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FINANCIAL FEASIBILITY ANALYSIS OF WAREHOUSE BOARDING AT THE PORT OF BAAI ISLAND BENGKULU

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ABSTRACT

Warehouse hoarding is one of the port facilities that serve to store goods coming from the ship or vice versa. With the increasing of commodity every year, it is necessary to build warehouse development plans to accelerate the time when the ship is tethered. This study aims to analyze the financial feasibility of the warehouses's construction at The Baai Island Port with two alternative scenarios of goods movement patterns. Alternative layout A is a U-shaped pattern of goods shifting, whereas layout B is a straight-line movement pattern. Financial analysis was performed using methods, NPV, IRR, BCR and PBP with interest rates of 12% for investment plans of 5, 10, 15 and 20 years. From the result of the analysis, layout B has the highest income with the feasibility of 10, 15 and 20 year of investment plan. In the 20 year investment plan, NPV gained Rp.7.895.134.545 IRR 20,19%, BCR 1,33 and forecast of capital at the investment around 13 years later. The analysis is continued by testing the investment parameters and it is concluded that if the construction rises up to 60%, the income decrease is 20%, and the operational cost increase by 30% then the project is still feasible to continue.

Keywords: Port, Warehouse Layout, Financial Feasibility, Sensitivity Analysis.

1. INTRODUCTION

The magnitude of the need for port services of Pulau Baai is influenced by the growing of cargo. This increase in demand can be seen in 2012 where port loading and unloading activities doubled by 4,265,431 tons compared to the previous year (PT Pelindo II Cab Bengkulu, 2013). As for some obstacles in the distribution of goods directly to the consumer is a warehouse that is still full, the ability of small freight transport, the weather is not supportive, and the distance of the consumer warehouse is relatively far from the port. With the existence of some of these barriers make the ship takes a long time for loading and unloading. For the types of rubber, cement, fertilizer, rice, flour and other basic commodities require storage warehouse before being loaded onto ships or distributed to consumers. This type of goods is called bag cargo, bag cargo is a load compacted in sacks or bags that have a certain weight. In this warehouse operation is not allowed to do the activities of packing, marking, labeling, sorting, and bagging. Problems arising in the construction of warehouses is a warehouse planning that has not been optimal in accommodating the cargo and worthy of getting up in terms of investment. Investment policies and operational costs, have an impact on the rate of return on investment. Efforts made in maximizing warehouse revenue is by improving warehouse management well.

The purpose of this study are:

1) Analyze the storage space requirement of cargo bag commodity.

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2) Analyze the financial feasibility with two alternatives layout of the pattern of goods movement in the plan to build the stockpile at the Baai Island Port of Bengkulu.
3) Analyze the sensitivity of financial feasibility in the plan to build a stockpile at the Baai Island Port of Bengkulu.

In this research will be conducted feasibility analysis of the plan for the construction of storage warehouses at the Port of Baai Island to determine whether or not proper development is done. The results of financial analysis obtained will provide input to the government and investors in investing.

2. LITERATURE REVIEW

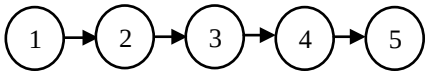
A stockpile is a warehouse used to stockpile or store imported or exported goods. Considering the provision of temporary shelter is intended to temporarily stockpile the goods, there is a need to limit the period of stocking of goods in it. The period of thirty days provided is sufficient to allow the interested parties to immediately remove their goods from the stockpile as well so as not to disrupt the smooth flow of goods at the port (congestion). Warehousing can be divided into 3 basic functions, namely (Purnomo, 2004):

1) Movement material consisting of receiving, transfer, order selection, shipping
2) Storage: Temporary and Semi-Permanent
3) Transfer information

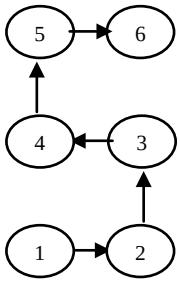
2.1 Transfer Flow Pattern

There are several types of warehouse flow patterns that can be applied namely;

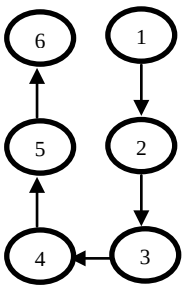
a. Straight Line Flow Pattern



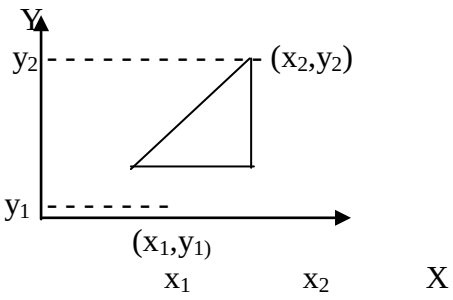
b. Shape Flow Pattern S



c. U-shape Flow Patterns



2.2 Moving Distance



$$D = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

D = Distance
(x_1,y_1) = Inlet point of material
(x_2,y_2) = Storage block point

2.3 Load Prediction

Predicted commodity loads can be obtained by projecting commodities.

Table 2.1 Projection Calculation

No.	Method	Pn
1.	Arithmetic	Pn = Po (1 + r . n)
2.	Geometric	Pn = Po (1 + r)^n
3.	Exponential	Pn = Po.e^{rn}

Pn = Number of commodities in year (n)
Po = The number of commodities at first
n = Projection time period
r = Commodity growth every year (%)
e = 2,7182818

2.4 Determination of Depth of Storage Space

1. Useable Area

   Plenty of pallets = $\frac{maximum\ amount\ of\ payload}{Pallet\ Capacity}$

   Area = Pallet Capacity x Area of Pallet Dimension

2. Wide Aisle Needs

   $d = \sqrt{p^2 + l^2}$

   d = Aisle width
   p^2 = Forklift length

l^2 = Commodity length

3. In -Transit Time

$$\text{In -Transit Time} = \frac{\text{Holding Capacity x 365}}{\text{Tonnase Commodity}}$$

Whereas:
In-transit Time = Average time of goods buried in warehouse (day)
Holding Capacity = Warehouse capacity (ton)
Goods Tonage = Weight of goods through the warehouse route in a year (ton)

4. Warehouse Room Utility

$$\text{Space Utility} = \frac{Total\ Block\ Area}{Spacious\ Room}\ x\ 100\%$$

2.5 Financial Feasibility Analysis

In general, the methods often used include:

a. Net Present Value Method (NPV)
b. Benefit Cost Ratio Method (BCR)
c. Internal Rate Of Return Method (IRR)
d. Payback Period Method (PBP)

2.6 Sensitivity Analysis

Sensitivity analysis is done by changing the value of a parameter at a time to further see how the effect on the acceptability of an investment. The parameters that usually change and the changes can affect the decision in the study of technical economics are the cost of investment, cash flow, residual value, interest rate, tax rate, and others (Pujawan; 2003).

3. RESEARCH METHODOLOGY

3.1 Data Collection Stage

Stage of data collection in this research is divided into 2 parts namely primary data and secondary data.

1. Primary data consists of interviewing officers and making observations to obtain preliminary data on warehouse development plans.
2. Secondary data consists of port map and data cargo per day bag cargo Port of Baai Island.

3.2 Data Processing Stage

The data related to the warehouse development plan is manually processed using Microsoft Excel. This data processing is a process to analyze the financial feasibility of development plan of Baai Island port warehouse.

3.3 Data analysis

The method of analysis used in this study are:

1) Needs Analysis of Storage Space

By analyzing the storage space requirement, the warehouse capacity will be obtained, the average time of the goods collected, the moving distance, and the warehouse utility.

2) Financial Feasibility Analysis
   In analyzing the financial feasibility it is necessary to know in advance the value of inflation and interest rates used. Inflation rate is obtained from the latest 5-year inflation rate obtained from the Central Bureau of Statistics. While the interest rate used is the prevailing bank interest rate of 12%. The methods used are Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR) and Pay Back Period (PBP).
3) Sensitivity analysis explains how sensitive the investment parameters are in assumptions if there are changes or differences from those calculated in the financial projection (construction, benefit, and operational cost).

4. RESULT AND DISCUSSION

4.1 Data

The first step of this research is to collect the data needed to analyze the financial feasibility of the construction of a storage warehouse at the Port of Baai Island. From the data payload per day it will get maximum payload data per day in one month.

Table 1. Cargo Data of Maximum Cargo Commodity Bag Year 2016 (PT Pelindo II Bengkulu)

No.	Commodity	Year 2016												Loads
		Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agst	Sep	Okt	Nov	Des	Maximum
1.	Rubber	734	522	986	911	761	903	1.003	761	904	879	606	972	16.982
2.	Fertilizer	906	1.112	1.040	732	1.322	986	788	1.062	942	1.202	934	906	35.322
3.	Cement	5.625	2.146	3.154	2.322	3.460	3.345	2.196	1.871	2.851	2.149	3.034	3.112	302.113
4.	Rice	978	787	972	1.129	972	1.256	749	1.112	1.062	986	870	1.137	27.706
5.	Flour	882	1.103	788	942	1.077	1.213	1.023	1.025	972	1.170	993	1.127	20.535

4.2 Growth Rate and Prediction of Cargo

Obtained cargo data of the last 5 years of each commodity will be used to calculate the rate of growth of cargo.

Table 2. Cargo Bag Growth Rate

		Year					r
		2012	2013	2014	2015	2016	
No.	Commodity	(ton)	(ton)	(ton)	(ton)	(ton)	
1	Rubber	15.452	14.148	15.126	15.731	16.373	0,025
2	Fertilizer	31.243	33.362	32.606	34.475	36.509	0,032
3	Cement	294.513	298.513	297.993	301.032	302.113	0,013
4	Rice	22.881	24.010	24.450	26.400	28.592	0,052
5	Flour	15.932	16.369	17.582	18.657	20.535	0,062

Once the growth rate is obtained, it can be predicted the load of each - each commodity. Calculation of commodity charge prediction of arithmetic method with investment plan scenario at 5, 10, 15 and 20 years.

Table 3. Cargo Bag Growth Rate

Age Plan (Year)	Year	Rubber Loads (Ton)	Fertilizer Loads (Ton)	Cement Loads (Ton)	Rice Loads (Ton)	Flour Loads (Ton)
	2016	16.782	36509	36509	28592	19833
	2017	17.202	38663	38663	30966	21084
5	2018	17.632	40944	40944	33536	22413
	2019	18.073	43359	43359	36321	23826
	2020	18.525	45917	45917	39336	25329
	2021	18.988	48626	48626	42602	26925
	2022	19.462	51495	51495	46139	28623
10	2023	19.949	54533	54533	49969	30428
	2024	20.448	57750	57750	54118	32346
	2025	20.959	61157	61157	58611	34386
	2026	21.483	64765	64765	63476	36554
	2027	22.020	68586	68586	68746	38858
15	2028	22.570	72632	72632	74454	41308
	2029	23.135	76917	76917	80635	43913
	2030	23.713	81455	81455	87330	46682
	2031	24.306	86260	86260	94580	49625
	2032	24.913	91349	91349	102432	52754
20	2033	25.536	96739	96739	110936	56080
	2034	26.175	102446	102446	120146	59616
	2035	26.829	108490	108490	130121	63374

4.3 Determination of Warehouse Space Requirement

4.3.1 Storage Area

The area of storage is calculated based on the maximum data of incoming goods per day and reduced loading capability of each commodity per ship. The result of the calculation is converted into pallet or rack so that many pallets or shelves will be obtained.

Ships = 3 ships

Max Cement Load Per Day = 5.265 ton

Unloading Performance Capability = 357 ton

Standard *Berthing Time* = 2 days

Warehouse Log In = 5.265 – 3 x (357 x 2)

= 3.123 ton

Pallet Cement Capacity = 5 ton

Number of storage / pallet = 1

$$\text{Pallets Cement} = \frac{Maximum\ \ payload}{Pallet\ \ Cement\ \ Capacity}$$

$$= \frac{3.123\ \ ton}{5\ ton}$$

= 625 pallets

Pallets Cement = 625 Pallet

Pallet dimensions = p x l

= 1,2m x 1m

= 1,2 m^2

Storage Area = 625 Pallet x 1,2 m^2

= 750 m^2

To know the area of storage is obtained by multiplying the number of pallets with pallet dimensions as calculated above.

Table 4. Storage Area 2016

Type of Commodity	Amount Maximum Input (ton)	Needs Pallet / Shelf	Storage Area (m^2)
Rubber	1.565	189	491,4
Fertilizer	1.071	214	616,32
Cement	3.968	794	952,8
Rice	1.310	182	524,16
Flour	1.400	194	558,72
Total Area of Storage Area			3.143,4

Table 5. Storage Area 2035

Type of Commodity	Amount Maximum Input (ton)	Needs Pallet / Shelf	Storage Area (m^2)
Rubber	1.565	189	491,4
Fertilizer	1.071	214	616,32
Cement	3.968	794	952,8
Rice	1.310	182	524,16
Flour	1.400	194	558,72
Total Area of Storage Area			3.143,4

4.3.2 Aisle Needs

The dimensions of the forklift are 3.1m long and 1.3m wide. It is known that the width of the largest commodity is rubber of 1.3m. To calculate the total length of the forklift is by reducing the width of the largest commodity 1.3m with a forklift fork length of 1.1m. The long difference is added with the length of the forklift and the total length of the forklift is 3.4m.

P^2 = 3,4m

l^2 = 1,3m

d = $\sqrt{p^2 + l^2}$

d = $\sqrt{3{,}4^2 + 1{,}3^2}$

d = $\sqrt{11{,}56 + 1{,}69}$

d = $\sqrt{13{,}25}$

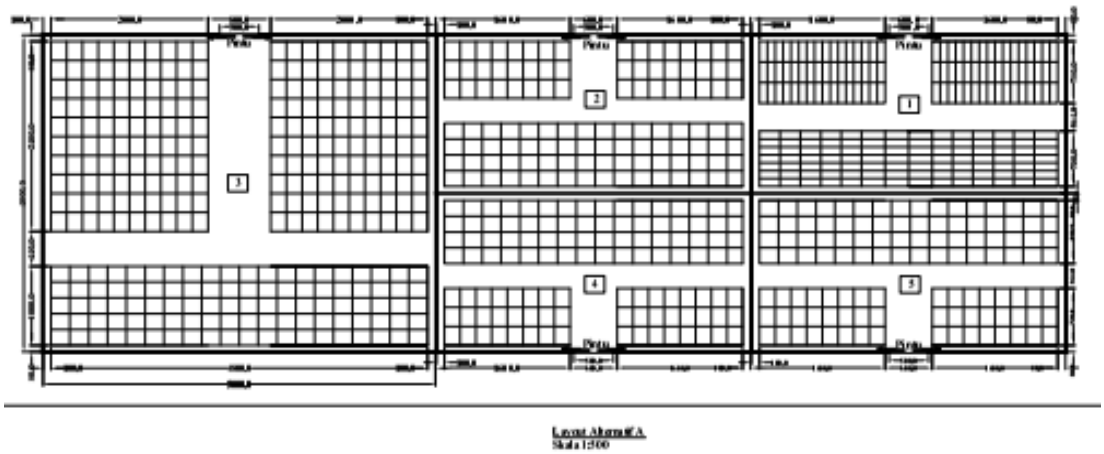
d = 3,64 m

4.4 Warehouse Layout Design

Once it is known that the warehouse space needs can be determined and the warehouse layout will be planned. There are two alternate layout plans for warehouses with the same warehouse area and different collection patterns.

A. Alternative Layout A

Alternative layout design A uses U shape flow patterns in the taking of goods. Alternative layout A storage using pallets and shelves. The storage system used in this layout is racking and block stacking.



1. Warehouse Capacity

From the alternative layout A then obtained the maximum capacity of each warehouse as follows:

Table 6. Alternative Warehouse Capacity Layout A

	Rubber	Fertilizer	Cement	Rice	Flour
Needs Pallet / Shelf	187	214	794	182	194
Pallet Capacity / Shelf	192	224	980	224	224

2. In – Transit Time

The average length of storage of each commodity warehouse on layout A can be calculated by multiplying the holding capacity of the warehouse by 365 days and divided by the tonnage of goods in a year.

Table 7. Average Dump Time

	Rubber (Day)	Fertilizer (Day)	Cement (Day)	Rice (Day)	Flour (Day)
In -Transit Time	0,79	1,85	5,58	1,85	1,85

3. Calculation of Moving Distance

On the measurement of the displacement distance is assumed for both storage and retrieval distance using a fixed path, so the distance is the same. With the central cue point set (0,0) on the warehouse door.

Table 8. Alternative Displacement Distance Layout A

No.	Commodity	Distance (m)
1.	Rubber	8.320,8
2.	Fertilizer	7.884
3.	Cement	30.600
4.	Rice	7.813,2
5.	Flour	7.884
Total Distance		**62.502**

4. Warehouse Utility Calculation

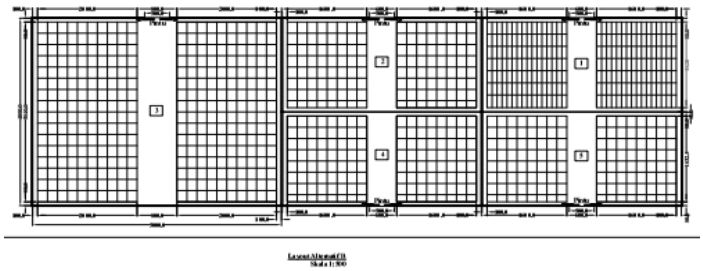
Utility calculation is obtained from the width of block usage divided by the area of each commodity warehouse.

Table 9. Utilities Alternative Warehouse Layout A

	Rubber	Fertilizer	Cement	Rice	Flour
Space Utilities	62,4%	80,64%	58,8%	80,64%%	80,64%%

B. Alternative Layout B

The design of alternative layout B uses straight line flow pattern in taking the goods. Alternative layout B storage using pallets and shelves. The storage system used in this layout is racking and block stacking.



1. Warehouse Capacity

From the alternative layout B then obtained the maximum capacity of each warehouse as follows:

Table 10. Alternative Warehouse Capacity Layout B

	Rubber	Fertilizer	Cement	Rice	Flour
Needs Pallet/Shelf	187	214	794	182	194
Pallet Capacity/Shelf	224	256	1.060	256	256

2. In – Transit Time

The average length of storage of each commodity warehouse in layout B can be calculated by multiplying the holding capacity of the warehouse by 365 days and divided by the tonnage of goods in a year.

Table 11. Average Dump Time

	Rubber (Day)	Fertilizer (Day)	Cement (Day)	Rice (Day)	Flour (Day)
In -Transit Time	0,92	1,92	5,95	1,92	1,92

3. Calculation of Moving Distance

On the measurement of the displacement distance is assumed for both storage and retrieval distance using a fixed path, so the distance is the same. With the central cue point set (0,0) on the warehouse door.

Table 12. Alternative Displacement Distance Layout B

No.	Commodity	Distance (m^2)
1.	Rubber	8.683,2
2.	Fertilizer	8.812,8
3.	Cement	32.960
4.	Rice	8.743,2
5.	Flour	8.812,8
	Total Distance	**68.012**

4. Warehouse Utility Calculation

Utility calculation is obtained from the width of block usage divided by the area of each commodity warehouse.

Table 13. Utilities Alternative Warehouse Layout B

	Rubber	Fertilizer	Cement	Rice	Flour
Space Utilities	72,8%	92,2%	63,6%	92,2%	92,2%

4.5 Financial Analysis

Financial analysis aims to know the estimates in terms of funding and cash flow, so it can be known whether or not the warehouse development plan to run. The things that are required in the estimated cash flow are as follows:

Inflation

The inflation rate approach is carried out using the average inflation rate of the last 5 years inflation data from BPS-Statistics Indonesia. The value of inflation used is the average inflation rate obtained at 6.52%.

Investment Cost

a. Construction Cost
   Based on the storage area and width of the width the width of the warehouse development plan is 5,200 m2. With a 5,200 m2 warehouse area, the construction cost plus inflation is Rp. 13.233.307.302.
b. Supporting Fee
   Supporting Costs in this development is the cost of pallets and shelves that will be used to put the commodities into the warehouse. The cost of pallet and shelf needs is Rp. 295,200,000.
c. Operational Costs and Maintenance
   The operational cost of this storage warehouse development plan consists of employee salary, electricity usage fee, office stationery cost and other costs. The estimated cost of warehouse operations is Rp. 477.560.373.
   Based on Regulation of the Minister of Finance of the Republic of Indonesia Number 65 / PMK.02 / 2015 About Standard Cost Input of Fiscal Year 2016 states that the unit of maintenance cost of domestic building for Bengkulu Province is Rp. 99,000 m2 / year. With a building area of 5,200 m2 and the unit cost of maintenance of domestic building for Bengkulu Province is Rp. 99.000 m2 / year then the estimated cost of warehouse maintenance is Rp. 541 million.
   Operational and maintenance costs are assumed to increase every five years due to the inflation factor.
d. Depreciation
   Depreciation is derived from the provisions of the Pph Act that establishes depreciation of permanent buildings at 5% of the cost. Assume the same depreciation value every year. From the calculation found that the value of depreciation warehouse each year is Rp. 661,665,365 at the acquisition cost of Rp. 13.233.307.302.

Benefit

The port warehouse revenue is obtained from the load in the warehouse multiplied by the warehouse rental rate and the average time of storage. Determination of Rental Rate of Warehouse

Nature of Commodity

a. Unobtrusive items: Rp. 1,000-ton
b. Interfering items: Rp. 1,500-, per ton.

Terms of warehouse rental port namely;

a. Period 1: 1-5 days subject to normal rates.
b. Period 2: 6-10 days normal rate + 50% normal rate.
c. Period 3:> 10 days subject to 200% of normal rate.

Table 14. Rental Rates Layout Warehouse A

	Rubber	**Fertilizer**	**Cement**	**Rice**	**Flour**
In -Transit Time	0,79 Hari	1,85 Hari	5,58 Hari	1,85 Hari	1,85 Hari
Rental Rates (Rp)	1.500	1.500	2.250	1.500	1.500

Table 15. Rental Rates Layout Warehouse B

	Rubber	Fertilizer	Cement	Rice	Flour
In -Transit Time	0,92 Hari	1,92 Hari	5,95 Hari	1,92 Hari	1,92 Hari
Rental Rates (Rp)	1.500	1.500	2.250	1.500	1.500

Net Present Value

NPV analysis is done with calculation for investment plan (n) 5, 10, 15, 20 years ahead in each layout. In this study the discount factor (DF) used is 12% (interest rate).

Table 16. Value of Net Present Value Layout A

No.	Age Plan (n)	PWB (Rp)	PWC (Rp)	NPV (Rp)	Information
1.	5	11.419.664.887	17.542.228.539	-6.122.479.163	Not Feasible
2.	10	20.604.321.991	21.206.904.948	-602.582.958	Not Feasible
3.	15	26.241.904.628	23.428.636.292	2.813.268.336	Feasible
4.	20	29.730.413.078	24.778.809.169	4.951.603.909	Feasible

Table 17. Value of Net Present Value Layout B

No.	Age Plan (n)	PWB (Rp)	PWC (Rp)	NPV (Rp)	Information
1.	5	12.155.825.940	17.542.228.539	-5.976.117.457	Not Feasible
2.	10	21.927.987.096	21.206.904.948	721.082.148	Feasible
3.	15	27.922.399.863	23.428.636.292	4.493.763.571	Feasible
4.	20	31.628.719.717	24.778.809.169	6.849.910.548	Feasible

Internal Rate of Return

Internal Rate of Return (IRR) is the method of assessment of investment where the interest rate (i) at the time value of NPV = 0. In the calculation of IRR it is necessary to experiment with interest rates that will be interpolated. IRR calculations are performed for the planned investment (n) 5, 10, 15, 20 years ahead in each layout.

Table 18. Value of Internal Rate Of Return Layout A

No.	Age Plan (n)	i (%)	NPV (Rp)	IRR (%)	i (Interest Rate)	Information
1	5	i_1=5 i_2=12	218.119.157 -6.122.479.163	5,20	12%	Not Feasible
2.	10	i_1=10 i_2=12	368.941.419 -602.582.958	10,53	12%	Not Feasible
3.	15	i_1=15 i_2=18	1.311.576.440 -623.243.912	17,03	12%	Feasible
4.	20	i_1=18 i_2=20	232.740.606 -1.032.321.241	18,37	12%	Feasible

Table 19. Value of Internal Rate of Return Layout B

No.	Age Plan (n)	i (%)	NPV (Rp)	IRR (%)	i (Interest Rate)	Information
1.	5	i_1=5 i_2=12	292.191.975 -5.976.117.457	5,73	12%	Not Feasible
2.	10	i_1=12 i_2=15	76.378.452 -5189952	14,99	12%	Feasible
3.	15	i_1=18 i_2=20	570.597.351 -590128909	18,98	12%	Feasible
4.	20	i_1=20 i_2=22	109.515.688 -1057378140	20,19	12%	Feasible

Benefit Cost Ratio

Benefit Cost Ratio (BCR) is a method to find the index of cost effectiveness level against the benefits obtained. In the calculation of BCR is by comparing the present benefit value (PWB) with the present cost value (PWC). The calculation of BCR is done for the planned investment (n) 5, 10, 15, 20 years ahead in each layout.

Table 20. Value of Benefit Cost Ratio Layout A

No.	Age Plan (n)	PWB (Rp)	PWC (Rp)	BCR	Information
1.	5	11.419.664.887	17.542.228.539	0,65	Not Feasible
2.	10	20.604.321.991	21.206.904.948	0,97	Not Feasible
3.	15	26.241.904.628	23.428.636.292	1,12	Feasible
4.	20	29.730.413.078	24.778.809.169	1,20	Feasible

Table 21. Value of Benefit Cost Ratio Layout B

No.	Age Plan (n)	PWB (Rp)	PWC (Rp)	BCR	Information
1.	5	12.155.825.940	17.542.228.539	0,69	Not Feasible
2.	10	21.927.987.096	21.206.904.948	1,03	Feasible
3.	15	27.922.399.863	23.428.636.292	1,19	Feasible
4.	20	31.628.719.717	24.778.809.169	1,28	Feasible

Payback Period

Payback Period (PBP) is an analysis of how long the capital we invest will return. PBP calculation is derived from comparing the initial investment with the average net income per year. The smaller the value of PBP the better the investment value to do.

Calculation of PBP value on alternative layout A is done with initial investment value is Rp. 13,233,307,302 and average net profit of Rp. 957.971.319.

$$PBP = \frac{Initial\ Investment}{Net\ Profit}\ x\ 1\ year$$

$$PBP = \frac{\text{Rp. } 13.233.307.302}{\text{Rp. } 957.971.319}\ x\ 1\ year$$

PBP = 14 years

PBP value calculation on alternative layout B is done with initial investment value is Rp. 13,233,307,302 and average net profit of Rp. 1.057.882.194.

$$PBP = \frac{Initial\ Investment}{Net\ profit}\ x\ 1\ year$$

$$PBP = \frac{\text{Rp. } 13.233.307.302}{\text{Rp. } 1.057.882.194}\ x\ 1\ year$$

PBP = 13 years

4.6 Layout Analysis

After doing the data processing then the analysis of the results that have been obtained from two alternative layout design with different flow patterns of goods.

Table 22. Comparison of Layout A and B

	Alternative Layout A	**Alternative Layout B**
Block Capacity	1844	2052
Block Area	3598,8 m^2	3788,8 m^2
Space Utilities	68,37%	72,08%
Moving Distance	62.502 m^2	68.012 m^2
NPV, IRR dan BCR	A 15 and 20 year investment plan is feasible	A 10, 15 and 20 year investment plan is feasible
PBP	14	13

4.7 Sensitivity Analysis

From the calculation of selected financial feasibility of alternative layout B which has the highest NPV, IRR, BCR value is 6,849,910,548, 20,19%, 1,28 and PBP value is shortest that is for 13 years. Sensitivity analysis is an analysis conducted to determine the effect of changes in production parameters on changes in production system performance in generating profit. The parameters used in analyzing sensitivity are construction cost, expense cost and warehouse revenue cost.

Table 23. Sensitivity Analysis

No.	**Description**	**I (%)**	**NPV (Rp)**	**IRR (%)**	**BCR**	**Information**
1.	Construction +50%	12	1924606685	13,59	1,06	Feasible
2.	Construction +60%	12	730501113	12,60	1,02	Feasible
3.	Construction +70%	12	-463604459	11,19	0,99	Not Feasible
4.	Benefit -20%	12	1569390601	13,79	1,07	Feasible
5.	Benefit -30%	12	-1593481370	10,11	0,93	Not Feasible
5.	Operational Cost +30%	12	775058993	12,73	1,03	Feasible
6.	Operational Cost +40%	12	-1598299524	10,70	0,95	Not Feasible

In the table obtained the first condition when construction costs rose 50% to 60%, revenue decreased 20% and operating costs increased by 30% then the investment plan is still considered feasible. The second condition is assumed if the construction cost is up to 70%, the income decreases 30% and the operational cost increases by 40% then the investment plan is not feasible.

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

After the analysis and discussion done it can be concluded the result as follows:

a. After the calculation of the need for storage area and width of the alley, the warehouse area needs is 5.200m^2.
b. Of the two alternative layouts that have been made selected layout B that has the value of NPV, IRR, BCR largest. For the planned investment age of 20 years layout B has a NPV Value of 6.849.910.548, IRR 20.19%, BCR 1.28 and PBP value is for 13 years.
c. Sensitivity analysis was done on alternative layout B. The analysis parameters used were construction cost, expense cost and warehouse income. The first condition if construction rises to 60%, revenue decreases by 20% and operational cost increases by 30% then the project is still considered feasible. The second condition assumed that construction cost increased by 70%, revenue decreased by 30% and operational cost increased by 40% then the project was not feasible.

5.2 Recommendation

1. Performed further calculation is to calculate material handling charge warehouse which in this study is ignored because the tool used for loading and unloading is usually owned (user).
2. With the increasing number of commodities every year, and efforts to reduce the waiting time of the vessel then the Port of Baai Island Bengkulu requires a stockpile to accelerate the loading and unloading rate of goods.

REFERENCES

Triatmodjo, Bambang. (2009). *Perencanaan Pelabuhan*. Penerbit Beta Offset.

Lasse, D.A. (2012). *Manajemen Muatan Aktivitas Rantai Pasok Di Area Pelabuhan*. Penerbit Jakarta: PT. Raja Grafindo Persada.

Apple, J. (1990). *Tata Letak Pabrik dan Pemindahan Bahan*. Penerjemah: Nurhayati Mardiono. Bandung: Penerbit ITB.

Aurora, Rachma Prima. (2011). *Analisa Teknik dan Finansial Proyek Pembangunan Apartemen Ciputra World Surabya*. Jurnal Pendidikan.

Gustang.A. (2010). *Analisis Kelayakan Pembangunan Pelabuhan Fery Garongkong Di Kabupaten Barru Sulawesi Selatan*. Jurnal Pendidikan.

Heizer, J & Render, B. Alih bahasa oleh Sungkono, C. (2009). *Manajemen Operasi (edisi 9)*. Jakarta: Salemba Empat.

Kusuma, I G Narendra. (2011). *Analisis Kelayakan Finansial Rencana Pembangunan Gedung Parkir Bertingkat di Pasar Lokitasari*. Jurnal Pendidikan.

Lasse, D.A. (2012). *Manajemen Muatan Aktivitas Rantai Pasok Di Area Pelabuhan*. Penerbit Jakarta: PT. Raja Grafindo Persada.

Peraturan Pemerintah Republik Indonesia Nomor 70 Tahun 1996 Tentang Pelabuhan.

Peraturan Mendag RI No: 16/M-DAG/PER/3/2006.
Purnomo, Hari. (2004). *Pengantar Teknik Industri*. Yogyakarta: Graha Ilmu.
Rindahwati. (2012). *Analisa Kelayakan Investasi Proyek Pembangunan Rumah Sakit Mojokerto Medical Center Dengan Pengdektan Penilian Terhadap Capital Budgeting*. Jurnal Pendidikan.
Soeharto, Imam. (1995). *Manajemen Proyek "Dari Konseptual Sampai Operasional"*. Penerbit Erlangga.
Soeharto, Imam,. (2002). *Studi Kelayakan Proyek Industri*. Penerbit Erlangga.
Triatmodjo, Bambang. (2009). *Perencanaan Pelabuhan*. Penerbit Beta Offset.
Undang-Undang No.10 Tahun 1995 dan No. 17 Tahun 2006 tentang Kepabeanan
Undang-Undang No. 9 Tahun 2006 Tentang Sistem Resi Gudang