

# The Relocation Planning of Logistics Port: Labuan Bajo Case Study

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## ABSTRACT

The relocation of the Labuan Bajo Logistics Port to a multipurpose terminal at the new location of Wae Kelambu Village, West Manggarai (KM Number 30 of 2020) is impacted by the development of transportation facilities and infrastructure of the Ministry of Transportation. In addition, the BOR has reached 72%, and the waiting time is 4 days. Thus, a plan which can support the relocation of the new terminal by taking into account the hinterland potential is needed. The growing potentials are agricultural, plantation, fishery, manufacturing, and tourism sectors. The method used in this study was linear regression of load current with GRDP of West Manggarai. In the last year of the 20th, the projected payload reached 1,644,285 tons which assumes to be 68% container load and 32% general cargo load. There were 400 ship-calls from container ships and 742 ship-calls of general cargo ships. The land and water port facilities obtained the projected cargo and ship visit results. The water facilities consist of a shipping lane width of 210 m with a minimum depth of -9 m. The maximum area of the mooring pond was 11.5 ha, and the rotating pool was 3.6 ha. The onshore facilities consist of a 138 x 15 m dock and a 1,000 x 15 m trestle; a warehouse area of 670 m<sup>2</sup>; stacking area of 6,840 m<sup>2</sup>. The investment cost for development was IDR 300 billion. In the 7th year, 2027, a 3,228 m<sup>2</sup> warehouse will be developed; in the 9th year, 2029, the procurement of loading and unloading equipment for Harbor Mobile Crane 2 units and a 19,737 m<sup>2</sup> stacking yard will be carried out as well. The impact of the relocation was to reduce ship operating costs by 37% -39% and 64% in docking costs. Providing income in port service from ships with a capacity of 736 TEUS of IDR 104 million per visit and increasing transportation fuel costs by 650%.

## INTRODUCTION

Labuan Bajo Port is a gateway for economic growth and support in West Manggarai. The Labuan Bajo Logistics Port is a port that collects and serves loading and to unload activities to meet the needs of the hinterland in West Manggarai. Port services for passenger, cargo, and container ships are carried out at one pier with a length of 245 meters and a depth of -6 to -11 meters LWS. Passenger ships are given priority in using the dock so that when a cargo/container ship is unloading or loading the goods, the ship will be moved to the mooring pond. Therefore, loading and unloading or embarkation-debarkation activities are less effective and less conducive, which then rearrangements are needed to support the activities at the port.

The tourism sector has become one of the main sectors in developing the country's economy, including Labuan Bajo, which has many stunning tourist attractions. Therefore, Labuan Bajo is included in the 10 New Bali or National Tourism Strategic Areas. In line with that, the

government is developing Labuan Bajo Port as an integrated passenger-only tourist port. The impact of this development is the separation of the passenger and logistics ports to provide smoothness and comfort for tourists [1] who will be diverted or moved to another area. The selected location was Wae Kelambu Village, Komodo Subdistrict, and West Manggarai.

## METHODOLOGY

The data was collected by selecting the data related to the research problems. The method used was an indirect method of data collection or data collection sourced from agencies searched via electronic devices. The analysis phases consisted of an analysis of GRDP and the potential of West Manggarai, forecasting the flow of container and general cargo, and forecasting the flow of ship visits. A technical analysis was carried out regarding the relocation. Based on the analysis, appropriate terminal planning was obtained per the needs and development and operational costs. Furthermore, the impact of the relocation on the stakeholders.

Table 1. Water Facilities.

Facilities	Size	Unit
Shipping lane		
Width	210	Meter
Depth	-9	MLWS
Rotating pool		
Radius	108	Meter
Area	3.6	Ha
Labuh Area		
GC-1 Ship	4.4	Ha
PK-2 Ship	11.5	Ha

Table 2. Ground Facilities.

Facilities	Unit	Short-Term (2021-2025)	Medium-Term (2021-2030)	Long-Term (2021-2040)
Dock	Meter	138x15	138x15	138x15
Mooring	Unit	1	1	1
Trestle	Meter	1,000x 15	1,000x 15	1,000x 15
Warehouse	M <sup>2</sup>	670	3,228	3,228
CY	M <sup>2</sup>	6,840	6,840	19,737
CFS	M <sup>2</sup>	54	54	54
Public Facility	M <sup>2</sup>	1,420	1,420	1,420

Table 3. Currency Values Accumulation

Components	Present Value Accumulation	Future Value Accumulation
<i>Benefit</i>		
Ship waiting time	IDR 107 billion	IDR 335 billion
Ship visit	IDR 13 billion	IDR 34 billion
Ground transportation cost	IDR 10 billion	IDR 28 billion
<i>Cost</i>		
Initial Development Cost	IDR 432 billion	-
Operational cost	IDR 58 billion	IDR 152 billion

## GENERAL DESCRIPTION

### A. General Condition of Manggarai Barat

West Manggarai Regency is located in the western part of Flores Island. Based on astronomical location, West Manggarai is at 8°, 14' - 9°, 00' South Latitude and 119°, 21' - 120°, 20' East Longitude. The geographical border of the West Manggarai Regency is the Flores Sea to the north, the Sawu Sea to the south, Manggarai Regency to the east, and the Sape Strait to the west. The land area of 3,141.47 km<sup>2</sup> consists of several large islands such as Komodo Island, Rinca Island, Longos Island, and other small islands. The capital of West Manggarai Regency is Labuan Bajo City.

The population of West Manggarai from 2015 – 2019 has an average growth rate of 2.24%. In 2019, the population was around 274,980 people. The population of Komodo District is 20% of the total population 54,668 people.

### B. Gross Regional Domestic Product of West Manggarai

From 2012 to 2019, the average GRDP growth of West Manggarai was 4.01%. The highest growth rate was in 2019, with a percentage of 5.54% indicating the accommodation and beverage provision sector as the highest growth rate, 11.67%. The second is construction with a percentage of 8.80%, and the third highest is the

other service sector at 8.67%. Those three highest sectors above are in line with the existence of a tourism development program in Labuan Bajo. It can be seen in Figure 1.

The role of each sector in generating gross value added can be seen from the distribution of GRDP according to the business sector. In 2019 the agriculture, forestry and fisheries sectors contributed the most with a percentage of 41.05%. The agriculture, forestry, and fisheries sectors are supported by the development of cultivation areas to support *agropolitan* and *minapolitan* areas. The second largest sector is government administration and defense at 13.51%, and the third is the construction sector at 13%.

### C. Policy

This policy is made to facilitate the relocation of Labuan Bajo Logistics Port to a multipurpose terminal. There are several steps, those are:

#### 1) National Tourism Development Master Plan

Komodo National Park, Labuan Bajo, has become a national tourism strategic area as stated in Government Regulation Number 50 of 2011 [2]. It is with determined criteria: the main function of tourism or tourism development potential, potential tourism resources to be the main attraction and have a broad image, and high market potential nationally and internationally.

#### 2) Regional Spatial Plan of West Manggarai

The regency strategic area is a prioritized area because it has a very important influence on the economy, social,

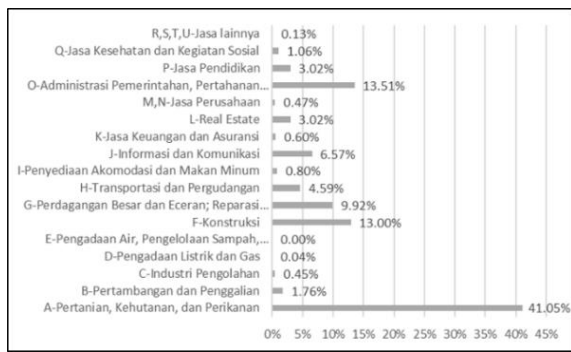


Figure 1. Flash in Boeing Plane 737-900.

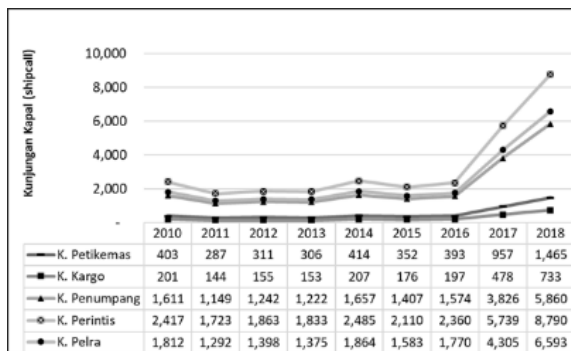


Figure 2. Trend of Ship Visit

culture, and environment within the district scope. The district strategic area is divided into 3 points of view.

Strategic area from the point of economic interest:

- Strategic urban area of Labuan Bajo
- Lembor *agropolitan* area
- The minapolitan area of the southern part of Komodo District, Boleng District, and Macang Pacar District
- Macang Pacar agro-industrial area
- The agro-tourism area of Sano Nggoang, Kuwus, Welak, Mbeliling, and Ndos.

### 3) Port Master Plan

The PMP contains a new port location in Rinca Island as a local feeder port. As well as the addition of a public terminal location [3] Port Master Plan. Based on the consideration of providing support for the acceleration and development of the Labuan Bajo tourism area as a premium-class tourist destination, it is necessary to relocate logistics activities to the new location, Wae Kelambu Village, Komodo Komodo District, West Manggarai.

#### D. Existing Condition of the Port

The port is a class II collecting port [3]. Labuan Bajo Port is a non-commercial port managed by the Port Administration Unit as the government. KUPP Labuan Bajo oversees 5 working areas: Rinca, Komodo, Aimere, Mborong, and Bari.

##### 1) Water Facilities

The shipping channel sea facility has a length of 1.44 miles, equivalent to 231.745 meters, a width of 250 miles / 402.336 meters, and a depth of 7 – 10 mLWS. Other facilities are a harbor that has an area of about 300 m<sup>2</sup> with a depth of 6 – 11 mLWS.

##### 2) Ground Facilities

It consists of a 245 meter main dock, 134 meter trestle, 125 m<sup>2</sup> passenger terminal and offices, 300 m<sup>2</sup> warehouse,

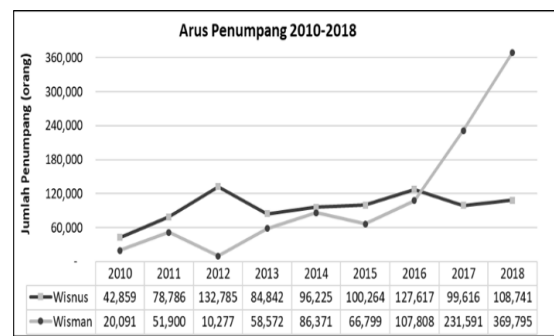


Figure 3. Passengers Trend.

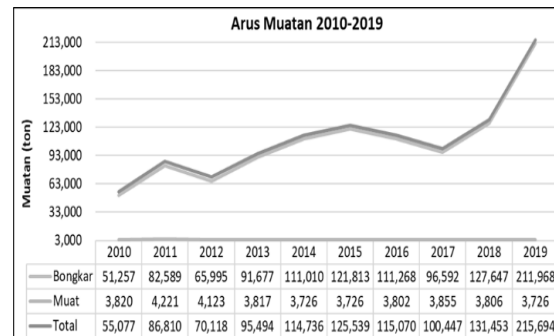


Figure 4. Loading Trend.

and containers yards of 11.100 m<sup>2</sup>. The heavy equipment consists of 2 units of forklifts and 1 unit of reachstacker.

### 3) Trend

Trend data includes ship visits from 2010 to 2018, as shown in Figure 2. The pioneer ships and passenger ships have the highest frequency. Ship visits fluctuate yearly, it can be decreasing or increasing; however, there has been an increasing number from 2016 to 2018.

Labuan Bajo Port has been visited mainly by local passengers for eight years. However, in the last two years, it has been dominated by foreign passengers. The average growth is 19% for domestic passengers and 101% for international passengers. International passengers mostly come from Germany, England, Spain, Australia, and other European countries.

The flow of goods is dominated by loading and unloading. There are only a few goods loaded through the port since the villagers mostly consume the products of agriculture, plantation, fishery, and other products, and they are developing processed products from these agricultural products. In 2013, in West Manggarai Regency, containers began to grow into the packaging of goods to be sent/unloaded with the assumption that the percentage of containers is 68% of the total cargo flow. 1 TEU is assumed to weigh 12 tons.

#### E. Hinterland Area

Labuan Bajo Port is a collecting port as a meeting place for several modes of transportation to serve areas around West Manggarai and Flores Island. The estimated area covered by Labuan Bajo Port includes the entire West Manggarai area because the road to several areas is well connected. The hinterland region has the greatest sectors of agricultural, plantation, fishery, and tourism products, which are centered in the Komodo District. The Hinterland region can be seen in Figure 5.

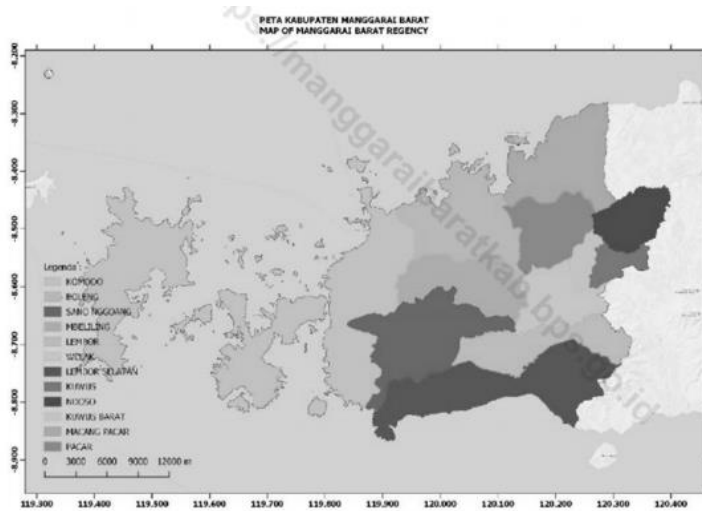


Figure 5. Hinterland Area.

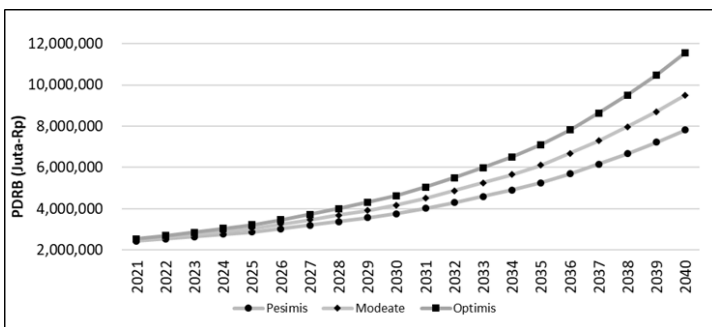


Figure 6. GRDP Projection.

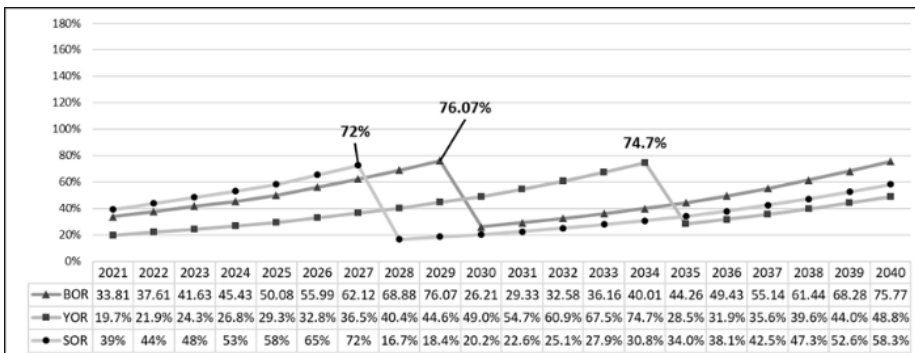


Figure 7. Facility Utilization

The existence of the cultivation, agriculture, plantations, fisheries, and marine has resulted in the development of industries in West Manggarai, namely the processing industry. The fishery processing area is located in the Komodo District. The industry is based on *agro* and *mina* by developing *agropolitan* and *minapolitan* areas.

ANALYSIS AND DISCUSSIONS

The plan will be developed gradually in 20 years with 3 time periods:

- a. Short-term : 2021 – 2025 (5 years).
- b. Medium-term: 2021 – 2030 (10 years).
- c. Long-term : 2021 – 2040 (20 years).

A. GRDP Projection

The GRDP projection for 20 years is conducted by considering the five-year average growth rate of 5.18%. This projection calculation is carried out in 3 scenarios:

pessimistic, moderate, and optimistic. The moderate scenario uses the average GRDP growth rate. Meanwhile, the pessimistic and optimistic scenarios are done by reducing and increasing 1% to the average growth rate. The average growth increases by 1.36% every five years, as shown in Figure 6.

B. Load Projection

The calculation of further projected loads is using a simple linear regression method involving the GRDP value. The relationship between the charge current and variables was tested for correlation. The correlation between the flow of general cargo and GRDP is 52%, which means a change in a GRDP variable will be followed by a change in the flow of goods variable. Based on the greatest sectors in West Manggarai Regency, commodity goods are dominated by agricultural, plantation and fishery products. Furthermore, the developments which can potentially become the flow of

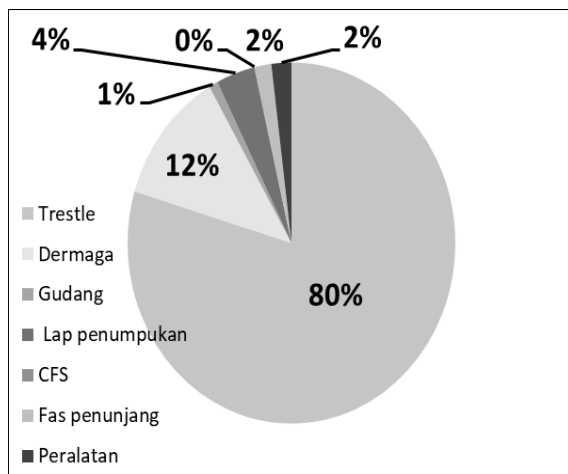


Figure 8. Construction Development Costs

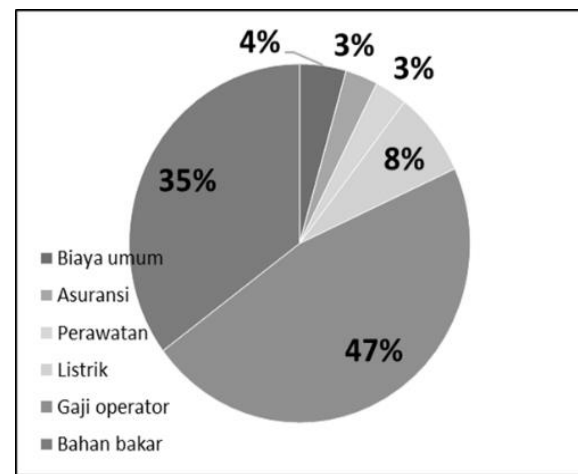


Figure 9. Percentage of Operational Costs.

goods sent through the port are being conducted alongside with the existence of the tourism potential in West Manggarai, for example: project equipment, building materials.

The mathematical equation for the general cargo flow projection model is as shown in formula (1).

$$y = 0.201 (x) - 271653.19$$

The overall loads projection is assumed to contain general cargo loads and containers, the percentage of containers is 68%, and general cargo is 32% of the total cargo. It can be seen in Figure 7.

C. Load Projection

Ship visits are divided into 2 ranges, ship sizes and their respective proportions to cargo. Container ships have sizes of 300 TEUS (60%) and 400 TEUS (40%). Meanwhile, general cargo ships consists of 500 DWT (24%) and 1,500 DWT (76%) sizes. The load factor of these ships is assumed to be 70% as seen in Figure 7.

D. Load Projection

Ground condition:

- a. There is no dock in the new location
- b. Access roads tend to be steep and winding with 5-6 meters wide.
- c. The distance from the city center is ± 15 km. Water condition
  - a. Wave height around 0.5 m – 1.25 m.
  - b. Depth based on Navionics with a range of 0 – 20 meters.
  - c. The current direction is east to west with 4-20 knots wind speeds.

E. Port Planning

The terminal that will be built is a multipurpose terminal that can serve various cargo types. This plan will dedicate the temporary terminal for general cargo and container loads. Operational time is assumed to be one working day for 24 hours of 365 days.

1) Water Facilities

The table of the water facilities can be seen in Table 1.

2) Equipment

This plan will also move two forklift units and one reachstacker unit to the new port location. Procurement of 6 units of internal trucks according to its operating time

from the storage area to the dock or vice versa. In the 9th year (2029), two units of *Harbor Mobile Crane* loading and unloading equipment will be procured to avoid lines of ships.

F. Utilization Indicator

There are 3 utilizations, namely *Berth Occupancy Ratio* (BOR), *Yard Occupancy Ratio* (YOR), and *Shed Occupancy Ratio* (SOR). In 2029 the dock usage ratio (BOR) will reach 76%; the usage of warehouse (SOR) has also reached 72% in 2027. In the long-term, in 2034 the yard usage (YOR) ratio will reach 74%.

G. Utilization Indicator

Details of port development investment costs for each period:

- a. Short-term (2021 – 2025) of IDR 300 billion
- b. Medium-term (2021-2030) of IDR 110 billion
- c. Long-term (2021-2040), there is a cost of IDR 21.9 billion.

There are two operational costs, namely fixed costs and variable costs. Fixed costs consist of insurance and maintenance costs for port facilities, costs for electricity usage, and salaries of heavy equipment operators. Meanwhile, variable costs include the costs of using fuel. The total operational cost per year is IDR 5.6 billion, as shown in Figure 9.

A. Analysis on Benefits Cost

The benefits of this study are:

1) Reducing ship waiting time (benefit)

The ship’s waiting time was around four days at the previous location. However, the simulation of ship visits at the new location showed that the waiting time was reduced to 8.7 hours. This reduction in time has an impact on operational costs when docking and shipping goods to the *consignee*. Operational costs include auxiliary engine fuel costs, lubricating oil costs, fresh water costs, and the costs for the crew supplies, as well as the cost of landing services. The difference in operational costs between the current condition and the new condition is the container ships with an annual operational cost of IDR 8.6 billion become IDR 5.3 billion, and a docking service fee of IDR 67 million becomes IDR 22 million. For general cargo ships, IDR 8.4 billion per year becomes IDR 5.3 billion, and the cost of docking services IDR 14 million becomes

IDR 5 million.

2) *The arrival of larger ships (benefit)*

At the new terminal's location, the water depth reaches  $> -12$  m LWS so that larger ships can visit the new location. In the future, ships weighing 10,000 DWT will visit the new terminal. The ship uses the assumption of the Meratus Kupang ship, which has a 7.8-meter draft with a payload of 736 TEUS; 8,170 GT. It is assumed that the Meratus Jaya Giri ship visits will be two shipcalls in a month. The total income of port services for the operator can be IDR 104 million per visit.

3) *Increasing cost for the ground transportation (dis-benefit)*

The current port distance to the hinterland is around 2 km, while the new terminal's location to the hinterland is around 15 km. The transfer of these goods has become further away, so ground transportation costs are higher than current costs. The higher cost is caused by the increasing fuel needed to get to/from the new location. The increasing fuel cost is 650% from the previous cost. The unit cost of ground transportation using container trucks is IDR 3.143.902 / TEU from IDR 3.076.692 / TEU, which is 2% difference from the initial cost. The impact of the additional fee is imposed on the recipient or sender of the goods.

Cost:

The cost component includes the construction cost of IDR 300 billion and the operational cost of IDR 5.6 billion. As shown in Table 3.

From the money currency value for the two *benefit* and *cost* components above, the BCR value is 0.23. The BCR value can be considered to be feasible when  $BCR > 1$ . Therefore, the development project is declared unfeasible regarding benefits and costs.

## CONCLUSIONS

According to the study that has been conducted, it can be concluded that:

- a. Water facilities consist of a shipping lane (210 m wide); docking pond (11.5 ha); rotating pool (3.6 ha). The ground facilities consist of a dock (138 x 15 m); trestle (1,000 x 15 m); warehouse (670 m<sup>2</sup>); CY (6,480 m<sup>2</sup>). Short-term costs (IDR 305 billion), medium-term (IDR 110 billion), and long-term costs (IDR 21 billion).
- b. The impact of the relocation is to reduce the ship operating costs by 37% -39% and 64% in docking costs. Providing port service income from ships with a capacity of 736 TEUS of IDR 104 million per visit and increasing ground transportation fuel costs by 650%.
- c. CBR of 0.23 is not feasible because the development costs exceed the benefits.

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