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ANALYSIS OF THE PROVISION OF RIVER DOCKS ON THE MUSI RIVER BASED ON PASSENGERS AND GOODS TRIP GENERATION

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Abstract: Musi River is a leading tourist destination in the city of Palembang and has a huge potential to be developed. It has 33 attracting places that can be accessed by boat. The purpose of this research is to know the level of requirement of river stop at Musi River Palembang City from supply and demand side so that can be identified what things need to be improved of its service to boast the existence of the river stop as a part of transportation system in Palembang city especially in tourism field. This study uses a method of generating motion, i.e. modeling stages that estimate the number of movements coming from a zone and the amount of movement that is attracted to a zone. This research needs a study about performance of river transportation in city. It requires a plan as an effort to increase the activity of river transportation as an alternative transportation to reduce road network load. In addition, it is necessary to plan the integration of inter-modal (river and land transportation), so that there will be ease of connection for river transportation users who will continue their journey using land transportation and vice versa and as well as efforts to increase the attractiveness of river transportation by combining the concept of waterfront city.

Keywords: Trip Generation, River Transportation, River Docks.

Introduction

Transportation plays an important role in the development of a country. Basically, the function of the transport system and its facilities is to connect one place to another apart with the various mechanisms contained therein, as land transportation also plays an important role in the development of a city (Kadarisman, 2016, Najoan, 2016). Prasadja (2017) discussed the growing use of transportation in tourism activities in Indonesia. Balen (2014) developed a scenario planning method to assess the potential economic impacts of river tourism on a port region. Kadarisman (2016) conducted a descriptive-qualitative study to analyze the development policy of sea freight transport. In general, river transportation in Indonesia is used to serve the mobility of goods and passengers, loading and unloading cargo (Brata, 2016).

River transportation not only plays an important role in the rural, but also in the developed areas. The river transport used initially in the form of a bamboo raft or large wooden rod formed by making a hole in the middle. Along with the development of the age of human thought slowly progressed to create various types of boats ranging from bamboo raft, boat mortar, canoe, to a boat that uses engine power. The river has a big role in the development activities, especially for rural areas and areas surrounded by rivers such as South Sumatra. River if utilized properly and optimally can help to overcome inequality among region especially in infrastructure aspect.

River resources in some areas are potentials that can be utilized as regional transportation infrastructure. This is supported by the geographical condition that is owned by several provinces in Indonesia where the potential of river resources is quite a lot and can be utilized as a means of transportation. River transport has several advantages compared to other modes, while the advantages are as follows. First, there is no need to make or build water way because the river as the infrastructure is naturally available and maintenance of infrastructure is not too costly. Second, river treatment is much lighter and cheaper than caring for roads because rivers only need signs and dredging. The importance of River transportation could reach the rural with the dominance of the waters. Chen et.al (2017) present current stressors, environmental and ecological status and challenges in the Yangtze River Economic Belt, and offer policy recommendations on how to include ecological conservation into its development.

This paper will present a pattern of revival of the movement of the use of river transportation mode in the Musi River Palembang City, so that it can be used as a reference in the construction of the dock. With the identification of the passengers' and goods' generated and attracted trip, the docks can be developed efficiently and optimally in supporting the activities of urban communities.

According to Miro (2005) transportation is an attempt to transport or move goods or passengers from a place to other places. Meanwhile, according to Miro (2005) transportation is defined as the effort to move, transport or

transfer objects from one place to another, so the object becomes more useful or useful for a purpose. The supporting tools used for performing such activities vary depending on the shape of the object to be moved, the distance between the place and the object, and the purpose of the object to be moved. Transport business is not just a movement of goods and people from other places in a static manner and condition, but the transportation is always in accordance with technological developments. The market relations impose to river transport, the strict requirements on acceleration of cargo and passenger delivery at the smallest costs of transportation are on decrease of the transport component in prime cost of production, on improvement of quality and reliability of transportations (Kondolf, 2017).

Three things that make the nation great and prosperous, namely fertile land, hard work, and smooth transportation, both people and goods from one country to another (Nasution, 2004). Transportation plays an important role for both individuals, the public, economic and socio-political growth of a country. Nasution (2004) mentions that transportation can create and increase accessibility of previously untapped and untreatable potential of natural resources. Progress of transportation will also lead to increased mobility of people, where the higher the mobility will be the higher the level of productivity. With the increase in productivity, it will have an impact on economic progress.

Palembang is the capital of South Sumatra Province. Palembang is the second largest city on the island of Sumatra. Palembang city has an area of 400.61 km2. Palembang City location is quite strategic because it is traversed by the path crossing the island of Sumatra that connects between regions on the island of Sumatra. In addition, in the city of Palembang also there is Musi River that serves as a means of transportation and trade between regions.

River transportation is a common mode of transportation for the community, many activities carried out by people using river transportation such as schools, work, tourism to conduct trading activities known as floating market. River transportation in Indonesia is generally used to serve the mobility of goods and passengers, both along the river and river crossings.

Mulyana (2005) stated that the navigable river water system must meet the technical requirements, namely: depth, flexibility, and certain current speed, so that it is safe and easy to navigate.

Musi River sailing channel is in South Sumatra Province and is located in several regional administration areas such as Palembang City, Musi Banyuasin Regency and Banyuasin Regency. Musi River voyage flow has a total length of up to 720 km with a variation of river flow width of 200 m to 2,749 m. The main port on the Musi river is the main port of Boombaru in Palembang City. This harbor is located about 90.33 km from the mouth of the Musi river in Tanjung Buyut. The main activity of Musi River transportation today is from Sungsang corridor to Palembang generally to serve cargo of PT. Pupuk Sriwijaya, PT. Pertamina RIP III Plaju, PT. Sinar Alam Permai, coal load, cement load, CPO load, container as well as daily interest of local community and transmigration area. The names of the docks and their locations in Palembang City are presented in Figure 2.1.

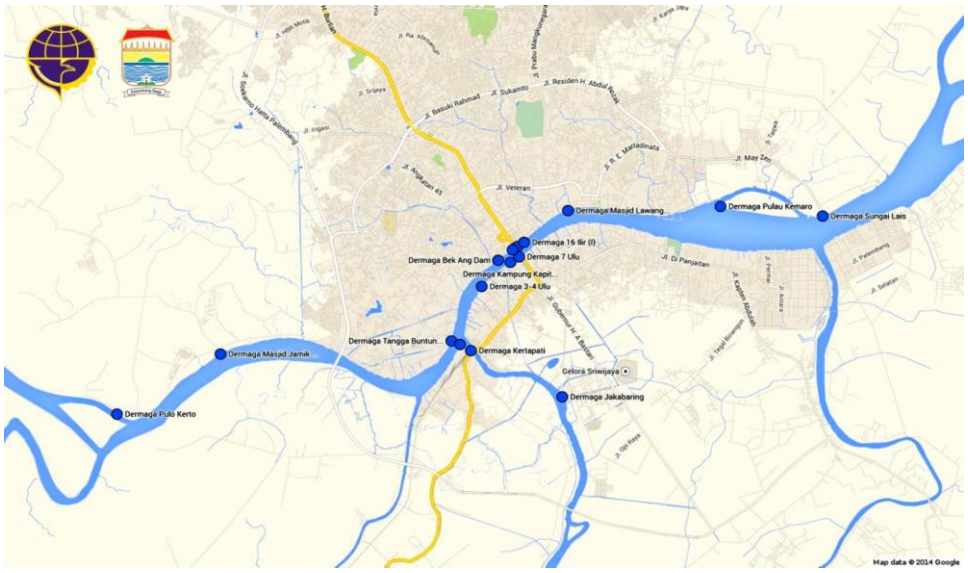

Figure 1. Map Location docks along Musi River Palembang City**.**

Method

Demand and supply analysis of river transportation will be done is to see the great movement of passengers and goods using the model of the trip generation and attraction. This study uses a method of generating motion, i.e. modelling stages that estimate the number of movements coming from a zone and the amount of movement that is attracted to a zone. The magnitude of the movement depends on the model generated and the support of actual movement data. The analysis of demand and supply that will be done is with the growth trend pattern of passenger and goods movement by using the model of the trip generation and attraction. The magnitude of the movement depends on the model generated and the support of actual movement data. From the trip generation and attraction of the resulting movement will then be estimated to the number of movement of passengers and goods in the next 20 years. Based on the characteristics of the movement of passengers and goods in the study area, the calculation of the movement of passengers and goods using the model of trip generation and attraction with regression analysis with the following general form (Tamim, 1997)

$$Y_{ei} = a + b_{1i}x_{1i} + b_{2i}x_{2i} + b_{3i}x_{3i} + \ldots + b_{ni}x_{ni} \quad (1)$$

Where Y_{ei} denotes the number of trips that are generated or are attracted from and to *i-th* zone as a variable bound to the model concerned. Whereas x_{ni} is the amount of free variable to *n* observed from *i-th* zone. The a,*b* is the constant to be derived from the calculation and b_{ni} is the partial regression coefficient. Activities conducted are macro then some specified free variables are not derived from the primary survey results, but the secondary survey sourced from the potential of the village in 2013. As for some variables used in the analysis are:

Xi: population
X_{2i}: number of families
X_{3i}: Number of Junior High Schools
X_{4i}: Number of Senior High School

X_{5i}: Number of Hospitals

X_{6i}: number of Posyandu

X_{7i}: Number of Puskesmas

X_{8i}: Area of Rice Farming

X_{9i}: Garden Area

X_{10i}: Non-agricultural land area

X_{11i}: number of markets

X_{12i}: Number of Recreation Sites

X_{13i}: Revenue Value Original (PAD)

Some of these variables must be determined in some areas that use river transportation as the mode of transportation. Based on the results of regression analysis conducted, it can be known some models of the trip generation of each province in Indonesia, which can then be known the value of the trip generation of passengers and goods using river transport.

Discussions and Result

The river transportation in South Sumatera Province was developed into 11 river corridor developments, where the value of the goods transport movement in South Sumatera Province was the largest in corridor 10, as well as the pull of goods in South Sumatera province, the biggest attraction was in corridor 10. For more details can be seen in the table below.

Table 1. Value of river transport goods generation and attraction Province of South Sumatera Year 2013**.**

Province	Corridor	2013	
		Generation	**Attraction**
South Sumatera	Corridor 1	288.564	279.355
	Corridor 2	267.953	259.402
	Corridor 3	362.867	351.287
	Corridor 4	326.455	316.037
	Corridor 5	357.853	346.433
	Corridor 6	268.362	259.798
	Corridor 7	292.422	283.090

Table 1, Cont. Value of river transport goods generation and attraction Province of South Sumatera Year 2013**.**

Corridor 8	**288.696**	**279.483**
Corridor 9	240.943	233.253
Corridor 10	381.201	369.036
Corridor 11	352.413	341.166

The number of movements that identify the characteristics of passenger and goods travel using river mode in the next 20 years is calculated based on movement data in 2013. The assumptions used to projecting over the next 20 years are based on several variables that affect the regression model that has been done. The result of projection of goods movement in South Sumatera Province in the next 20 years shows that the rise of goods in South Sumatera Province is decreasing and there is also an increase in movement, which can be shown in the picture below.

Table 2. Value of generation and attraction of river transport goods Province of South Sumatera year 2013-2033

Corridor	2013		2018		2023		2028		2033	
	Generation	Attraction	Generation	Attraction	Generation	Attraction	Generation	Attraction	Generation	Attraction
Corridor 1	288.564	279.355	288.385	279.182	288.207	279.009	288.028	278.837	287.612	278.434
Corridor 2	267.953	259.402	269.383	260.786	270.824	262.181	272.274	263.585	275.691	266.893
Corridor 3	362.867	351.287	365.761	354.088	368.686	356.921	371.640	359.780	378.633	366.550
Corridor 4	326.455	316.037	330.588	320.038	334.795	324.110	339.065	328.245	349.264	338.118
Corridor 5	357.853	346.433	362.214	350.655	366.650	354.949	371.151	359.307	381.890	369.703
Corridor 6	268.362	259.798	268.667	260.093	268.972	260.389	269.278	260.685	269.994	261.378
Corridor 7	292.422	283.090	292.255	282.928	292.088	282.766	291.920	282.605	291.531	282.227
Corridor 8	288.696	279.483	288.875	279.656	289.054	279.829	289.232	280.002	289.650	280.407
Corridor 9	240.943	233.253	239.287	231.650	237.646	230.063	236.020	228.488	232.271	224.859
Corridor 10	381.201	369.036	378.334	366.261	375.497	363.514	372.686	360.793	366.216	354.529
Corridor 11	352.413	341.166	352.865	341.604	353.318	342.042	353.771	342.482	354.832	343.509

The river transport in South Sumatera Province was developed into 11 developments of river corridor. The greatest value of passenger movement in South Sumatera Province is in corridor 10, so also with the attraction of passengers in South Sumatera province where the biggest passenger pull is in corridor 10. For more details can be seen in the table below.

Table 3. Value of generation and attraction of passenger transportation of river Province of South Sumatera year 2013.

Province	Corridor	2013	
		Generation	**Attraction**
South Sumatera	Corridor 1	7.874.640	7.669.919
	Corridor 2	7.312.169	7.122.071
	Corridor 3	9.902.299	9.644.864
	Corridor 4	8.908.649	8.677.046
	Corridor 5	9.765.460	9.511.583
	Corridor 6	7.323.340	7.132.952
	Corridor 7	7.979.925	7.772.467
	Corridor 8	7.878.242	7.673.428
	Corridor 9	6.575.089	6.404.153
	Corridor 10	10.402.606	10.132.165
	Corridor 11	9.617.001	9.366.984

The number of movements that identify the characteristics of passenger and goods travel using river mode in the next 20 years is calculated based on movement data in 2013. The assumptions used to projecting over the next 20 years are based on several variables that affect the regression model that has been done.

The result of projection of passenger movement in South Sumatera Province in the next 20 years shows that there is a rise of passengers that experienced an increase and there is also a decrease. The decreasing movement of passengers in corridors 1, 7, 9, and 10, while other corridors have increased movement. The generation and attraction of the highest passenger movement for the next 20 years in South Sumatera Province is located in corridor 5. The activities of the population in the corridor are certainly a factor influencing the magnitude of the movement and the pattern of river transportation movement. Based on the results of the analysis that can be seen there are still the number of families living on the banks of the river which is relatively high and there are villages that left behind. Other factors affecting the magnitude of the generating value in the corridor are the national port and the national activity center which became one of the triggers of the hike in corridor 1.

Table 4. Magnitude value of passengers and attraction of river transport passengers of South Sumatra Province year 2013-2033.

Corridor	2013		2018		2023		2028		2033	
	Generation	**Attraction**	**Generation**	**Attraction**	**Generation**	**Attraction**	**Generation**	**Attraction**	**Generation**	**Attraction**
Corridor 1	7.874.640	7.669.919	7.869.761	7.665.167	7.864.886	7.660.419	7.860.015	7.655.674	7.855.148	7.650.934
Corridor 2	7.312.169	7.122.071	7.351.200	7.160.088	7.390.524	7.198.389	7.430.101	7.236.937	7.469.975	7.275.774
Corridor 3	9.902.299	9.644.864	9.981.254	9.287.148	10.061.093	8.947.771	10.141.700	8.623.168	10.223.213	8.314.848
Corridor 4	8.908.649	8.677.046	9.021.431	8.786.896	9.136.220	8.898.701	9.252.766	9.012.218	9.371.403	9.127.770
Corridor 5	9.765.460	9.511.583	9.884.472	9.627.501	10.005.523	9.745.404	10.128.357	9.865.045	10.253.311	9.986.751
Corridor 6	7.323.340	7.132.952	7.331.664	7.141.059	7.340.000	7.149.179	7.348.348	7.157.310	7.356.710	7.165.454
Corridor 7	7.979.925	7.772.467	7.975.356	7.768.016	7.970.790	7.763.570	7.966.228	7.759.126	7.961.669	7.754.685
Corridor 8	7.878.242	7.673.428	7.883.115	7.678.173	7.887.991	7.682.923	7.892.871	7.687.676	7.897.755	7.692.433
Corridor 9	6.575.089	6.404.153	6.529.898	6.360.137	6.485.141	6.316.544	6.440.752	6.273.308	6.396.787	6.230.486
Corridor10	10.402.606	10.132.16	10.324.374	10.055.96	10.246.963	9.980.567	10.170.247	9.905.846	10.094.334	9.831.906
Corridor 11	9.617.001	9.366.984	9.629.339	9.379.000	9.641.699	9.391.039	9.654.078	9.403.096	9.666.479	9.415.175

Conclusion

This study has analyzed the large increase of passengers and goods in the Musi River until 2033. From this analysis it is found that passengers and goods tends to increase significantly. From the analysis results, it is obtained that the increasing number of passengers and goods occurred around the city of Palembang is generally for tourist destinations. The result of projection of passenger movement in South Sumatera Province in the next 20 years shows that there is an increasing of passengers. The movement using river transportation in the Musi River Palembang City experienced a shift that tends to land transportation, but for certain trips located on the river route the use of river transportation is still in demand. The occurrence of this shift due to changes in land use and the availability of road network, is also due to the availability of various alternative modes that can be selected to support the movement. Selection of the mode is not only based on the consideration of travel time, but also consideration of the costs and conditions of availability of existing modes of transportation on the way to travel. It is necessary to plan the integration of inter-modal, river and land transportation, so that there will be ease of connection for river transportation users who will continue their journey using land transportation and vice versa, as well as efforts to increase the attractiveness of river transportation by combining the concept of waterfront city.

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