

Transportation Limitation Access to the Small Islands (Case Study: Banggai Laut Regency)

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1. Introduction

Equity of development is still a homework for governments in various countries, especially for developing countries. In Indonesia, equity of development is a challenge for the government considering Indonesia's vast territory. Indonesia as an archipelagic country and a maritime country has approximately 17,504 islands that consist of big and small islands [1]. Indonesia's small islands have diverse roles and potentials such as marine tourism potential, energy and defense, environmental services and others. The contribution of small islands in Indonesia has not been matched by government attention in various sectors. One of them is the government's lack of support for the Small Islands management. Development allocations undertaken by the government are still centered on large islands and still prioritize on land area counts rather than on water areas [2]. Infrastructure has an important role in regional development, such as sea transportation to facilitate the movement of goods, services, logistics, and people from one island to another in an effort to improve the welfare. In the current condition, there are still many small islands in Indonesia that do not have adequate



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transportation infrastructure so that to reach small islands is quite difficult, whereas without transportation, it will be difficult for the community to get benefit from production activity [3]. These transport limitations have an impact on economic development on small islands where they often fall behind compared to large islands with adequate infrastructure.

One of the small islands that do not have adequate infrastructure is Banggai Laut Regency in Central Sulawesi Province. Banggai Laut Regency is a new regency, which separated itself from Banggai Kepulauan Regency and only about 4 years old. Access to Banggai Laut Regency is quite difficult, so it becomes an obstacle to develop the potential of the region. To reach the Banggai Laut Regency from the Sulawesi Island takes a long time and requires several changes of transportation type. In addition, transportation infrastructure within Banggai Laut Regency itself is not adequate, whereas the district has many different potentials for each island. If there is good accessibility in the movement of goods, services and people and the availability of adequate transportation infrastructure, then the potential can be well developed to improve the welfare of society and the regional economy. Based on the problem, the purpose of this research is to find infrastructure development strategy to support the development of Banggai Laut Regency.

The steps taken to achieve the research objectives include: 1.) identification of geographic conditions, population, potentials and problems in Banggai Laut Regency, 2.) identification of transportation facilities, infrastructure and accessibility in Banggai Laut Regency; 3.) analyze of accessibility development strategy in Banggai Laut Regency to develop the region.

2. Research Method

The research approach used in this research was the concurrent model mix method. This model was chosen because researchers combined qualitative and quantitative data to conduct a comprehensive analysis of existing research problems [4]. The quantitative method used was descriptive, through the frequency distribution of the criteria and variables used, while the qualitative method was used to explore and synthesize various information. The method of data collection was divided into two namely: primary and secondary data. Primary data were gained through field observations related to transportation infrastructure conditions and interviews with agencies and communities on transportation conditions between small islands in Banggai Laut Regency. Secondary data were obtained literature review and documents obtained from related institutions. Analytical techniques used are qualitative descriptive and Map Overlay techniques using GIS to describe the characteristics of study areas and spatial relationships between islands.

3. Literature Review

Small Island is an island with an area smaller than or equal to 2,000 km² along with its ecosystem unity. Coastal Resources and Small Islands are biological resources, non-biological resources, artificial resources, and environmental services. Biological resources include fish, coral reefs, seagrass beds, mangroves and other marine biota. Non-living resources include sand, seawater and seabed minerals. Artificial resources include marine and fishery-linked marine infrastructure, and environmental services in the form of natural beauty, seabed surface underwater installations associated with marine and fisheries and ocean wave energy contained in the Coastal Zone [5].

While Transportation is the activity of moving goods (cargo) and passengers from one place to another [3]. Transportation has several important roles for society, economic and socio-political development of a country [3] namely 1.) Transportation and Community Life, ie transportation is beneficial for people's life in terms of transporting raw materials and products produced by a region and distributed to other areas, 2.) Geographical Specialization, ie each region has different specialties, such as Tasikmalaya, Kalimantan, Yogyakarta handicraft will be different in each region. With adequate transport infrastructure, such goods can be sold and marketed outside their specialist area, 3.) Economical Production, ie a production will be useful and economical if there is enough transportation

mode, in the absence of transportation, the community will not get benefit of production, and 4.) National and Hankamnas development, ie the role of transportation for national development, development of the entire territory of Indonesia, equality of development and national defense of the Indonesian nation. There is a lot of understanding of accessibility, such as accessibility is a measure of potential or ease of people to achieve goals in doing a journey [6]. In line with the previous understanding, accessibility is a concept that combines land use systems geographically with the transport network system that connects them [7]. To express accessibility, accessibility levels can be measured through two things: distance and condition of the infrastructure, with the following classifications [8]:

Table 1. Accessibility Classification According to Black [8]

Distance	Far	Low Accessibility	Mid Accessibility
	Near	Mid Accessibility	High Accessibility
Infrastructure Condition	Very bad		Excellent

Accessibility is very influential factor on the development of a region, where the infrastructure sector is one of the sectors that have an important role in spurring economic growth, because basically the infrastructure sector acts as a liaison of various kinds of economic activity. One of which is Road construction, it has accessibility function to open less developed area and open mobility function to spur the developed area [9]. Transportation is not only the process of transporting people and goods from one location to another but having an impact on the economic condition of the region [10]. The existence of transportation improvement projects has an impact on the benefit of the poor and road users, namely to increase access to trade, education, health and so on, then decrease vehicle operating costs, and to save time or shorten travel time and increase in capital value [11].

4. Results and Discussion

Banggai Laut Regency is an archipelagic regency consisting of four major islands namely Banggai Island, Labobo Island, Bangkuring Island and Boka Islands. Banggai Laut owns 7 districts, 4 districts in Banggai Island that is North Banggai, Banggai, Central Banggai and South Banggai Districts. While the three other islands each consisting of one district that is Labobo District, Bangkuring District and Boka Islands District. The islands of Banggai Laut Regency are lowland areas where the entire island is <500 meters above sea level but has varying slopes, ranging from 0-2%, 2-15%, 15-40% to 40%. Here is the administrative boundary map of Banggai Laut Regency.



Source: Development Planning Agency at Sub-National Level of Banggai Laut Regency, 2015

Figure 1. Administrative Boundary Map of Banggai Laut Regency

Its form as archipelago and separated from the mainland of Central Sulawesi Province, makes Banggai Laut Regency quite remote and has the least population compared to other regencies or cities in Central Sulawesi Province. While in Banggai Laut Regency the population is mostly concentrated in the largest island, population and population density can be seen in following figure and table from each island:

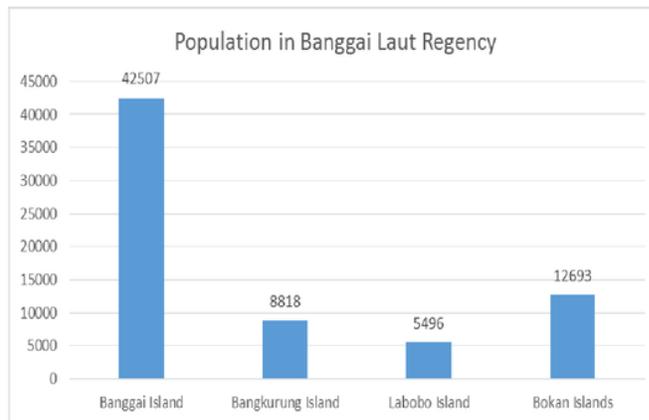


Figure 2. Population in Banggai Laut Regency, 2015 [12]

Table 2. Population Density in Banggai Laut Regency 2015 [12]

Island	Population	Area (Km ²)	Population Density
Banggai Island	42.507	294,39	144
Bangkurung Island	8.818	116,55	76
Labobo Island	5.496	85,65	64
Bokan Islands	12.693	229,08	55
Jumlah Total	69.514	725,67	96

From **Figure. 2** and **Table. 2** it can be seen that the largest population and the highest population density exist in Banggai Island. This is because Banggai Island is the main island located Banggai District as the Capital Regency. Banggai District is as the center of government and acts as a Center for Local Activities in the space structure of Banggai Laut Regency. Because on that issue all activities are more concentrated in Banggai Island, so that the facilities and infrastructure of this district is more complete compared to the other islands.

Characteristics of residents in Banggai Laut Regency occupying each island is quite diverse, among others, inhabited by various tribes such as Bajo tribes, Banggai tribes, Bugis tribes, Buton tribes and Javanese tribes. Each of these tribes has characteristics and traditions that are different from each other. The Bajo tribe has a tendency not to be out of their community, and in its history the Bajo tribe is quite difficult to merge with the mainland people, they never interact and even avoid other tribes because their activity is mostly done at sea. However, nowadays the value and customs of the Bajo tribe begin to shift and begin to open up to interact with the mainland people because of the

demanding needs of the economy [13]. Although the cultural values of the Bajo tribe have begun to change and begin to open up to interact with people outside the Bajo tribe, the intensity of their interactions will be different when compared to other tribes such as the Bugis tribe. Bugis tribe has a culture of wander since the 17th century and able to blend and adapt easily in places they stop [14].

The livelihoods of most people in Banggai Laut Regency are in agriculture, plantation, forestry, hunting and fishery as well as financial institution, real estate, leasing and corporate services. Both have the same percentage of 38%. Geographical condition which is an archipelagic regency and culture of several tribes such as Bajo tribe who live in the sea is also a driving factor of most people engaged in fisheries, namely as fishermen and cultivation of marine resources such as seaweed and pearl one of them. The livelihood of residents in Banggai Laut Regency can be seen in the following figure:

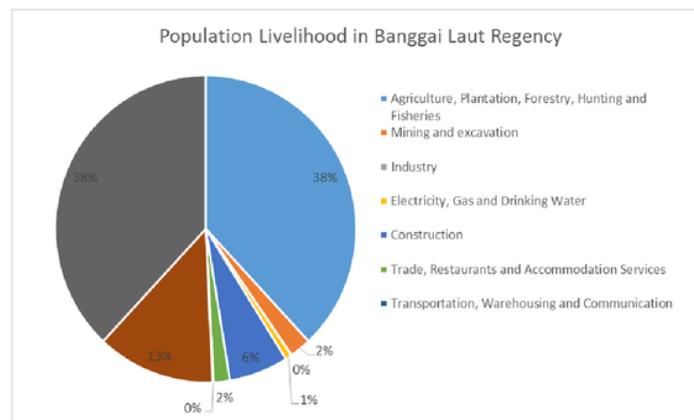


Figure 3. Population Livelihood in Banggai Laut Regency [12]

The potential of Banggai Laut Regency in addition to human resources, is the nature potential that is very beautiful and rich. Potentials are owned by the leading sectors are the fisheries and marine sector, that is seaweed in Bangkurung Island, Banggai Island and Bokan Islands Island. In addition to seaweed, there is also a pearl-producing island. Banggai Laut Regency also has potential in tourism sectors, especially marine tourism because of the beauty of the sea that is owned, among others, jellyfish lake in Bokan Islands, Kelapa Lima beaches, White Sands Beach and other marine tourism. Another potential of Banggai Laut Regency is mining where mining potential in Banggai Laut Regency is granite and quartz sand. Potential granite stone mines themselves are found in north of Banggai Island, Bangkurung Island and Labobo Island.

In addition to the potential, Banggai Laut Regency has various problems that could hamper the development of areas such as the threat of earthquake, landslide and tsunami prone disaster in all islands in Banggai Laut Regency and low accessibility to Banggai Laut Regency and within the regency itself.

The condition of land transportation infrastructure in Banggai Laut Regency can be seen from road condition in Banggai Laut Regency and can be seen in the following diagram:

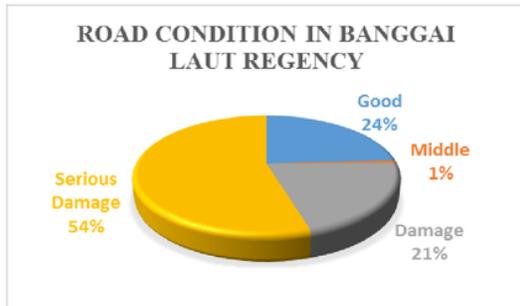


Figure 4. Road Condition in Banggai Laut Regency, 2015 [12]

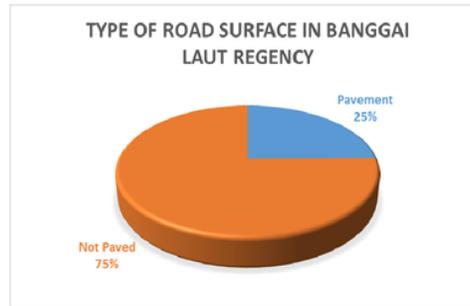


Figure 5. Type of Road Surface in Banggai Laut Regency, 2015 [12]

The Figure 4 and 5 above show that more than half of all roads in Banggai Laut Regency are 54% having condition with serious damage level. The remaining 21% of roads are damaged, 1% are in moderate condition and only 24% of roads are in good condition. As for the type of road surface that has been paved only 25%, the remaining 75% still not paved. Road conditions that are not feasible to cause inter-regional relationships are less developed quickly, thus requiring further handling, especially in relation to regional development efforts. With the condition of land transportation infrastructure such as it will inhibit the movement and slow the travel time to finally affect the important aspects in the development of one region is the economic aspect.

In addition to road conditions, transportation infrastructure in Banggai Laut Regency has not spread evenly in all villages. Where from the statistical data obtained that there are still villages that have transportation infrastructure that can not be passed by four-wheeled vehicles at a certain time, when it rains and not even passable by four-wheeled vehicles throughout the year. Here is a graph of the number of villages that use land transportation infrastructure according to the existence of roads that can be passed by four-wheeled vehicles:

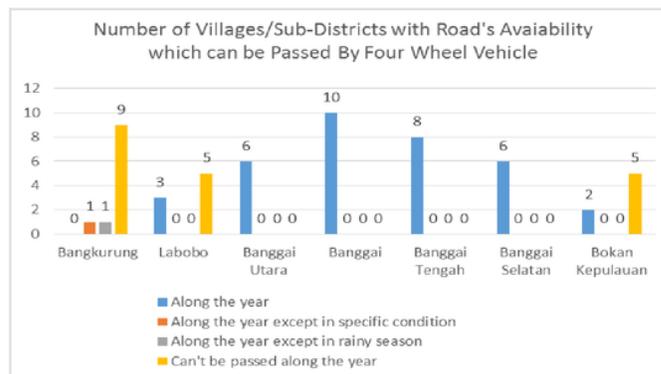


Figure 6. Number of Villages/Sub-Districts with Road's Availability which can be passed by four wheel Vehicle [15]

From the Figure 6 above can be seen that, some villages in Banggai Laut Regency still has a road that can not be passed by four-wheeled vehicles. From seven districts, Bangkukung district is in poor condition, because there is 1 village which the road inside cannot be passed by a four-wheeled vehicle at a certain time, 1 village which the road can be passed by four-wheeled vehicles but not in rainy season, and even 9 Villages which road infrastructure cannot be passed by four-wheel vehicles

throughout the year. Unlike districts in Banggai Island as the main islands of Banggai Laut Regency, namely North Banggai, Banggai, Central Banggai and South Banggai districts, where all villages in that four districts can be accessed by four-wheeled vehicles throughout the year. This shows that the development of transportation infrastructure has not been evenly distributed throughout the island, but still concentrated in Banggai Island as the center of activity in Banggai Laut Regency.

Banggai Laut Regency as an archipelago-shaped regency, sea transportation becomes the most crucial transportation to help people movement both to Banggai Laut Regency from other regency as well as the movement within the regency itself. Sea transportation in Banggai Laut Regency is boats without motor, outboard motor boats and inboard motor boats. Following figure is the number of boat in Banggai Laut Regency:

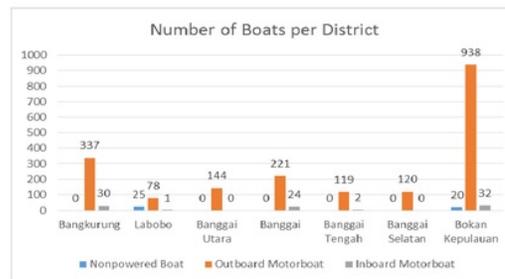
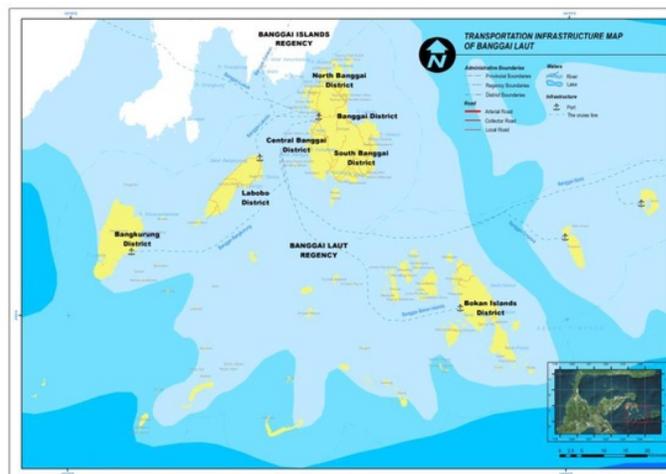


Figure 7. Number of boats per district, 2015 [16]

From the figure 7 it can be seen that the most sea transportation in Banggai Laut Regency is outboard motor boat and it is available in all districts. However, the problem is the existence of sea transportation in the form of boats that are used both for fishing activities and for crossing activities between islands has not been matched by the number of docks are adequate. The docks only exist on the big islands of Banggai Island, Labobo Island, Bangkuring Island and large islands in Bokan Islands, whereas for small islands such as those scattered around the main island of Bokan Islands do not have docks, so boats and motor boats are only anchored at the beach's border. The location of the dock can be seen in the following figure 8



Source: Development Planning Agency at Sub-National Level of Banggai Laut Regency, 2015

Figure 8. Dock Location in Banggai Laut Regency

Moreover, since sea transportation is the main transport in Banggai Laut Regency and considering its topography as an archipelagic district, the presence or absence of travel is highly dependent on weather conditions and sea waves. These factors can also affect accessibility in Banggai District because in addition to slow travel time, weather conditions and bad sea waves can increase the risk of travel until the cancellation of travel between islands.

The journey to Banggai Laut Regency can be reached by a limited mode of transportation where the journey to Banggai Laut Regency can not be directly reached by plane because it has no airport. Air transportation only arrived in Luwuk City, Banggai Regency. After using the air transport proceed with 2 alternative choices that are directly by sea or combination between sea and land transportation. The sea trip directly to Banggai Laut is for 9 hours by wooden ship, while for combination with sea and land transportation that is reached by speedboat to Salakan, Banggai Kepulauan Regency then continued by land transportation to the port at south end of Banggai Kepulauan Regency and continued again by using a small speedboat that can only accommodate 5 people to the only port on Banggai Island. Overall travel time from Luwuk to Banggai Laut Regency by using the combination of land and sea route is for 8 hours. The trip length to Banggai Laut Regency is also influenced by weather factors such as high wave or sea storm. Here is a route map to Banggai Laut Regency through a combination of sea and land transportation, white line describes the route, yellow dot shows the transit location, the rhombus symbol shows the use of sea transportation mode and the triangle symbol shows the use of land transportation mode:



Source: Development Planning Agency at Sub-National Level of Banggai Laut Regency, 2015

Figure 9. Travel Map from Luwuk to Banggai Laut by a combination of land and sea transportation

Banggai Laut district consists of several islands, so the inter-subway trips can only be reached by sea and with varying distance. The distance from the Capital Regency with the most distant district is Bokan Islands, which is about 34.5 miles of sea travel that can be reached by using wooden boats or

speed boats. Here are the distance and choice of transportation modes that can be used to go to other District from Banggai district as a Capital Regency:

Table 3. Distance between districts and transportation that can be used [17]

Regency/Capital City	District/Capital City	Distance		Can be reach by vehicle
		Land (km)	Sea (mil)	
Banggai Laut/ Banggai/ Lompio	Bangkurung/ Lantibung	-	31,7	Wooden ship / Speedboat
	Labobo/ Mansalean	-	9	Wooden ship / Speedboat
	North Banggai/ Lokotoy	15	-	Two-wheeled and four-wheeled vehicle
	Banggai/ Lompio	0	-	On foot
	Central Banggai/ Adean	5	-	Two-wheeled and four-wheeled vehicle
	South Banggai/ Matanga	28	-	Two-wheeled and four-wheeled vehicle
	Bokan Kepulauan/ Bungin	-	34,5	Wooden ship / Speedboat

Based on the data mentioned in the above points can be measured accessibility level as in Table 1 by grouping the data into two things, the distance and condition of facilities and infrastructure [8] as follows:

Table 4. Data Classification by Variable

Variable	Existing Condition of Banggai Laut Regency
Distance	<ul style="list-style-type: none"> • The distance between Banggai Regency and other surrounding areas: <ul style="list-style-type: none"> - With Banggai Regency 130 Km - With Banggai Kepulauan Regency 78 Km - With Makassar City 602 Km - With Palu City 418 Km • Distance between the Capital District with Other Districts <ul style="list-style-type: none"> - With Bangkurung District 31,7 mil - With Labobo District mil - With North Banggai District 15 Km - With Central Banggai District 5 Km - With South Banggai District 28 Km - With Bokan Kepulauan District 34,5 mil • Travel time from Banggai Regency using Wooden ship directly to Banggai Laut Regency for 9 Hours, and if using combination of land and sea route takes time for 8 hours • To reach Banggai Laut Regency, it is necessary to change transportation modes both from air transportation and land transportation to sea transportation
Facilities and Infrastructure Condition	<ul style="list-style-type: none"> • 54% of roads are heavily damaged and 75% of roads have not been paved • There are still villages where road conditions can not be passed by 4 wheeled vehicles either at certain times, during the rainy season or not passable throughout the year • Sea transport (boats and motorboats) have not been matched by adequate dock quantities • Docks are only available on large islands, while small islands do not have docks as ship berths • Do not have Airport yet, so the only way to get to Banggai Laut Regency is by sea • Travel duration and travel time depend on weather and sea waves

From the table it can be concluded that from the distance side, Banggai Laut Regency is classified as Far, seen from distance with other regency / city around it, distance between islands, long time travel and required change of various kinds of transportation to reach Banggai Laut Regency. In terms of infrastructure condition, Banggai Laut Regency is categorized as very bad condition, judging from the poor road condition, port and dock with insufficient number, and limited choice of transportation mode to Banggai Laut Regency. From both sides, it is found that the accessibility level in Banggai Laut Regency is included in the low classification or can be seen in the following table:

Table 5. Position of Banggai District accessibility level based on Black measurement [8]

Distance	Far	Low Accessibility	Middle Accessibility
	Near	Middle Accessibility	High Accessibility
Infrastructure Condition	Very Bad		Excellent

Explanation:

	Existing condition in Banggai Laut Regency
	Accessibility Level in Banggai Laut Regency

Interaction between regions with Banggai Laut Regency can be known by using the calculation of gravity model. This model can be used as a reference to estimate the attractiveness of a location with the location around it. It can also be applied to estimate the number of trips between the two places based on their attractiveness. The variables used to know the interaction between regions with the gravity model is the total population of Banggai Laut Regency, population in other area and the distance between Banggai Laut Regency and other area [18]. Then obtained the following results:

Table 6. Interaction between regions and inter-districts in Banggai Laut Regency

Interaction Between Banggai Laut Regency with Other Regency/City						
Regency A	Regency B	Population Regency A	Population Regency B	Distance (km)	Interaction	Interaction Criteria
Banggai Laut	Banggai	69,514	354,402	130	2,915,491	Low
	Banggai Kepulauan	69,514	114,980	78	2,627,456	Low
	Makassar	69,514	1,469,601	602	563,779	Low
	Palu	69,514	367,342	418	292,294	Low
Interaction Between Capital Regency with Other District						
District A	District B	Population District A	Population District B	Distance (km)	Interaction	Interaction Criteria
Banggai	Bangkuring	23,214	8,818	31.7	407,410	Low
	Labobo	23,214	5,496	9	3,150,226	Low
	North Banggai	23,214	6,517	15	1,344,761	Low
	Central Banggai	23,214	7,265	5	13,491,977	Low
	South Banggai	23,214	5,511	28	326,358	Low
	Bokan Islands	23,214	12,693	34.5	495,115	Low

Criteria :

High: Interaction $> 4 (\times 10^9)$

Mid: Interaction $2-4 (\times 10^9)$

Low: Interaction $0-2 (\times 10^9)$

From the **Table 6** can be seen that the interaction between Banggai Laut Regency with other Regency/Cities around it as well as between Capital Regency with other districts included in the criteria low. This is caused by the population is much less than the surrounding districts and other cities and the distance is quite far. In addition, based on observations, the low interaction between Banggai Laut Regency and surrounding Cities or District is influenced by distance and population, also supported by internal factors that is community activity and community habit, also transportation infrastructure to Banggai Laut Regency and infrastructure in the region as described in the previous section, namely the limited choice of transportation modes, inadequate conditions of transportation facilities and transportation infrastructure and also relatively longer travel times. Here is a map of inter-regional interaction in Banggai Laut Regency:



Source: Development Planning Agency at Sub-National Level of Banggai Laut Regency, 2015

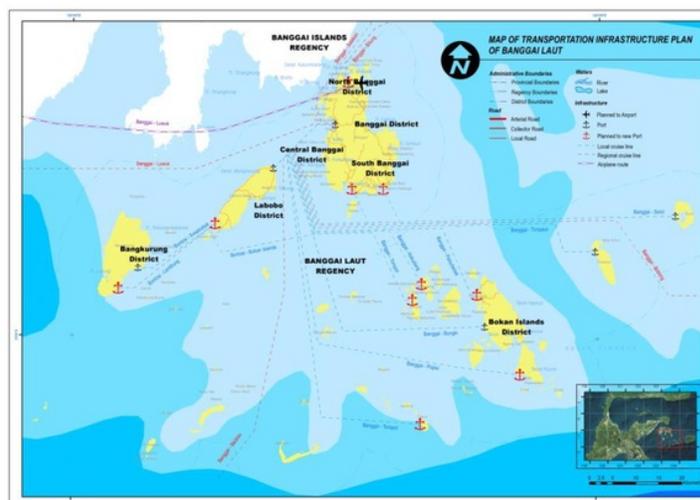
Figure 10. Map of District interaction in Banggai Laut Regency

Banggai Laut Regency has some problems, one of them is the accessibility with low accessibility level namely limited choice of transportation modes, inadequate transportation facilities condition, the distance is relatively far from other regencies and cities around it and also travel time is relatively longer. In addition, inter-regional and inter-island interactions lie in the low criteria because of far distance and the population is small. Whereas in the development of a region, infrastructure has an important role in its success, where infrastructure is one of the sectors that have an important role in spurring economic growth, because basically the infrastructure sector acts as a liaison of various kinds of economic activity [9]. In addition, the transportation itself has several benefits, one of which is a geographical specialization in which each region has different specialties or potentials, with the existence of adequate transportation then goods can be sold and marketed outside the specialist area [3]. Therefore, several strategies are needed to develop transportation accessibility to achieve the development of Banggai Laut Regency.

The problem of road quality in Banggai Laut Regency is inadequate, where 54% of roads are severely damaged and 75% of roads have not been paved and there are still villages that can not be passed by four-wheeled vehicles not only in certain conditions but can not be passed by four-wheeled vehicles throughout the year. It also shows the uneven distribution of infrastructure in Banggai Laut Regency. Therefore, a strategy is needed to improve the quality of roads, repairing damaged roads, paving roads and widening roads for areas that cannot be passed by four-wheeled vehicles to open and improve access in Banggai Laut Regency. Besides, it is also necessary equitable distribution of transportation infrastructure development throughout the island in Banggai Laut Regency so that adequate infrastructure condition is not only centered on Banggai Island and the potential and economy of other islands can be developed by the existence of better transportation access.

Banggai Laut Regency has only one port on each of the major islands, while in other smaller islands it has no ports such as Toropot Island, Kokudang Island and others, so boats and outboard motorboats only lean on the beach. Therefore, the strategy is needed to increase the number of docks/ports not only on the big islands but also in other small islands in Banggai Laut Regency.

The transportation mode choice to Banggai Laut Regency is still very limited, where Banggai Laut Regency does not have an airport so the route that can be reached is only two alternatives, namely by sea or sea and land combination which both have long travel time. Therefore, a strategy is needed to increase the type of transportation mode in the form of additional airports and flight route to Banggai Laut Regency. Airport development in Banggai Laut Regency to open connections to other regency and provinces, so that accessibility to Banggai Laut Regency can be reached easily and quickly. With easy accessibility among regions, it can develop the region and improve the economy and develop other sectors to support regional development. Strategies to add docks/ports and airports can be seen on the following map:



Source: Development Planning Agency at Sub-National Level of Banggai Laut Regency, 2015

Figure 11. Transportation Infrastructure Plan in Banggai Laut Regency

5. Conclusion

Banggai Laut Regency is an archipelagic district which still has some problems, namely, the low accessibility to Banggai Laut Regency and low accessibility within the district itself, that can be seen from the condition and availability of facilities and infrastructure that have not been sufficient which then impact on the length of travel time required. For the development of Banggai Laut Regency as a

new regency, transportation infrastructure is needed that can open and facilitate access between islands and to other regencies / cities around it. The development or strategy undertaken is to improve the quality of roads, to increase the types of transportation modes in the form of air transportation namely airport and flight route to Banggai Laut Regency, increasing the number of docks and equitable infrastructure development throughout the island.

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