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THEME : *" Unlocking New Marketing Strategies on ASEAN After Covid-19 Pandemic "*

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Magister Manajemen Sekolah Tinggi Ilmu Ekonomi Perbanas Surabaya
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FOREWORD

Alhamdulillah, praise be to Allah Subhanahu Wa Ta'ala for granting us the opportunity to organize and publish the proceedings of the 3nd International Conference on Business and Banking Innovations (ICOBBI) with the topic "*Unlocking New Marketing Strategies on ASEAN After Covid-19 Pandemic*". This proceeding contains several researches articles from many fields in Business & Marketing, Banking & Sharia Banking, Accounting & Financial Management, Human Resources Management, Operations Management, Investasi, Insurance & Capital Market, Strategic Management, Technology Management, and Information System.

The 3nd International Conference on Business and Banking Innovations was held on 6th – 7th March 2021 by virtual (online) meeting and organized by the Master Management Study Program of STIE PERBANAS Surabaya in Collaboration with three Higher Education Institutions in Indonesia and two Universities from Asia countries. Keynote speakers in this conference were: Prof. Jessa Frida T Festijo (Lyceum of the Philippines University), Prof. Krisda Tanchaisak, Ph.D (Ramkhamhaeng University Thailand) and Burhanudin, Ph.D (Head of Undergraduate Program In Management of STIE Perbanas Surabaya, Indonesia).

I would like to give high appreciation to the Rector of STIE Perbanas Surabaya for his support at this event. Acknowledgments and thank you to all the steering and organizing committees of the ICOBBI for the extra ordinary effort during the conference until this proceeding published. Thank you very much to all presenter and delegates from various Universities. Beside it, I would like to express our gratitude to the three universities, namely Universitas 17 Agustus Surabaya, STIE 66 Kendari, Institut Institut Bisnis dan Keuangan Nitro Makassar which has been the co-host of this event.

Hopefully, the proceeding will become a reference for academics and practitioners, especially the business and banking industry to get benefit from the various results of the research field of Business and Banking associated with Information Technology. Proceedings also can be accessed online on the website https://pascasarjana.perbanas.ac.id.

Chair of the Master Management Study Program
STIE Perbanas Surabaya

Prof. Dr. Tatik Suryani, M.M.

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Operating Management

Multi Criteria Decision Making Analysis of Supply Chain Alternatives for Coal Mining Concession at Central Kalimantan
Case Study: PT Hamparan Mulya

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ABSTRACT

Coal is a commodity which its selling price is influenced by market supply-demand. The selling price of coal tends to experience the significant fluctuations. During 2014 to 2016, a lot of coal mining companies were unable to continue their operation because of the coal low selling prices, only 20% of coal companies from 3000 companies were able to maintain their operation at that time. With the fluctuation of coal index price, coal mining companies must be able to perform their operations effectively and efficiently in order to survive and obtain good profit margin. Coal mining companies who have their concessions located on Central Kalimantan have another challenge beside the condition of the price index which mostly affected by natural condition, for this case study specifically for PT Hamparan Mulya mining concession, one of the coal mining concession located at Central Kalimantan. One of the biggest challenges for the company is its delivery route of barge. Every barge must deliver the coal from Barito River which has peculiarity on its water level. Beside the natural condition, other challenges are from the characteristics of coal which might experience the combustion that requires coal handling, and higher logistics cost. These challenges are the reasons of PT Hamparan Mulya to find the best supply chain of coal delivery solution to improve the sales and performance of the company. This research aims to determine the alternative coal supply chain for mining concessions in the Central Kalimantan, by using one of the Multi Criteria Decision Making (MCDM) methods which is Analytical Hierarchy Process (AHP) that divided into 4 Criteria and 10 Sub Criteria. The criteria used are Quality, Cost, Delivery and Barge Availability and 10 Sub-Criteria used are Coal Sizing, Quality Drop, Coal Combustion for Quality Criteria; Margin, Logistic Cost, Premium Sales Price for Cost Criteria; Volume, Leadtime, Continuity for Delivery Criteria and Barge Availability for Barge Availability Criteria. Possible alternative solutions are through the Salat Baru intermediate stockpile (ISP), ISP Indonesia Bulk Terminal (ISP IBT), Cargo Transfer and the current one through Taboneo. From the results of AHP analysis, it may conclude that the best coal supply channel is through intermediate stockpile (ISP) Indonesia Bulk Terminal.

Keywords: *Coal Supply Chain, Multi Criteria Decision Making, AHP*

1. INTRODUCTION

Indonesia as one of the largest coal productions worldwide has several territories of the coal distribution area. One of the areas which has the biggest coal resources is in Kalimantan area. Most of the coal resources are found in East Kalimantan, South Kalimantan, and Central Kalimantan area. A lot of coal mining companies have their interests to have mining concessions in East and South Kalimantan because its location which is near to the transshipment which is different with Central Kalimantan. Even though Central Kalimantan has its potential resources of the coal which has a great characteristic of coal, but the location which is far from the transshipment become the reason which make the coal mining company have a greater challenge as a coal mining concession in Central Kalimantan.

PT Hamparan Mulya as one of the coal mining concessions in Central Kalimantan has several challenges to perform its operation. In terms of nature, logistics lines for coal mining around Central Kalimantan are limited for using the mode of transportation. The largest river that crosses through Central Kalimantan is the Barito River with an average width between 650 and 800 meters and an

average depth of 8 meters. The water level in the Barito River, especially in the area of Central Kalimantan, is being influenced by the rainfall upstream. In a period of a year, dry season usually occur for 3 to 4 months from July to October. Beside in dry season, water level fluctuation in Barito river might be up and down significantly which makes the water level is difficult to be predicted. This Barito water level affects coal shipping transportation because the required water level needed at least 6 meters for barge to sail. Not all parts of the Barito River experience drought, the dry part of the river is passed by barges ranging from Bintang Ninggi (jetty) to Taboneo (anchorage area). The distance from Bintang Ninggi jetty to Taboneo is around 472.7 kilometers or approximately 3 days sailing. Along the Barito river channel, the most critical area has to be passed is around the Terusan where there is considerable sedimentation of the river which become shallower than other areas, this cause the barge not be able to pass this area in dry season.

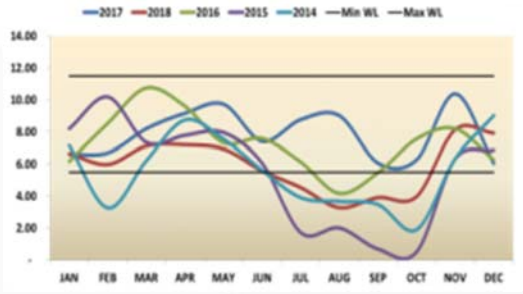


Figure 1: History of Water Level at Bintang Ninggi Jetty, 2014 – 2018.

Usually to overcome this challenge, barge vendors would hire a Pandu, local resident who knows the flow of the river. Usually the existence of dry season in Central Kalimantan takes 3-4 months in a year but sometimes it might be unpredicted. The coal supply chain is relying on the water level of Barito River because Barito River is the only route to deliver the coal to buyers by using multiple sizes and quantities of barges, usually 15-16 set of barges needed to fulfill the volume of every shipment. The barging process is a process to load the coal using the barge loading conveyor to barge. In jetty, it is required that the water level shall be minimum 5.5 meters to maximum 11.5 meters. In dry season, mostly the water level less than 5.5 meters. There are some amounts of days when the water level less than 5.5 meters which affect that there will be no barging activities. (Table 1)

Table 1: Number of Days without Barging Activities

	2010	2011	2012	2013	2014	2015	2016	2017	2018
JAN	14	5	6	21	13	5	10	11	10
FEB	-	4	7	4	25	1	-	10	10
MAR	4	13	9	-	12	5	-	4	4
APR	2	15	-	-	-	3	-	-	10
MAY	-	7	18	2	4	1	1	-	9
JUN	1	17	16	16	13	14	1	8	16
JUL	6	25	10	12	23	31	13	4	21
AUG	4	31	24	21	26	31	26	-	24
SEP	7	22	25	13	26	30	15	13	28
OCT	5	22	28	31	31	31	9	16	28
NOV	1	22	5	4	12	9	4	2	7
DEC	5	11	4	-	3	9	13	12	8
TOTAL DAYS	49	194	152	124	188	170	92	80	175
MONTH	1.6	6.5	5.1	4.1	6.3	5.7	3.1	2.7	5.8

Usually for delivering the coal, it would use direct barging from the jetty in Bintang Ninggi to transship to Taboneo Anchorage. It took 3 days of sailing in normal condition. To fulfill 75,000 metric tons of coal delivery directly to Taboneo is very challenging. The average time to fulfill the full quantity of vessel (75,000 metric tons) is 22 to 30 days, in some cases it could take more days because of the water level issue.

Another challenge is coming from the characteristics of coal owned by PT Hamparan Mulya, the characteristic of coal produced by PT Hamparan Mulya is medium calorie with gross calorific value 4,500 kcal/kg which is categorized as bituminous coal, this characteristic of coal is susceptible to have self-combustion in the event the coal is exposed to the air in long term and will be easily affected by weather changes. This situation made PT Hamparan Mulya must find alternative to transport the coal in immediate time for avoiding the coal to experience the combustion if it is being kept in stockpile for a long time.

On the technical side, when the water level in Barito river is good, the rainfall in the mine area is also high. The high rainfall condition will affect the mining operation which causes the production activities being delayed or being stopped completely. As a result of this situation, the number of effective working hours for operations has been diminished, which will affect the daily production capacity. The more handling that is carried out for coal handling, the lower the quality of the coal itself due to the increase percentage of Ash and the higher potential for coal losses.

There is also another risk for the additional costs, especially in logistics costs such as barge detention due to the length of time to fulfill the buyer's full quantity vessel and demurrage vessel caused by vessels' waiting time for barges to unload

the coal. There is also a potential risk in coal rejection due to high coal temperature. Another difficulty is the procurement of barges to fulfill shipment in large quantities of around 75,000 metric tons, the agreed contract quantity with the current buyer.

A lot of challenges for PT Hamparan Mulya as a coal mining concession in Central Kalimantan area affect the sales and company performance especially in 2018 (Figure 2 and Figure 3) that made the company urgently required reliable solution of coal supply chain alternatives to overcome those challenges. In 2018, the company is suffering loss in sales volume and the opportunity to achieve the annual target to take advantage in high coal price index in the market. Another effect of the challenge is the spontaneous combustion of coal which makes the company to bear additional cost for the treatment of coal.

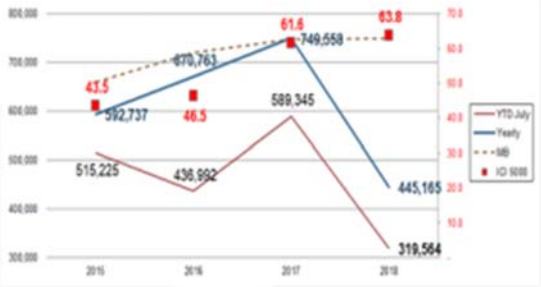


Figure 2: Sales Performance of PT Hamparan Mulya, 2015 – 2018.

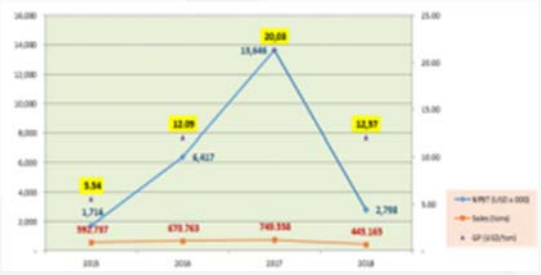


Figure 3: Company Performance of PT Hamparan Mulya, 2015 – 2018.

These several issues are the reasons of PT Hamparan Mulya losing its profit about 30% (Table 2) because of the increment in logistics cost. By having these issues in downstream process affected the upstream process as well such as overburden removal, coal getting and hauling process. It is also giving impacts to the other stakeholders such as mining contractor and hauling contractor of potentially losing their revenue.

To overcome the situation that affect the financial performance of PT Hamparan Mulya, management of the company must find the utmost reliable solution to get the alternative coal supply chain. This solution will be used for the company to have stability and sustainability operational activities and to reduce the cost of goods sold especially in logistics cost to get the optimal profit.

2. METHODS

2.1 Conceptual Framework

As part of the consequence of having a coal mining concession in Central Kalimantan, the company must deal with greater challenge than other mining concession in East Kalimantan and South Kalimantan especially for logistics process for coal shipping through the Barito River until being delivered in Taboneo anchorage. By experienced low production volume in 2018 which affected the company performance mainly caused by natural challenge and barges availability, hopefully this research would provide the solution to the company to overcome the supply chain challenge to find the most optimized supply chain process for PT Hamparan Mulya.

By having several supply chain alternatives would be expected for giving solution for achieving the annual production volume and reducing the logistics cost. To find the solution the conceptual framework is made as follow:

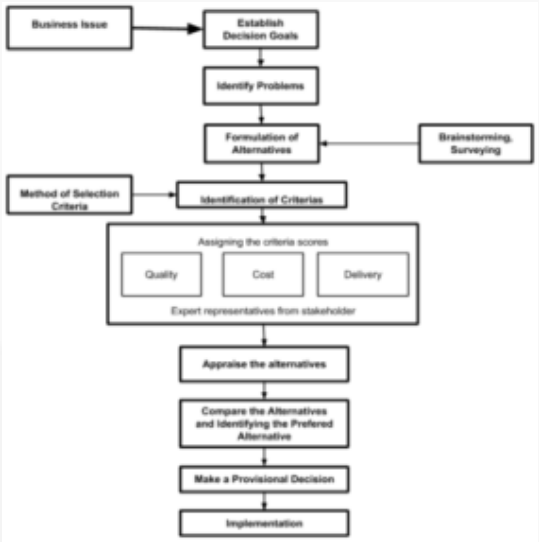


Figure 4: Conceptual Framework

Miles and Huberman (1994) defined a conceptual framework as a visual or written product, one that main things to be studied—the key factors, concepts, or variables—and the presumed relationships among them". The conceptual framework of this research using 2 (two) methods which be used for evaluating the quantitative and qualitative sides of the project. For the quantitative side, the Cost Analysis method is being used which compare the increment or decrement for the logistics cost for some of the alternatives as mentioned above and for strengthen the choice for the alternative the Analytical Hierarchy Process method is being used to support the result from the qualitative side.

The first step of this framework is to establish the decision goals to identify the problems. The second step in Multi Criteria Decision Analysis (MCDA) is to formulate alternatives to provide the most optimized supply chain process for coal mining concession in Central Kalimantan from having brainstorming with management and related departments such as operation engineering, marketing and sales together with supply chain department. The result of this brainstorming meeting lead to the decision to survey the supply chain alternatives along the Barito river to Banjarmasin as the route of coal mining concession in Central Kalimantan. The third step is to is to determine the criteria in the selection of alternatives which the approached concept is QCD (Quality, Cost and Delivery). This concept is a guideline used for a lot of companies in implementing their operation management. Each of these criteria will be described further into several sub-criteria which are considered to support the main used criteria. The further step is to use the main criteria and sub-criteria which will be done in Pairwise Comparison as stated in the questionnaire distributing to the related department and management representative to have the lowest and highest weight. By knowing the weight of the criteria, it will be used as a reference in assessing the alternatives that have been proposed from the result in field surveys as above mentioned in advance. In addition to support the result, the Cost Analysis method is being conducted in each alternative as a supporting quantitative reference of the MCDM. For having the best alternatives, each of the alternatives given will be explained for its strength(s) and weakness(es) also with the obstacles which might be faced by the operation. From these results, the mining company will have the utmost suitable alternative supply chain for mining concession in Central Kalimantan specifically PT Hamparan Mulya.

"explains, either graphically or in narrative form, the

The criteria used in this research are divided into 4 (four) criteria: Quality, Cost, Delivery and Barge Availability. These criteria are concluded from the company objective and the concern of top management. A measurement weight of criteria and sub-criteria will be used to select the best alternative solution. The criteria and sub-criteria used to assess each of the alternative coal supply chain are summarized in table below.

Table 2: Number of Days without Barging Activities

Criteria	Sub-Criteria
Quality	Coal Sizing
	Quality Drop
	Coal Combustion
Cost	Margin
	Logistic Cost
	Premium Sales Price
Delivery	Volume
	Leadtime
	Continuity
Barge Availability	

The following below is a hierarchy which explain the Goal for Selecting the Coal Supply Chain that will be using the 4 major Criteria which are Quality, Cost, Delivery, and Barge Availability then it be divided into several Sub-Criteria which are Coal Sizing, Quality Drop, Coal Combustion for Quality Criteria; Margin, Logistic Cost, Premium Sales Price for Cost Criteria; Volume, Lead Time, Continuity for Delivery Criteria and Barge Availability to support the weighting of Criteria which result for 4 possible alternative solutions to be carried out by PT Hamparan Mulya.

Figure 5: Hierarchy of Selecting Coal Supply Chain

This project involved 10 respondents from middle management to top management from several departments who were involved for the sales and operation meeting (S&OP Meeting or in PT maker represented by Chief of Operation Officer (COO) and supported by General Manager of Operation. Sales, Commercial Support and Logistic team will give input on downstream process for availability demand and barge. The Engineering, ABA Operation and Geologist will give information and perspective on upstream process especially for coal expose and capacity readiness. While the Supply Chain team as coordinator to ensure continuity from upstream to downstream for coal material. Through the distribution of the respondents, it is expected to provide thoughts of multiple perspectives to have the best result for PT Hamparan Mulya. List of the respondents shall be as follow:

Table 3: List of Respondents

Respondent No.	Job Position
Respondent #1	COO
Respondent #2	General Manager of Operation
Respondent #3	Business Unit & SCM Dept. Head
Respondent #4	Logistic Dept. Head
Respondent #5	Sales Dept. Head
Respondent #6	Commercial Support Dept. Head
Respondent #7	Customer & Technical Support
Respondent #8	Engineering
Respondent #9	ABA Operation
Respondent #10	Geologist

2.2 Method of Data Collection and Analysis

Data retrieval is done by distributing questionnaires to respondents containing Pairwise Comparison for each Criteria and Sub-Criteria, so the weighting used to assess each of the alternative coal supply chain solutions. Result of the questionnaires are inserted to the AHP free web-based application made by Klaus D. Goepel Implementation of an Online Software Tool for the Analytic Hierarchy Process. The outcome of this processed data will be compared to the actual preferences by the management and to review whether the implementation is applicable or not applicable for the current or further condition.. The analysis is done qualitatively and also simulates cost Hamparan Mulya called Cargo Meeting), so they have an overview of the PT Hamparan Mulya and supply chain operation. For operational decision analysis to calculate total logistic cost for each coal supply chain alternatives.

3. ANALYSIS

3.1 Alternatives of Coal Supply Chain

To answer the condition of PT Hamparan Mulya which there was a decrement in sales volume and an increment in costs resulted a significant reduction in the company's Net Profit then the company have to find the alternative of coal supply chain by having comparison of the logistics cost for each alternative which will use the Analytical Hierarchy Process (AHP) method.

3.1.1. Intermediate stockpile Salat Baru (ISP Salat Baru)

One of the shareholders of the ISP Salat Baru is an affiliate company of PT Hamparan Mulya which makes it possible for PT Hamparan Mulya to negotiate using the ISP Salat Baru facility. The location of the ISP Salat Baru is in the middle of the Barito River which is passed by the barges which carrying PT Hamparan Mulya coal and this location has less affected area of water level condition because it does not affected by the rainfall in upstream river. The distance from Bintang Ninggi jetty to the ISP Salat Baru is about 208 kilometers with a sail time of around 1.5 - 2 days. This port supports the dismantling of coal from a maximum barge size of 270 feet (5,200 - 5,500 MT) using a grab crane and loading coal using a loading barge conveyor (BLC) to a maximum barge of 330 feet (10,000 MT). The terminal rate for ISP Salat Baru is about 65.000 rupiah per metric tons.

3.1.2. Intermediate Stockpile Indonesia Bulk Terminal (IBT)

Another alternative is the Intermediate Stockpile of Indonesia Bulk Terminal which is located on Pulau Laut (outside alur Barito River stream) and integrated with the transshipment to the vessel so it does not need another barge to the transshipment process in anchorage area. The distance from Bintang Ninggi jetty to the Intermediate Stockpile Indonesia Bulk Terminal (IBT) around 731 KM or around 4 to 5 days of sailing days. This intermediate stockpile able to support for unloading the coal from the barge with the maximum size 300 – 330 feet (7,500 to 10,000 MT) using 2 grab crane and loading the coal from the barge loading conveyor (BLC) to

the vessel with the maximum size 77,000 MT (Panamax class).

3.1.3. Cargo Transfer

As the other alternative solution is a process of loading and unloading of coal by transferring the the landing craft tank. The potential location for Cargo Transfer is at Kelanis, South Kalimantan because the area is quite extensive and has sufficient depth, so it does not interfere another barge transportation. Cargo transfer from barge to barge will use 2 units of excavator PC400 and 4 units of Dozers D5 to support the excavator. The capacity for coal loading and unloading is about 7,200 – 8.000 metric ton per days which cost is about 12.500 – 14.000 rupiah per metric tons.

3.1.4. Direct Taboneo

The last alternative of coal supply chain is the existing delivery process which is Direct Taboneo. Set of barges are waiting at Barito Pacific area until the quantity of coal fulfilled, and the buyer's vessel arrived at Taboneo anchorage area. These barges will sail to Taboneo to load the coal to the buyer's vessel with floating crane (for gearless vessel) and with gear and grab equipment in the vessel (for geared vessel). The capacity of coal loading-unloading by floating crane and gear and grab equipment is about 15,000 metric tons per day.

From the result of 10 respondents for conducting pairwise comparison from 4 criteria which are Quality, Cost, Delivery and Barge Availability, then the result shall be as follow:

Table 4: AHP Group Result for Criteria

Weights	Barge Availability	Quality	Cost	Delivery	CR
Group result	**27.9%**	**13.2%**	**31.3%**	**27.7%**	**1.1%**
by participants:					
Respondent #1	7.6%	30.1%	10.2%	52.1%	19.7%
Respondent #2	14.7%	3.9%	66.6%	14.7%	18.6%
Respondent #3	68.3%	2.6%	22.2%	6.8%	43.1%
Respondent #4	64.5%	3.7%	23.7%	8.1%	31.2%
Respondent #5	25.5%	22.3%	33.7%	18.5%	17.8%
Respondent #6	11.9%	5.1%	31.7%	51.3%	75.0%
Respondent #7	26.5%	43.5%	14.6%	15.5%	34.7%
Respondent #8	8.8%	3.7%	24.8%	62.7%	32.6%
Respondent #9	36.2%	2.2%	29.2%	32.4%	119.3%
Respondent #10	13.2%	58.5%	15.1%	13.2%	1.2%

coal from small size barges from Bintang Ninggi jetty to larger size barges along the Barito river area which less affected from water level condition by using the heavy equipment such as excavators above

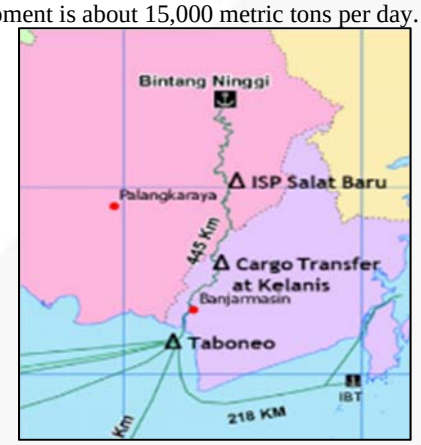


Figure 6: Location Map for Coal Supply Chain Alternatives

3.2 Results and Discussion

From the result, there are 2 respondents who consider Quality Criteria as the most important criteria while 3 respondents consider for the Cost Criteria, 3 respondents agree that the Delivery Criteria as the most important criteria in Quality Criteria and 2 respondents for Barge Availability Criteria. From the merging result of 10 respondents, the result is Consolidated Priorities and Consolidated Decision Matrix as below that concluded Cost Criteria (31,3%) is more important than the other criteria which place it as the first position which follow by Barge Criteria Availability (27.9%) as the second position and Delivery criteria (27.7%) as the third while the last position is for Quality criteria (13.2%).

Table 5: Consolidated Priorities and Decision Matrix for Criteria

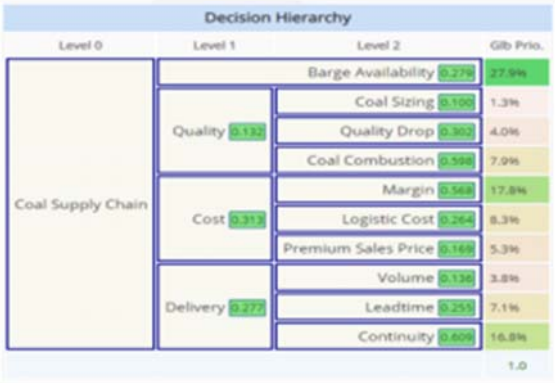
Cost Criteria is considered as the most important criteria because it has a direct impact to the company's performance that related with the coal sales margins. The selling price of the coal which tend to be fluctuate become the consideration for achieve the margin profit, the cost that might be able to be reduced are the production operational cost and the logistics cost as the and Overburden Removal. The other reason is due to the company's policy for maintaining the amount of coal stock at the port in consideration to avoid the deadstock which will affect the cash flow of the company and because of its coal characteristics which is quite easy to experience the self-combustion if the coal is stacked over a long period of time. Delivery Criteria also have considerable weight due to the importance of delivering coal as optimally as possible to fulfill the agreed volume of the contracts which is limited to one-year period from the signing date of the contract. The length of fulfillment of a shipment also has an impact to the logistics costs which the longer period of the fulfillment of a shipment the more expensive the logistics cost will be that will have an effect of the reducing of the margin profit. Having the challenge with the season in Central Kalimantan area, its is expected that 70% of the volume shall be delivered in the first semester because the second semester would not become effective due to the occurrence of the dry season that will take for 3 to months that will affect the ability of the barging days.

From the result of the Priority Evaluation Hierarchy, there are 3 most important sub-criteria which are:

1. Barge Availability with its percentage of 27.9%;
2. Margin with its percentage of 17.8%; and
3. Continuity with its percentage of 16.8%.

The details of the Decision Hierarchy are as follows:

Table 6: Decision Hierarchy for Selecting Coal Supply Chain



These 3 sub-criteria represent 62.5% from the total 100% of the sub-criteria for the assessment of alternative coal supply chain in PT Hamparan Mulya in order to facilitate the decision making related to the supply chain management in the company, the management as the decision maker in the company could consider to these 3 major things. However, for the purpose of this research, all sub-criteria are completely direct cost. The Barge Availability Criteria which is placed as the second important criteria because it is needed for support the delivery of coal from the coal stockpile to be received by the buyers on their vessels. In the event there is a challenge in providing the barges to fulfill the shipment, it certainly has an impact on the upstream mining processes such as Coal Hauling be used in the assessment for figuring the most suitable alternative for coal supply chain in PT Hamparan Mulya which the result of the questionnaire distributed to the respondents regarding the purpose of this research for figuring the most suitable alternative which be divided into 4 alternatives of coal supply chain which conducted from the 10 sub-criteria be shown as below:

Table 7: AHP Group Consensus for Selecting Coal Supply Chain

Name	Taboneo	ISP Salat Baru	IBT	Cargo Transfer	CR max
Group	**23.8%**	**22.4%**	**34.0%**	**19.8%**	**2.1%**
Respondent #1	17.9%	31.0%	30.2%	20.9%	3.1%
Respondent #2	19.7%	21.4%	44.4%	14.5%	3.1%
Respondent #3	27.8%	13.8%	46.1%	12.3%	8.0%
Respondent #4	33.0%	16.9%	32.8%	17.2%	4.3%
Respondent #5	28.3%	21.1%	36.1%	14.5%	6.4%
Respondent #6	50.9%	10.1%	16.6%	22.4%	8.6%
Respondent #7	26.2%	23.9%	24.8%	25.0%	2.7%
Respondent #8	13.0%	26.2%	35.6%	25.3%	5.4%
Respondent #9	27.9%	24.4%	27.9%	19.8%	5.0%
Respondent #10	19.0%	31.5%	31.4%	18.1%	6.8%

The merging result of the AHP processed data found that alternative coal supply chain which considered as the most suitable solution to PT Hamparan Mulya shall be as follow:

1. IBT with its percentage of 34,0%;
2. Direct Taboneo with its percentage of 23,8%;
3. ISP Salat Baru with its percentage 22,4%; and
4. Cargo Transfer with its percentage 19,8%.

The result of the calculation of weighting and assessment by 10 respondents on the sub-criteria are listed in the table below:

Table 8: AHP Group Consensus for Selecting Coal Supply Chain

3.3 Implementation of Business Solution

From the result of AHP methodology, it is proposed to have the alternative of coal supply chain for PT Hamparan Mulya by using intermediate stockpile owned by PT Indonesia Bulk Terminal (IBT). As a first process representative from Supply Chain Department of PT Hamparan Mulya conduct a communication with the representative from PT Indonesia Bult Terminal for a trial of using IBT as an alternative for coal supply chain for PT Hamparan Mulya. In parallel, Marketing Department of PT Hamparan Mulya will try to communicate with the existing Buyers that there will be a trial of coal shipments through the IBT so the buyer would be able to plan the arrival for the vessel at IBT, while the Logistics Department will conduct price survey for transporting barges with the barge vendors for the route from Bintang Ninggi to IBT. From the results of the meeting with the representative from IBT, the following shall be the quotation of the services provided by IBT to Hamparan Mulya:

The Agreed Volume for Trial: 80,000 MT
The Services Fee for using IBT: USD 2,15/MT excluding VAT which shall be paid in IDR with the following formula Q x BR x (NER/BER)
Q: Quantity
BR: Base Rate of IDR 29,025
NER: the prevailing exchange rate by reference to the Jakarta Interbank Spot Dollar Rate ("JISDOR") on the date of loading completion.
BER: Base Exchange Rate of IDR 13,500
Additional Charge for the Tug Assist USD 45,000 when the docking ship by Pelindo

So, the simulation of the Logistics Cost of using the alternative of coal supply chain of IBT when compared to the actual existing Logistics Cost through Direct Taboneo as shown in the table below:

Table 9: Simulation of Logistic Cost of using IBT compared to Taboneo

Cost Parameter	Budget	Taboneo 1	Taboneo 2	Avg Taboneo	IBT Trial (Estimation)
Freight Cost	$ 9.37	$ 9.83	$ 9.98	$ 9.91	$ 8.84
Floating Crane	$ 1.38	$ 1.47	$ 1.38	$ 1.43	$ -
ISP Cost	$ -	$ -	$ -	$ -	$ 2.37
Quality drop	$ -	$ -	$ -	$ -	$ 1.04
Port Charge	$ -	$ -	$ -	$ -	$ 0.91
Barge Detention	$ 1.00	$ 0.98	$ 0.92	$ 0.95	$ -
Treatment + Other	$ 0.75	$ 0.79	$ 0.75	$ 0.77	$ 0.20
Sub Total Opr	**$ 12.50**	**$ 13.07**	**$ 13.03**	**$ 13.05**	**$ 13.36**
Insurance	$ 0.10	$ 0.05	$ 0.05	$ 0.05	$ 0.05
Surveyor	$ 0.20	$ 0.18	$ 0.20	$ 0.19	$ 0.25
Marketing Fee	$ 1.25	$ 1.25	$ 1.25	$ 1.25	$ 1.25
Export	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02
Security	$ 0.08	$ 0.08	$ 0.08	$ 0.08	$ -
Sub Total Other	**$ 14.15**	**$ 14.65**	**$ 14.63**	**$ 14.64**	**$ 14.93**
Dead Freight	$ -	$ 1.26	$ 0.31	$ 0.79	$ -
Total Include DF	**$ 14.15**	**$ 15.91**	**$ 14.94**	**$ 15.43**	**$ 14.93**
Demmurage Vessel	$ -	$ 2.58	$ -	$ 1.29	$ -
Total Logistic Cost	**$ 14.15**	**$ 18.49**	**$ 14.94**	**$ 16.72**	**$ 14.93**

The Logistics Cost estimation by using IBT is cheaper than the cost of using the existing coal supply chain through Direct Taboneo with a difference around USD 1,79 per metric tons. As from cost side the IBT coal supply chain is better than the Direct Taboneo, it is also expected to have an impact for a better performance of the company.

The trial of using IBT as coal supply chain for PT Hamparan Mulya was conducted during February-March 2018 with the quantity of cargo 72,532 metric tons with 15 sets of barges. The days needed for the barge turnaround only take 7 days from the coal loading from barges to the IBT port. Compared to the Direct Taboneo it will take around 22 days for barge turnaround. By having this situation, it will give positive impact to PT Hamparan Mulya and to barge vendors because it will be able to avoid the cost for barge detention and coal combustion problems.

Table 10: Barge Rotation Trial at IBT

NO	TB/BG	JETTY	LOADING (BINTANG NINGGI) START	LOADING (BINTANG NINGGI) FINISH	TONASE (MT)	UNLOADING (IBT)	LEADTIME (DAYS)
1	SANLE 31/TGH 2516	BIMA	11-Feb	11-Feb	5,287.40	19-Feb	7
2	BAHAR 1281/TAMA 2726	SAKTI	10-Feb	12-Feb	5,488.37	18-Feb	6
3	SANLE 25/ TGH 2507	BIMA	14-Feb	14-Feb	5,294.76	8-Mar	22
4	SANLE 9 /TGH 2503	BIMA	21-Feb	22-Feb	5,188.40	7-Mar	13
5	ERINA 11/ SANTAN 195	BIMA	26-Feb	26-Feb	4,308.01	5-Mar	7
6	BAHAR 19/ GEMILANG 2352	BIMA	6-Mar	6-Mar	4,100.95	12-Mar	6
7	PRIMA 1259 /TAMA 2560	SAKTI	6-Mar	6-Mar	4,809.88	10-Mar	4
8	BUANA NUSANTARA 7/ BUANA NUSANTARA 6	SAKTI	11-Mar	12-Mar	4,639.49	16-Mar	4
9	BAHAR 1281/ TAMA 2726	BIMA	13-Mar	13-Mar	5,515.70	18-Mar	5
10	BUANA NUSANTARA 1/ BINA MARINE 10	SAKTI	13-Mar	13-Mar	4,685.28	19-Mar	6
11	PRIMA 1251/ GEMILANG 2590	BIMA	13-Mar	14-Mar	4,584.60	20-Mar	6
12	BINA MARINE 7 / NUSANTARA JAYA 2	SAKTI	13-Mar	14-Mar	4,288.00	19-Mar	5
13	BINA MARINE 17/ BINA MARINE 18	SAKTI	16-Mar	16-Mar	4,515.51	21-Mar	5
14	BINA MARINE 69 / BUANA NUSANTARA 4	BIMA	16-Mar	17-Mar	4,603.96	23-Mar	6
15	SANLE 35 / TGH 2510	SAKTI	16-Mar	17-Mar	5,222.37	26-Mar	9
TOTAL TONASE					72,532.69	Average Days	7

The process of coal unloading from the barges that arrived at the IBT jetty will be carried out with 2 units of grab tools with a capacity of 30 metric tons for each of them as integrated with the conveyor system. The production capacity for discharge is around 685 tons per hour and passes through the

metal detector to ensure the coal cargo has no unidentified material contamination. The unloaded coal then placed in 1 stockpile slot with the maximum capacity of 80,000 metric tons.

Figure 7: Unloading Process and Coal Stacking at IBT

The coal pile process is carried out by First In - First Out (FIFO) mechanism which the first loaded pile is carried out by using the D10 typed dozer so the entire stockpile area measuring 52.5 x 120 meters would be able to be used in maximum capacity. The height of the pile is set to the maximum of 10 meters to achieve the capacity of 80,000 metric tons.

On April 2018 the first trial of shipment was carried out through IBT for the shipment MV London 2012. Coal was loaded for 37,16 hours with the total loaded coal on the ship 72,850 metric tons. The average loading rate is 1,961 tons per hour. After the loading activities, PT Hamparan Mulya conducted a meeting with the IBT representatives on April 23th 2018, while the result of the review be as follow:

1. As a big picture, PT Hamparan Mulya feel satisfied with the operation of the unloading and loading of coal carried out by IBT;
2. The advantages of PT Hamparan Mulya by using IBT as coal supply chain are:
    1) The obstacle of the coal combustion as the effect of the increasing the temperature as occured by using Direct Taboneo method does not occur when using IBT as the coal supply chain;
    2) Resolve the production capacity obstacle by carrying out coal storage at IBT; and
    3) Resolve the logistic obstacle of uncertain water level issues.
3. The disadvantage of PT Hamparan Mulya by using IBT as coal supply chain is a disagreement and/or complaint from buyer, that there was a significant decrease in coal sizing which sizing with a size of + 50 mm is only 5-6% that the buyer expected the coal with size +50 mm is 15%.

Table 11: Results of Quality Analysis of Coal on Ships Owned by PT Hamparan Mulya

NO	MOTHER VESSEL	BUYER	QUANTITY (MT)	AS RECEIVED		AIR DRIED BASIS						HGI	SIZE	
				TM	CV	IM	ASH	VM	FC	TS	CV		0-50 MM	> 50 MM
				%	kcal/kg	%	%	%	%	%	Kcal/kg		%	%
1	MV.AMAZON	ADANI.1	66,730	31.02	4503	15.14	5.76	38.94	40.16	0.16	5540	54	84.00	16.00
2	MV.ABY SCARLETT	ADANI.2	75,005	31.09	4502	14.41	5.48	39.08	41.03	0.19	5592	45	83.31	16.69
3	MV.LONDON 2012	ADANI.3	72,850	31.68	4435	15.36	5.37	38.85	40.42	0.19	5494	47	93.21	6.79
	CUMULATIVE		214,585	31.30	4480	15.00	5.50	39.00	40.50	0.18	5543	48.50	86.90	

The buyer stated that the market in India would prefer coal with larger size of coal than the usual size it is also supported that PT Hamparan Mulya agree to provide the coal sizing greater than 50 mm would be approximately 15%. As a result of the trial, the buyer does not feel satisfied enough with the trial. As a result of the further discussion the buyer may accept the coal with this specification but has to deal with different contract with the different selling prices and the premium price would not be applicable.

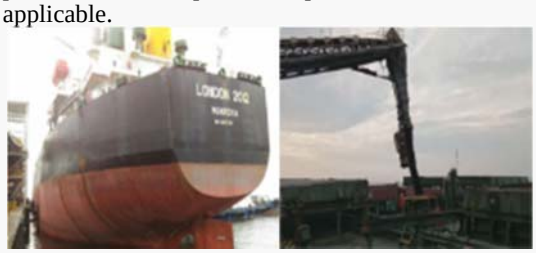


Figure 8: The Process of Loading Coal to MV London 2012 at the IBT Jetty

After having the result with the buyer who did not feel satisfy with the trial, then PT Hamparan Mulya conduct a discussion with IBT team to understand the reason of the coal sizing issue and the following results are obtained from the analysis by both parties:
1. The hardgrove grindability index (HGI) of the coal owned by PT Hamparan Mulya is in the figure of 48,50 that make the coal is easily fragile and require special treatment for the process of stacking and loading;
2. The main reason which cause the decrease in coal sizing is the movement of the D10 Dozer above the stockpile during unloading and loading; and
3. The usage of dozer technique carried out by cutting from the top of the stock.

In term of cost, the result of the first trial of IBT provides significant logistical cost saving which is good for long-term use. The following below is a table that shows comparison of the actual logistics costs incurred with the estimation before the trial:

Table 12: Actual Logistic Cost Trial Using IBT

Cost Structures	Budget	Avg Taboneo	IBT (Plan)	IBT (Actual)
Freight Cost	$ 9.37	$ 9.91	$ 8.84	$ 8.74
Floating Crane	$ 1.38	$ 1.43	$ -	$ -
ISP	$ -	$ -	$ 2.37	$ 2.39
Port Charge	$ -	$ -	$ 0.91	$ 0.94
Barge Detention	$ 1.00	$ 0.95	$ -	$ -
Sub Total Opr	**$ 11.75**	**$ 12.28**	**$ 13.16**	**$ 12.08**
Treatment + Other	$ 0.75	$ 0.77	$ 0.20	$ -
Insurance	$ 0.10	$ 0.05	$ 0.05	$ 0.13
Surveyor	$ 0.20	$ 0.19	$ 0.25	$ 0.30
PSM Fee	$ 1.25	$ 1.25	$ 1.25	$ 1.25
Export	$ 0.02	$ 0.02	$ 0.02	$ 0.04
Keamanan	$ 0.08	$ 0.08	$ -	$ 0.04
Sub Total Other	**$ 14.15**	**$ 14.64**	**$ 14.93**	**$ 13.83**
Dead Freight	$ -	$ 0.79	$ -	$ 0.63
Total Include DF	**$ 14.15**	**$ 15.43**	**$ 14.93**	**$ 14.45**
Demmurage Vessel	$ -	$ 1.29	$ -	$ (0.33)
GRAND TOTAL	**$ 14.15**	**$ 16.72**	**$ 14.93**	**$ 14.13**

But this condition do not last long because after the trial the owner of intermediate stockpile Indonesia Bulk Terminal increase their price and add some parameter which burden for future implementation and also impact to the increment of logistic cost about 22% from initial cost on trial shipment.

Table 13: IBT New Rate Simulation Cost vs Average Cost Taboneo 2019

NO	ITEM	2018	2019					AVG	IBT NEW RATE
	BL DATE	08-Apr-18	12-Jan-19	29-Jan-19	26-Feb-19	18-Mar-19	09-Apr-19		
	SHIPMENT	ADANI 3 IBT - 2018	AGARWAL 1 - 2019	AGARWAL 2 - 2019	ADANI 1 - 2019	AGARWAL 3 - 2019	ADANI 2 - 2019	2019	
1	Freight	$ 8.74	$ 9.93	$ 10.64	$ 10.47	$ 10.85	$ 10.36	$ 10.42	$ 9.30
2	Floating Crane	$ -	$ -	$ -	$ 1.45	$ -	$ 1.49	$ 0.74	$ -
3	Surveyor + LS	$ 0.30	$ 0.23	$ 0.27	$ 0.16	$ 0.22	$ 0.19	$ 0.20	$ 0.30
4	Insurance	$ 0.13	$ 0.06	$ 0.06	$ 0.06	$ 0.07	$ 0.07	$ 0.07	$ 0.13
5	Export Docs	$ 0.04	$ 0.03	$ 0.02	$ 0.01	$ 0.02	$ 0.02	$ 0.02	$ 0.04
6	Dead Freight	$ 0.63	$ -	$ -	$ -	$ -	$ 0.19	$ 0.06	$ -
7	Barge Detention	$ -	$ 3.19	$ 1.97	$ 2.65	$ 2.10	$ 5.00	$ 2.68	$ -
8	Cek Temperatur	$ -	$ 0.01	$ 0.01	$ 0.01	$ 0.01	$ 0.01	$ 0.01	$ -
9	Keamanan	$ -	$ 0.06	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.04	$ 0.04
10	Handling cargo	$ -	$ -	$ -	$ 0.01	$ 0.00	$ 0.00	$ 0.00	$ -
11	Despatch Vessel (Accrued)	$ (0.33)	$ (0.37)	$ (0.13)	$ 0.13	$ (0.19)	$ -	$ (0.09)	$ -
12	Cooling down (by Floating Crane)	$ -	$ -	$ -	$ -	$ -	$ 0.01	$ 0.02	$ -
13	Port Charges IBT	$ 0.32					$ -	$ -	$ 0.94
14	Stevedoring	$ -	$ 0.60	$ 0.60	$ -	$ 0.60	$ -	$ 0.40	$ -
15	Biaya Claim Tongkang	$ -	$ -	$ -	$ -	$ 0.00	$ 0.04	$ 0.01	$ -
16	Compact cargo	$ -	$ 0.49	$ 0.52	$ 0.61	$ 0.61	$ 0.64	$ 0.60	$ -
17	Tug Assist	$ 0.62	$ -	$ -	$ -	$ -	$ -	$ 0.00	$ 0.62
18	Resizing (Hammerman)	$ -	$ -	$ -	$ 0.07	$ -	$ 0.06	$ 0.03	$ -
19	ISP IBT	$ 2.39				$ 0.00	$ -	$ 0.00	$ 4.33
20	Split COO	$ -	$ -	$ 0.00	$ -	$ 0.00	$ -	$ 0.00	$ -
21	Additional Analysis	$ -	$ -	$ -	$ -	$ 0.00	$ -	$ 0.00	$ -
22	Pengawalan Airud	$ -	$ -	$ 0.01	$ 0.00	$ 0.03	$ 0.01	$ 0.01	$ -
23	Izin muat alat berat	$ -	$ 0.00	$ -	$ -	$ 0.10	$ -	$ 0.02	$ -
24	PNBP + Pengawasan Kegiatan Bongkar Muat	$ 0.04	$ 0.10	$ 0.10	$ 0.10	$ -	$ 0.10	$ 0.08	$ -
	Total Logistic Cost	**$ 12.87**	**$ 14.32**	**$ 14.09**	**$ 15.75**	**$ 14.45**	**$ 18.21**	**$ 15.31**	**$ 15.69**

4. CONCLUSIONS

In this study, there are four (4) alternatives location for Coal Supply Chain which priorities to be evaluated by Multi Criteria Decision Making analysis. The Multi Criteria Decision Making method utilizes Analytical Hierarchy Process (AHP) methodology for assessment with Pairwise Comparison and also supported by comparison of financial calculation. The results of this research are:

1) The best alternative based on Analytical Hierarchy Process methodology is coal supply chain through intermediate stockpile Indonesia Bulk Terminal (ISP IBT). By ranking order is Rank 1 - Intermediate Stockpile Indonesia Bulkt Terminal (ISP IBT), Rank 2 – Direct Taboneo, Rank 3 – Intermediate Stockpile Salat Baru (ISP Salat Baru) and the last Cargo Transfer.
2) From the global prioritization of AHP, the most important aspect is Barge Availability with relative score of 27.9% followed by Margin which is sub-criteria of Cost with relative score of 17.8% and Continuity which is sub-criteria of Delivery with relative score of 16.8%. These three aspect are sufficient to represent as much as 62.5% in the future analysis on decision making related to coal supply chain.

3) Overall results obtained from the Analytical Hierarchy Process methodology and preference of respondents are relatively have similar result on choosing the alternatives of coal supply chain and seeing the advantages or dis-advantages of each alternatives. Intermediate Stockpile Indonesia Bulk Terminal (ISP IBT) and Direct Taboneo are the two top of ranking in AHP methodology and preference of respondents.
4) After conducting a trial through the coal supply chain by using the intermediate stockpile of IBT and some feedback from the existing buyer of PT Hamparan Mulya, the management decided for having the coal supply chain by continue the current delivery of coal method through the existing coal supply chain route which is Direct Taboneo because some of the following considerations:
    a) The current buyer (which has the agreement with PT Hamparan Mulya in term of volume and period during 2018 – 2019) refuses the coal supply chain by using the intermediate stockpile of IBT because of coal sizing which result reduction in calories and addition in moisture content of the coal.
    b) There is pressure from the current buyer if PT Hamparan Mulya conduct the coal supply chain by using the intermediate stockpile of IBT, then the buyer would eliminate the Premium Sales Price of coal as agreed in the Agreement and PT Hamparan Mulya would potentially lost the currently available niche market.
    c) The cost for using the coal supply chain by using intermediate stockpile of IBT for long-term usage in 2019 would be increased which will affect the total logistics costs that approximately would be equal to the actual logistics costs through Direct Taboneo (Table 13). However, the consideration of the costs incurred with coal supply chain of intermediate stockpile of IBT would be fix cost while with current coal supply chain through Direct Taboneo is still fluctuating.

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