A Novel Approach For Planning An Aerocity (Aerotropolis) In Negombo-Katunayake Peri-Urban Region

E Dineth J Perera, P K S Mahanama, Prasanna Gamage

Town Planner, Aerocity Development Project (ADP),
Sethsiripaya Stage II, Battaramulla, 10120, Sri Lanka – Tel: +940778558034, Fax: +94112870753.
dineth_urb@hotmail.com

Senior Lecture, Department of Town & Country Planning,
University of Moratuwa, Moratuwa, 10400, Sri Lanka
mahanamapks@gmail.com

Visiting Researcher, Melbourne Networked Society Institute,
The University of Melbourne, Australia – 5G FTTH Integration
p.p.a.gamage@hotmail.com

Abstract: Airports have historically positioned in the periphery of the cities to be used as a global gateway to the city thereby mitigating the spatial disconnection and become a major economic hub in economic development. By being so, has hampered the substantial future economic development. With the emerging twenty-first-century aviation economic era, airports become strategic economic hubs in new cities. Urbanization is the diffusion of the influence of urban centers and to the rural hinterland via peri-urban. It is often argued that the urban and economic centers such as airports been highly vulnerable to chaotic land use changes, which are not compatible or not in best use. Significant growth of Asia-Pacific aviation business in next few decades and position of Sri Lanka and its socio-political stability require to reconceive the Airport city as a new urban form through expanding the Bandaranaike International Airport (BIA), Colombo, Sri Lanka towards a sub-metro region of Negombo-Katunayake metro-region. The analysis guided by the notion of the integrated airport region that ultimately requires a rapprochement between the airport master plan and broader urban planning strategies. The research paper explains, how and in what scenarios been capitalized in the processes of applying this novel approach (Aerotropolis) to BIA centric Negombo-Katunayake Metro sub-region. Ultimately, it explains its complexity and market-oriented model, which was redesigned, and the adaptation methodology in order to achieve the long-term sustainability of the new urban form.

Keywords: extended city, urban development, airport city, airport corridor, Aerotropolis

1. Introduction

With the introduction of the open-economy to Sri Lanka in the late 70s, the cities and townships became highly vulnerable to socio-economic and physical challenges. These challenges emerged as a result of many reasons including, adopting ineffective and unsustainable policies, an adaptation of isolated lethargic dilapidated planning systems, uncertainties in acquiring and utilizing technologies in the process of planning and management of Sri Lankan cities. However, it has been revealed that Sri Lankan urban centers and urban corridors became highly populated and dense in the past few decades. This led to a variety of consequences in socio-economic sectors as well as in the environment and political aspects. It is predicted that these challenges would reach to threaten the future of human well-being. In this context; global issues, political constraints, and knowledge drain in Sri Lanka affected the economy. However, it was witnessed a release of pressure with the introduction of new integrated planning concepts in this new era. Aerotropolis [Airport Cities] has been one of the key strategic development initiates to overcome such socio-economic challenges in the developing regions. Airports in Singapore, Malaysian, Indonesian, Indian, have become significant players in property development, and centers for urban growth, with cities growing up around the airport infrastructure. This trend is now referred to as Aerotropolis (Wikipedia) and is seen as a major influence on future city development [4]. This paper explores the evidence of current emerge of Aerotropolis concepts in the Asian region with future predictions of the aviation industry and future market potentials and policy trends in application to the Sri Lankan context.

2. The new airport sub-region

American urban economist as well as sociologist Dr. John Kasarda emphasis the role of airports which are shaping the urban form in the twenty-first century much as highways did in the twentieth century, railroads in the nineteenth century, and seaports in the eighteenth century. He suggests that this fourth innovative wave of transportation technology impacts primarily through business location and the new dictum of ‘‘survival of the fastest’’ with supply chain logistics and other time-sensitive economic activity, valuing proximity to airports as gateways and conduits for flows of people, materials, and information [12]. According to Kasarda[9], an Aerotropolis is a metropolitan sub-region, which the infrastructure, land-use, and economy are centered on an airport. Further, he explains, the traditional metropolis made up of a central city commercial core and its outlying commuter-linked suburbs. However, the Aerotropolis consists of a multimodal airport-based commercial core (Airport City) and outlying corridors and clusters of aviation-linked businesses and associated residential developments that feed off each other by accessibility to the airport. As it is a key catalyst in economic growth scenario, employment opportunities taking as an indicator

of the economic growth: Sydney airport created more than 258,300 jobs in freight and tourism for the people of Sydney, and which is 6.4% of the NSW economy[14]. According to the research findings, in average, a 10% increase in passenger numbers as creating a 2% growth in the local economy [4]. Every regularly scheduled flight that travels through a hub airport supports around 2000 jobs [4].

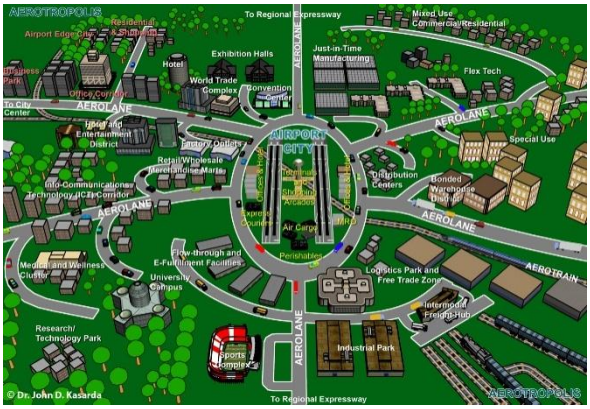

Figure 1: *Aerotropolis concept visualization, Dr. Johan Kasarda*

The transformation of airports from transport centers to urban centers have driven through numerous factors, that [12] explain in their research, as quoted in the following paragraph. Such as, the airport operator's need to create additional revenue streams for profit-seeking and counter-cyclical business reasons, industry's pursuit of affordable and accessible urban land, the globalization of supply chain management and rise of ''just in time'' manufacturing and delivery, the increasing role of e-commerce and logistics, the increasing role of airports as meeting places incorporate interactions, and the emergence of airports as gateways if not destinations in their own right for passengers and tourists [10],[13]. However, such aspects have been integrated and applied to diverse contexts in different regions. The nature of these facts and trends are uneven and being performed in diverse scopes and scales in different airports with a mix of airport activities in their urban forms.

3. Aviation Sector Analysis and impacts on BIA Sri Lanka

According to the International Air Transport Association (IATA) annual report 2017 [7], 7.8 billion passengers will travel by 2036 in worldwide. Evidently, the biggest driver of demand will be the Asia-Pacific region, which will be almost half of the world demand. It is forecasted that China will displace the United States as the world's largest aviation market by 2022. However, this eclipse would take place faster than anticipated. Considering the decline in the aviation sector of the United States (US) compared to higher growth in the aviation sector in China. As per the IATA analysis, the UK will fall to fifth place, surpassed by India in 2025, and Indonesia in 2030. Thailand and Turkey will enter the top ten largest markets, while France and Italy will fall in the rankings to 11th and 12th respectively [7] Figure 2.

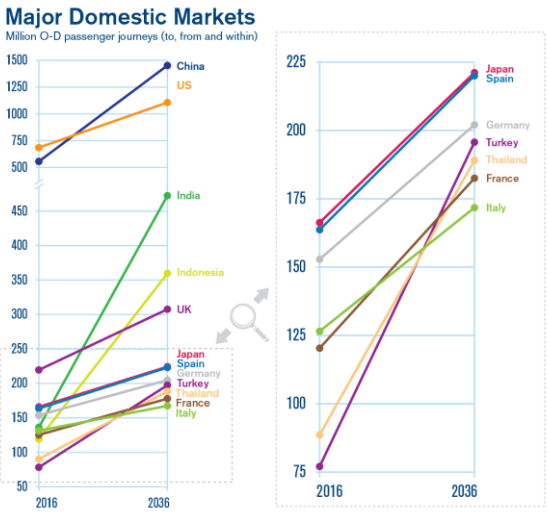

Figure 2: *Predictions of major market behavior from 2016 to 2036*
Source*: International Air Transport Association (IATA) Passenger Forecast report, 2016*

The latest update to IATA's 20-Year Air Passenger Forecast demonstrates that an increasing shift to East-wards in the center of gravity of the industry is behind the continued strong growth. Over the next two decades, it forecasts a 3.5% compound annual growth rate (CAGR), leading to a doubling in passenger numbers from today's levels. With this massive growth, the association warned, however, that growth prospects for air transport and the economic benefits are driven by aviation, could be curtailed if protectionist measures are implemented by governments. In other words, the improvement of airport infrastructure and innovative solution to attract the exceeding demand which is highly recommended by IATA. The impacts of the global aviation sector growth to Sri Lanka has considered in two steps. Firstly, the impact of being the center for the Asia-Pacific, African and Middle-East growth centers with an annual average growth rate of 4.6%, 5.9%, and 5.0% respectively. According to the IATA predictions and past trends, China, India, Indonesia, and Thailand will be in the top 10 markets in 2030. Such massive market opening up to diverse economic opportunities range from traveling, manufacturing, service providing, education and technology innovation, etc. Similarly, the major cause for this pragmatic shift is due to the soar of the middle-income class in Africa and Asia. Such regions as emerging regions in air passenger growth clubs,the risein middle-class population have a positive correlation with emerging Sri Lankan aviation sector. According to figure 3, 55% growth is earmarked in the period of 2025-2035. As the emerging middle class increases, more people will find themselves with excess income which can be spent on flying, among other luxuries. According to the IATA analysis, consider that just 3 in 10 people from emerging countries took a flight in 2016, compared to 1.8 trips per American person per year. However, with the benefit of higher incomes, 8 out of 10 people in emerging countries will be flying by 2036 [7]. With that being the case, the economist and aviation specialists predict that Sri Lanka has a great opportunity to grab the potential of emerging neighboring markets expansion. However, Sri Lanka has

not yet been capitalized its resources to actively integrate with these economies. However, it evident that most of the neighboring economies who are already exploring such outward aviation markets to strengthen their economic and social development. On the other hand, nearly 90% of business-to-consumer e-commerce today is delivered by air. Remarkably, this percentage grew from 16% to 83% in just the six-year period between 2010 to 2016 [7].

Figure 3: *Middle-class population distribution,*
Source: *Oxford Economics, Airbus*

This rapid growth, over such a short period of time, provides a concrete testament to the direct relationships which exist between air transport capability, and e-commerce profitability. This is an area that untapped sector where Sri Lanka which is not been utilized effectively. Clearly, this is a huge market where Sri Lanka can get in to. Secondly, with the paradigm of aviation mega-city developments in neighboring economies, indicate to rethink on reshaping the Sri Lankan policy reforms, development initiations on a new philosophy, and strategic moves to enter into such competitive markets. Given the massive operational challenges, limited financial resources and strategic ambition at stake, Mega-Aviation Cities are among the most critical projects across the globe. Therefore, these projects are highly dependent on robust strategic business and implementation plans that are shared by airport managers, partner airlines, investors, political and economic leaders, and other relevant organizations. There are different strategic interventions being practiced in the global market. Among all, "Extended Aviation City" concept is practicing as a diverse urban and business model. From an Industrial Free Trade Zone to an iconic theme park, almost everything can be envisioned. Contemporary Mega-Aviation City projects as global urban and economic centers spread over the countries such as, London, Paris, New York, Istanbul, Dubai, Abu Dhabi, Doha, Frankfurt, Rome, Munich, Moscow, Madrid, Barcelona, Sao Paulo, Rio, Incheon, Beijing, Hong Kong, Shanghai, Singapore, Kuala Lumpur, Sydney, and many more. However, Djakarta, Manila, Bogota and many more will soon compete by stepping into this new global market. According to Mega-Aviation Cities' Project [2], the following three challenges were highlighted to explain the readiness in such conversion of landform.

1. Passenger attraction and cargo traffic.
2. Become globally recognition in the aviation-related industry and logistical center.
3. Become a diversified service and urban center facilities.

Figure 4: *Projected Aviation Mega-cities distribution in the world,*
Source: *UNPD, Airbus GMF, 2016*

According to the Airbus explanation, figure 4 shows that Sri Lanka has a potential to develop as an aviation mega city in 2035. That is ranked in the second category which is >20,000 daily long-haul passenger demands. This is evaluated by considering the country's GDP, population growth, passenger trips, in-service trips, and policy changes in the aviation sector. There are strong evidences to prove that, Sri Lanka is well positioned and predict as a positive position to attract the new economic trend to resurrect its economy.

4. A catalyst to extend the katunayake airport as an Aerocity, sub-region of Negombo-Katunayake Metro region

Currently, Aerocity concept is used to describe the growth of aeronautical and non-aeronautical land developments taking place in and around modern airports worldwide. The concept of extended airport city which plan for integrating real estate development between the city and the airport arose as a result of interactions between global markets and players, and local conditions. Other than Atther D's explanation, [11], identified four critical factors for airport city development. Those factors should not be regarded independently from one another; on the contrary, mutual interactions can be quite significant. They are Connectivity; Economic potential of the hinterland; Commercial attitude of the airport operator; Sustainable development context. By and large, mainstreaming spatial planning models which have identified the nature of the emerging airport agglomeration effects in diverse interfaces in specialist aviation discourse. Such discourse brands are ''avioport,'' ''aeroville,'' ''aeropolis,'' "aerocity" and ''aviapolis.'' Thus, Katunayake-Negombo airport region (peri-urban area) is branded as "Aerocity – Katunayake". By and large, Katunayake-Negombo region already equipped with the prerequisites to transform into a global urban hub. In parallel, there are constraints, which has to be carefully tackled and has to be reduced the pressure to perform the potentials naturally. Unplanned development initiatives and un-stabilize policy directions have led to many constraints than potentials in achieving vision development. The new urban form is proposed by centering Bandaranaike International Airport (BIA) Colombo, covering Negombo Divisional Secretariat (DS), Katana DS, Divlapitiya DS, Minuwangoda DS, Ja-ela DS, Wattala DS, areas. The total study area extends to 315 km2 as it demonstrated in Figure 05.

Figure 3: *Location of Aerocity Development study area*

The new urban expansion focuses on creating a unique urban form that relies on BIA performance and its integrated land transportation infrastructure to speedily connect high-value, time-sensitive firms to their distant suppliers, customers, and enterprise partners. It targets to facilitate multimodal airport-based commercial core (center) and outlying corridors and clusters of aviation-linked businesses and associated mixed-use commercial/residential developments that feed off of each other and their accessibility to the airport. Thus, by analyzing [figure 6& 7] the urban context of natural-environment systems and their impacts, social patterns, political feedbacks, transport network, market study, and case-studies, defined and reshaped the Katunayake-Negombo Aerocity concept. Figure 9 and 10 illustrate the new urban form, which is planned to achieve as a future aerocity of Katunayake.

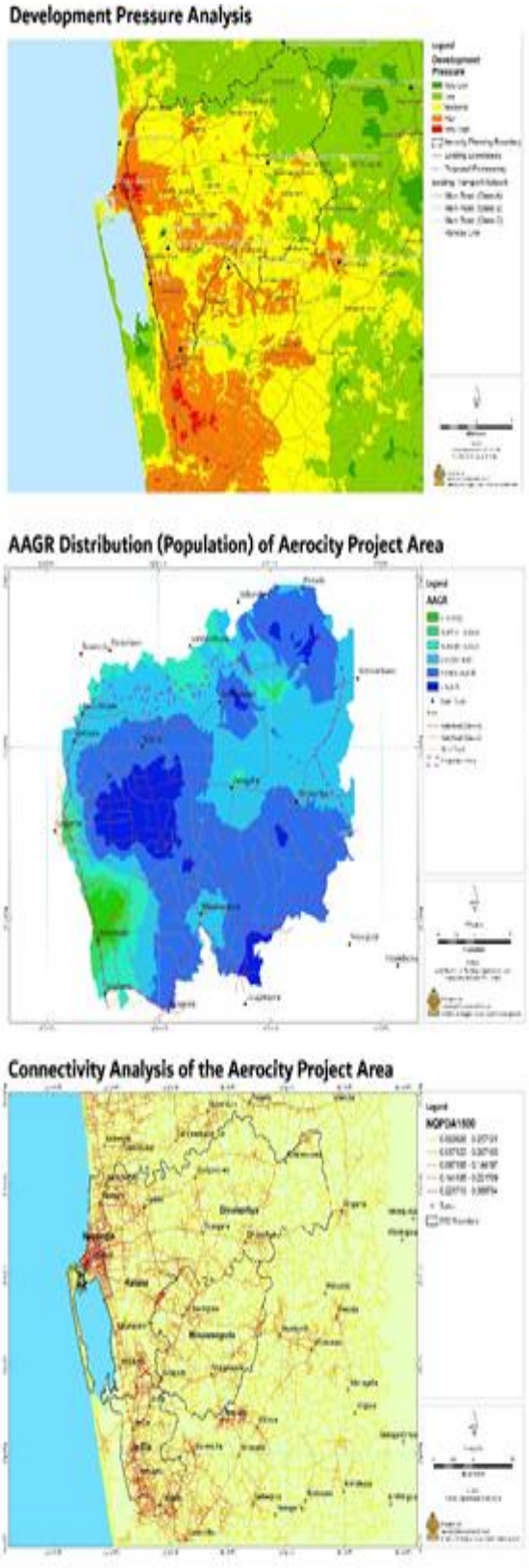

Figure 4: *urban form analysis in Aerocity development area, Katunayake-Negombo*

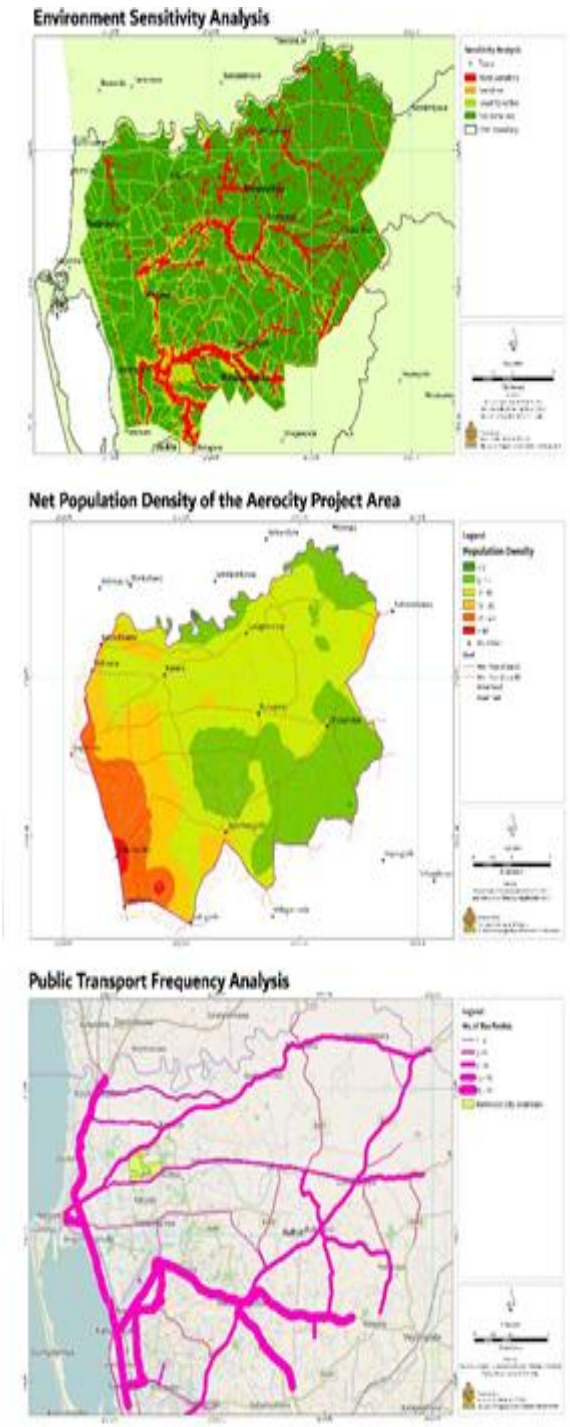

Figure 5: *urban form analysis in Aerocity development area, Katunayake-Negombo*

Spatial pattern and transport network is connected from BIA to; Colombo seaport, Economic Processing Zones (EPZs), financial city core, through expressways, railroads, and mass transport modes as shown in Figure 8.Selection of suitable areas for specific developments became crucial as most of the area has affected by urban sprawl already. The area to be developed for the extended city was chosen by considering the effects of BIA master plan, connectivity among major transport and economic hub/s, environmentally less/non-sensitive lands, natural population, and pattern of real-estate development has, and other tourist and resources locational advantages. When reshaping to a new urban form [9] the studies explain common elements that should be in line with any Aerotropolis plan is as follows,

- Market demand for air commerce,
- Sufficiency and efficiency of air and ground connectivity,
- Customers' and stakeholders' wants and needs,
- The management of commercial real estate development, and
- Attracting investors and investment.

Figure 6: *Transport connections with BIA and surrounding destinations*

Those common elements are inextricably interwoven and the master plan must reflect those characters as it concludes. BIA has already challenged with its infrastructure capacity and cohesiveness with surrounding real estate development trend. According to the Airport and Aviation Services [Sri Lanka] Limited annual report 2017 findings [1], there is a 12% annual increase in tourist arrivals in 2017 while 14% growth rate of air cargo at BIA in the same period. Due to rapid growth in passenger and cargo markets, BIA has faced with a capacity crunch in passenger terminal and runway as well as in cargo terminal infrastructure. By addressing such challenges and to attract new economic opportunities with market potentials and business potentials, airport redevelopment has already implemented by covering, new passenger terminal II, doubling the cargo terminal and logistics facilities, second runway development, MRO center, entertainment and lodging facility improvement, in priority. Mega-Aviation City will consist of a bundle of clusters that may differ according to their level of

dependence to the airport's aeronautical activities and to the competitive intensity with other possible locations [2]. These clusters will attached with the core aviation city, involving aviation/ airlines support services and the extended aviation city, with diversified service activities. Core aviation city is closely related to the quantity and quality of traffic hosted activities and extended aviation city clusters with real estate development such as, long-distance logistics, free trade zones, convention centers or luxury leisure resorts, business centers, tourist development. Aerocity development project is conceptualized with key development initiations as illustrated in figure 9. According to the development plan; airport expansion, logistics & industrial economic clusters, gateway & eco-tourism clusters, city regeneration, are demarcated as key development clusters in priority. Each cluster defines with its unique new urban character cohesively develop with existing positive peri-urban form. The clusters are planned to connect with the airport and major city (Negombo City), with 20km radial townships as service clusters.

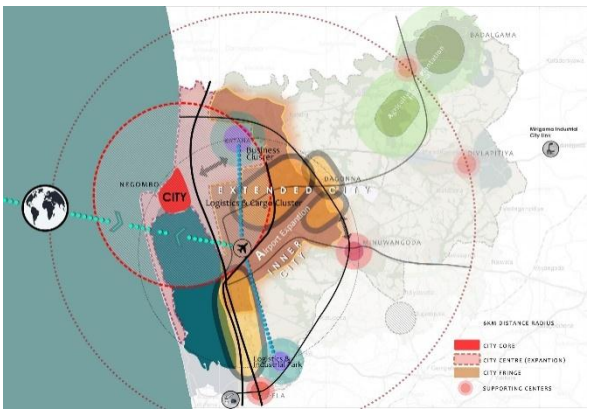

Figure 9: *Aerocity concept plan 2035*

The overall image of the development plan visions to attract international businesses related to aviation industry especially overfilled matured economies, facilitate efficient and sustainable infrastructure network, and facilities for local (logistics, industrial, technology, education and technology parks, tourism and transport) activities. Aerocity Negombo-Katunayake entails a scope, which is similar to the cluster of core aviation city of Aerotropolis concept, through airport expansion such as; terminal improvements, second runway construction, airport direct service centers expansion (ground handling, catering, jet fuel storage, lodging and entertainment), establishment of cargo village and Aircraft Maintenance, Repair and Overhauling (MRO) center establishment. Quality and quantity of the labour market in aviation sector along with steady and growing supply-chain/logistics are vital to attracting core aviation cluster activities [2]. Ever growing scenario of such characteristics will further strengthen at the airport expansion cluster as a major core of the development.

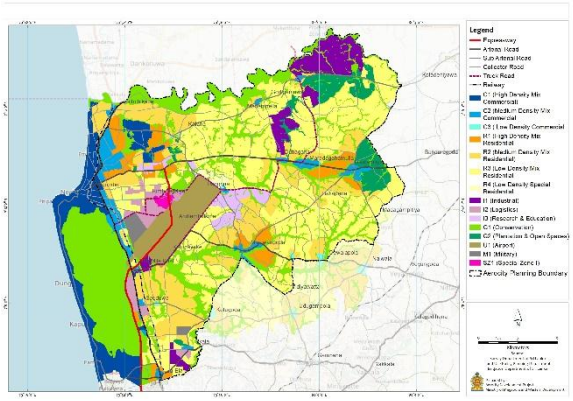

Figure 10: *Aerocity zoning plan 2035*

Extended cluster at Aerocity development initiation includes: business and commercial developments (cargo, logistics, distribution facilities, hotels, hospitals, convention hall, and offices), special areas for traditional medication, university and knowledge hubs, commercial core for aviation headquarters and businesses, free trade zones, entertainment and tourist destination development and most importantly variety of residential facilities (Apartments [Luxury to affordable], townhouses, high-rise to low-rise housing opportunities). The overall development plan of Aerocity Katunayake project has initiated to grow as a Negombo-Katunayake metro region under this novel futuristic urban form.

5. Economic impact of Aerocity development

Consequently, airports have diversified the sources of revenues, engaging in non-aeronautical business activities. Numerous airports achieve a higher percentage of revenues from non-aeronautical sources than aeronautical sources, which is estimated at four times greater than aeronautical revenue. This resulted in much interest in real estate business in the airport's landside and surrounding lands leading to the emergence of new urban form. The research studies argue that daily consumer population at major airports is larger than that of many mid-sized cities and with higher incomes. On the other hand, non-aviation commercial revenues (notably, retailing, and car parking) on average now account for half of all airport income worldwide [6]. Terminal-based stores in American airports generate annual sales in the range $600–$2500 per square foot, significantly above the level of non-anchor tenants in ordinary suburban malls [8]. Thus, rapid commercial development around airports creates urban growth generators as airport areas become significant employment, shopping, trading, and business destinations in their own right. As critical transactional spaces (monetary) in a global economy facilitating inter-regional and international travel, trade, and tourism, that they have become vital hubs in the worldwide ''space of flows'' [3],[5]. There is no detailed assessment done to evaluate the real economic value (Aeronautical and non-aeronautical) as an airport city. However, the annual report of BIA explains where it stands now and how far it can be direct with its potentials. According to the report findings, Non-Aeronautical revenue comprises of Embarkation, Rental, Concession, Lounges income

(Embarkation levy 35%, Rental 22%, Concession 30%, Other Non-Aeronautical 13%), Non-aeronautical revenue generation contributed significantly to the overall growth profile delivering growth rates of 16% [1] figure 11. Utilization of positive market behaviors and national policy changes, the Aerocity development can act as a key catalyst to overcome the socio-economic issues that country experiencing now, by converting it as a key economic hub of Asia.

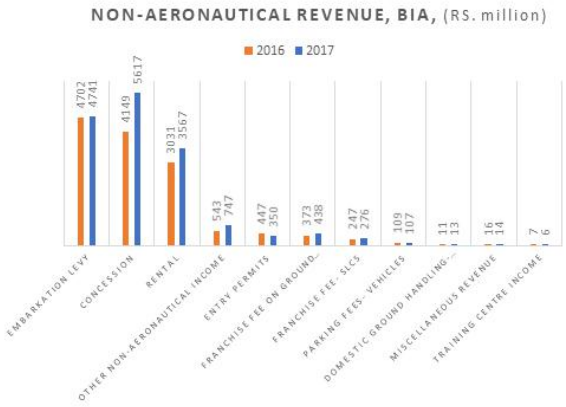

Figure 11: *Non-Aeronautical Revenue of BIA 2016-2017*

6. Conclusion

This paper describes how new planning approach which is 'Aerotropolis' been adopted to attract and linked-up with the new emerging market while providing sustainable solutions for the socio-economic and political issues that country is suffering. According to the research findings: institutional re-structuring, good governance, positive aviation led policy changes, enforcing new laws and alterations, as well as attitude changes of the citizens, should be account in applying these types of novel urban forms and systems. Thus, it is a long run process to make it more socio-economically sustainable and to meet the high-income nation standard and livable city environment as main targets of this intervention. By utilization of strategic position of Sri Lanka as an island access with five to ten hour flight distance to Asia, Africa, Arab and Europe countries, with strong trade routes, renown destination for tourism, natural resources, as well as in human capital, for its prosperity as well as the economic position as a center in the world, have huge potential to convey it to where it targeted. This concept encompasses multiple dimensional relations in different perspectives involved in the development. It is a business model of airport-centered real estate development and is a marketing and branding tool to promote the attractiveness of the airport area for well-known companies and businesses. Further, it is an urban form, where is a diverse mix of spaces for working, business, shopping, meeting, and leisure activities. The research method consisted on Aerocity development project details and findings, which includes information on surveys from a diverse group of experts from different fields (such as academics, urban planners and architects, airport operators, aviation consultants, and territorial authorities) complemented with aviation industry analysis and outcomes. Beyond that, the research extracted information from an inclusive analysis of various aspects of airport city development in similar contexts, in order to regenerate the existing urban system to a new version of urban development as an airport city. The adopted Aerocity new urban activities and infrastructure improvements target to achieve in the next few decades. The new extension of BIA towards an airport city is a relatively young concept to Sri Lanka. However, looking at the geospatial and locational advantage, enough resource capacity, growing aviation economy, and economic trends have a great potential to attract the aviation market and expand the Colombo airport (BIA) to an airport city. Thus, by examining the research findings and project work experience, it is recommended to consider the following factors in the process of implementation and policy-making in Aerocity development in order to achieve the ultimate goals and objectives of the project.

- Aerocity has to be taken into account as a new type of urban development to achieve socio-economic and sustainable targets in the future;
- The aviation market-oriented policy changes, as well as infrastructure improvement, should in high priority [analyzing the airport city potentials, it is important to focus on economic, transport, land, and technical capacities of an existing airport, rather than on political purposes and type of ownership];
- The institutional integration is the key to strengthening the implantation [The communication between urban planners, airport authorities, workforce, landowners, service providers, government, and other social groups could be more efficient if they were on the one stage [15];
- BIA should take the advantage of growing market (local and regional) behavior by further strengthening and capacity improvement in; passenger and freight traffic, increasing non-aeronautical revenues, as well as long term business models to promote small and medium local business.

Finally, the aerocity project should focus on detailing and implementing each and every cluster by prioritizing the future needs while adhering to sectoral changes in local as well as regional. We believe this will be an inspiration to engage in more research works to re-design and analyze this type of novel planning models to further develop and explore new opportunities to innovate more comprehensive and strategic products.

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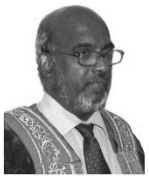
Mr. E. Dineth J. Perera
Graduated in BS.c. (Hons) in Town and Country Planning, University of Moratuwa (UoM), SL, and Masters in Urban Design, University of Salford, UK. Worked as a research assistant at UoM in my early career, then employed in urban design and project development offices in private and government sectors, and currently work as a Town Planner at Ministry of Megapolis and Western Development.



Prof. P.K.S. Mahanama
Graduated in Geography and masters and Phd in urban planning university of Moratuwa Sri Lanka. Senior lecture at Department of Town & Country Planning, UoM. Currently position as a Deputy Vice Chancellor, UoM. Research interest in urban environment planning, Remote-sensing, Climate change and disaster mitigatory planning, sustainable urban interventions.

Dr. Prassanna Gamage
Received the Certificate in General Management, B.Sc. in Engineering, Post Graduate Diploma in Computer Science, M.Sc in Telecommunication Engineering and PhD degree in Electrical and Electronic Engineering from the National Institute of Business Management, Sri Lanka, the University of Moratuwa, Sri Lanka, the Victoria University of Technology, Melbourne, Australia, RMIT University, Melbourne, Australia and the University of Melbourne, Melbourne, Australia, in 1990, 1996, 2000, 2004 and 2009, respectively. In his long career, currently engage in research and lecturing as a visiting researcher, Melbourne Networked Society Institute, the University of Melbourne, Australia