ECONOMIC AND FINANCIAL FEASIBILITY OF PORT DEVELOPMENT IN EAST KALIMANTAN PROVINCE

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Abstract

The port is an infrastructure that connects land and sea transportation modes, which greatly affects the movement of goods and passengers. The construction or development of a port requires an in-depth study, because it is associated with large costs. Several parameters are needed to conduct a feasibility study for the construction of a port, which includes the demand for loading and unloading of goods and ship visits. In this study, a feasibility study was conducted on the construction of a port in East Kalimantan Province. This study shows that the planned development of a port in East Kalimantan Province is economically feasible but not financially viable.

Keywords: port; development feasibility; economic feasibility; financial feasibility.

Abstrak

Pelabuhan merupakan infrastruktur yang menghubungkan moda transportasi darat dan moda transportasi laut, yang sangat berpengaruh terhadap pergerakan barang dan penumpang. Pembangunan atau pengembangan suatu pelabuhan memerlukan kajian yang mendalam, karena terkait dengan biaya yang besar. Diperlukan beberapa parameter untuk melakukan kajian kelayakan pembangunan suatu pelabuhan, yang mencakup kebutuhan bongkar muat barang dan kunjungan kapal. Pada studi ini dilakukan kajian kelayakan pembangunan suatu pelabuhan di Provinsi Kalimantan Timur. Studi ini menunjukkan bahwa rencana pembangunan suatu pelabuhan di Provinsi Kalimantan Timur layak secara ekonomi tetapi tidak layak secara finansial.

Kata-kata kunci: pelabuhan; kelayakan pembangunan; kelayakan ekonomi; kelayakan finansial.

INTRODUCTION

Indonesia is the 4th largest country in the world with a population of more than 250 million people and also one of the largest archipelago countries with more than 60% waters territorial, and has a coastline with more than 50,000 km (Vickers, 2005; Herdiyeni et al., 2014; Adam, 2015). This geographical condition realizes the importance of creating a marine transportation system that can guarantee the connectivity of all regions in Indonesia to

improve people's welfare and support economic development (Setiono, 2010; Dwarakish and Salim, 2015; Mankiw, 2015; Putra and Djalante, 2016; Chen et al., 2018). The port is needed as a connecting facility for land and sea transportation modes that affect the movement of goods and passengers, as well as commercial and financial services activities (Ligteringen, 2017). The construction of the port must be carried out in an integrated manner so that the system can run properly (Kadarisman and Majid, 2016).

Law No. 17 of 2008 about Shipping, states that the port must have a Port Master Plan that contains plans for the designation of land and waters territorial. Thus, the port can be in the form of terminals and vessel berths that have shipping safety and security facilities, as well as port support activities also intramoda and intermodal transportation transfers. Interesting things to be discussed more in the preparation of Port Master Plan is the projection of demand for loading and unloading of goods and projection of vessel visits, used to determine the needs of facilities at each stage of port development. This study took the case of a port in Tanjung Redeb in East Kalimantan Province. This port has development constraints due to limited land availability so it is necessary to develop other ports as new locations around existing ports. Furthermore, economic and financial feasibility analysis needs to be done as a factor that is taken into account in the port development plan.

Project investment is an attempt to build a new project or expand a project. Long-term project investments require large funds and high risk. By evaluating the feasibility of the project, before making a decision about whether the project is feasible or not, the risk can be minimized. The project feasibility evaluation is divided into 2 stages, namely a pre-evaluation study and a project feasibility study (Sutojo, 2000). Evaluation of project feasibility is carried out by considering the advantages and disadvantages, efficiency, and effectiveness of a business or activity to be carried out (Prawirohardjono, 1991). The focus of pre-evaluation studies is to look for critical inhibiting factors, which are likely to be insurmountable. The feasibility study focuses on market and marketing aspects, production, technical and technological aspects, management and human resources aspects, as well as economic and financial aspects related to the project (Sutojo, 2000). Evaluation of the economic and financial feasibility of port development includes port area analysis, port hinterland analysis, land facility needs analysis, and economic and financial analysis, such as investment costs, operating and maintenance costs, as well as revenues and benefits.

METHODS

The port used as a case study is a regional feeder port that serves general cargo, containers, liquid bulk, and dry bulk. A regional feeder port is a port that serves a limited number of domestic sea transportation activities and is a feeder for the main port and collecting port, as a destination for passengers and/or goods with an inter-provincial service range (Kementerian Perhubungan, 2016).

The stages in this research include preliminary studies, data collection, regional economic analysis, economic and financial analysis, and drawing conclusions. The literature used is literature related to ports and literature on economic and financial feasibility. Data collection is carried out to obtain an overview of the port hinterland, as well as the movement of demand at the port. The port hinterland data includes regional socio-economic data, such as population and Gross Regional Domestic Product, based on 2010 constant prices in Berau Regency and in East Kalimantan Province.

Demand movement data includes loading and unloading data for general cargo, containers, liquid bulk, and dry bulk. The demand movement data is taken from 2013 to 2018.

Regional economic analysis is related to those that affect the development of transportation networks, namely port area analysis and port hinterland analysis. The analysis of the port area includes an analysis of regional potential and socio-economic analysis of the region using the Location Quotient Method (Xu et al., 2018; Stimson et al., 2006) and the Klassen Typology method (Klassen, 1965; Widodo, 2006; Kuncoro, 2007; Rahayu, 2010; Ragilawan et al., 2018). The port hinterland analysis was conducted to determine the independent variables involved in the movement of demand towards port development. Analysis of demand movements includes forecasting short-term, medium-term, and long-term demands (Montgomery et al., 2008; McGuigan et al., 2011). Firdaus et al. (2019) conducted a research on demand forecasting at a port in Maluku Province, Eastern Indonesia, and concluded that econometric projections (Enders, 2015) with a linear regression approach are a suitable method for predicting loading and unloading activities.

The projection period for this case study uses a period of 20 years, and is divided into short term (2020-2024), medium term (2025-2029), and long term (2030-2039). The results of these projections are used to calculate the demand for port land facilities, with reference to the Guidelines for Planning for Collecting Port Land Facilities, Regional Feeders, and Local Feeders from the Directorate General of Sea Transportation, Ministry of Transportation of the Republic of Indonesia.

Economic and financial analysis covers the sector of financial benefits and feasibility associated with investment and financing (Helfert, 2001; Giatman, 2006; McAfee and Lewis, 2009; Newman et al., 2012). Calculation of Capital Expenditure (CAPEX) refers to the Regulation of the Minister of Transportation Number 78 of 2014, and calculation of Operational Expenditure (OPEX) refers to the study of Wu and Clemens (2007), using a value of 7% of investment costs as operational expenditure (OPEX) followed by an increase by 3.49% annually.

The calculation of port revenue is based on the Regulation of the Minister of Transportation Number 121 of 2018 and Government Regulation Number 11 of 2015. While the calculation of port benefits uses an increase of 1.5% from a certain GRDP value in 2010, based on constant prices, referring to the results of the Location Quotient (LQ) and Klassen's typology based on the 1994 World Development Report.

RESULT AND DISCUSSION

Port Area Analysis

Location Quotient method is used as a measurement technique by comparing business fields in Berau regency to the relative demands of these business fields in East Kalimantan province. Meanwhile, the Klassen Typology method is used to identify economic positions related to potential business fields in the observation area. The results of Location Quotient method analysis and Klassen Typology method are presented in Table 1 and Table 2.

Table 1 Results of Berau Regency Location Quotient Analysis of East Kalimantan Province in 2018

	Industrial Sector	GRDP at 2010 Constant Price (billion Rp)		LQ
		2018	2018	
		Berau Regency	East Kalimantan Province	
A	Agriculture, forestry, and fisheries	2,638	32,201	1.42
B	Mining and quarrying	16,603	217,605	1.33
C	Processing indrustry	1,085	97,499	0.19
D	Electricity and gas procurement	11	262	0.70
E	Water supply; household, waste management and recycling	11	228	0.84
F	Construction	1,051	33,719	0.54
G	Large and retail trade; car and motorcycle repair	1,680	2,653	1.14
H	Transportation and warehousing	1,378	14,099	1.70
I	Provision of accommodation and drinking	259	4,127	1.09
J	Information and communication	293	7,405	0.69
K	Financial services and insurance	130	6,817	0.33
L	Real estate	240	4,227	0.99
M	Company services	25	896	0.48
N	Government administration, defense and compulsory social security	280	8,019	0.61
O	Education services	654	6,835	1.66
P	Health services and social activities	249	2,693	1.61
Q	Other services	180	2,536	1.23
	Total	26,766	464,823	

From the 17 existing industrial sectors, 8 potential sectors were obtained in Berau regency to East Kalimantan Province as case study port areas, namely: (1) agriculture, forestry, and fisheries, (2) mining and quarrying, (3) large and retail trade and car and motorcycle repair, (4) transportation and warehousing, (5) provision of accommodation and drinking, (6) education services, (7) health services and social activities, and (8) other services. These 8 potential industrial sectors are used as the basis for determining independent variables in the port hinterland analysis.

The socioeconomic analysis of the region used population growth data in Berau Regency and East Kalimantan Province GRDP at 2010 constant price data published by the Central Berau of Statistics (2019). The existing data from 2013-2018 is projected by time-series method with a linear regression approach for a period of 20 years. From this analysis, the estimated population in East Kalimantan Province in 2039 is 5,216,741 people and in

Berau Regency as many as 348,661 people. For economic growth, based on 2010 GRDP at constant prices, it is estimated that East Kalimantan's GRDP will reach IDR 547,628,000,000,000 and for Berau Regency of IDR 30,710,000,000,000 in 2039.

Table 2 Results of Berau Regency Typology Klassen Analysis of East Kalimantan Province in 2018

	Industrial Sector	Classification of Klassen
A	Agriculture, forestry and fisheries	Developed
B	Mining and quarrying	Developed
C	Processing indrustry	Underdeveloped
D	Electricity and gas procurement	Underdeveloped
E	Water supply; household, waste management and recycling	Underdeveloped
F	Construction	Developing
G	Large and retail trade; car and motorcycle repair	Stagnant
H	Transportation and warehousing	Stagnant
I	Provision of accommodation and drinking	Stagnant
J	Information and communication	Underdeveloped
K	Financial services and insurance	Underdeveloped
L	Real estate	Developing
M	Company services	Developing
N	Government administration, defense and compulsory social Security	Underdeveloped
O	Education services	Stagnant
P	Health services and social activities	Stagnant
Q	Other services	Stagnant

Port Hinterland Analysis

The analysis of the interior of the port consists of analysis of independent variables and analysis of movement. The independent variable analysis was carried out by considering the following facts. Based on data on the origin of goods, it is known that the leading commodities of loading and unloading activities are potential sector commodities from the City of Surabaya, Balikpapan City, Berau Regency, East Java Province, and East Kalimantan Province in 2019. In addition, there is the demolition of construction materials and equipment at the hinterland site. In addition, the analysis carried out is also based on population growth data in Berau Regency for 20 years. Based on these things, a correlation analysis of the projected variables was carried out on the collected loading and unloading demand data, so that the resulting independent variables were selected for each demand projection scenario. The selected independent variables from each category are presented in Table 3 and Table 4 for general cargo, in Table 5 and Table 6 for container cargo, in Table 7 and Table 8 for liquid bulk cargo, and in Table 9 and Table 10 for cargo dry bulk.

Table 3 Selected Independent Variable for General Cargo Unloading Demand Projection Scenario

No	Variable
1	Berau regency population
2	Berau regency total livestock and poultry
3	Surabaya city vegetable crop harvest area
4	Berau regency construction GRDP at 2010 constant price
5	East Kalimantan province industry GRDP at 2010 constant price
6	Balikpapan city industry GRDP at 2010 constant price
7	East Java province trade GRDP at 2010 constant price
8	Surabaya city trade GRDP at 2010 constant price

Table 4 Selected Independent Variable for General Cargo Loading Demand Projection Scenario

No.	Variable
1	Berau regency population
2	Cacao production
3	Berau regency total GRDP at 2010 constant price
4	Berau regency trade GRDP at 2010 constant price
5	Berau regency transportation and warehousing GRDP at 2010 constant price
6	East Kalimantan province total GRDP at 2010 constant price
7	Balikpapan city total GRDP at 2010 constant price
8	East Java province total GRDP at 2010 constant price
9	Surabaya city total GRDP at 2010 constant price

Table 5 Selected Independent Variable for Container Unloading Demand Projection Scenario

No.	Variable
1	Berau regency population
2	Berau regency total GRDP at 2010 constant price
3	Berau regency trade GRDP at 2010 constant price
4	Berau regency transportation and warehousing GRDP at 2010 constant price
5	East Kalimantan province total GRDP at 2010 constant price
6	East Kalimantan province trade GRDP at 2010 constant price
7	Balikpapan city total GRDP at 2010 constant price
8	Balikpapan city trade GRDP at 2010 constant price
9	East Java province total GRDP at 2010 constant price
10	East Java province trade GRDP at 2010 constant price
11	Surabaya city total GRDP at 2010 constant price
12	Surabaya city trade GRDP at 2010 constant price

Table 6 Selected Independent Variable for Container Loading Demand Projection Scenario

No.	Variable
1	Berau regency population
2	Berau regency total GRDP at 2010 constant price
3	Berau regency industry GRDP at 2010 constant price
4	Berau regency agriculture GRDP at 2010 constant price
5	Berau regency transportation and warehousing GRDP at 2010 constant price
6	East Kalimantan province total GRDP at 2010 constant price
7	Balikpapan city total GRDP at 2010 constant price
8	East Java province total GRDP at 2010 constant price
9	Surabaya city total GRDP at 2010 constant price

Table 7 Selected Independent Variable for Liquid Bulk Unloading Demand Projection Scenario

No	Variable
1	Berau regency population
2	Berau regency total GRDP at 2010 constant price
3	Berau regency agriculture GRDP at 2010 constant price
4	Berau regency palm oil plantation area
5	Berau regency palm oil production

Table 8 Selected Independent Variable for Liquid Bulk Loading Demand Projection Scenario

No.	Variable
1	Berau regency population
2	Berau regency total GRDP at 2010 constant price
3	Berau regency agriculture GRDP at 2010 constant price
4	Berau regency industry GRDP at 2010 constant price
5	Berau regency palm oil plantation area
6	Berau regency palm oil production

Table 9 Selected Independent Variable for Dry Bulk Unloading Demand Projection Scenario

No.	Variable
1	Berau regency population
2	Berau regency total GRDP at 2010 constant price
3	Berau regency construction GRDP at 2010 constant price
4	Berau regency trade GRDP at 2010 constant price

Table 10 Selected Independent Variable for Dry Bulk Loading Demand Projection Scenario

No.	Variable
1	Berau regency population
2	Berau regency total GRDP at 2010 constant price
3	Berau regency agriculture GRDP at 2010 constant price
4	Berau regency industry GRDP at 2010 constant price
5	Berau regency trade GRDP at 2010 constant price

General cargo loading and unloading demand projection

From the selected independent variables, projections of general cargo and loading demand are made using three predictive values, namely pessimistic predictions, moderate predictions, and optimistic predictions. The projection value is obtained using the Malcom equation:

$$Y = (a + 4m + b)/6 \quad (1)$$

with:
Y = Projection Value
a = Pessimistic Prediction
m = Moderate Prediction
b = Optimistic Prediction

By using equation (1), the results of loading and unloading requests for general cargo at Tanjung Redeb Port are obtained, for the short term (2020-2024), medium term (2025-2029), and long term (2030-2039), which are summarized in the projected cargo demand, as shown in Table 11.

Table 11 Tanjung Redeb Port General Cargo Demand Projection

Year	Unloading (ton)	Loading (ton)	Total (ton)
2024	161,540	76,752	238,292
2029	158,584	102,175	260,759
2039	146,453	152,742	299,195

Container loading and unloading demand projection

From the selected independent variables, a container loading and unloading demand projection is made using the same method as the general cargo demand projection. A summary of the projected value of container demand obtained can be seen in Table 12.

Table 12 Tanjung Redeb Container Demand Projection

Year	Unloading (TEUs)	Muat (TEUs)	Total (TEUs)
2024	16,909	22,881	39,790
2029	19,819	30,814	50,633
2039	24,983	46,767	71,750

Liquid bulk loading and unloading demand projection

From the selected independent variables, a projected demand for loading and unloading of liquid bulk is made using the same method as the projected demand for containers. The results are summarized and presented in Table 13.

Table 13 Tanjung Redeb Liquid Bulk Demand Projection

Year	Unloading (ton)	Loading (ton)	Total (ton)
2024	148,588	85,026	233,613
2029	159,836	124,809	284,645
2039	193,782	256,882	450,664

Dry bulk loading and unloading demand projection

Using the selected independent variables, dry bulk loading and unloading demand projections are made using the same method as the liquid bulk demand projections. The results obtained can be seen in Table 14.

Table 14 Tanjung Redeb Dry Bulk Demand Projection

Year	Unloading (ton)	Loading (ton)	Total (ton)
2024	164,936	43,597,948	43,762,883
2029	125,799	47,243,423	47,369,222
2039	77,922	54,001,147	54,079,070

Port demand projection

The projected demand at the Port, which is the object of this study, is based on the demand that cannot be served at Tanjung Redeb Port. The existing general cargo storage

facilities at Tanjung Redeb Port are storage warehouses with an area of 1,700 m^2, or equivalent to a throughput capacity of 180,000 tons/year, and container storage facilities in the form of a stacking field covering an area of 2,847 m^2, or equivalent to a container capacity of 17,814 TEUs/year.

The projected general cargo demand at the port being observed is what is needed at the end of the next 20 year period, which is 119,678 tons. The projected demand for containers required at the end of the next 20 years is 53,936 TEUs. Field data also shows that there is potential to develop this port so that it can serve loading and unloading activities of liquid bulk and dry bulk. Existing field data divides the proportion of liquid bulk and dry bulk demand into each development period, namely short term (2020-2024), medium term (2025-2029), and long term (2030-2039). The proportion of distribution of liquid bulk demand to the total liquid bulk demand is 25% (short term), 35% (medium term), and 50% (long term). Meanwhile, the proportion of dry bulk demand to total dry bulk demand is 5% (short term), 7.5% (medium term), and 10% (long term).

Number of vessel visits projection

Projection of the number of ship visits is needed to be able to assist the process of analyzing the needs for facilities and port revenues. In planning, the ship specifications to be used are the largest existing ships, which have docked at Tanjung Redeb Port, namely container ships with a weight of 4820 DWT and general cargo ships with a weight of 4000 DWT. The design ship weight used, to project the number of visits by liquid and dry bulk vessels, is also 4000 DWT.

From the use of the ship's data plan and the results of port demand projections, it is possible to obtain a projection of the number of ship visits that will occur at the port. The results of the projected ship visits at this port can be seen in Table 15.

Table 15 Number of Vessel Visits Projection in Port X

Year	Vessel Visits (call)				
	General Cargo	Container	Liquid Bulk	Dry Bulk	Total
2024	30	163	19	695	907
2029	33	244	32	1,122	1,431
2039	38	400	71	1,700	2,209

Port Land Facilities Needs Analysis

Analysis of land facility requirements is carried out using projected port requirements data and projected ship visits. The number of land facilities needed such as trestles, stacking yards, storage fields, (Toresen, 2003), is divided according to the respective development period, namely short term, medium term, and long term. The results of the analysis of short-term needs can be seen in Table 16, medium-term needs in Table 17, and long-term needs in Table 18.

Table 16 Short-term Needs of Port Land Facilities

No.	Port Land Facilities	Unit	Existing	Short-term Needs (2020-2024)
1	Trestle			
	Length	m	120	120
	Width	m	12	12
	Elevation	m	5	5
2	Container Area			
	Stacking Yard	m^2	0	8,100
	Container Freight Station	m^2	0	1,620
	Empty Container Stacking Yard	m^2	0	810
	Truck Parking Area	m^2	0	405
	Total container area	m^2	0	10,935
3	General Cargo Area			
	Warehouse	m^2	0	310
	Outdoor Storage Field	m^2	0	510
4	Dry Bulk Area			
	Storage Field	m^2	0	2,540
5	Liquid Bulk Area			
	Liquid Bulk Refinery (2,000 kL Capacity)	unit	0	3
	Total Liquid Bulk Area	m^2	0	2,000
6	Port Administration Office			
	Office	m^2	0	120
7	Port Equipment			
	Container Trucks	unit	0	4
	Reach Stacker	unit	0	1
	Forklift	unit	0	1
	Stacking Yard	m^2	0	100
8	Guard Post (2 unit @ 12 m2)			
	Entry Post	m^2	0	12
	Exit Post	m^2	0	12
9	Public Facilities			
	Toilet (3 x 9)	m^2	0	27
	Mosque (8 x 8)	m^2	0	64
	Canteen Area (3 x 12)	m^2	0	36
10	Port Local Street			
	Street Access (width 6 m)	m^2	0	1,116
	Street Acess (width 4 m)	m^2	0	180
11	Drainage Channels	LS	0	1
12	Electrical Installation	m^2	0	1
13	Communication Infrastructure	unit	0	1
14	Wastewater Treatment Plant	unit	0	1
15	Shipping Safety Facilities (Beacons)	unit	0	1
16	Port Sign Post	unit	0	1
17	Fire Fighting Facilities	LS	0	1
18	Green Open Space	m^2		

Table 17 Mid-term Needs of Port Land Facilities

No.	Port Land Facilities	Unit	Existing (Short-Term)	Mid-term Needs (2025-2029)
1	Trestle			
	Length	m	120	0
	Width	m	12	0
	Elevation	m	5	0
2	Container Area			
	Stacking Yard	m^2	8,100	3,900
	Container Freight Station	m^2	1,620	780
	Empty Container Stacking Yard	m^2	810	390
	Truck Parking Area	m^2	405	195
	Total container area	m^2	10.935	5,265
3	General Cargo Area			
	Warehouse	m^2	310	30
	Outdoor Storage Field	m^2	510	50
4	Dry Bulk Area			
	Storage Field	m^2	2,540	1,560
5	Liquid Bulk Area			
	Liquid Bulk Refinery (2,000 kL Capacity)	unit	3	2
	Total Liquid Bulk Area	m^2	2,000	1,400
6	Port Administration Office			
	Office	m^2	120	0
7	Port Equipment			
	Container Trucks	unit	4	0
	Reach Stacker	unit	1	0
	Forklift	unit	1	0
	Stacking Yard	m^2	100	0
8	Guard Post (2 Unit @ 12 m^2)			
	Entry Post	m^2	12	0
	Exit Post	m^2	12	0
9	Public Facilities			
	Toilet (3 x 9)	m^2	27	0
	Mosque (8 x 8)	m^2	64	0
	Canteen Area (3 x 12)	m^2	36	0
10	Port Local Street			
	Street Access (width 6 m)	m^2	1,116	0
	Street Acess (width 4 m)	m^2	180	0
11	Drainage Channels	LS	1	0
12	Electrical Installation	m^2	1	0
13	Communication Infrastructure	unit	1	0
14	Wastewater Treatment Plant	unit	1	0
15	Shipping Safety Facilities (Beacons)	unit	1	0
16	Port Sign Post	unit	1	0
17	Fire Fighting Facilities	LS	1	0
18	Green Open Space	m^2		

Table 18 Long-term Needs of Port Land Facilities

No.	Port Land Facilities	Unit	Existing (Mid-Term)	Long-term Needs (2030-2039)
1	Trestle			
	Length	m	120	0
	Width	m	12	0
	Elevation	m	5	0
2	Container Area			
	Stacking Yard	m^2	12,000	7.800
	Container Freight Station	m^2	2,400	1.560
	Empty Container Stacking Yard	m^2	1,200	780
	Truck Parking Area	m^2	600	390
	Total container area	m^2	16,200	10,530
3	General Cargo Area			
	Warehouse	m^2	340	50
	Outdoor Storage Field	m^2	560	80
4	Dry Bulk Area			
	Storage Field	m^2	4,100	2,110
5	Liquid Bulk Area			
	Liquid Bulk Refinery (2,000 kL Capacity)	unit	5	5
	Total Liquid Bulk Area	m^2	3,400	3,300
6	Port Administration Office			
	Office	m^2	120	0
7	Port Equipment			
	Container Trucks	unit	4	0
	Reach Stacker	unit	1	0
	Forklift	unit	1	0
	Stacking Yard	m^2	100	0
8	Guard Post (2 unit @ 12 m2)			
	Entry Post	m^2	12	0
	Exit Post	m^2	12	0
9	Public Facilities			
	Toilet (3 x 9)	m^2	27	0
	Mosque (8 x 8)	m^2	64	0
	Canteen Area (3 x 12)	m^2	36	0
10	Port Local Street			
	Street Access (width 6 m)	m^2	1,116	0
	Street Acess (width 4 m)	m^2	180	0
11	Drainage Channels	LS	1	0
12	Electrical Installation	m^2	1	0
13	Communication Infrastructure	unit	1	0
14	Wastewater Treatment Plant	unit	1	0
15	Shipping Safety Facilities (Beacons)	unit	1	0
16	Port Sign Post	unit	1	0
17	Fire Fighting Facilities	LS	1	0
18	Green Open Space	m^2		

Economic and Financial Analysis

Port revenue analysis

Port income is obtained from port service tariffs for each ship that uses port services. The calculation of port service standards is based on the Minister of Transportation Regulation Number 121 of 2018 and Government Regulation Number 11 of 2015. The summary of port revenue projections can be seen in Table 19.

Table 19 Port X Revenue Projection

Year	Berthing Services (Rupiah)	Mooring Services (Rupiah)	Unloading Services (Rupiah)	Stacking Services (Rupiah)	Parking (Rupiah)	Total (Rupiah)
2024	140,194,633	107,057,720	1,274,496,667	1,241,130,501	1,693,045,074	4,455,924,595
2029	219,067,243	167,287,713	1,991,520,392	1,890,414,615	2,677,874,074	6,946,164,037
2039	341,033,791	260,425,804	3,100,307,190	3,180,039,732	4,128,015,161	11,009,821,678

Capital expenditure (CAPEX) and operational expenditure (OPEX) analysis

CAPEX analysis is carried out based on cost calculations according to the needs of port land facilities. The cost standard used is the Regulation of the Minister of Transportation No. 78 of 2014, concerning Cost Standards within the Ministry of Transportation. The results of the CAPEX calculation are adjusted to the needs of the first 5 years (short term) of port land facilities and the needs of the second 5 years (medium term).

The total CAPEX for short-term needs (2020-2024) for port land facilities is Rp.104,603,108,431. The total CAPEX for medium-term needs (2025-2029) for Port X land facilities is Rp. 35,844,297,421. Meanwhile, the total CAPEX for long-term needs (2030-2039) is IDR 80,242,953,810. Thus, the total CAPEX is Rp. 220,690,359,661.

It can be seen that the total short-term CAPEX value is very large, due to the physical development, in the form of trestles, port equipment, and supporting facilities. Medium-term CAPEX costs are used for warehouse development and stacking yards, as is the case with long-term CAPEX.

The next step is to perform an OPEX analysis. The OPEX value used is 7% of the total CAPEX with an increase of 3.49% per year. The summary of the OPEX calculation results can be seen in Table 20.

Table 20 OPEX Analysis Results

Year	Operational Expenditure (Rupiah)
2024	17,720,458,320
2029	21,036,180,324
2039	29,644,952,201

Port economic analysis

Economic analysis is carried out by calculating the benefits arising from the construction or development of a port. Port development certainly requires new access which will have further beneficial impacts.

The selection of the independent variables used is based on the results of the regional potential analysis. The growth of the potential sector that is expected to be affected is used as the basic variable in the calculation. The increase in the value of the benefits obtained is 1.5%, in accordance with the 1994 WDR elasticity value, regarding infrastructure development. The summary of the results of the benefit analysis can be seen in Table 21.

From the results of the benefit analysis, with CAPEX and OPEX data, the calculation of the payback period and BCR with an interest rate of 12% can be carried out, according to

the standards of the Ministry of Transportation. The cash flows are modeled, as can be seen in Figure 1, and the results of the economic feasibility analysis are presented in Table 22.

Table 21 Port X Benefit Analysis Results

Year	Berau Regency GRDP at 2010 Constant Price Projection (Billion Rupiah)				Benefit (Rupiah)
	Trading	Transportation and Warehousing	Accommodation and Drinking	Health Services and Social Activities	
2024	1.970	1.468	326	351	61,726,021,937
2029	2.240	1.531	385	435	68,863,122,110
2039	2.778	1.618	504	604	82,568,250,652

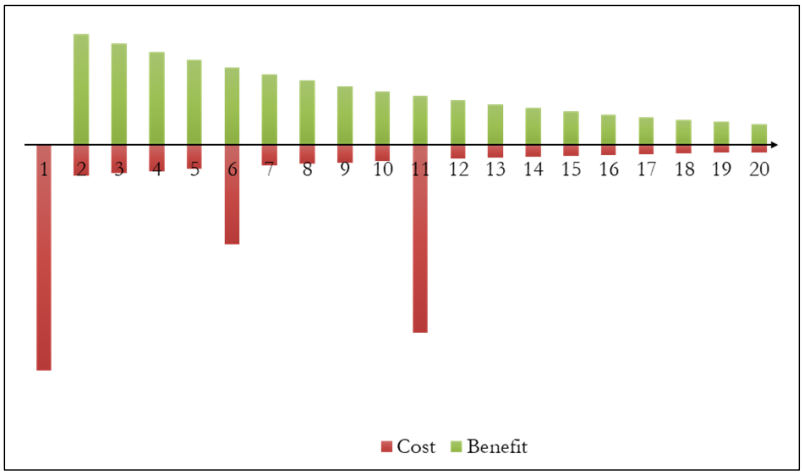

Figure 1 Port X Economic Cash Flow Diagram

Table 22 The Results of Port X Economic Feasibility Analysis

No.	Parameter	Unit	Result	Economic Feasibility
1	Benefit Cost Ratio (BCR)	N/A	1.32	Feasible
2	Economic Rate of Return (EIRR)	%	20%	Feasible
3	Economic Payback Period	Year	4	Feasible
	Parameter Awal			
1	Bank Interest	%	12	
2	Study Period	Year	20	

Port financial analysis

Data generated from revenue calculations, CAPEX, and OPEX are used in financial analysis using an interest rate of 12%. The financial analysis cash flow used is modeled in Fig.2 and the results of financial feasibility analysis are presented in Table 23.

The data generated from the calculations of revenues, CAPEX, and OPEX are used in financial analysis using an interest rate of 12%. The financial analysis of cash flows is modeled and can be seen in Figure 2, and the results of the financial feasibility analysis are presented in Table 23.

Figure 2 Port X Financial Cash Flow Diagram

Table 23 The Results of Port X Financial Feasibility Analysis

No.	Parameter	Unit	Result	Financial Feasibility
1	Financial Rate of Return (FIRR)	%	0.30%	Not Feasible
2	Net Present Value (NPV)	Rupiah	-249,387,019,619	Not Feasible
3	Economic Payback Period	Year	>20	Not Feasible
	Parameter Awal			
1	Bank Interest	%	12	
2	Study Period	Year	20	

In this study, it is known that there are 8 potential business sectors, which provide a projected demand for goods, and this demand is increasing every year. The projected increase in demand at the end of the 20-year period for general cargo is 36%, for containers by 132%, for liquid bulk by 121%, and for dry bulk by 33% in Berau Regency to East Kalimantan Province. This condition resulted in the development of Tanjung Redeb Port, to serve the distribution of demand for these goods. With limited land in the existing port, additional land facilities are needed to be used as docks and supporting facilities for port development, namely stacking yards, warehouses, roads, and equipment for loading and unloading activities. Furthermore, an analysis of economic feasibility and financial feasibility is also carried out, which includes investment costs and operational costs of existing port facilities and their development, as well as port benefits for trade, transportation, and warehousing, food and beverage accommodation, as well as health services and social activities for residents in the province. East Kalimantan, as well as the value of port revenues from berthing services, mooring services, loading and unloading services, stacking services, and parking services.

CONCLUSIONS

This study discusses the economic and financial feasibility of port development in East Kalimantan Province. The results show that the projected demand for loading and

unloading of general cargo is 299,195 tons; containers of 71,750 TEUS; liquid bulk 450,664 tons; dry bulk 54,079,070 tons; and a total of 2,209 ship visits in 2039. Based on projected demand, it is necessary to develop land facilities, in the form of docks, stacking yards, warehouses, harbor roads, port posts, office areas, wastewater treatment plants, green open spaces, and loading and unloading equipment. Further analysis shows that the project is economically feasible but not financially viable.

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