

Kualanamu International Airport: Current Development toward Aerotropolis

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Abstract— Nowadays, an airport is no only a place for passengers to come and go, but it plays a significant role in developing and driving the local economy. Realize or not, there will be urban areas that offer connectivity at the airport (aerotropolis), and each airport has different aerotropolis potential. This study aims to analyze changes occurring around Kualanamu International Airport during the pre-construction and post-construction of the airport in 2007 and 2013. Six of the seven criteria of the establishment of aerotropolis show positive results, including air traffic, connectivity, sustainable development, economic income, government support, and Demographics. Significant growth was seen in the added value of the industry, the size of the industrial area, and the increase in GDP per capita. The added value of the industry has an average growth of 99.72% per year from the previous only 1.4% per year, the total area of the industry increased to 780 hectares from the previous only 200 hectares, and the GRDP also more than doubled. The only criterion that has not shown a positive potential is the status of ownership and management by the private sector because until now there has been no partnership in managing Kualanamu International Airport. To realize the development of the concept of aerotropolis in this region, the role of government and stakeholders is needed, both for policies related to aerotropolis development, public-private partnership discourse, the form of partnership, the concession period, and its contribution to the area around the airport.

Keywords— Kualanamu; aerotropolis; transportation; airport; public-private partnership.

I. INTRODUCTION

Nowadays, an airport is no longer just a transportation infrastructure that only serves the arrival and departure of air passengers, but has turned the function of being a stimulator of the development of surrounding areas, both physically and socio-economically. It is similar to highways that moved the economy in the 20th century, the railway in the 19th century, and the harbor in the 18th century [1]. Whether we realize it or not, a new city of aerotropolis will be created.

Aerotropolis is a city where layout, infrastructure, and economy are centered on airports (airports). Like the concept of a metropolitan city, the airport as the center of aerotropolis also has a suburb that is connected by infrastructure and mass transportation. The development of the airport area and its surroundings to be the center of business activities that will trigger other regions to grow, thus forming a business cluster. So, we can conclude that the basic concept of the original aerotropolis is the concept of integration between the airport and the surrounding city.

Aerotropolis was first introduced by Nicholas De Santis in 1939, and re-popularized by John D. Kasarda in 2000. In his

concept, Kasarda says that aerotropolis can evolve due to the challenge of the airport and the surrounding areas, which offer time efficiency in movement as it connects directly to the airport [2].

The concept of aerotropolis generally develops outside the airport location, but has close access to the airport. The existence of aerotropolis can have a positive impact on the development of cities and regions that have not been maximized in its development, mainly due to limited access to transportation. In addition, the growth of aerotropolis in some areas will help strengthen the industrial supply chain at the regional, national, and global levels. Stenvert and Penvold [3] argue that this metamorphosis has made the direction of airport development strategies shifted to stimulate investment, create jobs and business activities.

Some airports in the world have succeeded in developing the concept of aerotropolis, such as Schipol International Airport in Amsterdam, Incheon International Airport in South Korea, and Swarnabhumi International Airport in Thailand [4]. For example, the business area of Zuidas is currently expanding around Schipol International Airport. In this region, there are several Europe-based global companies,

including ABN Amro and ING Bank. There are also in this area residential areas, shopping centers, and entertainment centers. Every day, Schipol Airport can employ 52 thousand people. There are two major motorways and a modern railway linking the airport directly to central Amsterdam and other surrounding cities.

In principle, Yin [5] says that the existence of the airport and the surrounding area has a relationship of mutual influence. The area around the airport is growing due to its proximity and accessibility to the airport area, and the airport area itself is growing due to the city center. Wijk [6], Neufville and Odoni [7] state that each airport has its own uniqueness and excellence to develop, therefore regional airports can be developed into aerotropolis if it is in the right location and has appropriate infrastructure [8].

In Indonesia, there are 318 airports that spread evenly in 34 provinces. One of the airports with good regional potential is Kualanamu Airport, North Sumatra. The airport is in an area of 1,365 Ha and is connected directly to the city

center, port, special economic area and other strategic areas in North Sumatra. To develop it into aerotropolis, it should evaluate the criteria for aerotropolis formation, regional potential, and land-use change during pre-and post-airport construction.

II. MATERIALS AND METHODS

A. Aerotropolis Criteria

In this study, the author evaluated some previous studies related to aerotropolis. From twenty-five previous studies, the author found seven criteria for the formation of aerotropolis as shown in Table 1. These seven criteria would then be measured using eighteen indicators. The seven criteria include: aviation traffic, connectivity, economic revenues, sustainable development, government support, ownership and management, and demography.

TABLE I
CRITERIA OF THE AEROTROPOLIS

No	Criteria	Parameters	Indicators are used	Reference
1	Air traffic	There is an increasing number of people using air travel	1) Number of air passengers 2) Number of tourists	[9], [10], [11], [12]
2	Connectivity	There is a transportation accessibility from the airport to the surrounding area, and vice versa	1) The road network from/to the airport 2) Airport train	[4], [10], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21],
3	Sustainable development	There is a potential utilization of the region with integrated and sustainable land use	1) Manufacturing industry 2) Plantation industry 3) Logistics/cargo 4) Entertainment center 5) Ritel and commercial 6) Hospitality	[4], [5], [6], [8], [9], [11], [12], [13], [14], [15], [18], [22], [23], [24], [25],
4	Economic income	There is a statistically significant increase in the economy	Gross Regional Domestic Product	[4], [11], [15], [22]
5	Government support	There are plans for the development of airports and surrounding areas that are included in strategic plans, regulations and local policies	1) Strategic plans 2) Urban Spatial Planning 3) Local regulations and policies	[12], [14],
6	Management	There is a percentage of ownership and management of airports by the private sector	Public-private partnership schema	[12], [23], [24], [26],
7	Demographics	There is a statistically increasing population	1) Density 2) Labor	[5], [15], [20]

Air traffic is measured based on there is or not an increasing number of people using air travel. This criterion is used by Kelly and Baker [9]; Derudder, Devriendt, and Witlox [10]; Callanan [11]; and Krylova [12]. Connectivity is measured based on there is or not transportation accessibility from the airport to the surrounding area, and vice versa. This criterion is used by : Keast, Baker, and Brown [13]; Freestone [14]; Hovee and Yosick [15]; Derudder et al. [10]; Yin [5]; Carter and Danes [16]; Ashford,

Mumayiz, and Wright [17]; Peneda, Reis, and Macario [18]; Zhou [4]; Zapezauer [19]; Appold [20]; Siska [21]; and Krylova [12]. Economic income is measured based on there is or not a statistically significant increase in the economy. This criterion is used by: Graham [22]; Hovee and Yosick [15]; Zhou [4]; Callanan [11]. Sustainable development is measured based on there is or not a potential utilization of the region with integrated and sustainable land use. This criterion is used by : Wijk [6]; Kelly and Baker [9]; Keast et

al. [13]; Freestone [14]; Hovee and Yosick [15]; Graham [22]; Pongias [8]; Stevens, Baker, and Freestone [23]; Walker [24]; Yin [5]; Peneda et al. [18]; Zhou [4]; Callanan [11]; Krylova [12]; Banai [25]. Government support is measured based on there are or not plans for the development of airports and surrounding areas that are included in strategic plans, regulations and local policies. This criterion is used by: Freestone [14] and Krylova [12]. Management is measured based on there is or not a percentage of ownership and management of airports by the private sector. This criterion is used by: Stevens et al. [23]; Walker and Baker [24], Regmi [26]; Krylova [12]. Demographics is measured based on there is or not a statistically increasing population. This criterion is used by: Hovee and Yosick [15]; Yin [5]; Appold [20].

B. Time and Zone of Reviews

To simplify the analytical process, the timing of the review is divided into pre-construction and post-construction periods, as shown in Figure 1. The pre-construction period is set one year before the construction of the airport (2007), and the post-construction period is set in the year when the airport starts to operate (2013).



Fig.1 Time range of review

Kualanamu International Airport is an international airport serving the city of Medan, North Sumatra. The airport is located in Deli Serdang Regency, which has an area of 2,808.91 km² with the capital of Lubuk Pakam such in Figure 2.



Fig. 2 Deli Serdang regency and Medan city.

In Figure 2, Deli Serdang Regency surrounds Medan City, which is the capital of North Sumatra, and Kualanamu International Airport is 26 km east of the downtown of Medan City. This airport is the third largest airport in Indonesia, after Soekarno-Hatta Jakarta and Kertajati Bandung. Not only serving Medan city, but Kualanamu Airport is also a flight hub on the island of Sumatra, which serves domestic and foreign transits.

III. RESULTS AND DISCUSSION

A. Current Situation

The entire document should be in Times New Roman or Times font. Type 3 fonts must not be used. Other font types may be used if needed for special purposes. Recommended font sizes are shown in Table 1.

1) *Air traffic:* After the start of Kualanamu Airport, the increase can be seen statistically in the number of tourist and air passengers as shown in Figure 3. The number of air passengers increased 13% from 4,459,274 passengers (2007) to 5,038,754 passengers (2013); while the number of tourists increased 93.32% from 134,128 people to 259,299 tourists.

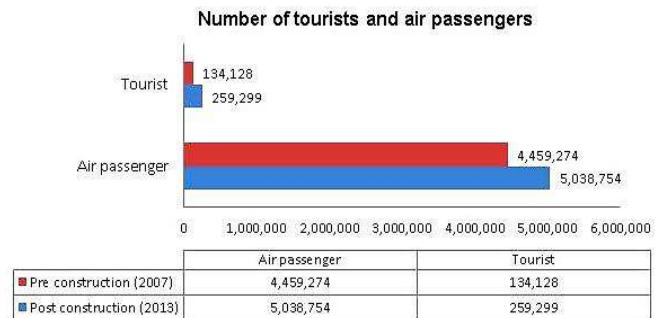


Fig. 3 Number of tourists and passengers

2) *Connectivity:* Kualanamu International Airport has direct access to the city center and surrounding areas, such as highways and airport train. This highway connects Kualanamu - Tanjung Morawa - Medan - Belawan, Kualanamu - Tanjung Morawa - Kota Binjai, and Kualanamu - Tebing Tinggi. The airport train connects directly from the airport terminal to downtown Medan, Belawan Port, Binjai and Tebing Tinggi, as shown in Figure 4.



Fig 4 Transportation accessibility from/to Kualanamu International Airport

The integrated transport network connectivity strongly supports passenger and cargo accessibility from/to Kualanamu Airport. The concept of integrated transportation has unwittingly stimulated the development of the airport around it.

3) *Sustainable Development*: Since the construction of Kualanamu International Airport (2007-2013), there has been a continuous development around the airport. Regional potentials such as Medan Industrial Estate (KIM), Special Economic Zones (KEK), logistics areas, mining areas, and non-aeronautical commercial areas continue to be developed.

Figure 5 shows the changes in land use prior to the construction of airports and after construction. The most significant sustainable development is seen in the industrial and commercial sectors of airports. This industrial estate in 2007 is only located in the center of Medan City with an area of 200 ha consists of 100 companies. During the construction of the airport, this industrial area continues to expand to Deli Serdang Regency with an area of 780 ha consisting of 358 companies. This area employs 50,618 workers (2013) from 47,989 workers (2007); and provides industrial value added of 7,315.54 billion rupiahs (2013) from the previous 1,340.80 billion rupiahs (2007).

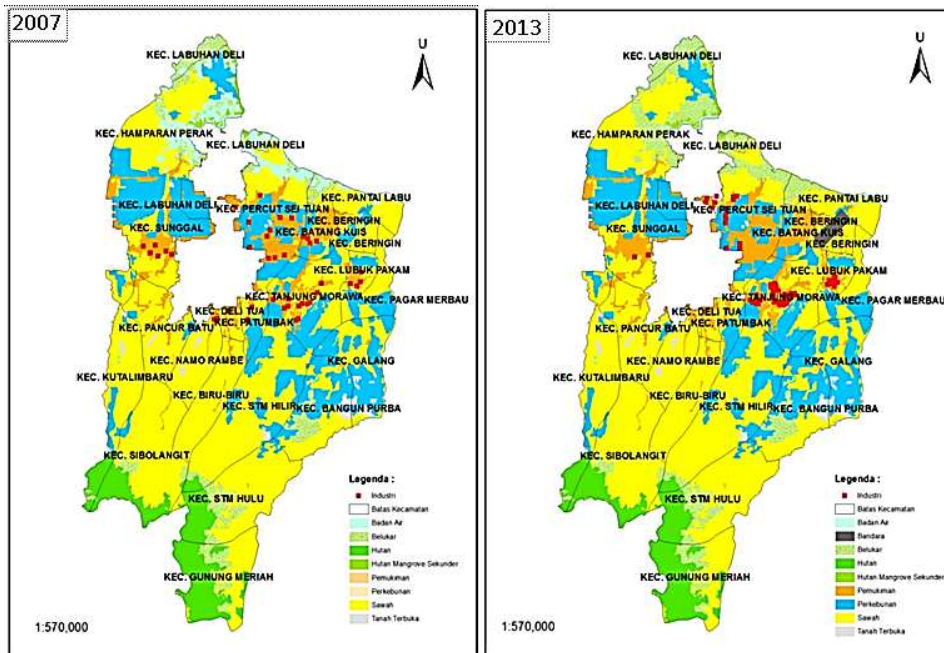


Fig. 5 Land use change of Deli Serdang Regency

Not only in the industry sector, retail and commercial non-aeronautics development in this airport area also shows major enhancements. There are several retail and commercials that grow around the airport, both inside and

outside of the airport area. Such retail and commercials include several hotels, cafes, markets, and entertainment centers as shown in Figure 6.



Fig. 6 Commercial area in the Kualanamu International Airport

Although less significant, other potentials show continuous development. Sei Mengkei for example, is a special region which is developed to support the plantation sector in Sumatera Utara, with an area of $\pm 2,000.00$ ha. This plantation region is believed to grow and thrive because of transportation connectivity, to the harbor, city center, industrial region, and to the airport. At this moment, KEK Sei Mengkei is one of the strategic projects in Sumatera Utara and is included in the corridor nodes of Sumatera economy. After the construction of Kualanamu Airport, the plantation industry area increased from 1,072,345.6 ha to 1,149,360 ha (7.18%) and production increased from 10,446,662.06 ton to 11,400,841 ton (9.13%). Administratively, this region is outside of Deli Serdang Regency. It is included in the administrative region of Simalungun Regency which is 40 km away from Kuala Tanjung harbor and ± 110 km away from Kualanamu International Airport.

Logistics (cargo unloading) currently are still centered in Belawan Harbor. This logistic region is continuously developed, including the development of Kuala Tanjung harbor as the center of national logistics in the future, which is included in the national maritime toll plan. There is a 7% increase from 7,841,872 ton (2007) to 8,387,357 ton (2013) of cargo. In addition to serving as a logistic region, Kuala Tanjung harbor is also developed as an aluminum mining site, that the whole production process of aluminum is done in a smelting factory with an area of 200 hectares (ha) located in Kuala Tanjung.

4) *Per capita income*: The development of several potential areas around the airport provides a contribution to the increase of revenue, both to the airport and the local government of Deli Serdang Regency. The value of Gross Regional Domestic Product grows 134.37%; becoming 61,061.85 billion rupiahs from the previous 26,053.71 billion rupiahs, as seen in Figure 7.

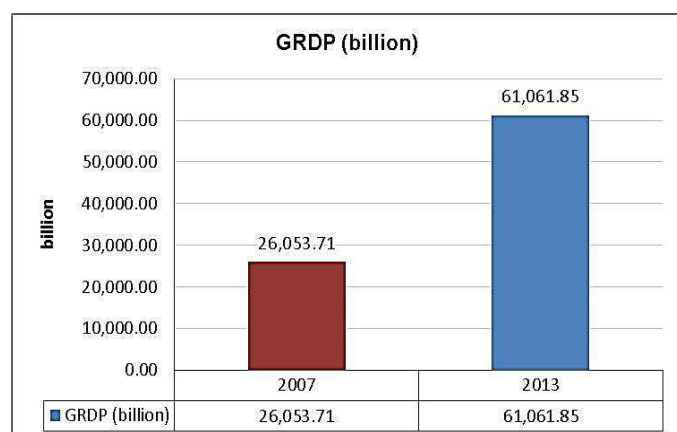


Fig. 7 Growth of GRDP

5) *Government support*: The development of Kualanamu Airport into an aerotropolis is inseparable from the support of local government. The government plays an active role in land acquisition in order to build toll roads and railways that connect the airport to/from Medan city and other strategic places, construction and development permits for the manufacture and plantation industry, as well as making

Kuala Tanjung harbor to support international logistics. Such local government supports are listed in the Regional Spatial Plan of Deli Serdang Regency, Strategic Plan of the Ministry of Public Works and Housing of 2015-2019, and Regional Spatial Plan of North Sumatera Province.

6) *Management and Ownership*: Walker & Baker (2010) state that privatization of airports has a massive impact in land use inside and around the airport area, and airports managed by private sectors has more flexibility than those managed by the public sector. In Indonesia, the management and ownership of the airport is carried out by State-Owned Enterprise, Military Forces, Airport Management Unit and local technical implementing unit/regional government. In Kualanamu airport, management and ownership is fully performed by State-Owned Enterprise, there is no management in the form of public-private partnership.

7) *Demographics*: High activity in airports also affects demographic changes around the airport areas, these include changes in population number, density, and labor. Deli Serdang has gone through the population and density growth by 11.86% and 11.5% respectively. Initially, Deli Serdang's population was only about 1,686,366 people with a density of 675 people/km². This number has increased to 1,886,388 people and 755 people/km² after the construction of Kualanamu Airport. Compared to Medan and other four regencies with high density in Sumatera Utara, Deli Serdang Regency ranks first. Meanwhile, the number of labors in Deli Serdang Regency increases by 12.31%; from 650,230 to 730,250 labors.

B. Potential in Each Criterion

The research results on each criterion can be seen in Table 2, where the average growth per annum during airport pre-construction and post-construction are reviewed for each criterion. From the seven criteria analyzed, six of it shows a positive potential. They are increasing in numbers of air traffic, integrated transportation system, sustainable development, increase in income per capita, support from local government and increase in demographic numbers. Another criterion that has not shown the positive result is management and ownership by the private sector. Until now, there is no partnership between public-private sector in management and ownership of Kualanamu Airport.

TABLE II
AVERAGE DEVELOPMENT PER ANNUM ON EACH CRITERION

No	Criteria	Results
1	Air traffic	After the construction of Kualanamu Airport, air passenger increases with the average number of 21.02% per annum from 6.30% per annum, and tourist numbers increase with growth number 3.37% per annum from 3.04% per annum.
2	Connectivity	There are interconnected toll roads and airport trains that connect Kualanamu airport to Medan, and other strategic areas around the airport.
3	Sustainable	There are sustainable developments in

	development	and around Kualanamu airport. Some of the centers of strategic developments include: Medan Industry Region (KIM), Special Economy Region (KEK) of Sei Mengkei, as well as logistics and mining area in Belawan and Kuala Tanjung harbor. The constructions of these areas were done gradually and are in the area of Regional Spatial Planning of Deli Serdang Regency. The most significant development takes place in the manufacture industry sector and non-aeronautics commercial. In the manufacturing industry, Industry-added value increases to 99.72% per annum from 2.86% per annum. Meanwhile, commercials in the airport can be seen in the emergence of retails, hotels, cafes, markets and entertainment center around the airport area.
4	Economic income	After the construction of the airport, PDRB per capita in Deli Serdang Regency increases to 16.72% per annum from 11.75% per annum.
5	Government, support, and regulations	The local government is very supportive of developments of several strategic areas around the airport; it can be seen in land acquisition, permits and stipulation of administrative border. Such local government supports are listed in the Regional Spatial Planning of Deli Serdang Regency, Strategic Plan of the Ministry of Public Works and Housing 2015-2019, and Regional Spatial Planning of North Sumatera Province.
6	Management and ownership	So far, there has not been any partnership between public-private sector in ownership and management in Kualanamu airport. Until now, management and ownership are still performed by the State-owned Enterprise.
7	Demographics	After the construction of the airport, the number of residents, density and labors in Deli Serdang Regency increase to 3.65%; 7.23% and 5.45% respectively per annum.

IV. CONCLUSIONS

Changing the local airport into an Aerotropolis is a big challenge. In Kualanamu, the results of the study show that there are several areas around it that have the potential to develop independently, such as: KIM, KEK Sei Mengkei, ports, and mining areas. there was a significant change in land use after the construction of the airport. Accessibility of public transportation to/from Kualanamu International Airport which is a key to aerotropolis, owned by Kualanamu. Of the seven aerotropolis development criteria, six of them showed positive changes. The six criteria are: increased air traffic, accessibility to/from the airport, sustainable development, increased per capita income, and increased non-aeronautical demographic and commercial values. The

most significant changes occur in the non-aeronautical retail sector, and the manufacturing industry has almost doubled per year. Industrial value added increased by 99.72% per year. The only aerotropolis criteria that have not shown positive results at Kualanamu airport are management and ownership by the private sector, because until now there has been no partnership in managing Kualanamu International Airport. This is a big task for the government and related stakeholders.

The development of a local airport into an aerotropolis demands a development strategy as early as possible. As a regulator, governments must be prepared with regulations that support the development of potential areas and these integration with airports. The government must be open to the discourse of public-private cooperation. Kualanamu International Airport, which is currently under the management of PT Angkasa Pura II, must be prepared with the concept of partnership both in administration, management, and its contribution to the region.

There are several forms of partnerships in collaborative projects, of course each has a different concession period and classification. The Sumatera Utara regional government together with PT Angkasa Pura II along with relevant stakeholders must be prepared for this cooperation discourse. So that in time, the development of Kulanamu International Airport toward Aerotropolis will grow well.

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