Infrastructure Performance Indicators for Sea and Air Transportation Sectors in Indonesia

A. Ayomi Dita Rarasati

Civil Engineering Department, Faculty of Engineering, Universitas Indonesia, Kampus UI Depok, Indonesia 16424
Center for Sustainable Infrastructure Development, Faculty Of Engineering, Universitas Indonesia
e-mail: ayomi@eng.ui.ac.id

Yusuf Latief

Civil Engineering Department, Faculty of Engineering, Universitas Indonesia, Kampus UI Depok, Indonesia 16424
Center for Sustainable Infrastructure Development, Faculty Of Engineering, Universitas Indonesia

Isti Surjandari Prajitno

Industrial Engineering Department, Faculty of Engineering, Universitas Indonesia, Kampus UI Depok 16424
Center for Sustainable Infrastructure Development, Faculty Of Engineering, Universitas Indonesia

Jade Sjafrecia Petrociany

Civil Engineering Department, Universitas Pancasila, Srengseng Sawah, Indonesia 12640
Center for Sustainable Infrastructure Development, Faculty Of Engineering, Universitas Indonesia

Perdana Miraj

Center for Sustainable Infrastructure Development, Faculty Of Engineering, Universitas Indonesia

ABSTRACT: This research is conducted to assess infrastructure performance in Indonesian sea and air transportation sector. The performances are assessed based on indicators which are identified within the initiation of this research. There are seven indicators identified which are the number of infrastructure existed; passengers demand per year; cargo demand per year; local government revenue; passenger growth per year; cargo growth per year; and the city population. The aim of this paper is to present the most significant indicators which are affecting the infrastructure performance. Based on a descriptive analysis, it can be showed that these indicators affect Indonesian sea and air transportation performance. Three perspectives from central government, local government and academics were further elaborated in this paper. From the government point of view, the most important indicator of sea and air transportation performance are the numbers of ports or airports and passenger growth per year.

Keywords: *air transportation, infrastructure indicator, sea transportation.*

1. GENERAL INSTRUCTIONS

There are indicators to measure the performance in transportation sector. The number of ports, maritime navigation system, international and domestic facility, the number of passenger freight are the main components in sea transportation infrastructure. While in air transportation, the number of airport, air traffic management system, and international and domestic facility for passenger and cargo are considered as the main components (Schiff, 2013).

In America, transportation performance index had been developed to quantify how well transportation systems are meeting this nation's demands (US Chamber of Commerce, 2010). Supply, quality of service, and utilization are three categories considered within the index. Indicators stated for sea transportations are density (availability of waterways), port access (proximity of ports), and congestion (inland waterway delays) which are measured by miles of waterways per 10,000 population, distance from the metropolitan statistical area to the closest international container port and average lock delay per tow respectively. Whilst indicators stated for air transportations are access (proximity of airports), capacity (availability of airport service), congestion (airport congestion), safety (chances of crashes) and reserve capacities which are also measured by percent population within 50 miles of major airports, airport arrival and departure rate per hour, percent of on-time departures, runway incursions per million operations and percent of capacity used from 7am to 9pm respectively.

In Indonesia, the assessor of Local Government Performance Assessment in Public Works has conducted a rating cities on road infrastructure. The Government of Indonesia also have assessed and awards in several cities in the context of urban transport and traffic management, which is named by Wahana Tata Nugraha (Indonesian Minister of Transportation Regulation, 2010). However, assessment on sea and air transportation has never been conducted. It is therefore, this research is conducted to assess indicators which can influence sea and air transportation performance in Indonesia. This research scope is limited to the sea and air transportation located in and around the capital cities of Indonesian provinces.

This paper aims to explore indicators which affect sea and air transportation performance which will be used to validate capital cities which have been assessed in the preceding research based on these indicators. The preceding research results are indicating that the highest indicator at sea transportation infrastructure is the flow of goods in major ports (Latief, 2016). This condition might occurs because the port prioritize transport of goods rather than passengers because marine infrastructure can transport volume of goods in large quantities, more efficient and more profitable. Furthermore, the Minister of Transportation regulation also prioritize the flow of goods more than passengers (Indonesian Minister of Transportation Decree, 2002) so that it is making the transportation of goods has the characteristics of a clearer pattern comparison to the movement of passengers.

On the indicator of air transport infrastructure, the highest weighting is the flow of passengers at the airport collector (hub). Setting the number of passengers at the airport is set on the Minister of Transportation regulation (Indonesian Minister of Transortation Regulation, 2013) about the Order of National Airport, but the regulation lack of airport

regulations in governing the flow of cargo. The flow of passengers takes precedence in air transportation over the transport of goods because it is financially more profitable and have an impact on economic growth for a city (Latief, 2016). In contrast to marine infrastructure, the infrastructure cannot carry the volume of air cargo or goods in large quantities only small volumes of carriage, the carriage on a passenger precedence because it is more efficient in terms of time and financial. The number of passengers at the airport gatherer (hub) as the most important criterion because the airport hub is considered as the busiest airport.

2. RESEARCH METHODS

The data used in this research is primary data which are collected through a closed ended questionnaire survey. The questionnaire was distributed to the transportation stakeholders such as people in the central government or ministry, local government, state own enterprises, academics and transportation association. There were 53 questionnaire returned and analyzed in this research. A descriptive analysis was conducted to explore indicators which affect sea and air transportation performance. A descriptive statistics can be used to analyse transportation indicators as exploratory and graphical methods (Black,2002). Results will be presented in statistic distribution and charts to compare each indicator.

3. RESULTS AND DISCUSSION

The paper aims to provide suggestions given by practitioners and academicians to sea and air transports growth and issues. A survey has been conducted to provide the data, followed by the respondents with experience in transportation sector. The respondent numbers are 53 and had various and wide background due to their institution, time of experience and educational background. Figure 1 shows the profile charts of the respondents.

As shown in Figure 1, the respondents are mainly from the central government or ministry, which has important contributions to the national regulation in transportation. The next contributors come from the local government, followed by University and last by the companies' respondents. The institutional background which is mainly dominated by central and local governments provide the perspective of sea and air transportation problems from the regulator's side. The regulators perspectives will then be compared to those come from the university and company respondents. The university respondents represent the academicals opinions of the problems and the company respondents provide the problems from the users perspectives.
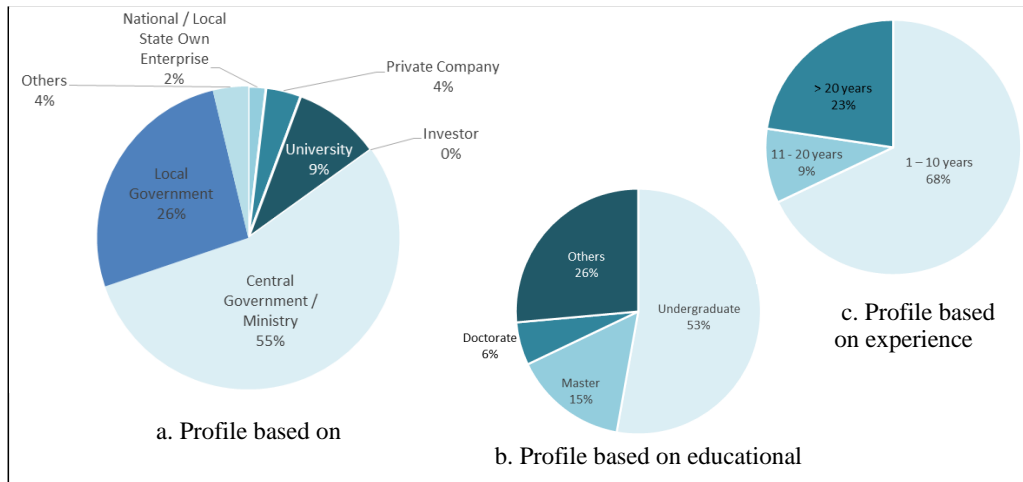
Figure 1. The profile of respondents' based on institutions, educational background and experience.

There are several indicators of air and sea transportation's performance: the numbers of ports/airports, passenger demand/year, cargo demand/year, local government revenue, passenger growth/year, cargo growth/year, city population (Indonesian Ministry of National Development Planning, 2012, Shen, 2011, Jeon,2005) and others as shown in Figure 2. The respondents were asked to shows which factor are dominant influencing the sea and air transportation's performance and the results are plotted in radar diagram.

For the sea transportation, the numbers of ports are the most affecting performance indicator, while the air transportations suggest the same but not so high as the sea transport. Passenger demand/year influence moderate contribution to air transportation performance, however just few respondents were agree the influence of passenger demand to sea transportation performance. The cargo demand/year factor shows the reversing results from passenger/year; the sea transportation reach moderate responses while the factor has low affection on air transportation. The local government revenue raise a moderate influence for both air and sea transportation, while the passengers growth/year relatively gave high impact to the sea and air transportation's performance. The reverse results occur in cargo growth/year which are low affection on both transportation performance, and the city population moderately affect air transportation but low contribution to the sea transportation.

Figure 2. The overall respondent's responses

As the respondents mainly comes from the regulator's side, it is important to notice that the main indicators represent the regulator's perspectives of the most influencing performance indicator related to national or regional development. The number of ports/airports and the passengers' growth directly described the rate of increasing activities in the region of interest, and could be seen as dynamic interdependent development of several regions. For the sea transportation the most influenced indicator is the numbers of ports while the air transportation is the growth of passenger/year. The survey also shows other indicators such as passenger demand/year, cargo demand/year, local government revenue, cargo growth/year and city population has various influence to the transportation performance. This point of view, dominated by the regulators, suggest the most important component in regional and national transportation development. Since Indonesian archipelago has wide area and separated by sea, the air and sea transportations becomes the most important aspect to connect the national economic centers and drive the national economic activities based on regional economic activity. The survey shows low to moderate affection of cargo demand and cargo growth indicator, means that air and sea transportation still dominated by people activity. The transportation performance dominated by people activity indicates the growth of creative economy based on the increase of mobile population. The goods distribution via air or sea still the secondary needs of transportations provided by regulators. Moreover, some indicators, such as local government revenue and city population, contribute low to moderate affection in transportation performance. The revenue will influence some of the economical dynamics in the region, and directly or indirectly drives the transportation performance. As the population increase, the growth of population will obtains the supply and demand process due to the life needs and raise the growth of passenger and cargo demand. The local government revenue as the economic incentive in the local regions catalyze the economic activities and directly or indirectly drive the influences to leverage the transportation performance.
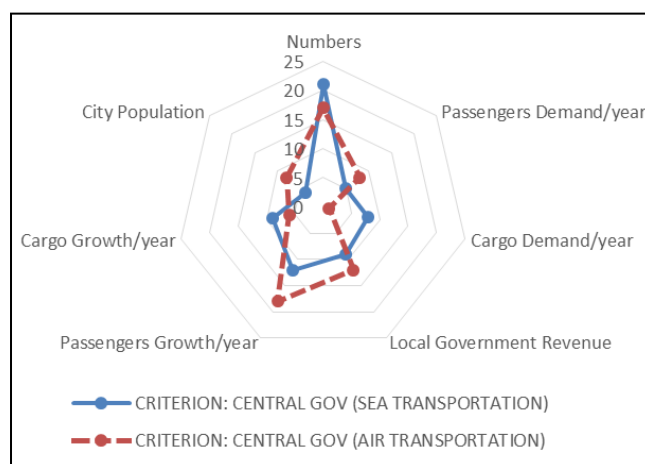

Figure 3. The central government perspective responses

Figure 3 shows indicators from the central government point of view. The main indicators by central government respondents are the number of ports/airports followed by the passenger growth/year for sea and air transportation. From this point of view, the central government main concern is the rate of passenger increase, and the ports/airports are built to anticipate the passenger growth. The cargo demand and cargo growth indicator for the

sea transportation is relatively high compared to those on air transportation, suggest the sea transportation as main factor for goods distribution. The local government revenue has moderate affect to the both transportation performances, shows that in the central government point of view the local government has important roles to develop the performance of transportation in their area of responsibility. Meanwhile the numbers of citizens get the lowest aspect from central government view, suggest the performance of transportation is relatively not affected by the numbers of population, but mostly influenced by the growth of passenger or people who need to use the transportations. The number of ports/airports as the main indicators show from the government points of view, when the infrastructure is fairly built, it will drives the economic activities of the regions, raising the number of passenger and directly affect to the performance of transportation.

Figure 4 shows the local government point of view. From this point of view, the main indicators of sea transportation performance are the number of ports and the growth of passenger/year. Cargo demand/year yield a moderate influence on the performance.
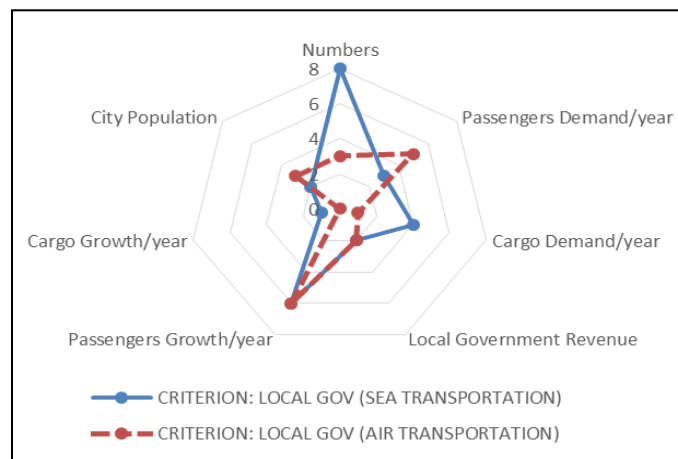

Figure 4. The local government perspective responses

The air transportation has the passenger growth/year as the main indicator, while the passenger demand/year reach the second most influenced indicator. This point of view describes the main concern of the local government: the sea transport as the main transportation for people and goods, while the air transportation mostly used for people transportation. The numbers of airport in this perspective does not seems important, however the number of ports is treated as the main indicator for sea transportation. In fact, the number of airport on many islands of the Indonesian archipelago, is not sufficient to the "ideal" criteria. The local government sees the lack of airports is not the biggest indicator to the air transportation performance, but mostly influenced by passenger growth. This argument could be justified by the city population factor, where the indicator shows moderate influence for the air transportation. Finally, the local government sees the revenue as minor indicator. If the perspective of both central and local government are put together, the combined frame shows two different perspective of both sides. The central government sees the revenue from local government is moderately important, but the local government see the revenue as low influencing factor. The central government also suggest that the main indicator of performances are the numbers of infrastructure for both transportation modes, while the local government see the main factor is the numbers for the sea transportation and the passenger growth/year for air transportation. The two perspective suggests that local government see the sea transportation as the main

transportation for people and goods mobility. The two perspectives could be compared to final perspective provided by academic respondents as shows in Figure 5.

Figure 5 shows the academic responses. Passenger growth/year for air transportation in this perspective lead as the main indicator followed by cargo growth/year and local government revenue. For the sea transportation the passenger growth/year share as the main indicator along with the passenger demand/year and the number of ports. The academic point of view emphasize the air transportation as the main transportation mode for peoples and goods mobility. This perspective also suggest the main purpose of sea transportation as the people transportation. From the results described above, the development of air transportation performance are moderately affected by local government revenue, shows the role of local government to leverage the performance of air transportation.
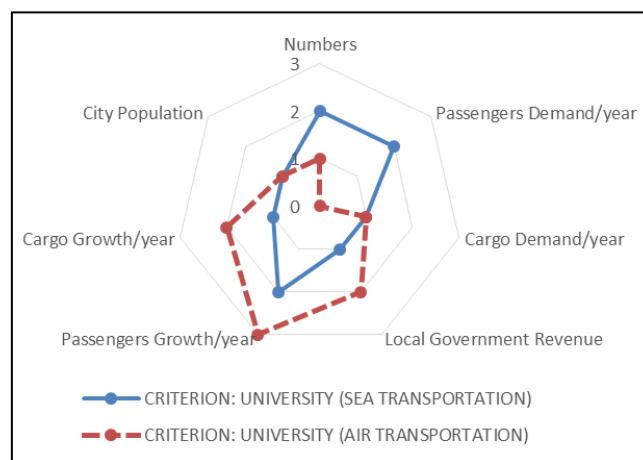

Figure 5. The academic perspective responses

The results also shows that the development of sea transportation performance mainly affected by numbers of port as the passenger growth and passenger demand raise. This point of view emphasize the significance of air transportation rather than sea transportation to transport peoples and goods, and emphasize the importance of local government revenue to raise the air transportation performance. Compared to those on central and local government, the point of view suggest passenger growth as the major aspect to the performance, but emphasize the air transportation with local government role as the main inter-island transportation.

4. CONCLUSION

From the whole point of view dominated by the regulators, the most important indicator of sea and air transportation performance are passenger growth and numbers of ports/airports. The central and local governments suggest the number of ports/airports as the main indicator. These two perspectives are also could be compared by the looks to importance of local government role: the central government suggests the importance of local government revenue to develop the performance, but the local government mostly sees the revenue has low contribution. The academic point of view suggest the importance of air transportation, while the local government see the most important mode is sea

transportation. The perspective's difference should be continue to investigate to get the complete picture of the sea and air transportations.

ACKNOWLEDGEMENT

REFERENCES

Schiff, A., Small, J., & Ensor, M., "Infrastructure performance indicator framework development", New Zealand: covec and Beca, Mar, 2013, Retrieved from http://www.infrastructure.govt.nz/plan/2011implementation/ipifd-mar13.pdf

US Chamber of Commerce, "Transportation performance index", Sep, 2010

Indonesian Minister of Transportation Regulation No. 5, "The Guideline awards of Wahana Tata Nugraha", 2010

Latief, Y., Berawi, M. A., Rarasati, A. D., Supriadi, L. S., Berawi, A. R. B., & Hayuningtiyas, I. S., "Mapping priorities for the development of the transportation infrastructure in the provincial capitals of Indonesia", International Journal of Technology, Vol. 7, No. 4, pp. 544-552, 2016

Indonesian Minister of Transportation Decree No. 53, "The order of national port", 2002

Indonesian Minister of Transortation Regulation No. 69, The order of national airport , 2013

Black, J., Paez, A., & Suthanaya, P., "Sustainable urban transportation: Performance indicators and some analytical approaches", Journal of Urban Planning and Development, Vol. 128, No. 4, pp. 184-209, Dec, 2002

Indonesian Ministry of National Development Planning, "The study of evaluation development in Indonesian transportation sector", 2012

Shen, L., Wu, Y., & Zhang, X., "Key assessment indicators for the sustainability infrastructure projects", Journal of Construction Engineering and Management, Vol. 137, No. 6, pp. 441-451, Jun, 2011

Jeon, C. M., & Amekudzi, A., "Addressing sustainability in transportation systems: definitions, indicators, and metrics", Journal of Infrastructure Systems, Vol. 11, No. 1, pp. 31-50, Mar, 2005