The Implementation of Aerotropolis Concept on New Town Planning and Design in Mebidangro, Sumatera Utara

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Abstract. Mebidangro is a metropolitan area in Sumatera Utara Province that consists of some regencies and cities of Medan, Binjai, Deli Serdang, and Karo. The region becomes one of the national strategic developments that have been assigned by The President. In the planning, a part of the spatial arrangement refers to the role of Kualanamu International airport as the international transportation hub. Meanwhile, PT Angkasapura proposes the aerotropolis, a new town concept that based on the strategic function of the airport. The model is derived from John Kasada’s idea about the airport influence in generating and accelerating economic activity in a “city airport.” The study aims to explore ideas on planning and design a new town in Mebidangro that applies some aerotropolis theories, including spatial structure, land use and urban design guidelines. The result of the study indicates that aerotropolis can fit the vision of Mebidangro development in improving economic activity as well as community quality of life. However, the implementation should deal with some problems of land ownership and the community readiness. The research can contribute to enrich the way to implement any “import” town planning and design theory that corresponds to local environment condition.

1. Background and issues
Since 2013 Kualanamu International Airport-KNIA has been operating. In line with the growth of passenger flight either cargo, PT Angkasapura enrolls the aerotropolis concept that adopted from John Kasarda’s idea [1]. This concept is city planning which is integrated by the airport as the center of development of goods and services. With this function, airport no longer operated as transportation terminal, but also develops into the area with typical services centers intensive urban society. Many kinds of community activities and facilities, such as residential, commercial, offices, business center, and recreation, planned based on simply access from the city to the airport and otherwise. This concept is a proved work and has been applied to the other international airport, like in South Korea, Hongkong, Dubai, and Netherlands [2].

The success of an Aerotropolis City depends on proper planning. It makes this concept can be successfully implemented in several International Airport Cities. However, this achievement is not necessarily in the same way to be applied in Indonesia. One of the city planning problems in Indonesia is how hard to execute a plan into physical appearance of cities. This issue concerns to the difference of spatial structure, society social culture, and especially, the problem of land ownership. These things become the nature of city planning in Indonesia, including Mebidangro metropolitan area.

Medan Binjai Deli Serdang Karo (Mebidangro) urban area has been established through Presidential Decree number 62/2011 [3]. Mebidangro Metropolitan planning is assigned as a new city development center. One of them is Percut Sei Tuan area, which is located on a “gold triangle” area.
Belawan-Kualanamu-Medan. This city will become the city that functionates as goods and services center area, high technology industry, and international residential scale [4]. This research means to analyze the implementation of the aerotropolis concept on a new town in Percut Sei Tuan. Since the planning should fit local people needs [5], the result of this research is expected to give a contribution to apply aerotropolis concept that responsive to potential and city problem in North Sumatra, particularly Mebidangro.

2. Literature review

2.1 New Town Concept

History of the new town in the world begin in 19 century in England when ‘old town’ have become more dense and problematic – slum, traffic density, environmental pollution. A new city was then built around London, on purpose to accommodate new activities which hard to accommodate in the city center. The success of new city development in London inspired the other new born town in Europe, America, and Asia including Indonesia. The new town is proved worked well, for example Milton Keynes in UK and Pu Dong in China [6].

In Indonesia, the raise of new town was started from Jakarta. The living condition in Jakarta becomes more discomfort because of many complicated problems, such as traffic jam, flood, crowding, and inadequate public transport. Meanwhile, the increasing of middle up income people, as the result of economical growth in 1990s, needs a more livable environment to live, work and leisure. The condition becomes an opportunity for private developers to ‘taking-over’ government’s task in providing housing with high quality facilities [7]. The development of new town in becomes an effort to increase citizen’s quality of life. In line with the planning of Mebidangro, the development of new town in Percut Sei Tuan can be a prospect to accelerate the quality of local improvement.

2.2 Mebidangro

Mebidangro covers the region of Medan and its surroundings. They are Medan, Binjai, Deli Serdang, and Karo [4]. The planning is based on several issues as follows:

- Mebidangro have a strategic position located on International Shipping Conference line, as one of the centers of growth sub-regional cooperation (IMT-GT) in trading, investment, and tourism, also as the production spot in North Sumatra to export to regional and international area and as the gate of Sumatra development, and its surround provinces (NAD & West Sumatra)

- Mebidangro area as one of mainstay which push the region surround, to develop industry-leading sector, plantation, food crops, tourism, and fishery; as the gate of national and international; as the hub of state transportation; as the hub of distribution and collector for goods and services; and government goods and services center; with the support of regional transportation that increases strategic value Mebidangro Metropolitan Area; which is road network expansion ‘Lintas Timur Highway’; expansion railway network; development of Belawan International Port and Kuala Namu International Airport.

- Most of the investment is still centralized in Medan. It makes a gap between the development of Medan as the center city with its satellites towns and underdevelopment satellites cities.

- The land use that has not been integrated with the transportation system and inefficient transportation system in Mebidangro region. This thing can be seen from the shape of Mebidangro structure which lengthwise to East – West and North – South like a ribbon, transportation network which connected Binjai – Lubuk Pakam only served by one line network and railways must pass Medan city, and also the traffic burden Medan network roads even though most of them reserved for traffic local flow.

- Mebidangro Metropolitan spatial planning is not solid and not yet integrated into districts/city. This thing can be seen on the transportation network (roads network and railway) in Medan
which undeveloped and society distribution pattern that not equally, which more than 50% population is concentrated in Medan

- City infrastructure condition which supports economic and urban mechanism simplicity and bureaucracy invest which affect the investor’s comfortable to invest in Mebidangro.
- Mebidangro area has land reserves which pretty significant for activity development Mebidangro Metropolitan, especially in Deli Serdang district, also has the area with the high soil bearing capacity and availability of nice soil water, also huge water surface potency in supporting Mebidangro activity.

In Development of Mebidangro spatial pattern, Kuala Namu International Airport has a significant role as the transportation network which becomes the trigger of development planned areas. Next on spatial pattern plan can be seen that the strategic transportation connection, Kuala Namu International Airport, and Belawan Port, connected by neither highway nor railway. Sumatra Trans highway will be built and develops the primary arterial road along West-East and North-South. Thereby, the secondary arterial road which connects the planned activity centers (Figure 1).

![Figure 1. Spatial structure (left) and Spatial pattern (right) of Mebidangro](source: Kementrian Pekerjaan Umum Republik Indonesia, 2010)

As the purpose of Mebidangro plan is to balance the development of Medan and the activity centers outside the city, the plan plots some new activity centers (Figure 2), as follows:

- Primary activity center, consist of industry activity center, goods, and services activity center, culture activity center, transportation activity center
- Secondary activity center, include: Medan city center, Medan Belawan, Medan Marelan, Medan Perjuangan, Medan Area, Medan Helvetia, Medan Selayang, Medan Timur, Sunggal, Pancur Batu, Deli Tua, Tanjung Morawa, Pagar Merbabu, Batang Kuis, Percut Sei Tuan Tembung, Lubuk Pakam, Binjai
- Countryside service center, consist of Namorambe, Sibolangit, Bangun Purba, Gunung Meriah
2.3 Aerotropolis

Aerotropolis is a new form of town which is based on airport and infrastructure which is integrated. The purpose of this integration is to reach a connection which is high quality, can save the time needed between factory and supplier, customer and buyer, and so on. This concept includes the commercial airport center and business corridors, multi-function regions which support each other. In another word, this kind of concept has got infrastructure, land use and economic factors which are centered on an airport [1].

The boundary of an aerotropolis is not determined on the administrative border, but by the connectivity of the business activities which are connected to an airport’s functions. There is no particular term on this connectivity standard, but in some studies, Aerotropolis Plan uses the radius of 20-30 minutes. In order to analyze this aerotropolis concept, three aspects are used, such as functional form, spatial form, and connection or linkage.

Spatial form of aerotropolis consists of physical development and the surrounding of an airport along the connecting corridor which can be observed (Figure 3). The distance could reach up to 20 miles from the biggest airport hub, with a typical aerotropolis corridor which connects it with the city center. This connection and linkage are supported by internal and external infrastructure which integrated the spatial and functional form which created a land use and operational efficiency. The highway, main access of railway, the high road which connects the airport, and the regions outside, creates the main way of aerotropolis’ mobility and connectivity with its business profits.
Figure 3. The Kasarda’s Aerotropolis Concept Plan

With the needs of this time efficiency, an Aerotropolis Region acts as an “urban pipe.” The impact of this urban pipe is the achievement of domestic and international flight acceleration. An aerotropolis city consists of one set of a commercial and logistic facility which supports flight related business, including cargo and logistic businessman, distribution facility, hotel, hospital, meeting hall, offices which are integrated with a shopping mall, restaurant, and recreation. Therefore, the goal of aerotropolis region planning is to achieve economic efficiency, an active city, and the sustainability of an environment [2]. One of the strategies is to apply clusters which are connected to open green space. A wider cluster boundary shows suburban region which is not too crowded. Some critics of aerotropolis concept are linked to the issues of architectural identity, public activities in a settlement environment, walkability and the life of a crowded city. In this case, an architect is expected to create an aerotropolis city which applies the physical and social function, implemented the concept of new urbanism and smart growth as a concept which supports aerotropolis.

3. Methodology

3.1 Scope of study
This study is a descriptive, explorative study, which is to explore the design concepts of aerotropolis and to apply them in the design of Percut Sei Tuan New Town. This concept application is based on the problems and the potential of the existing condition, as a part of the Metropolitan Mebidangro activity.

3.2 Data collecting
The secondary data is originated from Dokumen Perencanaan Mebidangro and Rencana Umum Tata Ruang Wilayah Kabupaten Deli Serdang. After that, the collecting of the primary data on existing location is conducted, involving land use, topography, support of land and socio-cultural population.

3.3 Data analysis
The study analyzes data by the descriptive, explorative approach to creating design ideas in relation with aerotropolis theory.
4. Design Exercise

4.1. Study Area
The study area is located in sub-region of Percut Sei Tuan. In the planning of Mebidangro, this region will be developed as a new town. Development of the New Town of Percut Sei Tuan refers to the Development Planning of 6 economy corridors of the Master Plan Percepatan dan Perluasan Pengembangan Ekonomi Indonesia (MP3EI).

4.2. The strength and potency
The main potency of this area is its good carrying capacity, such as the availability of fresh water, food resources, and a large land area. Most of the land is owned by PTPN 2 so that it is easier to be used, compared to but individual’s land. Furthermore, the region is located in between two ‘primary magnet’: Kualanamu International Airport (KNIA) in the East side and Medan City and Belawan Port in the West. Referring to the concept of ‘urban pipe’ in Kasada’s aerotropolis [3], the pipe from KNIA to Medan should pass through Percut Sei Tuan. The urban pipe will generate the acceleration of the surroundings area development, so Percut Sei Tuan can becomes a new advanced urban zone in Mebidangro.

4.3. Problems
The main problems of the planning is the consolidation of plantation land that disperse in several areas. Besides, the infrastructure network is inadequate to support a new town. However, it can be an opportunity to new investment because of the good prospect of this development by improving infrastructure and diversification of town functions and activities.

4.4. Basic concept
Percut Sei Tuan New Town implements the basic concept as follow:
- Compact Aerotropolis: expressing a compact new town that has integration with the airport. The concept is supported by the sustainable environment city and based on digital information management.
- The World in our hand: a symbol of
  - 5 continents: the places that can be reached by the world class international airport
  - 5 center points: the main functions in the new town
  - 5 fingers: symbolizing Percut Sei Tuan New Town, a local settlement that can hold international community (Figure 4)
4.5. The implementation of Aerotropolis

4.5.1. Spatial concept
The spatial form of aerotropolis consists of physical development around the airport that connected by a corridor. Along the connector, the corridor can be observed with up to 20 miles from the airport hub. The corridor connects the airport to the city center [2]. Initially, the only city center in the Mebidangro Metropolitan Area is Medan. By the presence of Percut Sei Tuan New Town, it can be one more city center: in this new town. There is a main arterial road that connects Kuala Namu and Belawan, as an initial plan of Mebidangro. The corridor connects to the City Center of Percut Sei Tuan New Town by two roads. The first connector is laid along West to East of the town. The second road connects the corridor to the city from North to South. The activity center of the town is placed on this ‘main bone’ and configures clustered spatial organization (Figure 5)

4.5.2. Functional concept
An aerotropolis city consists of a set of the logistic and commercial facility that supports the airport – relation business. This business includes cargo, logistics, distribution facility, hotel, hospital, convention hall, and office that has integration with shopping area, dining, and
recreational facility. Thus, the main goal of aerotropolis model is to attain economic efficiency, a livable city and environment sustainability [3]. Referring to the figure 6, the functional arrangement of Percut New Town implements the concept by introducing various land use, as follow:

4.5.3. Housing
In this city, there are several types of housing with different development intensity, such as high-rise apartment, condominium and 'high-end' single housing in Central Business District (CBD) area, middle rise flat in transit point zone. All the arrangement refers to the easiness to access to the other activity centers, both inside and outside the town. The low-cost housing takes place around train station as the movement node. This node connects to train networking of North Sumatra Province, include to the airport. The transit node is also located in CBD so that the apartment and condominium residents can connect to the airport easily.

4.5.4. Central Business District (CBD)
The CBD is the center of many business functions, such as financial development, research center, and global office complex. The CBD is built in the highest intensity development and takes place in the city center. Typical with the residential facility, this business area connects to the airport by arterial road and train station.

4.5.5. Commercial area
The business district in this city relates to the regional level of service of Mebidangro Metropolitan Area as well as local coverage. This area has easy access to and from the airport. The transportation mode can be train or bus and taxi through the Trans Sumatra Highway.

4.5.6. Industrial district
The development of industrial zone takes place along Trans Sumatra Highway as the main hub to and from Kualanamu airport and Belawan port.

![Figure 6. Land use map of Percut New Town](image)
4.5.7. Linkage concept
The connection and linkage of an aerotropolis city is supported by internal and external infrastructure. The networking makes an integration of spatial and functional form. The highway and train line connect the airport to the outside part. This linkage creates a mobility and connectivity main bone between aerotropolis and its business pockets. Percut New Town implements the connection by a movement network that connects to the airport as a structural hierarchy road. In the city, Kualanamu Airport becomes the ‘estuary’ of the arterial roads that lay through the city. Every part of the city can access the airport easily, vice versa (Figure 7).

![Figure 7. The linkage concept](image)

5. Conclusion
The study shows that the idea of aerotropolis is suitable with the main idea of Mebidangro Metropolitan development. There is a bigger opportunity to apply this model to the new town design since the current land is not community settlement. The wider implementation can be executed to the entire Mebidangro, particularly in several main corridors that have connected straightly to the Kualanamu Airport. However, the land ownership of local residence needs an intensive socio-cultural approach. This research is a concept exercising to examine the aerotropolis model. The next study can take place to the other part of Mebidangro area, especially in the area of denser buildings community. Thus, the whole picture of implementation opportunity to apply this theory becomes more comprehensive and clearer.

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