

Recode Group
& SecDev

Revisiting *the* Aerotropolis:

Enter the Next Generation
Green and Regenerative
Airport City



RECODE

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There are at least 2,500 airports around the world providing infrastructure and services to more than 4 billion annual passengers. A central feature of the globalized economy, air travel and facility development also generate negative externalities (e.g. 3 percent of greenhouse gas emissions). Over the past two decades there has been growing interest in developing economic growth strategies around airports to drive urban development. The focus is typically on aviation-dependent business and commercial service ranging from high-tech



Dubai Festival City

manufacturing and logistics to hotels, commercial centers, business parks and residential facilities. A growing focus is on not just the “clusters” of airport-linked activities, but also living spaces that are planned and designed with environmental and social dimensions front and center.

The central contention of the “aerotropolis” is that an international airport can form a city’s urban core and thus drive all aspects of development. On the one hand, the city is externally facing, connected to international markets and global supply chains. On the other hand, the city purpose-builds mixed-use economic zones and integrated development that radiate outward from the city. The current emphasis of these airport cities is on mobility, accessibility, connectivity and efficiency across multiple overlapping local, regional and global networks. The concept is not without its critics, spawning a counter-movement called, appropriately, the Global Anti-Aerotropolis Movement, which decries the impacts of greenfield development on local residents, environments and ecosystems.



Hilton Hotel,
Schiphol Airport

The underlying expectation of investors in aerotropolises is that airports and their facilities can serve as economic hubs driving urban and regional development. This is because they have the potential to cluster suppliers, manufacturers, warehousing, logistics and distribution in order to tap global commerce and markets. But they also have the means of leveraging knowledge and tourist economies, potentially generating economies of scale and speed. While varying in form and function, aerotropolises are increas-

ingly common across Asia, the Americas, Europe and the Middle East, and also present in Latin America and Africa. Their size, scale and ambition were, before COVID19, growing dramatically.

The Rise of the Aerotropolis

There is no one archetype of the aerotropolis, though they do tend to converge around two models. Very generally, there are examples of (1) airports that act as self-contained minicities and (2) entirely “new” cities connected to airports. A widely cited example of the former is Singapore’s Changi International Airport which combines accommodation and retail with business centers, health clinics, sports facilities and an indoor rainforest. An example of the latter is Songdo, South Korea, a purpose built city that integrates a mixed-use economic development area that is symbiotically linked to Incheon Airport.

Aerotropolises	Scale	Economics
Amsterdam Schiphol	72 million passengers in 2019 (down to 20 million in 2020) and covering 28 km ²	300,000 jobs and \$30 billion to Dutch economy
Dallas Fort Worth Airport	75 million passengers in 2019 (down to 39 million in 2020) and covering 78 km ²	148,000 jobs and \$31 billion to the Texas economy
Dubai and Festival City	86 million passengers in 2019 (down to 25 million in 2020) and 29km ² (but growing to 145km ²)	90,000 jobs (supports up to 400,000) and \$26.7 billion to UAE economy
Frankfurt International Airport	63 million passengers in 2019 (down to 16 million in 2020) and 23km ²	81,000 jobs (supports up to 175,000) and \$25 billion to the German economy
Helsinki Airport	21 million passengers in 2019 (down to 5 million in 2020) and growing to 45km ²	35,000 permanent jobs (supports up to 50,000 part-time) and \$5.8 billion to Finnish economy
Istanbul	39 million passengers in 2019 (down to 15 million in 2020) though new airport expected to reach 200 million passengers and cover 75km ²	16,000 jobs (but new airport indirectly employ up to 225,000 by 2025) and \$4.4 billion contribution to Turkish economy
Paris CDG	69 million passengers in 2019 (down to 19 million in 2020) and 32km ²	86,000 direct jobs and over \$20 billion to the French economy
Singapore Changi International Airport	67 million passengers in 2019 (down to 11 million in 2020) and covers 13km ²	119,000 direct jobs (375,000 indirect jobs) and \$36 billion in added value to Singapore economy (11.8% of GDP)
Shenzhen	52 million passengers in 2019 (down to 37 million in 2020) currently 11km ²	
Icheon, Songdo	70 million passengers in 2019 (down to 12 million in 2020) and covers 56.7km ²	Over 40,000 direct jobs and \$13.7 billion to Korean economy
Zurich Airport	31 million in 2020 (down to 8 million in 2020) and covers 8km ²	Ovr 27,000 jobs and added-value of \$5 billion to Swiss economy

Amsterdam Airport Schiphol was one of the first to adopt the airport city concept in the 1990s. Administered by the Schiphol Area Development Company, Schiphol AirportCity connects air, rail and road corridors together with the Schiphol Central Business District (CBD) outlay of hotels and restaurants, conference facilities, recreation, retail, museums and libraries. The “Base”, a 47,000 m² office and commercial complex, was built a 10 minute walk from the terminal in 2019. It also connects to multiple business parks. The airport employs 65,000 people and houses over 500 companies delivering \$30 billion and 300,000 jobs to the Dutch economy. Managing over 70 million passengers a year, it is an economic driver for the Randstad region.

Meanwhile, **Dubai International Airport** is currently the world’s busiest and several of its terminals feature hotels, recreation, retail and a host of services. Its 690,000 m² “free zone” features distribution centers, office space and manufacturing as well as a 10,000 m² perishable center. It’s second airport - Al Maktoum - is in development. It promises to be a 145 km² \$33 billion purpose built aerotropolis with logistics, residential, recreational and exhibition functions while also aiming to manage 160 million passengers and 12 million tons of cargo annually. Still in development since 2003, “Festival City” is also located next to Dubai International Airport and is home to 100,000 residents and features a wide range of residential, commercial and leisure infrastructure.

The **Dallas Fort Worth airport** is a de facto airport city, featuring its own police and zip code. It covers a 78 km² area that integrates warehouses, factories, hotels, office space, a golf course, car dealerships, business parks and Amazon’s 730,000 m² “fulfillment center”. Next to the airport is Las Colinas - home to 8,000 businesses and the

headquarters of seven F500 firms. While it lacks residential neighborhoods, it has attracted multiple company headquarters and given rise to suburbs such as “SouthLake” to executives and entrepreneurs. It generates over 148,000 jobs and \$31 billion in annual economic activity.

The **Frankfurt airport** and its surrounding area make up the Frankfurt Airport City. At the center is “The Squire” - a nine-story building covering 140,000 m² employing over 10,000 people just 10 minutes from check-in. Additional features are Gateway Gardens and Monchhof Logistics Park that together feature hotels, education and medical facilities, exhibition zones, leisure and entertainment complexes. Green areas and protected forests spatially contain the development.

Helsinki airport is also developing an aerotropolis concept, bringing together the city of Vantaa, Finavia, real estate firms and local landowners. The so-called Aviapolis Airport City is the largest public-private investment ever undertaken in Finland. It covers a 42 km² area and contains multiple hotels, a congress center, 87,000 m² entertainment center, massive retail outlets, a world trade center and office parts. The area now hosts over 2,000 companies and employs 35,000 individuals.

The **Paris Charles de Gaulle-Le Bourget Airport Area** is another fast growing aerotropolis. Its epicenter is 13km² airport. But the entire area covers a 420km² area and features over 17 logistics parks, 85 business parks, multiple convention centers and over 12,000 hotel rooms. Overall, it hosts 700 firms employing 90,000 people, and future plans to build more complexes may generate over \$15 billion in investment and 130000 new jobs by 2025. The airport development has spawned a cottage industry of (critical) academic research and advocacy.

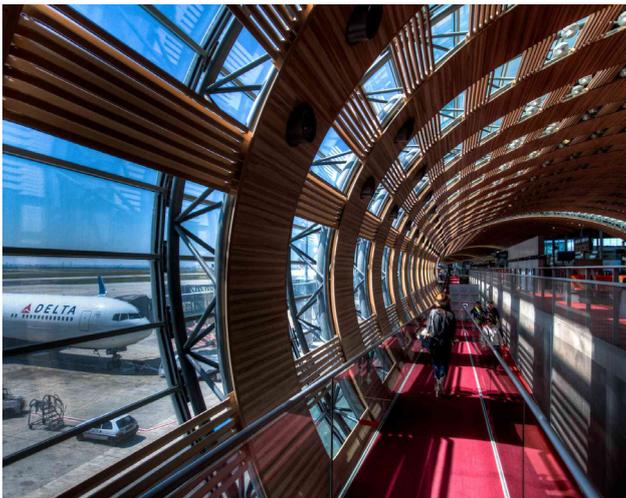
The **Incheon airport** in Songdo, South Korea, is linked to a mixed-use development area spanning 210 km². The “greater aerotropolis” brings together the international airport, central business districts (“Air-City”) and the Songo Business District (Songdo, IBD) with office, convention, hospitality, shopping, recreation and logistics complexes. A 21 km² bridge links the two facilities while a \$35 billion aviation-oriented smart city was built on land reclaimed from the sea in the Incheon Free Economic Zone (IFEZ).

There is also a “new” city built next to the new **Istanbul airport**, among the world’s largest with six runways and 1.5 million m² of indoor space. The airport is expected to manage over 200 million passengers annually - twice the number of the world’s current leader, Atlanta. The urban area includes over 1,700 acres of residential, office and hospitality space as well as power and waste treatment plants, marine infrastructure and high-speed rail to the “old” city. It is expected to employ 225,000 people directly and indirectly by 2025 and there are plans, eventually, to build the Istanbul Airport City.

The fastest growth of these airport cities are in **China**, many of them approaching mega-project status. Beijing Capital Airport has developed an “airport city logistics park” that is part of a 178 km² Beijing Airport Core Economy Zone. Baiyun Airport is also part of Guangzhou’s wider aerotropolis development and is being built on a 116 km² Guangzhou Aerotropolis Development District. The Zhengzhou Xinzheng Airport is even larger, spanning 415 km² with expected homes and amenities for 2.6 million people by 2025 and expected to move as many as 70 million passengers yearly by 2030. The vast majority of these are focused on growing manufacturing sectors for just-in-time and just-in-case distribution.

Criticism of the Aerotropolis Model

Even as investor enthusiasm for aerotropolises grows, there is a push-back against it from some quarters. Indeed, some critics are concerned about the ways in which airport city plans can lead to chaotic and unappealing urban development, override regional and sustainable development priorities, and negatively disrupt the livelihoods of local residents. The loss of farmland, forests, evictions of locals and carbon-intensive infrastructure are all commonly reported. Issues of sound pollution are also noted.



CDG Paris

There are generally concerns that airport city developments on greenfield sites are top-down and side-step local priorities. There is limited evidence of land-use patterns around airports and their urban peripheries. What is known is that the land mix tends to be unpredictable and airports themselves do not necessarily change the character of economic development within their geographic sectors. The aggregation of economic activity (in the forms of retail and employment) does not necessarily imply

“clustering” with local development. Airport developers typically neglect regional and local planning agendas, often overriding local knowledge and needs even where “consultative and planning” bodies are introduced.

The expansion of airport cities and airport corridor concepts over the past two decades has been motivated by the expected economic benefits and inevitability of clustering commercial activities on airport platforms. Investors and planners often rely on simplistic models extrapolating positive economic dividends, especially regional employment, which is



Frankfurt International

inevitably positively correlated with airport traffic. A key design flaw in their development models is the overemphasis on top-down approaches to planning, overly optimistic projections of economic activity, and a rudimentary approach to measuring benefits.

Another concern related to aerotropolises is about the wider future of the air transport sector. COVID19 provoked a dramatic downturn in global air travel, though it has partially recovered.

Future health-related crises and, more fundamentally, shifts in fossil fuels, could change the global dependence on air travel more generally. The idea of premising an entire urban development strategy around an industry that faces acute risks raises certain questions about sustainability.

The “Emergent” Aerotropolis

The idea of leveraging major transport infrastructure to shape urban development is not new. Over the past five decades there has been experimentation with ways to integrate airports, seaports, and road transportation hubs into the wider urban landscape. Rather than positioning and pushing these projects to the periphery, the goal has been to make them more central to commerce and residential development. It is possible to trace out several “generations” of the aerotropolis over the past half century. These are not necessarily strictly chronological - indeed, most of them exhibit characteristics across stages.

Generation	Description
First generation (Fort-Worth, Atlanta)	Repurposed “aerotropolis” from existing airport system. Enhanced airport experience, logistics focused, linked to business parks and carbon intensive.
Second generation (Amsterdam, Helsinki)	AirportCity. Integration of airport and neighboring commercial areas, partnerships with the region (Haarlemmermeer).
Third generation (Dubai, Singapore, Songo)	Purpose-built aerotropolis linking AirPort City with regional and national development strategy. Designed satellite cities with heavy emphasis on PPP and economic zones.
Fourth generation (e.g. Shezhen, Istanbul)	Mega-aerotropolis with large-scale regional development integration. Focus on large scale mobility, manufacturing and residential projects linked to economic zones.
Fifth generation (e.g. Chiang Mai)	Nature-based and zero carbon designed aerotropolis. Emphasis on digital connectivity and entrepreneurship, health and wellbeing, renewable energy and high integrated to local community.

COVID19 and the climate crisis are forcing a recalculation of the concept of the aerotropolis. Air travel declined between 50-70 percent between 2019 and 2021 and precipitated a recalculation of the overall imperative of business and leisure travel. Moreover, the 2021 IPCC report provides a chilling forecast of the massive climatic, environmental and biodiversity dangers posed by a “business-as-usual” scenario. There is virtually unanimous consensus among climate scientists that short-term shocks will become more frequent and intense and that longer-term stresses on temperatures and human livelihoods will be severe. At the very least, dependency on the volume of air travel is not a sufficient urban development strategy. More fundamentally, there is consensus across the scientific community that a radically new approach to the urban form is necessary to contribute to mitigation and adaptation measures, one that designs environmental stewardship and ESGs at the center of a masterplan.

Several **core principles** are warranted in the thinking through the evolution of the aerotropolis model.

Design-in participation and simulations at all stages:

Local populations must be given meaningful opportunities to contribute with ideas and aspirations to any design process. Consultations cannot be treated as an afterthought or a process that slows down planning approvals. Indeed, the reverse is true. Municipal leaders will engender



Chang Mai

more rapid buy-in from their constituencies and accelerate planning by building legitimacy into the process. The strengthening of “reputational capital” is critical in the social media and marketing era. Cutting corners can not only result in poor quality outcomes, it can generate negative externalities affecting the brand. This is particularly important given the likely disruptions to be generated by a massive surge in new arrivals. Examples of effective participation processes are Clear-village.org and Ethelo.org.

Invest in low-impact and automated construction:

Construction methods should meet and exceed environmental standards and avoid wherever possible concrete and other major polluting materials (which are among the top contributors to GHGs). Urban development could be tied to carbon sequestration directly offsetting the main airport hub site (and serving as a tourist draw). The embedded CO₂ of new construction is exceedingly difficult to absorb over time and will dramatically slow the speed of its carbon neutrality. Embedding upcycled materials mixed with 3D fabrication and distributed manufacturing techniques (including automated construction robots) would not just distinguish the city, but allow it to more rapidly attain zero carbon status. An example with pathways is Supernature.

Optimize renewable energy generation and self-sufficiency:

Cities must build on their natural resource endowments and assets, including solar, wind and thermal. There are opportunities for major solar power and next generation non-lithium battery options that can be intentionally designed into the building of mid-rise and single occupancy homes. Clearly large-scale generation capacity is required for the airport. Solar-charged lighting and electricity chargers will be a basic feature of mobility corridors. However a distinguishing factor could be to ensure that housing and most commercial space is self-sufficient. The concept of cellular cities is worth exploring

Water and waste management optimisation:

A minimum investment in waste water recycling and rainwater capture will be essential for any self-sufficient city. Building automated and digitized water water management systems to commercial and residential properties and using chilled water for air temperature control are also features that are increasingly common to smart cities. Setting targets to be “waste neutral” or having a “zero waste footprint” (including through recycling, reuse and retrofits) and optimizing waste management should be key. The Veolia Living Machine offers some insights into how this can be achieved at scale.



Bua Thong Waterfall

Invest in urban farming, high value agriculture and regenerative forestry:

Some areas are closer to food autonomy than others. Yet adapting to a 10x increase in population will require a flexible and adaptive food supply chain as well as distribution and cold chain systems to accommodate demand. Developing food production capabilities that are both “just-in-time” in partnership with local communities is critical.



Chang Mai

Maximize virtual and IRL aspects of cultural assets:

Preserving the authenticity and integrity of cultural assets is critical for short and long-term visitors. Developing links between past and future, including the concept of responsible custodianship, must be at the heart of any cultural preservation and eco-tourism strategy. Inspiring understanding of the qualities of the past, inspiring curiosity and capital to maintain the future, and attracting global and local talent

to contribute to its preservation are essential. Culture is the binder and catalyst for a grand vision to take root and endure. Investments in arts and crafts villages is a good starting point.

World-class healthcare and education:

Ensuring access to the highest quality healthcare and wellness opportunities are major assets to any city. Building on existing healthcare capabilities and offering a range of services to short and long-term residents is a major differentiator. The added benefits of both western and eastern traditions can also provide a comparative advantage. Top-of-class educational services for primary, secondary, tertiary and life-learning opportunities is also a major value-add. Partnerships with both local and international education providers (e.g. Green School) could prove an attractive draw for both younger and older demographics.

Technology incubators and hubs

Digital neighbourhood management: [Regenvillages.com](https://www.regenvillages.com) village OS

Next level mobility and liveability: Buckminster Fuller Institute.

Chiang Mai aerotropolis concept: Meuxng pā – Forest City

The ForestCity will be the world's first ultra green, carbon negative, regenerative and nature-based city. It will environment-appropriate construction and prioritize digital innovation across all verticals - from entrepreneurship and healthcare and to energy and food production. The urban layout will be designed on the basis of participatory inputs and simulations that optimize wind flow, minimize heat and ensure cooling, including through chilled water systems. Smart energy grids will ensure maximum CO2 reductions and allow users to monitor consumption. City services will be future-proofed to accommodate



Chang Mai Natioanl Park

emerging technologies. At least half of the area will be devoted to protected reservoirs and corridors to ensure catchment for anticipated increasing rainfall. It is, in effect, a doppelganger to the airport - future proof to accommodate emerging technologies

A key emphasis of ForestCity will be on ensuring mitigation and adaptation to future climate and environmental changes. The region is expected to experience significant increases in temperatures (1.4-1.8C by 2050s and 3-3.8C by 2090s) and precipitation (30-75% by 2090s). ForestCity will ensure that every residence is within a 10 minute walk from a park space. The built environment will be human-centric, ensuring a car-free environment with parking spaces underground at appropriate “edges” of the city. Cycling routes (in partnership with Mobike In) and community farms will be mixed into residential spaces. Support for digital entrepreneurship, in partnership with global and national tech companies, will be prioritized. Connections to other parts of Chiang Mai will be through mass rapid transit/buses.

The master plan for ForestCity will need to be connected to the wider 2017 “smart city” plans established by the Digital Economy Protection Agency (DEPA). Chiang Mai was selected for smart city development, notably a major investment in dashboards, analytics, apps and cloud-powered systems to promote digital connectivity and local entrepreneurship. A key focus of DEPA and other government agencies is on promoting digital entrepreneurs, smart low-emission transportation, smart healthcare (including in partnership with IBM and the University of Chiang Mai), smart tourism, and smart agriculture including wireless systems for irrigation, drones to manage crops and better data tools to improve forecasting, modelling and sales.

Next steps

The partnership offers a next generation approach to aerotropolis, one that builds nature and regeneration into the master plan. It recognizes that while AirportCities can and do contribute regional and local urban development, they can also generate a host of negative externalities. The temptation to apply top-down high-tech “solutions” must be tempered by a clear assessment of bottom-up priorities, capabilities and carrying capacities. We are proposing a data-driven and evidence-based approach to engaging with Chiang Mai, one that seeks to generate positive feedback loops between airport- and city-specific investments.

Over September-December 2021 period, we propose to combine insights from data science and deep expertise in regenerative urban development to develop core concepts for a proposed airport city.

Possible activities in the short term include:

Mapping and visualizing the positive and negative attributes of aerotropolises globally;

Collecting and visualizing data on smart cities in Southeast Asia, with a specific focus on Thailand;

Developing an interactive spatial analytics dashboard for Chiang Mai and the wider administrative regions to layer geographic, climatic, demographic, socio-economic, social media sentiment, telemetry, and other data layers;

Designing an XR experience to allow users to assess different urban design, circular and regenerative models of city design;

Establishing a large visioning exercise with global and local specialists to set standards for how such a place should grow until 2050 which will both promote the project nationally and internationally, and

Site visits to iterate possible design concepts and initiate consultations with a wide bandwidth of stakeholder.

Recode Group & SecDev

Thomas Ermacora /
Robert Muggah

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Recode Group :

Recode Group is a regenerative urban design futures unit. It brings together the knowledges of architectural conception, development strategy, exponential technology and data science in order to incubate, guide and accelerate city innovation. At the center of Recode's practice philosophy is a commitment to human-centred and participatory place-making. The group is focused on ensuring inclusion, equity and transparency are built-into planning processes rather than treated as an afterthought. Recode is devoted to projects aiming to push the boundaries of sustainability and nature-based solutions, as well as culturally vibrant, to create liveable and resilient environments for both people and planet. Founded by futurist and creative polymath Thomas Ermacora, a pioneer and edge player in the urban regeneration movement, Recode works to transform the way cities evolve by bringing in its constellation of domain expert partners including SecDev and Supernature.



SecDev : Managing risk and building capacity

At SecDev, we help our clients manage risk both online and off. SecDev applies a public health approach to mitigate risks, strengthen protective factors and enhance digital resilience. We apply ethical data science on demand combined with deep experience working in vulnerable settings. SecDev develops and deploys early warning systems, intelligence as a service, super forecasting and geospatial risk analytics to anticipate crises and drive more informed decision-making.

For more information on SecDev's digital risk monitoring, management and transformation practice, contact us at risk@secdev.com and visit www.secdev.com