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Optimizing Charter Scheme Selection for Coal Transport Vessels Through Capital Budgeting Indicators

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Coal distribution via maritime transport is essential to meeting Indonesia's national energy demands, creating business opportunities for bulk carrier operators and prompting a financial feasibility study on four investment schemes at a Surabaya-based shipping company: MV. Alpha (owned vessel) and MV. Beta (chartered vessel), each under Voyage Charter and Time Charter contracts. The assessment employs capital budgeting methods—Payback Period (PP), Net Present Value (NPV), and Benefit-Cost Ratio (BCR). Results show that all schemes are financially feasible. MV. Alpha–Voyage Charter records a PP of 4.6 months, NPV of Rp 41.1 billion, and BCR of 1.15, while Time Charter results in PP 7.4 months, NPV Rp 16.5 billion, and BCR 1.11. MV. Beta–Voyage Charter has a PP of 12.1 months, NPV Rp 15.3 billion, and BCR 1.03; whereas Time Charter achieves a PP of 5.3 months, NPV Rp 44.4 billion, and BCR 1.09. Incremental analysis reveals that MV. Alpha–Voyage Charter yields an incremental benefit of Rp 147.8 billion over Time Charter with an additional cost of Rp 123.2 billion, resulting in an incremental BCR of 1.20. For MV. Beta, Voyage Charter incurs Rp 29 billion in extra costs without added benefits, producing an incremental BCR of 0, making Time Charter the more efficient option.

Keywords: Investment Feasibility, Bulk Carrier Operations, Voyage Charter Contract, Time Charter Contract, Capital Budgeting Analysis.

I. INTRODUCTION

Indonesia, as an archipelagic nation, faces an increasing electricity demand, most of which is still supplied by coal-fired power plants (PLTU). According to the Ministry of Energy and Mineral Resources (ESDM), there are currently 253 PLTU units operating across the country, with the highest concentration in Kalimantan (26 units), followed by Banten and East Java with 22 units each (Indira, 2023). The total capacity of these coal-fired power plants has reached 45.35 gigawatts (GW), based on data from the Global Energy Monitor. Given the bulk volume and distance of coal distribution, maritime transport serves as the most effective logistics mode for coal delivery (Dovana, 2024), presenting promising business opportunities for dry bulk carrier operations.

A shipping company based in Surabaya specializes in bulk carrier operations and currently operates two owned vessels—MV. Alpha and MV. Charlie—and one chartered vessel, MV. Beta, with deadweight tonnage ranging from 29,000 to 58,000 MT. These vessels operate under two types of charter contracts: Time Charter and Voyage Charter. Time Charter involves renting a vessel for a specific period, while Voyage Charter involves chartering for a specific voyage or route (Kosasih, 2012). Given the potential for switching between charter types based on market needs, evaluating the feasibility and profitability of each alternative is essential.

To address this, the study employs capital budgeting analysis—specifically Payback Period (PP), Net Present Value (NPV), and Benefit-Cost Ratio (B/C)—to assess the financial viability of four vessel operation alternatives. The alternatives include combinations of ownership (owned vs. chartered) and contract type (Voyage vs. Time Charter). The goal is to determine the most financially optimal investment scenario. The study is also supported by incremental analysis to refine investment decisions between feasible alternatives, aligning with the strategic capital

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planning needs of maritime logistics businesses (Akhmad, 2019; Pujawan, 2019).

II. RESEARCH METHODOLOGY

2.1 Type and Research Approach

This study adopts a quantitative descriptive-evaluative approach, aiming to measure and compare the investment feasibility of owned and chartered bulk carrier vessels under two contractual schemes: Voyage Charter and Time Charter. The analysis is based on historical operational cost data and estimated revenue in order to assess the efficiency and profitability of each investment alternative.

2.2 Research Object

This research focuses on the operation of two vessels owned and operated by a shipping company based in Surabaya, namely MV. Alpha (owned vessel) and MV. Beta (chartered vessel). Both vessels are analyzed under two contractual schemes: Voyage Charter and Time Charter. Thus, a total of four investment alternatives are evaluated to determine the most financially feasible scenario. The general specifications (ship particulars) of each vessel are presented in Table 1.

Table 1. Ship Particular MV. Alpha dan MV. Beta.

SHIP PARTICULAR									
		MV. ALPHA			Ann.	MV. BETA			Ann.
A. Main Specification									
Gross Tonnage	:	26,059.00			MT	31,117.00			MT
Nett Tonnage	:	14,880.00			MT	18,159.00			MT
B. Cargo Capacity									
Grain Capacity	:	57,208.00			m^3	65,044.98			m^3
Bale Capacity	:	55,565.00			m^3	-			
Avg. Coal Stowage Factor	:	1.23			m^3/MT	1.23			m^3/MT
Approx. Max Capacity	:	46,510.57			MT	52,882.10			MT
C. Present Speed & Daily Fuel Consumption									
Avg. MFO Viscosity	:	0.9448			Kg/L				
Avg. MGO Viscosity	:	0.8542			Kg/L				
At Sea - Ballast									
Speed	:	11.00		Kts		12.00		Kts	
MFO	:	20.41	MT/Day	21,600	L/Day	25.00	MT/Day	26,461	L/Day
MGO	:	-	MT/Day	-	L/Day	0.20	MT/Day	234	L/Day
At Sea - Laden									
Speed	:	9.50		Kts		11.50		Kts	
MFO	:	20.41	MT/Day	21,600	L/Day	26.00	MT/Day	27,519	L/Day
MGO	:	-	MT/Day	-	L/Day	0.20	MT/Day	234	L/Day
At Port - Idle									
MFO	:	-	MT/Day	-	L/Day	3.50	MT/Day	3,704	L/Day
MGO	:	1.03	MT/Day	1,200	L/Day	0.20	MT/Day	234	L/Day
At Port - Working									
MFO	:	-	MT/Day	-	L/Day	5.80	MT/Day	6,139	L/Day
MGO	:	2.46	MT/Day	2,880	L/Day	0.20	MT/Day	234	L/Day
Maneuvering									
MFO	:	-	MT/Port	-	L/Port	-	MT/Port	-	L/Port
MGO	:	1.54	MT/Port	1,800	L/Port	-	MT/Port	-	L/Port
Fresh Water	:	15.00		MT/Day		-		MT/Day	

2.3 Data Analysis Technique

The data analysis in this study is conducted through the following stages:

1. Identification of Financial Components
- Estimating the annual operational expenses (OPEX) for the four contractual schemes.
- Estimating the annual revenue for each of the four contractual schemes.

2. Cash Flow Modeling
- Preparing five-year cash flow projections for all four contractual schemes.

3. Investment Feasibility Analysis

Calculating investment feasibility indicators using the following methods:

a. Payback Period (PP)

Payback Period refers to the time required to recover the initial investment using the

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project's net cash inflows or proceeds. It represents the duration needed for an investor to fully regain the capital invested in a project (Akhmad, 2019).

The formula used for calculating the Payback Period is presented in Equation 1.

$$P \quad P \quad = \frac{C \quad \times 1 \, t_i \, hu}{P} \quad (1)$$

Description:
Outlay = The total investment or capital expenditure incurred.
Proceeds = The total cash inflow or revenue received.

An investment alternative is considered feasible if the result of the Payback Period analysis is the shortest among all options or shorter than the planning horizon.

b. Net Present Value (NPV)

According to Akhmad (2019), Net Present Value (NPV) is the difference between the present value of total proceeds and the present value of total investment. If the present value of proceeds is greater than or equal to the present value of the investment, then the investment proposal is accepted. Conversely, if the present value of proceeds is less than the present value of the investment, the proposal is rejected. Another definition states that NPV is a method to calculate the present value of a series of future cash flows by considering the time value of money. The formula used for calculating the NPV is presented in Equation 2.

$$N \quad = \sum_{t=L}^{n} \frac{K}{(1+i)^t} - C_{\square} \quad (2)$$

Description:
NPV = Net Present Value
CF_t = Cash flow in period t
t = Time period (0, 1, 2, 3...n)
r = Discount rate
C_0 = Initial investment

An investment alternative is considered feasible if the result of the NPV analysis is greater than 0.

c. Benefit-Cost Ratio (BCR)

According to Kosasih (2012), the Benefit-Cost (B/C) Ratio is the comparison between the present value of business revenue and the present value of cash expenditures, including investment outlays and debt repayments related to the investment. If during the payback period the B/C ratio is greater than 1, it indicates that the present value of cash inflows is sufficient to cover the present value of cash outflows, making the investment financially feasible to proceed.

An alternative is considered feasible if the result of the B/C ratio analysis is greater than 1. The formula used for calculating the BCR is presented in Equation 3.

$$B \quad = \frac{P \; B}{P \; C} \quad (3)$$

Description:
PV_B = Present Value of Total Benefit
PV_C = Present Value of Total Cost

An investment option is deemed financially viable when the Benefit-Cost Ratio (B/C) exceeds 1.0, indicating that the present value of expected benefits outweighs the present value of associated costs.

III. RESULT AND DISCUSSION

The investment feasibility analysis begins with the identification of key financial components, namely the estimated annual operating expenses (OPEX) and annual revenue for four vessel operation alternatives: MV. Alpha and MV. Beta, each evaluated under both Voyage Charter and Time Charter schemes. These estimates are derived from historical operational data of a national shipping company based in Surabaya, reflecting actual and relevant field conditions. The results are presented in summary tables to provide an initial overview of the financial characteristics of each investment alternative.

Subsequently, a five-year operational cash flow model is developed. The initial investment is determined based on the highest estimated operational cost under each charter scheme, representing the maximum funding requirement. This information serves as the foundation for constructing the cash flow projections and conducting a comprehensive investment feasibility analysis in the following stage. Table 2 presents the projected cash flow for the MV. Alpha alternative under the Voyage Charter scheme.

p-ISSN 2622-2027
e-ISSN 2622-2035

Table 2. 5th Cash Flow-MV. Alpha-Voyage Charter.

YEAR		MV. ALPHA VOYAGE CHARTER CASH FLOW	
0	2025	-Rp	4,973,266,462
1	2026	Rp	12,967,319,400
2	2027	Rp	13,226,665,788
3	2028	Rp	13,491,199,104
4	2029	Rp	13,761,023,086
5	2030	Rp	14,036,243,548

Projected cash flow for MV. Alpha Time Charter alternative shown in the table below.

Table 3. *5th Cash Flow*-MV. Alpha-*Time Charter*.

YEAR		MV. ALPHA TIME CHARTER CASH FLOW	
0	2025	-Rp	3,484,503,200
1	2026	Rp	5,635,961,606
2	2027	Rp	5,748,680,838
3	2028	Rp	5,863,654,455
4	2029	Rp	5,980,927,544
5	2030	Rp	6,100,546,095

Projected cash flow for MV. Beta Voyage Charter alternative shown in table below.

Table 4. 5th Cash Flow-MV. Beta-Voyage Charter.

YEAR		MV. BETA VOYAGE CHARTER CASH FLOW	
0	2025	-Rp	6,056,297,436
1	2026	Rp	6,009,624,516
2	2027	Rp	6,129,817,007
3	2028	Rp	6,252,413,347
4	2029	Rp	6,377,461,614
5	2030	Rp	6,505,010,846

p-ISSN 2622-2027
e-ISSN 2622-2035

Projected cash flow for MV. Beta Time Charter alternative shown in table below.

Table 5. 5th Cash Flow-MV. Beta-Time Charter.

YEAR		MV. BETA TIME CHARTER CASH FLOW	
0	2025	-Rp	6,307,714,687
1	2026	Rp	14,258,881,540
2	2027	Rp	14,544,059,171
3	2028	Rp	14,834,940,355
4	2029	Rp	15,131,639,162
5	2030	Rp	15,434,271,945

After estimating the five-year cash flow projections for each investment alternative, the next step is to conduct a capital budgeting analysis. This analysis involves applying three financial evaluation methods: Payback Period (PP), Net Present Value (NPV), and Benefit-Cost Ratio (BCR). The Payback Period is used to determine how long it takes for an investment to recover its initial cost. The NPV method evaluates the net value generated by the investment by discounting future cash flows to their present value. Meanwhile, the BCR assesses the ratio of the present value of benefits to the present value of costs, serving as a measure of the investment's overall financial efficiency. Together, these methods provide a comprehensive assessment of the feasibility and attractiveness of each operational scheme.

A. Payback Period Analysis (PP)

Based on the discussion in the previous chapter and by applying the formula stated in Equation 1, the Payback Period for each investment alternative has been calculated. The results of these calculations are presented in Table 6 below, providing a comparative overview of the time required to recover the initial investment under each operational scheme.

Table 6. Payback Period Analysis

MV. ALPHA VOYAGE CHARTER		PAYBACK PERIOD		MV. ALPHA TIME CHARTER		PAYBACK PERIOD	
CASH FLOW		In Month	In Year	CASH FLOW		In Month	In Year
-Rp	4,973,266,462	4.6	0.38	-Rp	3,484,503,200	7.4	0.62
Rp	12,967,319,400			Rp	5,635,961,606		
Rp	13,226,665,788			Rp	5,748,680,838		
Rp	13,491,199,104			Rp	5,863,654,455		
Rp	13,761,023,086			Rp	5,980,927,544		
Rp	14,036,243,548			Rp	6,100,546,095		
MV. BETA VOYAGE CHARTER		PAYBACK PERIOD		MV. BETA TIME CHARTER		PAYBACK PERIOD	
CASH FLOW		In Month	In Year	CASH FLOW		In Month	In Year
-Rp	6,056,297,436	12.1	1.01	-Rp	6,307,714,687	5.3	0.44
Rp	6,009,624,516			Rp	14,258,881,540		
Rp	6,129,817,007			Rp	14,544,059,171		
Rp	6,252,413,347			Rp	14,834,940,355		
Rp	6,377,461,614			Rp	15,131,639,162		
Rp	6,505,010,846			Rp	15,434,271,945		

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The results of the Payback Period analysis show that MV. Alpha under the Voyage Charter scheme requires approximately 4.6 months, or 0.38 years, to recover its initial operational investment. Under the Time Charter scheme, MV. Alpha requires 7.4 months, or 0.62 years. For MV. Beta, the Payback Period under the Voyage Charter scheme is 12.1 months, equivalent to 1.01 years, while under the Time Charter scheme, the required period is 5.3 months, or 0.44 years. These findings indicate the duration needed for each operational alternative to return the initial investment and reflect the relative financial efficiency of each scheme in terms of capital recovery.

B. Net Present Value (NPV)

Based on the methodology outlined in the previous chapter and by applying the established formula presented in Equation 2, the Net Present Value (NPV) for each vessel operation scheme has been calculated. The NPV analysis aims to assess the present value of net cash flows over a five-year operational horizon, discounted at a predetermined rate that reflects the company's required rate of return. The results are shown in Table 7.

Table 7. Net Present Value Analysis

MV. ALPHA VOYAGE CHARTER		NPV (Net Present Value)		MV. ALPHA TIME CHARTER		NPV (Net Present Value)	
CASH FLOW		DF (i=14%)	Present Value	CASH FLOW		DF (i=14%)	Present Value
-Rp	4,973,266,462	1	-Rp 4,973,266,462	-Rp	3,484,503,200	1	-Rp 3,484,503,200
Rp	12,967,319,400	0.8772	Rp 11,374,841,579	Rp	5,635,961,606	0.8772	Rp 4,943,825,970
Rp	13,226,665,788	0.7695	Rp 10,177,489,834	Rp	5,748,680,838	0.7695	Rp 4,423,423,236
Rp	13,491,199,104	0.6750	Rp 9,106,175,115	Rp	5,863,654,455	0.6750	Rp 3,957,799,738
Rp	13,761,023,086	0.5921	Rp 8,147,630,366	Rp	5,980,927,544	0.5921	Rp 3,541,189,239
Rp	14,036,243,548	0.5194	Rp 7,289,985,064	Rp	6,100,546,095	0.5194	Rp 3,168,432,477
		NPV	Rp 41,122,855,495			NPV	Rp 16,550,167,461
MV. BETA VOYAGE CHARTER		NPV (Net Present Value)		MV. BETA TIME CHARTER		NPV (Net Present Value)	
CASH FLOW		DF (i=14%)	Present Value	CASH FLOW		DF (i=14%)	Present Value
-Rp	6,056,297,436	1	-Rp 6,056,297,436	-Rp	6,307,714,687	1	-Rp 6,307,714,687
Rp	6,009,624,516	0.8772	Rp 5,271,600,453	Rp	14,258,881,540	0.8772	Rp 12,507,790,825
Rp	6,129,817,007	0.7695	Rp 4,716,695,142	Rp	14,544,059,171	0.7695	Rp 11,191,181,264
Rp	6,252,413,347	0.6750	Rp 4,220,200,917	Rp	14,834,940,355	0.6750	Rp 10,013,162,184
Rp	6,377,461,614	0.5921	Rp 3,775,969,241	Rp	15,131,639,162	0.5921	Rp 8,959,145,112
Rp	6,505,010,846	0.5194	Rp 3,378,498,795	Rp	15,434,271,945	0.5194	Rp 8,016,077,205
		NPV	Rp 15,306,667,112			NPV	Rp 44,379,641,904

Based on the Net Present Value (NPV) analysis, all four vessel operation schemes demonstrate positive outcomes, indicating financial feasibility. The NPV for MV. Alpha under the Voyage Charter scheme is Rp 41.122.855.495, while under the Time Charter scheme it is Rp 16.550.167,461. For MV. Beta, the NPV under the Voyage Charter scheme is Rp 15.306.667.112, and under the Time Charter scheme, it reaches Rp 44.379.641.904. A positive NPV signifies that the present value of expected cash inflows exceeds the initial investment, meaning the investment is projected to generate a net financial gain over the analysis period. Therefore, all four investment alternatives are considered financially viable.

C. Benefit Cost Ratio (BCR)

Based on the explanations presented in the previous chapter and by applying the formula outlined in Equation 3, the Benefit-Cost Ratio (BCR) results for each investment alternative have been obtained and are presented in Table 8. The BCR analysis provides a ratio that compares the present value of benefits to the present value of costs. A BCR greater than 1 indicates that the benefits outweigh the costs, thus confirming that the investment is financially viable and should be considered for implementation.

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Table 8. BCR - MV. Alpha - Voyage Charter.

BCR (Benefit-Cost Ratio)					
Benefit/Revenue	Cost/OPEX	DF (i=14%)	PV Benefit	PV Cost	BC Ratio
Rp -	Rp 4,973,266,462	1	Rp -	Rp 4,973,266,462	1.15
Rp 89,030,000,000	Rp 76,062,680,600	0.8772	Rp 78,096,491,228	Rp 66,721,649,649	
Rp 90,810,600,000	Rp 77,583,934,212	0.7695	Rp 69,875,807,941	Rp 59,698,318,107	
Rp 92,626,812,000	Rp 79,135,612,896	0.6750	Rp 62,520,459,737	Rp 53,414,284,622	
Rp 94,479,348,240	Rp 80,718,325,154	0.5921	Rp 55,939,358,712	Rp 47,791,728,346	
Rp 96,368,935,205	Rp 82,332,691,657	0.5194	Rp 50,051,005,163	Rp 42,761,020,099	
		Total PV	Rp 316,483,122,780	Rp 275,360,267,285	

As for MV. Alpha - Time Charter shown in table 9. on this below

Table 9. BCR - MV. Alpha - Time Charter.

BCR (Benefit-Cost Ratio)					
Benefit/Revenue	Cost/OPEX	DF (i=14%)	PV Benefit	PV Cost	BC Ratio
Rp -	Rp 3,484,503,200	1	Rp -	Rp 3,484,503,200	1.11
Rp 47,450,000,000	Rp 41,814,038,394	0.8772	Rp 41,622,807,018	Rp 36,678,981,047	
Rp 48,399,000,000	Rp 42,650,319,162	0.7695	Rp 37,241,458,910	Rp 32,818,035,674	
Rp 49,366,980,000	Rp 43,503,325,545	0.6750	Rp 33,321,305,341	Rp 29,363,505,603	
Rp 50,354,319,600	Rp 44,373,392,056	0.5921	Rp 29,813,799,516	Rp 26,272,610,276	
Rp 51,361,405,992	Rp 45,260,859,897	0.5194	Rp 26,675,504,830	Rp 23,507,072,353	
		Total PV	Rp 168,674,875,614	Rp 152,124,708,153	

As for MV. Beta - Voyage Charter shown in Table 10. on this below

Table 10. BCR - MV. Beta - Voyage Charter.

BCR (Benefit-Cost Ratio)					
Benefit/Revenue	Cost/OPEX	DF (i=14%)	PV Benefit	PV Cost	BC Ratio
Rp -	Rp 6,056,297,436	1	Rp -	Rp 6,056,297,436	1.03
Rp 146,685,300,000	Rp 140,675,675,484	0.8772	Rp 128,671,315,789	Rp 123,399,715,336	
Rp 149,619,006,000	Rp 143,489,188,993	0.7695	Rp 115,126,966,759	Rp 110,410,271,617	
Rp 152,611,386,120	Rp 146,358,972,773	0.6750	Rp 103,008,338,679	Rp 98,788,137,762	
Rp 155,663,613,842	Rp 149,286,152,229	0.5921	Rp 92,165,355,660	Rp 88,389,386,419	
Rp 158,776,886,119	Rp 152,271,875,273	0.5194	Rp 82,463,739,275	Rp 79,085,240,480	
		Total PV	Rp 521,435,716,163	Rp 506,129,049,051	

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As for MV. Beta - Time Charter shown in Table 11. on this below

Table 11. BCR - MV. Beta - Time Charter.

BCR (Benefit-Cost Ratio)					
Benefit/Revenue	Cost/OPEX	DF (i=14%)	PV Benefit	PV Cost	BC Ratio
Rp -	Rp 6,307,714,687	1	Rp -	Rp 6,307,714,687	1.09
Rp 146,685,300,000	Rp 132,426,418,460	0.8772	Rp 128,671,315,789	Rp 116,163,524,965	
Rp 149,619,006,000	Rp 135,074,946,829	0.7695	Rp 115,126,966,759	Rp 103,935,785,495	
Rp 152,611,386,120	Rp 137,776,445,765	0.6750	Rp 103,008,338,679	Rp 92,995,176,495	
Rp 155,663,613,842	Rp 140,531,974,681	0.5921	Rp 92,165,355,660	Rp 83,206,210,548	
Rp 158,776,886,119	Rp 143,342,614,174	0.5194	Rp 82,463,739,275	Rp 74,447,662,070	
		Total PV	Rp 521,435,716,163	Rp 477,056,074,259	

The results of the Benefit-Cost Ratio (BCR) analysis indicate that all investment alternatives are financially viable. MV. Alpha operating under a Voyage Charter scheme yields a BCR of 1.15, while the Time Charter scheme produces a BCR of 1.11. Similarly, MV. Beta under the Voyage Charter scheme results in a BCR of 1.03, and the Time Charter scheme achieves a BCR of 1.09. Since all values are greater than 1, each option is considered feasible. A BCR value above 1 implies that the present value of benefits exceeds the present value of costs, indicating that the investment is expected to generate net positive returns and is therefore economically justified.

Due to limited capital, the company can operate only two vessels—one owned (MV. Alpha) and one chartered (MV. Beta)—so only one contract scheme per vessel can be selected. To identify the most financially optimal choice, this study uses incremental analysis, which compares additional benefits and costs between feasible alternatives. Following Hilton et al. (2000), this method isolates key financial differences to support better investment decisions. The analysis starts by comparing each scheme against the status quo, with results ranked by Present Value (PV) of Benefit and summarized in Table 12.

Table 12. MV. Alpha - PV Benefit Rank

ALTERNATIVE	PV BENEFIT	PV COST	B/C
MV. ALPHA VOYAGE CHARTER	Rp 316,483,122,780	Rp 275,360,267,285	1.15
MV. ALPHA TIME CHARTER	Rp 168,674,875,614	Rp 152,124,708,153	1.11
QUO STATUS ALTERNATIVE	Rp 0	Rp 0	0

In the incremental analysis approach, the alternative with a lower PV Benefit "challenges" the higher one to assess whether the additional benefit justifies the additional cost. Therefore, the Quo Status is first compared to MV. Alpha – Time Charter. If Time Charter proves financially feasible, it then challenges the highest PV Benefit alternative—Voyage Charter—to determine the optimal scheme. This step-by-step analysis is presented through calculations of incremental benefit, incremental cost, and incremental B/C ratio, as shown in Table 13 for MV. Alpha.

p-ISSN 2622-2027
e-ISSN 2622-2035

Table 13. MV. Alpha - Incremental Analysis

MV. ALPHA					
INITIAL ALTERNATIVE	COMPARATIVE ALTERNATIVE	INCREMENTAL BENEFIT	INCREMENTAL COST	INCREMENTAL B/C RATIO	CONCLUSION
MV. ALPHA TIME CHARTER	QUO STATUS ALTERNATIVE	Rp 168,674,876,614	Rp 152,124,708,153	1.11	MV. ALPHA TIME CHARTER
MV. ALPHA VOYAGE CHARTER	MV. ALPHA TIME CHARTER	Rp 147,808,247,166	Rp 123,235,559,132	1.20	MV. ALPHA VOYAGE CHARTER

Incremental analysis on MV. Alpha operations show that Time Charter is more feasible than the Quo Status, with an incremental B/C ratio of 1.11. When Voyage Charter is compared to Time Charter, it yields a higher incremental B/C ratio of 1.20, indicating greater financial benefits relative to additional costs. Therefore, Voyage Charter is the most optimal and profitable investment option for MV. Alpha. As for MV. Beta rank can be shown in Table 14.

Table 14. MV. Beta - PV Benefit Rank

ALTERNATIVE	PV BENEFIT	PV COST	B/C
MV. BETA VOYAGE CHARTER	Rp 521,435,716,163	Rp 506,129,049,051	1.03
MV. BETA TIME CHARTER	Rp 521,435,716,163	Rp 477,056,074,259	1.09
QUO STATUS ALTERNATIVE	Rp 0	Rp 0	0

As for MV. Beta incremental analysis can be shown in Table 15. Below

.**Table 15.** MV. Beta - Incremental Analysis

MV. BETA					
INITIAL ALTERNATIVE	COMPARATIVE ALTERNATIVE	INCREMENTAL BENEFIT	INCREMENTAL COST	INCREMENTAL B/C RATIO	CONCLUSION
MV. BETA TIME CHARTER	QUO STATUS ALTERNATIVE	Rp 521,435,716,163	Rp 477,056,074,259	1.09	MV. BETA TIME CHARTER
MV. BETA VOYAGE CHARTER	MV. BETA TIME CHARTER	Rp 0	Rp 29,072,974,792	0	MV. BETA TIME CHARTER

Incremental analysis on MV. Beta operations indicate that Time Charter is financially feasible compared to the Quo Status, with an incremental B/C ratio of 1.09, exceeding the minimum viability threshold. When compared to Voyage Charter, both alternatives show identical PV benefits; however, Voyage Charter incurs additional costs without generating added financial gains, resulting in an incremental B/C ratio of 0. This suggests inefficiency. Therefore, MV. Beta – Time Charter is the most appropriate and cost-effective investment option.

IV. CONCLUSION

Based on the results of the analysis that has been carried out and discussed, the following conclusions are obtained:

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1. Based on the capital budgeting analysis using Payback Period (PP), Net Present Value (NPV), and Benefit-Cost Ratio (B/C), all four investment alternatives—MV. Alpha and MV. Beta under Voyage Charter and Time Charter is financially feasible. MV. Alpha under Voyage Charter shows the best outcome with a PP of 4.6 months, NPV of Rp 41.1 billion, and B/C ratio of 1.15. Meanwhile, MV. Beta under Time Charter yields a PP of 5.3 months, NPV of Rp 44.4 billion, and B/C ratio of 1.09, making it the more favorable option.
2. To determine the optimal investment, incremental analysis was applied. For MV. Alpha, Voyage Charter outperformed Time Charter with an incremental benefit of Rp 147.8 billion, incremental cost of Rp 123.2 billion, and an incremental B/C ratio of 1.20, making it the optimal choice. Meanwhile, MV. Beta's Voyage Charter incurred an additional cost of Rp 29 billion without an added benefit, resulting in an incremental B/C ratio of 0. Thus, Time Charter is deemed the more efficient option. In conclusion, the optimal investment combination is MV. Alpha under Voyage Charter and MV. Beta under Time Charter.

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V. REFERENCES

[1] Akhmad, E. P. A. (2019) "*Capital Budgeting Analysis* in Fixed Asset Investment Plans at the Shipping Company (Case Study of Container Ship Purchases at PT. SI)", Jurnal Aplikasi Pelayaran dan Kepelabuhanan,9(2), pp.104–112.

[2] Abdi, Sudirman. (2017). Analisis Rencana Investasi Aktiva Tetap Terhadap Perluasan Usaha pada PT. TASPI TRD COY di kota Makassar. Fakultas Agama Islam Universitas Indonesia Timur Makassar. Journal IDAARAH Vol I No 2, Desember 2017.

[3] Au, Tung et Thomas P. Au. (1992). Engineering Economics for Capital Investment *Analysis*, 2nd Ed., New Jersey: Prentice-Hall International, Inc.

[4] Bizhare Contributor. (2023). Kapasitas PLTU di RI 51 GW, Malah Bengkak Sejak Paris Agreement.CaPex dan OpEx: Pengertian, Perbedaan, Contoh, dan Rumus Cara Menghitungnya.

[5] C. J. V. Sitorus, Harlian K., Hariyono. (2024). EVALUASI *PROFITABILITY INDEX* MODEL OPERASIONAL TUG-BARGE BERBASIS CHARTER ATAU KEPEMILIKAN KAPAL DALAM PENGANGKUTAN BIJI NIKEL. (2024). INOVTEK Polbeng, 14(02), 188-198.

[6] C. J. V. Sitorus, M. Idrus, and A. S. Chaerunnisa. (2024). "Tug-barge operating costs based on Charterer Versus Ownership Perspective. A Case Study: Nickel Ore Transport BoenagaFatufia Route" EPI International Journal of Engineering, vol. 6, no. 1, pp. 49–55, Jan. 2024,

[7] Dovana. (2024). Kapasitas PLTU di RI 51 GW, Malah Bengkak Sejak Paris Agreement.

[8] Dwibastyantoro, B. (2023). Feasibility Study for Tugboat Expansion Project Using *Capital Budgeting* And Sensitivity *Analysis* (Case Study: PT. ABC). International Journal of Current Science Research and Review.

[9] Hilton, R.W., Maher, M.W., and Selto, F.H., 2003. Cost management: Strategies for business decisions. 3rd ed. New York: McGraw-Hill/Irwin.

[10] Indira. (2023). 4 PLTU Terbesar Indonesia yang Didominasi di Pulau Jawa.

[11] Kosasih, Engkos. (2012). Manajemen Perusahaan Pelayaran: Suatu Pendekatan Praktis dalam Bidang Usaha Pelayaran. Jakarta: Rajawali Pers.

[12] Pujawan, I Nyoman. (2019). Ekonomi Teknik Edisi 3. Yogyakarta: Lautan Pustaka.

[13] Tetley, W. (2008). Marine Cargo Claims (4th ed.). Montreal: International Shipping Publications.