeneration, and the adaptation of new metropolitan concepts in Stockholm reflects a metamorphosis in the past 20 years. From management to application, its contribution to both local and regional success is outstanding, and even for the projected years, further achievements are inevitable. Considering today's concerns on our planet, Stockholm could inspire many other candidate airport-centered cities regarding many concepts related to measures to improve sustainability, as the city underscores the fact that nothing is a dream when attempting to reach sustainable targets. The findings of this research suggest how policymakers could pursue a more sustainable path in airport cities prior to economic emancipation, shift their approach from quantity to quality, and achieve urban emancipation as exemplified in the Stockholm case, particularly in the light of the actions of Swedavia and local bodies. Moreover, with decisions regarding the

social dimensions of planning, in addition to physical design and environmental control planning, Stockholm has experienced increased employment opportunities, economic gains, and social development measures (Table 4).

The evolution of the city from the 20<sup>th</sup>-century town, with streets filled with the last horse-drawn vehicles, to today's postmodern cities, which enable air travel across the globe, is not completed yet. As new technological improvements occur in transportation, accommodation, and services, we will inevitably experience postmodern cities and other metamorphoses. Due to humankind's persistence in resolving the problems that airport cities face, pondering what will happen to airport cities in metropolitan areas is only limited by one's imagination. Further developments in technology and transportation systems will surely transform airports into super-hubs, stronger than their existing scope and capacity, as well as more efficient in international flows of people, goods, and information. In addition, their locations will become more attractive and accessible, making them worldwide focal points. Therefore, it is possible to foresee that airport cities—which are currently compact and self-sufficient subcenters connected to other cities by aviation—might become regional powers in terms of social development with environmentally friendly policies and effective physical plans. Thus, they may come to define metropolitan areas.

**Table 4.** Theories Explained for Airport Cities and Corresponding Practices in the Case of Stockholm Airport City

Theory	Definition and Terms	Case of Stockholm Airport City
Components of airport cities	An airport city basically comprised some common characteristics	In the case of Stockholm Airport City, each characteristic is accounted for within the design phase that corresponds to each other.
Characteristics of airport city	An airport city formulated from either a city airport or a city built on nothing	Stockholm Airport City is not based on the initial formulation but on further development decisions.
Effects on environment	Contamination of natural values	Thanks to Swedavia, Stockholm Airport City closely relates to zero-carbon cities and arranges many contracts for more nature-friendly applications in regional measures.
Social and structural effects	Motivations and demotivations for the development of metropolitan areas	These include social development strategies to overcome demotivations.
Sustainable strategies for airport cities	Economic emancipation	The airport corridor is spatially parallel to the TOD to ease the application of more emancipated economic management.
	Shift in approach, i.e., from quantitative to qualitative	Stockholm Airport City measures its success with passenger mobility and manages its processes within a customer-oriented approach, ensuring customer satisfaction.
	Urban emancipation	The project offers a unified urban fabric continuously from beginning to end, at the same time enabling more available land for sustainability in future development scenarios.

## References

- Airport city Stockholm: An assessment of current and future economic contributions, (2014) Retrieved July 25, 2018, from <http://www.connectsweden.se/wp-content/uploads/2014/06/ACS-08032014.pdf>
- Calthorpe, P. (1993) *The next American metropolis: Ecology, community, and the American dream*, Princeton Architectural Press, New York, USA.
- Chandu, A. (2017) "The world's first purpose built airport city: Melbourne Airport, Tullamarine", *Planning Perspectives*, 32 (3), 373-400.
- Conventz, S. & Thierstein, A. (2014) "Airports and the knowledge economy: A relational perspective", *Airports, Cities and Regions*, London: Routledge, pp. 131-147.
- Evrard A. S., Lefèvre M., Champelovier P., Lambert, J. & Laumon, B. (2017) "Does aircraft noise exposure increase the risk of hypertension in the population living near airports in France?" *Occupational and Environmental Medicine*, BMJ Publishing Group, 74, published online first: 01 August 2016. doi: 10.1136/oemed-2016-103648, pp. 123-129.
- Freestone, R. & Baker, D. (2011) "Spatial Planning Models of Airport-Driven Urban Development", *Journal of Planning Literature*, doi: 10.1177/0885412211401341
- Furuto, A. (2013) *Airport city Stockholm: urban design strategy proposal / spacescape*, Retrieved July 25, 2018 from <https://www.archdaily.com/371822/airport-city-stockholm-urban-design-strategy-proposal-spacescape>.
- Garreau, J. (1991) *Edge City: Life on the New Frontier*, Anchor Books, New York, USA.
- Istanbul 3rd Airport Environmental Impact Assessment Report (EIA), (2013) Ministry of Transportation, Maritime Affairs and Communication, General Directorate of Infrastructure Investments.
- Kasarda, J.D. (2013) "Airport cities: the evolution", *Airport World*, 18(2), pp. 24-27. Retrieved December 26, 2017 from <http://www.airport-world.com/features/airport-design/2555-airport-cities-the-evolution.html>
- Kasarda, J.D. (2019) "Aerotropolis", *The Wiley Blackwell Encyclopedia of Urban and Regional Studies*, pp. 1-7.
- Kasarda, J.D. & Lindsay, G. (2011) *Aerotropolis: The way we'll live next*, Farrar, Straus and Giroux, USA.
- Kasioumi, E. (2015) "Emerging planning approaches in airport areas: the case of Paris-Charles de Gaulle (CDG)", *Regional Studies, Regional Science*, 2(1), pp. 408-414, doi: 10.1080/21681376.2015.1064012
- Kelbaugh, D. (1989) *The pedestrian pocket book: A new suburban design strategy*, Princeton Architectural Press, New York, USA.
- Klühspies, J. (2015) "'Smart City' Songdo—Ein taugliches Vorbild?" *Standort*, 39(2-3), pp. 132-138.
- OECD (2013) "Green Growth in Stockholm, Sweden", *OECD Green Growth Studies*, Paris, doi: 10.1787/9789264195158-en.
- Peneda M., Reis, V.D. & Macario, M.R. (2011) "Critical Factors for development of airport cities", *Journal of Transportation Research Board*, pp.1-9, doi:10.3141/2214-01
- Roost, F. & Volgman, K. (2013) "Airport Cities: Gateways der metropolitanen Ökonomie", *Erkunde* 67(3), pp. 279-281.
- Swedavia's Annual and Sustainability Report, (2016) Retrieved July 25, 2018 from <https://www.swedavia.com/contentassets/68b9813f480e4c378d9650739294e6a3/swedavia-annual-and-sustainability-report-2016.pdf>
- Swedavia's Annual and Sustainability Report, (2017) Retrieved July 25, 2018 from <https://www.swedavia.com/globalassets/om-swedavia/roll-och-uppdrag/swedavias-annual-and-sustainability-report-2017.pdf>.
- Transit Oriented Development Advances, (n.d.), Retrieved January 4, 2018 from <http://www.newurbanism.org/bookstore/todadvances.html>
- Yigitcanlar, T., Martinez-Fernandez, C., Searle, G., Baker, D.C., & Velibeyoglu, K. (2008) "Understanding the Conditions for the Emergence of Airport Knowledge Precincts: A Framework for Research" in M. Schrenk, V. Popovich, D. Engelke & P.Elisei (Eds.). *Proceedings REAL CORP 008*, Vienna, pp. 465-475.