Transportation Strategy in Optimization the Economic Value and Operational Reliability (Case Study of PT Adaro MetCoal (AMC), Subco from PT Adaro Energy Tbk)

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Abstract: PT Adaro MetCoal Companies (AMC) is one of the subsidiaries of PT Adaro Energy, Tbk, which in October 2016 was acquired 100% from BHP Billiton. AMC has assets consisting of seven Coal Contracts of Work (CCoW). BHP Billiton initially explored the Maruwai Coal Basin, in which the seven CCOWs are located and made a significant capital investment over a number of years for studying and defining the potential and coal quality of the area. AMC requires more than 73 km to transport coal from the Pit (mining location) to Stockpile by hauling trucks in the road and about 615 km from Stockpile to the Taboneo offshore port, transported by tug and barge through the river. AMC faces difficulties in their existing coal supply chain. There are three transportation options that required investment which can be carried out by Adaro Group as a logistics solution for AMC, namely Optimizing existing operations, direct barging (upper and lower cycles) and Transferring trough the river. The study was carried out by analyzing technical, operational, financial of the three options, with the same indicators to get the through-put cost per ton. The results of the study show that the third option provides sufficient investment returns and efficiency to AMC in their logistics costs.

1 INTRODUCTION

In the existing coal port to port logistics, AMC needs more than 73 km to transport the coal from mining pit to stockpile, which located near from River Port, by hauling truck via road and 615 km from its stockpile to the Taboneo Offshore Anchorage, in the mount of Barito River, by tug & barge. AMC faced difficulties in their existing coal supply chain. Total production is 0.5 million ton in 2016 needs 125 shipments with eight dedicated set of tug & barges employed. This condition is still far from AMC target to produce and sale with production volume target about 3 million ton per annum (MTPA) started in the year of 2020.

The existing of AMC infrastructure in the entire their coal supply chain was first designed with the particular capacity to be used at a certain project time. It is clear that to increase production in succeeding years, and the infrastructure will finally reach its limit. The maximum capacity was designed with production volume 1 MTPA. This maximum capacity is influenced not only by the infrastructure but also by the natural condition, since the AMC operation located in the Central of Kalimantan with several difficulties supply chain due to port and river condition at hulu barito, tug & barge size limitation, and weather uncertainty which cause tidal river draft.

Below table describes the total existing through-put logistics cost (TC) per ton that AMC pays to the third party. With total volume 1 MTPA and total TC about 16.67 per ton (rise and fall formula applied for fuel price & exchange rate), AMC spent about 16.7 million USD per year.

The question that needs to be answered is highlighted on the improvement and development in current operation, which faced on the logistics port to port coal supply chain from the Pit to the export point, Taboneo Offshore Port;

> "What is the efficient way to operate coal transportation about 3 MTPA for Adaro MetCoal (AMC) in Central Kalimantan trough Barito River?".

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Table 1: AMC Existing Logistics Capacity & existing through-put logistics cost (TC) per ton.

Service	Product/Service Description	Maximum volume handled	The dedicated capacity provided	Unit Cost (USD/mt)	Service provider
Upper Cycle route	Freight Services	1 Mtpa coal	12 set dedicated small Tug & Barges 230ft employed	7.56	Third party
Intermediate stockpile	Coal Handling – Discharging/Stockpiling/Loading	1 Mtpa coal	Total Installed Capacity is 1,312,000 mt, while dedicated to AMC is 150.000 mt	4.2	Third party
Lower Cycle route	Freight Service Transshipment service	1 Mtpa coal	3 set dedicated a large size of Tug & Barges 300-330ft employed 1 unit Floating Crane	3.4 1.5	Third party

Source: Company Data

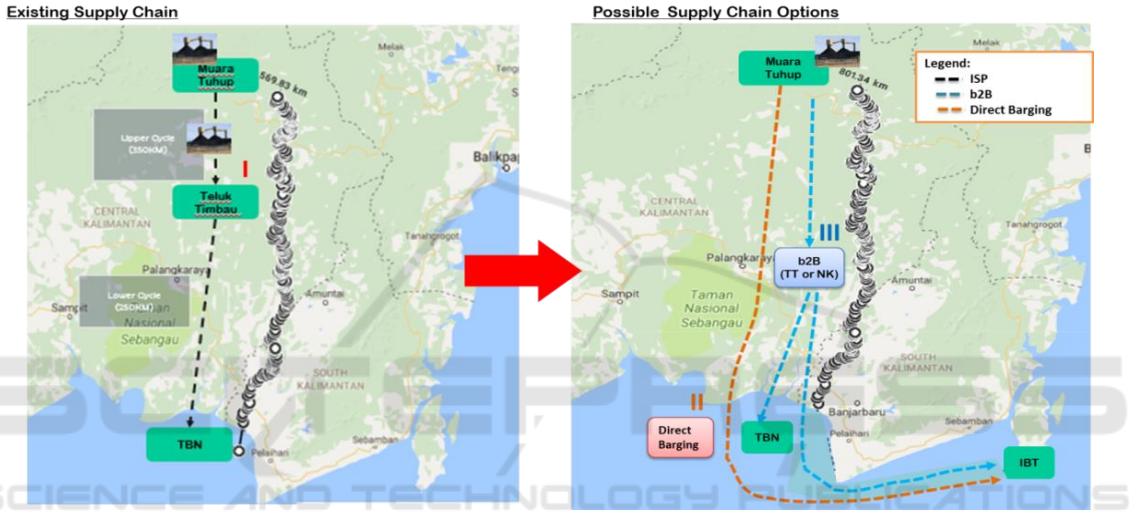

Figure 1: Identifying Options along Barito River (Source: Company Data).

Hence, the objective is to seek the best alternative on the port to port supply chain model to transport coal with production volume plan 3 MTPA for AMC in Central Kalimantan trough Barito River without sacrifice safety and coal security.

2 IDENTIFYING OPTIONS

To be able to transport 3 MTPA efficiently, herewith the three options to be compared from this paper:

1. Optimizing existing operation with additional investment in current facilities and equipment.
2. Direct barging method to transport coal directly from Muara Tuhup to IBT Onshore Terminal in Pulau Laut as a hub for export shipment.
3. Conducting river barge to Barge transfer (b2B) to transport coal from Muara Tuhup using a small barge to be transferred to a large barge then head to Taboneo Offshore anchorage for export shipment.

The map can be seen in figure 1.

3 METHOD AND DATA COLLECTION

The analysis will be done through both quantitative and qualitative assessment. Quantitative will focus on financial matters (investment indicators) while qualitative will focus on the comparison of several factors, which covers technical, operational, safety and other important components.

The quantitative assessment is carried out by comparing existing TC with the new TC obtained from the investment calculation of each option, with an economic variable defined as a company standard. Data Collected consist of primary data and secondary data, however mostly secondary data from the

Company's Internal Database, Consultants, Annual Report, Conferences and Investor Presentations, as well as from the internal study of the relevant literature.

4 RESULT AND DISCUSSION

4.1 Coal Overview

4.1.1 Global Coal Overview

Coal price in Indonesia highly depends on the global situation. China and India are key players in the coal markets, both as producer and consumer. They give import a balancing role to fulfill the portion that cannot be covered by domestic supply, so due to the large scale of these countries, fluctuations in their imports can influence the global market. China currently operates approximately 920 gigawatts (GW) of coal-fired power plants, with more than 140 GW additional capacities expected to commence operations in the next three years. In the long run, China's plan to continue relying on coal as the main fuel for power generation will keep it the most dominant consumer in the global coal market.

On the other side, the projected industrial growth of India is expected to push the country to require more coal. India currently has approximately 70 GW of coal-fired capacity under construction, and another 130 GW under the proposal. To support their electrification, the Indian government has implemented aggressive plans to increase domestic coal production from Coal India. Regardless of the efforts, the higher ash content and impurities of Indian coal requires the country to continue importing coal of lower pollutant content in order to balance its domestic coal. India is estimated to be one of the key drivers in the seaborne thermal coal markets along with the Southeast Asian countries.

Southeast Asia (SEA), currently the 3rd largest economic region in Asia and the 7th largest globally, is a major driver of Asia's economic growth. The region's rapidly growing economy and population have increased demand for electricity by an average rate of 6% per annum since 2000. Wood Mackenzie predicts that the demand will keep growing at a rate of 4.6% per annum until 2035. As of 2016, the region had approximately 240 GW installed power generation capacity, and an addition of 111 GW is expected by 2025.

4.1.2 Indonesia Coal Overview

Indonesia, currently expected its 35,000 MW electrification program, is spearheading the growth of coal-fired power plants in Southeast Asia. The program expects to add approximately 20,000 MW of coal fired capacity, which translates to an addition of 70 Mt to 80 Mt of coal demand on top of the current level as in table 2. For Indonesia, coal is not only the most consumed fuel for the electrification program but also a significant contributor to the country's foreign reserves and non-tax revenues. As in figure 2, 96% of Indonesia coal export focuses on the region of Asia with India and China.

It is projected that domestic coal consumption will increase significantly due to the government policy for electricity using coal power plant. Rupiah per kWh for coal is the lowest price compared to other sources of energy. In 2017, the using of coal as a source of energy valued Rp. 859 per kWh, meanwhile fuel valued Rp. 6.691 per kWh.

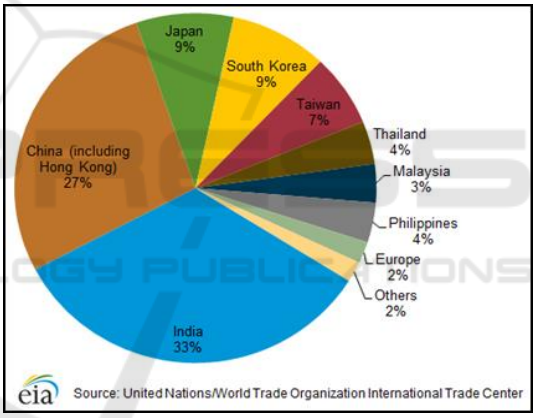

Figure 2: Indonesia Coal Export by Destination.

Table 2: Coal Production Data during Period of 2013 – 2017.

Description	2013	2014	2015	2016	2017
Total Production (Millon Tons)	474	458	461	463	476
Export (Millon Tons)	402	382	375	372	369
Domestic (Millon Tons)	72	76	86	91	107
Domestic to Total Coal Production	15%	17%	19%	20%	22%

Source: Ditjen Minerba 2017

4.2 Industry Analysis

Coal remains as the fuel of choice for developing economies in Southeast Asia, Affordable and abundant. For Indonesia, it will need to constantly balance its export and domestic market, especially in the near term when exports remain high. Exports are expected to remain strong in the near term, staying around 350-360 Mt until 2020.

Applying the result of the analysis through Porter's 5 Forces Model to the Indonesia coal industry, the result emerges as in table 3.

Table 3: Porter's 5 Forces Model to the Indonesia coal industry.

<table>
<tr>
<td>Bargaining Power of Suppliers (low to medium)
• Coal is a commodity product
• Suppliers are concentrated, especially coal mining contractors
• Limited or no potential of forwarding integration by suppliers
• The industry association is important for players, especially in influencing government policy
• High switching cost for players</td>
<td>Bargaining Power of Buyers/Customer (low to medium)
• Contract sales consist of a direct order from buyer, trader, and spot sales from small companies. Mostly dominated by trader with a long term contract
• Coal price easily benchmarked among suppliers
• Limited or no potential of backward integration by customers
• Limited type of product (coal). Easily compared with the competitors
• Type of product (coal) affects customer's overall production costs
• High switching cost for customers (to switch the sources of product)</td>
</tr>
<tr>
<td colspan="2">Competitive Rivalry within the Industry (low to medium)
• Only a few companies operate on a larger scale
• Industry growth is relatively directly correlated to (global) economic growth
• The industry has a high fixed cost
• This industry characterized high exit barriers
• Competitors approach customers in relatively the same way/style</td>
</tr>
<tr>
<td>The threat of substitute (low to medium)
• Few substitutes exist for coal, which are Oil, LNG, and Renewable Energy. Their switching or application requires adjustments in technology and equipment)
• Growth of the energy sector outpaces the rate of growth of emergence and development of the substitute for coal
• Regulation is critical to the success of development and application of new substitute</td>
<td>The threat of New Entrants (low to medium)
• High capital requirement (to develop coal concession area, to acquire heavy equipment, or to employ a massive work force)
• Regulation intensive (a company must obtain permits and license to operate in this sector)
• Limited availability of coal concession areas for new players
• Economy of scale (on supply-side) is important to achieve operational cost-efficiency
• Network effect (on demand-side) exists, especially in gaining long-term sales contract
• High advantages for incumbents, especially in access to raw materials, locations, government relations, and international market</td>
</tr>
</table>

Table 4: Adaro Group SWOT Analysis.

<table>
<tr>
<td>Strengths:
• Diversified mining operations with several types of calorie product
• Qualified operation & technical team
• Robust financial performance
• Awards and recognition
• Integrated Port to port operational within one holding group company
• Strong Shareholder support for Management</td>
<td>Weaknesses:
• For certain mining concession is far from the export point, impacting on the high logistics cost</td>
</tr>
<tr>
<td>Opportunities:
• Increasing coal demand, both of Domestics and Export.
• Robust of government expenditure in Infrastructure development, particularly for domestic Coal Fire Power Plant (CFPP)</td>
<td>Threats:
• Government intervention on the concession given
• Operational hazards
• Adverse weather conditions</td>
</tr>
</table>

4.3 Internal Analysis

The SWOT Analysis of PT. Adaro Energy, Tbk (Adaro Group) based on the history, current achievement, and future opportunity are detailed as in table 4.

4.4 Supply Chain Management Concept

According to Hui Jiang (2006), et al. through their research on "The study on characteristics of Coal Supply Chain", the development of coal supply chain should be designed based on characteristics of R, S, C, T, which described in the following quote.

> "*The manufacturing industry emphasizes the Q (quality), C (Cost), S (service), V (Velocity), emphasize the quick in action and logistics service, after-sales service. This is different from the situation of coal products. Coal is a consumptive energy product, and the consumer needs change slightly, just some changes in ash, moisture, sulfur or size, and others. So, coal supply chain management should emphasize the stability and price, and the content of stability includes two aspects, the stable quantity, and stable quality. The stability of supply is influenced by distance and transport conditions. Therefore, the core of the coal supply chain management is R (resources), S (stability: including Q (quality) and Q (quantity)), C (cost), T (Transport)".*

The transportation method will be a leading indicator to generate the level of trough-put cost (TC) expected. Hence, to be considered on the parameter, those three options will definitely impact on the total TC paid by AMC To support the quantitative analysis, Chase and Jacobs (2011) explained the relation of several important factors through Process Performance Matrices, as in figure 3.

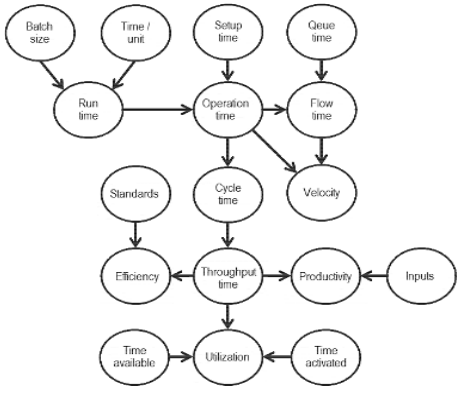

Figure 3: Process Performance Matrices.

Above figure is explained as follows:

Operation time	=	Setup time + Run time
Flow time	=	Average time for a unit to move though the system
Velocity	=	Flow time/Value-added time
Cycle time	=	Average time between completion of units
Throughput rate	=	1 / cycle time
Efficiency	=	actual output /standard output
Productivity	=	Output/Input
Utilization	=	Time activated / Time available

5 RESEARCH RESULT

To obtain total through-put cost is required to run a financial model with basis variable economic from Adaro Group Standard as in table 5.

Table 5: Variable economic used.

Parameters	Variable Economic
WACC	12.5%
Projection period	15 years
Tonnage volume	3 MTPA
Talk time	2000 TPH
Fuel Price	USD 1.06 per litre
Exchange rate	Rp 15.178 per USD

Source: Company Data

5.1 Option 1, Optimizing Existing Operation with Additional Investment in Current Facilities and Equipment

There are two cycles in the existing operation to transport the coal using Tug & Barges from Stockpile Port to Taboneo Offshore Anchorage. The first cycle is called Upper Cycle, which is the cycle transporting the coal from Stockpile Port in Muara Tuhup (mining site) to Intermediate Stockpile (ISP) in Teluk Timbau. In this cycle, due to port and river condition at Hulu Barito, Tug & Barge size limitation, coal only can be carried out by small Tug & Barges with capacity 4000 DWT or 230-250 feet.

The second cycle is called lower cycle, that is the cycle transporting the coal from ISP Teluk Timbau to Taboneo Offshore Terminal for conduction ship to ship transfer to Mother Vessel (Bulk Carrier) for export shipment.

The financial result is described in table 6 and table 7.

Table 6: Upper Cycle Barging Investment Result.

Financial Summary: *upper cycle barging investment*	Annual figure (USD)
Revenue	30.275.783
EBITDA	13.774.729
EBITDA Margin	45%
Net Profit	10.128.896
Net Profit Margin	33%
Capex Investment	72.916.667
Fleet Requirement	29 set Tug &Barge
Payback Period	Six years
Throughput-Fee (TF)	10.09 per tonne

Table 7: Lower Cycle Barging Investment Result.

Financial Summary: *Lower cycle barging investment*	Annual figure (USD)
Revenue	11.235.585
EBITDA	4.303.310
EBITDA Margin	38%
Net Profit	1.783.310
Net Profit Margin	16%
Capex Investment	25.200.000
Fleet Requirement	7 set Tug & Barge
Payback Period	7 years
Throughput-Fee (TF)	3.75 per tonne

Based on financial analysis on the new investment in sets of tug and barges in this option, the comparison between the actual costs which AMC pays to the third party as table 1 and new TC obtained from the investment financial modelling particularly from new tug and barge in the upper and lower cycle are described in table 8.

According to table 8, total saving obtained from the optimizing existing operation with additional investment in current facilities and equipment, particularly tug & barge in the upper and lower cycle is 48 cent per ton which is equivalent to USD 1.440.000 per year.

5.2 Option 2, a Direct Barging Method to Transport Coal Directly from Muara Tuhup to IBT Onshore Terminal in Pulau Laut as a Hub for Export Shipment

The second option is to use a direct barging method which there will be no separation in the shipment cycle, either the upper cycle or lower cycle. The coal will be transported directly from Muara Tuhup to IBT using small size tug and barges, with size 4000 DWT. IBT, Indonesia Bulk Terminal, is a subsidiary company from Adaro Logistics, Subholding Company of Adaro Energy which located in Pulau Laut, South Kalimantan. The total distance from Muara Tuhup Port to the IBT is 799 km, through river and sea. The allowable speed for tug & barge depends on the weather and crowd along Barito River. The range of allowable speed for tug & barge is 3.5 – 6 knot, hence one round trip for that vessel from Muara Tuhup to IBT and back to the Muara Tuhup is 18.5 days.

The financial result is described in the following table 9.

Table 9: Direct Barging Investment Result.

Financial Summary: *direct barging investment*	**Annual figure (USD)**
Revenue	57.271.445
EBITDA	21.740.573
EBITDA Margin	38%
Net Profit	15.490.573
Net Profit Margin	33%
Capex Investment	125.000.000
Fleet Requirement	50 set Tug &Barge
Payback Period	7 years
Throughput-Fee (TF)	**18.94 per tonne**

Table 8: Option 1 Result.

Description	UOM	Existing cost (TF) based on Formula	OPTION I	Remarks
Fuel Price	USD/Ltr	1.06	1.06	
FX	IDR/USD	15,179	15,179	
Projection year	year		15 years	
Annual Throughput volume	MT/ yr	**1 MTPA**	**3 MTPA**	
Lower cycle barge capacity	DWT	10,000	10,000	
Upper Cycle (4000 dwt)	USD/ ton	10.18	10.09	Option 1: new investment
Current ISP cost	USD/ ton	4.20	4.20	third party income
Lower cycle	USD/ ton	4.14	3.75	Option 1: new investment
Transshipment at Taboneo (Gearless)	USD/ ton	1.94	1.94	adaro group income
TOTAL COST	USD/ ton	**20.46**	**19.98**	*saving: 48 cent usd*

Table 10: Option 2 Result.

Description	UOM	Existing cost (TF) based on Formula	OPTION II	Remarks
Fuel Price	USD/Ltr	1.06	1.06	
FX	IDR/USD	15,179	15,179	
Projection year	year		15 years	
Annual Throughput volume	MT/ yr	**1 MTPA**	**3 MTPA**	
Upper Cycle (4000 dwt)	USD/ ton	10.18		
Direct Barging (4000 dwt)	USD/ ton		18.94	Option 2: New Investment
Current ISP cost	USD/ ton	4.20		
Lower cycle	USD/ ton	4.14		
Transshipment at Taboneo (Gearless)	USD/ ton	1.94		
IBT Handling Fee	USD/ ton		2.50	Adaro Group Income
TOTAL COST	USD/ ton	**20.46**	**21.44**	*loss: 98 cent usd*

Based on financial analysis on the new investment in sets of tug and barges in this option, the comparison between the actual costs which AMC pays to the third party and new TC obtained from the investment financial modeling particularly from new tug and barge in direct barging method are described in the table 10.

The option 2, direct barging method, is more expensive than total existing TC, where instead it contributes negatively by USD 2.940.000 per year.

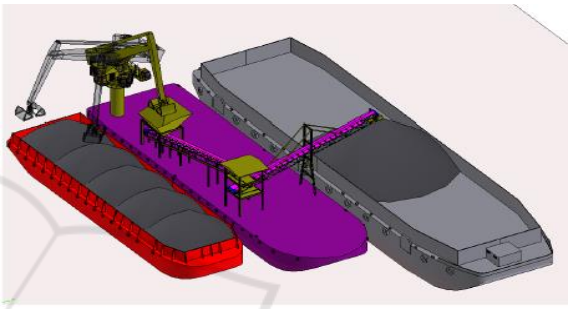

Figure 4: Process Performance Matrices.

5.3 Option 3, Conducting River Barge to Barge Transfer (b2B) to Transport Coal from Muara Tuhup using a small barge to be Transferred to a Large Barge then head to Taboneo Offshore Port for export Shipment

As in figure 1, the b2B transfer method is the new method replacing ISP requirement, which it is used to transfer coal directly from small barge to the large barge in the river without unloading the coal to the onshore facility (ISP). There will be still required two cycles for barging activity, upper and lower cycle. The export point stills same to be located at Taboneo offshore port.

The financial result is described in the following table 11.

Based on financial analysis on the new investment in sets of tug and barges and b2B transfer facility in this option, the comparison between the actual costs which AMC pays to a third party and new TC obtained from the investment financial modeling are described in table 12.

Table 11: b2B Transfer Facility Investment Result.

Financial Summary: ***direct barging investment***	**Annual figure (USD)**
Revenue	12.061.790
EBITDA	6.128.782
EBITDA Margin	51%
Net Profit	1.229.259
Net Profit Margin	10%
Capex Investment	38.483.744
Payback Period	6 years
Throughput-Fee (TF)	**4.02 per tonne**

The total saving obtained from conducting river barge to Barge transfer (b2B) to transport coal from Muara Tuhup using a small barge to be transferred to large barge in the river then head to Taboneo Offshore Anchorage is 66 cent per ton which is equivalent to USD 1.980.000 per year.

5.4 Qualitative Assessment

Qualitative assessment will focus on the comparison of several factors, which covers technical, operational, safety and other important components which explained in table 13.

Table 12: End to End Total Cost Summary Result.

Description	UOM	Existing cost (TF)	OPTION I	OPTION II	OPTION III
		based on Formula			
Fuel Price	USD/Ltr	1.06	1.06	1.06	1.06
FX	IDR/USD	15,179	15,179	15,179	15,179
Projection year	year		15 years		
Annual Throughput volume	MT/ yr	**1 MTPA**	**3 MTPA**		
Upper Cycle (4000 dwt)	USD/ ton	10.18	10.09		10.09
Direct Barging	USD/ ton	-	-	18.94	-
ISP / b2B	USD/ ton	4.20	4.20		4.02
Lower Cycle	USD/ ton	4.14	3.75		3.75
Transshipment at Taboneo (Gearless)	USD/ ton	1.94	1.94		1.94
IBT Handling Fee	USD/ ton	-		2.50	-
TOTAL COST	USD/ ton	**20.46**	**19.98**	**21.44**	**19.80**

Table 13: Qualitative assessment.

	Option 1	Option 2	Option 3
Technical analysis	Option 1 is less risk compared to the other option since it is only improved from the existing method with increase the capacity of tug & barge.	Technically direct barging method is feasible to be done for 799 km distance, from Muara Tuhup to IBT. The small tug & barge will be used along the way for 18.5 days cycle time.	Option 3 is more complicated compared the other since it needs to develop a new system, b2B transfer in the river. New expertise, System, and operation schedule must be prepared.
Operational analysis	Option 1 operationally feasible to be carried out.	Direct barging will cause a heavy operation since there is a lot of tug * barge employed.	Option 3 operationally feasible to be carried out with a new system and procedure.
Safety & other	No issue in the safety	Big issue in the safety that needs to mitigate	The new system and procedure must in-line with new risk mitigation on the safety.

6 CONCLUSION

Coal logistics is the second biggest cost in coal mining activity after fuel cost. Hence to survive and efficient in the operation, AMC needs to move and manage the cost of their logistics. Until now, the coal logistic activity causes huge inefficiency even less that cost goes to the third party. Those three options that have been analyzed can be used to optimize the production of about 3 MTPA. Operationally and technically doable to be conducted in Barito River with the certain risk that to be mitigated, however, according to table 13 options 1 and 3 are less risk compared the option2. Hence, the main parameter to be compared to justify decision making is the financial result of the new additional investment.

Based on table 12, End to End Total Cost Summary Result, the most efficient option to be proposed to AMC is option 3. The efficiency from the total throughput is about USD 66 cent per ton or equivalent with USD 1.98 million per year with production volume 3 MTPA.

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