Potential of Sea Passenger Movement Post Ports Development in Kepulauan Seribu

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Abstract. This study aims to determine the potential movement of sea transport passengers in Kepulauan Seribu. This study used a quantitative approach and a descriptive method with a multiple linear regression analytical technique on transportation modelling. The data that is used for analytical based on data survey of 300 respondents that is randomly distributed. Based on the calculation of the trip generation and trip attraction of passengers and goods in each zone in Kepulauan Seribu Regency, it can be seen that the biggest trip generation and pull is in the Jakarta Zone. This is because the zone is a large city which is the center of activity of Kepulauan Seribu Regency Sea transportation so that most of the movement towards and originating from the Jakarta Zone. It is known that the largest value obtained from the OD Matrix for the next 20 years is 6,970 people per day for the movement from the Pulau Kelapa Zone to the Jakarta Zone, while the movement from the Jakarta zone to the Pulau Kelapa Zone is 6,970 people per day. Based on the results of this study it can be seen that the level of passenger travel for sea modes found in Kepulauan Seribu Regency has the potential to increase significantly.

1. Introduction
Transportation system planning is an activity that aims to provide transportation services both facilities and infrastructure that are tailored to the needs of transportation for people in an area in the future or in the plan year that will be used for various transportation planning investment policies [1]. While transportation modeling is a basic behavior model of interaction between components of the transportation system and the mode of interaction of the components of the transportation system with time [2]. Kepulauan Seribu Regency is an archipelago located on the north coast of DKI Jakarta Province.

Movement that occurs between Kepulauan Seribu Regency and Jakarta can only be reached using sea transportation, in this case, sea transportation in the form of motorized boats, crossing vessels or feeders for local inter-island movements in Kepulauan Seribu Regency. Daily necessities such as food, building materials, fishery products are obtained and sold to Jakarta so that sea transportation is very important for residents of Kepulauan Seribu Regency. Until 2019 ports have been developed on ten inhabited islands in Kepulauan Seribu Regency [3]. The impact of the construction of these ports makes the movement that occurs between Kepulauan Seribu Regency and Jakarta become more smooth and easy. There are several attributes of travel services that are similar and competitive in terms of offering transportation services price (cost), time (time), service (comfort and convenience) and also safety (security and safety) [4].
This can be seen based on the trend of tourist visits to Kepulauan Seribu Regency and the number of homestays has also increased in recent years [5]. Considering these impacts, it is important to note that the capacity of these islands, especially tourist islands, has limitations that need to be taken into account in the future, therefore this study aims to determine the potential movement of sea transport passengers in Kepulauan Seribu.

2. Method
This study used a quantitative approach and a descriptive method [10] with a multiple linear regression analytical technique on transportation modelling [1] [2] [7]. The data that is used for analytical based on data survey of 300 respondents that is randomly distributed.

3. Results and Discussion
At present conditions there are existing trajectories of sea transportation at several vertices, this is a reference for developing transportation zones in Kepulauan Seribu Regency Sea, with consideration of looking for potential movements of Sea transportation, the zones used for sea transportation analysis are islands in Kepulauan Seribu Regency. The zones that have been set are 12 zones including Jakarta and Tangerang which are the centers of attraction and generation of Kepulauan Seribu Regency Sea transportation movement, for more details, each zone can be seen in Figure 1 below.

![Figure 1. Zoning Movement in Kepulauan Seribu](image-url)
From the survey data conducted on Kepulauan Seribu Regency Sea transportation combined with the results of transportation sea passanger data [3,8]. By looking at the results of sampling data to the population of both passenger and freight trips, the seizure obtained can be seen in the following Table 1.

Table 1. Trip Generation and Trip Attraction in Kepulauan Seribu Year 2019

| No. | Zone            | Trip Generation (person) | Trip Attraction (person) |
|-----|-----------------|--------------------------|--------------------------|
| 1   | P. untung Jawa  | 2.594                    | 3.326                    |
| 2   | P.Payung        | 188                      | 526                      |
| 3   | P.Tidung        | 5.157                    | 4.768                    |
| 4   | P.Pari          | 2.335                    | 2.597                    |
| 5   | P.Lancang       | 1.454                    | 1.061                    |
| 6   | P.Kelapa        | 6.661                    | 5.209                    |
| 7   | P.Pramuka       | 1.689                    | 4.819                    |
| 8   | P.Panggang      | 6.260                    | 4.429                    |
| 9   | P.Haparan       | 2.343                    | 1.945                    |
| 10  | P.Sebira        | 729                      | 729                      |
| 11  | Jakarta         | 17.707                   | 17.707                   |
| 12  | Tangerang       | 4.578                    | 4.578                    |

Movement magnitude analysis is carried out to find out current movement demand in each zone by using a trip generation model. The magnitude of movement depends greatly on the model produced and the actual movement data support. In connection with the study location in Kepulauan Seribu Regency Sea, several assumptions can be formulated which can facilitate the process of calculating the magnitude of the movement Characteristics of the regions represented by vertices are considered to have the same characteristics.

Based on the assumptions above, it can generally be concluded that an increase in population, the presence of facilities, and commodity production in a zone will be followed by an increase in the number of movements to and from the zone. This is in line with what Everet S. Lee said that the movement factor is also influenced on the basis of needs, supply, and networking [6]. By using these variables, it can be seen the generation of passenger movements per zone in the study area as described in Table 2.

Table 2. Trip Generation and Trip Attraction in Kepulauan Seribu Year 2039

| No. | Zone            | Trip Generation (person) | Trip Attraction (person) |
|-----|-----------------|--------------------------|--------------------------|
| 1   | P. untung Jawa  | 3.480                    | 4.463                    |
| 2   | P.Payung        | 252                      | 706                      |
| 3   | P.Tidung        | 6.918                    | 6.397                    |
| 4   | P.Pari          | 3.133                    | 3.484                    |
| 5   | P.Lancang       | 1.951                    | 1.424                    |
| 6   | P.Kelapa        | 8.936                    | 6.988                    |
| 7   | P.Pramuka       | 2.266                    | 6.465                    |
| 8   | P.Panggang      | 8.398                    | 5.942                    |
| 9   | P.Haparan       | 3.143                    | 2.609                    |
| 10  | P.Sebira        | 978                      | 978                      |
| 11  | Jakarta         | 23.755                   | 23.755                   |
| 12  | Tangerang       | 6.142                    | 6.142                    |

Based on the calculation of the trip generation and trip attraction of passengers and goods in each zone in Kepulauan Seribu Regency, it can be seen that the biggest trip generation and pull is in the Jakarta Zone. This is because the zone is a large city which is the center of activity of Kepulauan...
Seribu Regency Sea transportation so that most of the movement towards and originating from the Jakarta Zone.

The travel distribution in this study that is used is a synthetic model that is the gravity method with the consideration that this model is a suitable model for regions/zones that have different growth rates. This method assumes that: the growth of each zone varies greatly, can be used for land use forecasting or traffic generation forecasting. This method assumes that the characteristics of the trip generation and the pull of movement are related to several parameters of the origin zone, for example, population and MAT cell values that are also related to accessibility as a function of distance, time, or cost [6]. The distribution trip can be seen in Table 3 below.

From the calculation of MAT according to the conditions in 2019, information was obtained that the movement of passengers in the internal zone for the mode of the sea in 2019, namely in the Jakarta zone to the Pulau Kelapa zone and vice versa has a high intensity of movement. It is known that the largest value obtained from the MAT is 5,196 people per day for the movement from the Coconut Island zone to the Jakarta zone, while the movement from the Jakarta zone to the Pulau Kelapa zone is 5,196 people per day. The movement of sea transportation passengers between islands tends to be high [9] (See Figure 2).

| Origin-Destination | P. untung Jawa | P.Payung | P.Tidung | P.Lancang | P.Kelapa | P.Pramuka | P.Panggang | P.Haparan | P.Sebira | Jakarta | Tangerang | Ot |
|-------------------|---------------|----------|----------|-----------|----------|------------|-------------|-----------|----------|---------|-----------|-----|
| P. untung Jawa    | 0             | 0        | 0        | 0         | 0        | 0          | 0            | 0         | 1.031    | 1.563   | 2.594     |     |
| P.Payung          | 0             | 0        | 75       | 0         | 0        | 11         | 13           | 24        | 0         | 62      | 188       |     |
| P.Tidung          | 0             | 464      | 1.392    | 0         | 0        | 0          | 0            | 0         | 3.300    | 0       | 5.157     |     |
| P.Pani            | 0             | 0        | 0        | 257       | 0        | 0          | 0            | 0         | 0         | 514     | 1.564     | 2.335 |
| P.Lancang         | 0             | 0        | 0        | 262       | 0        | 0          | 131          | 0         | 0         | 262     | 800       | 1.454 |
| P.Kelapa          | 733           | 0        | 0        | 0         | 0        | 0          | 733          | 0         | 0         | 5.196   | 0         | 6.664 |
| P.Pramuka         | 0             | 0        | 0        | 0         | 0        | 0          | 0            | 0         | 1.402    | 287     | 1.689     |     |
| P.Panggang        | 0             | 0        | 0        | 0         | 0        | 0          | 2254         | 0         | 0         | 4.006   | 0         | 6.260 |
| P.Haparan         | 0             | 0        | 0        | 0         | 0        | 0          | 398          | 375       | 0         | 1.570   | 0         | 2.343 |
| P.Sebira          | 0             | 0        | 0        | 0         | 0        | 0          | 0            | 0         | 365      | 365     | 729       |     |
| Jakarta           | 1.031         | 62       | 3.300    | 514       | 262      | 5.196      | 1.402        | 4.006     | 1.570    | 365     | 0         | 17.707|
| Tangerang         | 1.563         | 0        | 0        | 1564      | 800      | 0          | 287          | 0         | 365      | 0       | 0         | 4.578 |
| Ot                | 3.326         | 526      | 4.768    | 2.597     | 1.061    | 5.209      | 4.819        | 4.429     | 1.945    | 729     | 17.707    | 4.578 |
|                   |               |          |          |           |          |            |              |           |          |         |           | 51.695 |

Table 3. Origin Destination Sea Passenger in Kepulauan Seribu Year 2019
From the calculation of MAT according to conditions in 2039 obtained information that the movement of passengers in the internal zone for the mode of the sea in 2039 is found in the Jakarta zone to the Pulau Kelapa zone and vice versa has a high intensity of movement. It is known that the largest value obtained from the MAT is 6,970 people per day for the movement from the Pulau Kelapa zone to the Jakarta zone, while the movement from the Jakarta zone to the Pulau Kelapa zone is 6,970 people per day [9] (See Table 4 and Figure 3).
Table 4. Potentially Origin Destination Sea Passenger in Kepulauan Seribu Year 2034

| Origin-Destination | P. untung Jawa | P. Payung | P. Tidung | P. Pari | P. Lancang | P. Kelapa | P. Pramuka | P. Panggang | P. Haparan | P. Sebira | Jakarta | Tangerang | OI |
|--------------------|----------------|-----------|-----------|---------|------------|-----------|------------|-------------|------------|-----------|---------|-----------|----|
| P. untung Jawa     | 0              | 0         | 0         | 0       | 0          | 0         | 0          | 0           | 0          | 0         | 1.383   | 2.096     | 3.480 |
| P. Payung          | 0              | 0         | 101       | 0       | 0          | 18        | 13         | 33          | 0          | 0         | 83      | 0         | 252 |
| P. Tidung          | 0              | 623       | 1.868     | 0       | 0          | 0         | 0          | 0           | 0          | 0         | 4.428   | 0         | 6.918 |
| P. Pari            | 0              | 0         | 345       | 0       | 0          | 0         | 0          | 0           | 0          | 0         | 689     | 2.099     | 3.133 |
| P. Lancang         | 0              | 0         | 351       | 0       | 0          | 176       | 0          | 0           | 0          | 0         | 351     | 1.073     | 1.951 |
| P. Kelapa          | 983            | 0         | 0         | 0       | 0          | 983       | 0          | 0           | 0          | 0         | 6.970   | 0         | 8.936 |
| P. Pramuka         | 0              | 0         | 0         | 0       | 0          | 0         | 0          | 0           | 0          | 0         | 1.881   | 385       | 2.266 |
| P. Panggang        | 0              | 0         | 0         | 0       | 0          | 3.023     | 0          | 0           | 0          | 0         | 5.375   | 0         | 8.398 |
| P. Haparan         | 0              | 0         | 0         | 0       | 0          | 334       | 503        | 0           | 2.106      | 0         | 2.106   | 0         | 3.143 |
| P. Sebira          | 0              | 0         | 0         | 0       | 0          | 0         | 0          | 0           | 0          | 489       | 489     | 978       |     |
| Jakarta            | 1.383          | 83        | 4.428     | 689     | 351        | 6.970     | 1.881      | 5.375        | 2.106      | 489       | 0       | 0         | 23.755 |
| Tangerang          | 2.096          | 0         | 0         | 2.099   | 1.073      | 0         | 385        | 0           | 0          | 489       | 0       | 0         | 6.142  |
| Dd                 | 4.463          | 796       | 6.397     | 3.484   | 1.424      | 6.988     | 6.465      | 5.962        | 2.609      | 978       | 23.755  | 6.142     | 69.352 |

Figure 3. Potentially Sea Passenger Desire Line in Kepulauan Seribu Year 2039
4. Conclusion
Based on the results of this study it can be seen that the level of passenger travel for sea modes found in Kepulauan Seribu Regency has the potential to increase significantly. The Jakarta zone is a zone with a high origin and high movement destination, this is because Jakarta is the starting point for tourists entering Kepulauan Seribu where Kepulauan Seribu is a National Strategic Tourism Area so that it has a high impact and attraction.

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