

# Improving regional development through aerotropolis conceptual design

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**Abstract.** The airport has a great role in the modern life and has been shown significant influence in shaping the layout and structure of the city. Along with the high growth of passenger and logistics activities, the airport has been developed into a city-based airport. Although airports in the world have commonly implemented this concept, most cities in Indonesia are not familiar and prefer the traditional approach by locating airport far from the city with limited consideration of urban expansion. This research will conduct a study to develop the most suitable model of the aero – city. The study will use a combination of quantitative and qualitative approaches. The results shows that Aerotropolis development required 1,446.9 Ha and divided into four components. Airport use 53.21% of the area for about 770 Ha, an industrial zone about 430.6 Ha (29.76%), Mixed – use area about 101.6% (7.03%) and supporting infrastructure about 144.7 Ha (10%).

## 1. Introduction

In the current era of globalization, the human activity involves speed, effectiveness, and efficiency, especially related to people movement, goods, and information [1]. High mobility requires transportation facilities and infrastructure, whether land, sea, or air. The land transportation mode offers flexibility and ease of reach but provides a limited cruising range. The sea transportation mode suggests a considerable carrying capacity with longer travel times. On the other hand, air travel mode proposes a high speed, and capable of reaching remote and distant area in shorter time [2].

The airport is traditionally located far away approximately more than 20 km from the city center. The main purpose of the airport location is for technical consideration without having a significant influence on economic growth or massive regional development around the airport. The airport developed into an airport-based economic zone or airport-based city due to increasing passenger growth and logistics activity [3, 4]. Today, in addition to serving as a liaison between users and goods, airports play a significant role in promoting national industry and become the main gateway to foster regional economic growth [5].

The concept aims to improve the accessibility of airports with urban growth centers, and a better planning development [6]. It is resulting in an orderly, efficient, and effective form of integration in



delivering benefits for users [7]. Many airports applied the concept of aerotropolis, such as Amsterdam Schipol Airport in the Netherlands, Los Angeles Airport in the United States, Incheon Airport in South Korea, and Changi Airport in Singapore, are examples of aerotropolis that integrates the city, airport, and business area. The ultimate goal is not only to achieve efficiency, speed, and connectivity, but also to improve the quality of life in urban space that is safe, comfortable, productive and sustainable.

Indonesia as an archipelagic country certainly needs the role of air transportation to reach islands throughout Indonesia. However, airport development in Indonesia experiencing problems such as inadequate infrastructure, affordability of airports, unplanned airport development, to inadequate airport facilities. Therefore, this research investigates the development of aerotropolis application in Indonesia by using Radin Inten II Airport in Lampung province as the case study. The airport is potential to be developed due to its land availability and strategic location. Furthermore, this study is expected to provide inputs to the government in the context of enhancing regional and national economies and suggest an international debate for airport development.

## 2. Methodology

This research uses a desk study and in – depth interview to generate the conceptual of Aerotropolis. Benchmarking and literature review on desk study investigates gross regional domestic product (GRDP) and the population of Lampung province. The literature retrieved from credible resources such as books, public records such as The Annual Statistic Report, policies and government reports [8, 9]. The input will be used for further analysis through Location Quotient (LQ) method. Its attempt to evaluate the diversity of regional economic basis. It has been applied in many sectors of an industry [10], marine sector [11], environment [12] to tourism [13].

LQ measure an economic indicator of specific over a general area by taking into account GRDP, population to workforce per sector. A sector selects as the potential for development when the result shows value over one. The equation of LQ can be seen as follows.

$$LQ_i = \frac{e_i/e}{E_i/E}$$

Where:

$LQ_i$	= LQ value for i sector in a district
$e_i$	= GRDP for i sector in a district
$e$	= GRDP whole sector in a district
$E_i$	= GRDP sector i in province of the district
$E$	= GRDP whole sector in province of the district

In depth interview conducted in Jakarta to three experts on infrastructure policy with more than ten years of experience. The instruments use semi – structured questionnaire and take 15 – 30 minutes to collect sufficient data to be analyzed. The result from in – depth interview and LQ analysis is correlated, thus the output valid and reliable [14].

## 3. Result and Discussion

### 3.1. Location Quotient Analysis

Firstly, the supporting data for location quotient (LQ) analysis such as GRDP of Lampung Selatan regency and GRDP of Lampung province is gathered from reports issued by Statistics Indonesia. Out of seventeen sectors, six sectors shows LQ figure above 1. It means the sector has the potential for further development. Processing industry select as the highest LQ figure by 1.3 followed by construction, electricity and gas, water supply and waste management, transportation and warehousing as well as

wholesale and retail, car and motorcycle repairation. The summary of LQ analysis can be seen in Table 1.

**Table 1.** LQ Ratio for GRDP Contributing Factor in Lampung Selatan Regency.

GRDP Contributing Factor	LQ Ratio	Rank
Agriculture, Livestock, Forestry, and Fishery	0.956926188	8
Mining and Quarrying	0.259469712	17
Processing Industry	1.342998162	1
Electricity and Gas	1.223311359	3
Water Supply, Waste Management	1.21344653	4
Construction	1.253388662	2
Wholesale and Retail, Car and Motorcycle Repairation	1.073021	6
Transportation and warehousing	1.156065163	5
Accommodation, Food, and Beverage	0.961749015	7
Information and Communication	0.786107104	12
Financial Services	0.853402654	10
Real Estate	0.793079142	11
Business Services	0.609564882	15
Government, Defense, and Social Assurance	0.622694281	14
Education Services	0.863663229	9
Health Services and Social Activity	0.586320045	16
Others Services	0.683451107	13

### 3.2. Conceptual Design of Aerotropolis

The concept for aerotropolis design at Lampung province consists of four components such as the airport, industrial area, mixed – use and supporting infrastructure. The development of Radin Inten II Airport is carried out to the terminals, buildings, runways, and other supporting components. The airport expected to have a capacity of 30 million passengers and 2.7 million tons of cargo with two runways and total terminal area of 625,000 m<sup>2</sup>.

Cities associated with heavy congestion, pollution, and a dense neighborhood. The development of property businesses and commercials in the city center encourages high mobilization from suburb area. In this case, the concept of urban particularly in developing countries must well design and able to cope future development in minimizing user behavior in using private vehicles. A mixed-use system by integrating property products (office, hotel, residence, commercial) into one area propose as the solution for city development.

The concept has been implemented in many developed countries such as Singapore, Japan, Hongkong, to America. The city of Atlanta in Georgia, America has a transit-based traffic system under the MARTA (Metropolitan Atlanta Rapid Transit Authority) which also controls the development of TOD-based cities and mixed-use development in its urban system. The existing transit system reaches both residential to designated areas (offices, shops, schools, and others). The concept applied in the form of vertical mixed-use. In that way, open spaces within the city are possible due to a small building block and supporting infrastructure.

In the Aerotropolis concept, mixed use area divided into two different locations. First mixed – use has 445,786 square meters and the second has 570,319 square meters. Both have a similar building from commercial, apartment, office, hotel, open space, infrastructure, and public facilities. Each building has a different percentage from 8% for office to 30% for the open space. Some building and maximum floor

depend on the local regulation by taking into account building coefficient and land availability. Summary for the mixed – use planning for the aerotropolis concept is shown in Table 2.

**Table 2.** Mixed – Use Planning in Aerotropolis Concept.

	Commercial	Apartment	Office	Hotel	Open Space and Infrastructure	Public facility
<b>Mixed – Use 1</b>						
%	10%	12%	8%	7%	50%	13%
Land availability (m <sup>2</sup> )	44,579	53,494	35,663	31,205	222,893	57,952
Building needs (m <sup>2</sup> )	44,579	2,000	1,300	1,000	-	-
Total Building Size (m <sup>2</sup> )	178,314	416,000	702,000	248,000	-	-
<b>Mixed – Use 2</b>						
%	10%	12%	8%	7%	30%	13%
Land availability (m <sup>2</sup> )	57,031.90	68,438.28	45,625.52	39,922.33	285,159.5	74,141.47
Building needs (m <sup>2</sup> )	28,516	2,000	1,300	1,000	-	-
Total Building Size (m <sup>2</sup> )	228,128	544,000	910,000	320,000	-	-

Furthermore, industrial development in the concept aims to create a competitive atmosphere, thus able to attract investment from local and international enterprises. The result from LQ in the previous sub – section is used as the baseline for the analysis where processing industry as the main focus for development. The industrial area in the concept considers industries that relate to the processing industry. It consists of cassava, corn, cane sugar, pineapple cans, palm oil, and coffee. The industry will take place in five industrial development with total about 430.6 Ha. As the regulation only allows 70% of the land for buildings, thus 301.42 Ha is being used for the industry. The summary of production capacity planning for each industry shown in Table 3.

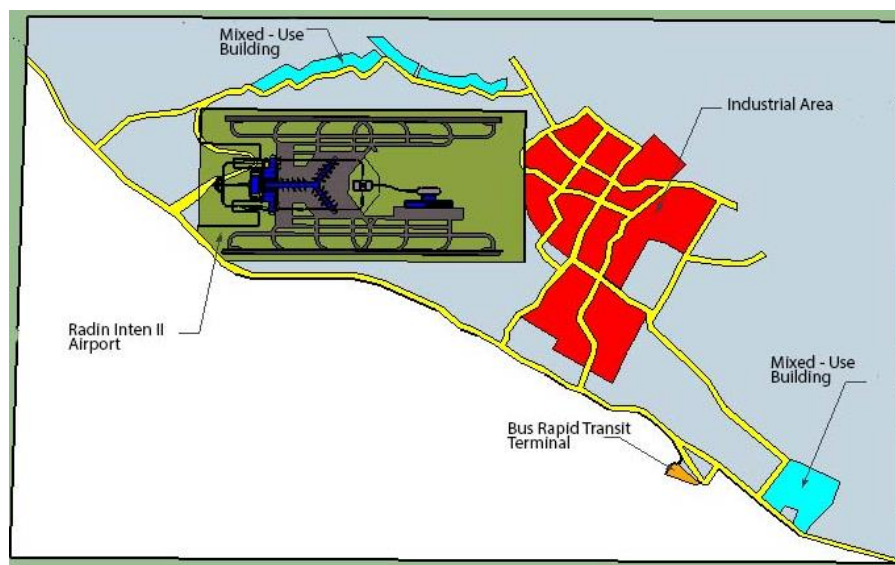
**Table 3.** Capacity Production Plan for Industrial Development.

Industry	Required Land (Ha)	Available Area (Ha)	Coefficient	Production Capacity	Unit
Cassava	2	190	95.00	684,000	ton/year
Corn	3.82	44	11.52	4,360,158	ton/year
Cane sugar	1.5	20	13.33	213,333	ton/year
Pineapple cans	0.1	18.71	187.10	673,560	ton/year
Palm oil	6	18.71	3.12	1,403,250	ton/year
Coffee	0.04	10	250.00	15,000	ton/year

Supporting infrastructure in the concept consist of three component from water and waste management, bus rapid transit and renewable energy. Water treatment plan will take place in the area of 57.43 Ha with production capacity about 7 million cubics per year. On the other hand, Wastewater treatment plant will process the black and gray water from industry and users. The plant has an area about 14.35 Ha and able to process 2.8 million cubics of waste per year. The development of transportation aims to support economic, social, and cultural activities as well as the environment. It is carried out by providing

extensive public transport services through a bus rapid transit system along the site. The system has two main terminals with 38 bus station and a capacity of passenger around 54 million per year.

Electricity is required for people to conduct daily activities. However, producing the energy heavily depends on fossil fuel which the availability shows a gradual decrease during the last decade. Thus, investment for the use of renewables should be supported by all the stakeholders. The concept attempt to use geothermal to provide electricity and power to the Aerotropolis area. The basis lies based on the potential energy at Natar area – a sub district located 10 km from the current airport site. It has a potential production that estimated for about 394,200 MWh per year and requires 5.5 Ha for development. Overall, the grand concept for Aerotropolis at Radin Inten II Airport in Lampung province can be seen in Figure 1.



**Figure 1.** Grand Concept for Aerotropolis in Lampung Province.

Aerotropolis development required 1,446.9 Ha and divided into four components. Airport use 53.21% of the area for about 770 Ha, follows by the industrial zone about 430.6 Ha or equal to 29.76%, Mixed – use area about 101.6% (7.03%) and supporting infrastructure around 144.7 Ha or equal to 10%.

#### 4. Conclusion

The airport has a great role in the modern life and has been shown significant influence in shaping the layout and structure of the city. Aerotropolis that integrates the city, airport and business area is one of the solutions to achieve efficiency, speed and connectivity in a region. This research produces an alternative concept of Aerotropolis in Indonesia by taking Radin Inten II at Lampung province as the case study. Aerotropolis development required 1,446.9 Ha and divided into four components. Airport use 53.21% of the area for about 770 Ha, an industrial zone about 430.6 Ha (29.76%), Mixed – use area about 101.6% (7.03%) and supporting infrastructure about 144.7 Ha (10%).

The result expected to provide an alternative approach to develop cities by focusing airport as the central hub of economic activities for the people. The output also can be used for related stakeholders in developing supported policies and regulations in term of regional development as well as airport design and master plan.

#### 5. Acknowledgements

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