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DECISION ANALYSIS OF ABANDONMENT AND SITE RETIREMENT FOR SAND PLANT FACILITIES GATHERING STATION

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ABSTRACT

Aging infrastructure can pose risks to safety, environmental impact, and production efficiency. Therefore, PERTAMINA has implemented a comprehensive maintenance and inspection program for its oil and gas infrastructure in the Rokan Block. The company regularly inspects and tests its equipment to detect any potential issues and ensure that it is in a safe working condition. PERTAMINA also invests in the upgrade and replacement of aging infrastructure components to improve production efficiency and reduce environmental impact. The purpose of the study is to provide light on how sand plant facilities gathering station abandonment and site retirement decisions are made. A cross-sectional survey with a quantitative approach was employed as the research design for this study, and data were gathered from both primary and secondary sources. Based on the preliminary results of Simple Multiple Attribute Rating Technique (SMART) exercises, which were conducted to compare the benefits and drawbacks of each alternative, it was determined that alternative 2—disassembled and put in temporary storage as scrap—was the most appealing choice.

INTRODUCTION

PERTAMINA Hulu Rokan (PHR) is a subsidiary of PERTAMINA, Indonesia's state-owned oil and gas company. PHR is responsible for the exploration, development, and production of oil and gas reserves in the Rokan Block in Riau province, Sumatra, Indonesia, the Rokan Block is one of Indonesia's largest oil fields, covering an area of approximately 6,279 square kilometers (Pertamina Siaran Pers, 2021a). PHR took over the management of the Rokan Block from Chevron in 2021 and is now the operator of the block until 2041 (Asmarini, 2018; Karyza & Harsono, 2021).

PHR's operations in the Rokan Block include drilling, production, and distribution of crude oil and natural gas (Rizki et al., 2023; Syafrinaldi et al., 2022). The company is committed to maintaining safe and environmentally responsible operations while maximizing the potential of the Rokan Block PHR also aims to contribute to the local community's social and economic development in the Riau province (Pertamina Siaran Pers, 2021b). The company has implemented various community development programs, including education, health, and infrastructure projects, to improve the standard of living in the region (Pertamina Hulu Indonesia, 2022).

As one of Indonesia's largest oil producers, PERTAMINA Hulu Rokan (PHR) plays a significant role in meeting the country's oil demand. The Rokan Block, where PHR operates, has estimated oil reserves of over 6 billion barrels, making it one of the most significant oil fields in Indonesia, PHR aims to maximize the production of oil from the Rokan Block to support

Indonesia's energy needs and reduce the country's dependence on oil imports. In 2021, PHR took over the management of the Rokan Block from Chevron, with a production target of 170.000 barrels oil per day (BOPD).

PHR's production from the Rokan Block will be sold to the domestic market, supporting Indonesia's energy security and economic growth. The company also plans to increase investment in technology and infrastructure to improve production efficiency and maximize the potential of the Rokan Block.

Abandonment site retirement refers to the process of permanently decommissioning oil and gas facilities and infrastructure that are no longer in use (Chandler et al., 2017; Ojukwu, 2020). This process involves the safe and proper closure of wells, pipelines, platforms, and other equipment, as well as the removal of all associated infrastructure (Jagerroos & Kayleigh, 2020). The goal of abandonment site retirement is to ensure that the decommissioned sites are safe, environmentally sound, and pose no risk to public health or safety (Bullard & Johnson, 2000; Malin, 2015; Rezaie & Anderson, 2020). It also involves restoring the site to its original condition or better, minimizing any impact on the environment and surrounding communities.

In the oil and gas industry, abandonment site retirement is required by regulations and industry standards to ensure that decommissioned sites are left in a safe and secure condition, PERTAMINA have a dedicated team responsible for overseeing the abandonment site retirement process and ensuring compliance with regulations and best practices.

The abandonment site retirement process typically involves several steps, including site assessment, plugging and abandonment of wells, removal of equipment and infrastructure, site remediation and restoration, and ongoing monitoring and maintenance (Jones et al., 2022). Abandonment site retirement is a critical part of the oil and gas industry (Jing et al., 2021). PERTAMINA are committed to ensuring that decommissioned sites are safe and environmentally sound, contributing to the long-term well-being of the communities where they operate.

The Duri Field is an oil field located in Riau Province, Indonesia, which is operated by PERTAMINA, the state-owned oil and gas company of Indonesia. The Duri Field is one of the largest oil fields in Indonesia and has been in operation since the 1950s, there are several gathering stations located in the Duri Field that are used to collect crude oil from various wells and prepare it for transportation. These gathering stations typically include separators to remove impurities, pumps to increase the pressure of the oil, and tanks to store the oil before it is transported to processing or refining facilities.

One of the facilities inside the gathering station is the sand plant facility, which is a facility for processing and separating sand from petroleum wells, oil that is lifted to the surface containing grains of sand from the bowels of the earth. The sand must be separated from the oil content so that the quality of petroleum can be accepted according to standards. The facility was built in 2000, used for 12 years until 2012, but is currently no longer in use because other more effective methods have been found to clean sand from the bowels of the earth. The Sand Plant Facility is planned to be included in the work plan for post-operation activities Abandonment site retirement (ASR).

The research would like to unveil the decision-making of abandonment and site retirement for sand plant facilities gathering station. The researchers hope that this study can give readers more information regarding the issue discussed and how Pertamina deals with it.

METHOD

The research design used for this study was a cross-sectional survey through quantitative approach in which the data were collected from primary source and secondary source. After that, the collected data were analyzed using Simple Multi Attributes Rating Technique (SMART) which is a structured technique for organizing and analyzing complex decisions. SMART is one of the methods which aims to gather information about all data related to multiple attributes and multiple criteria. The data parameters are the data of the past and the future as needed. The performance of each alternative is represented in the value on scales of numeric, which will evaluate through a direct rating-procedure.

In this study, the primary data was collected through Focus Group Discussion (FGD) and interview with experts which has more than 10 years working experiences in project to have broad and deep view of the problems and solutions.

For alternative or option solution to the problem and factors affecting it, author generated Value-Focused Thinking (VFT) as follow:

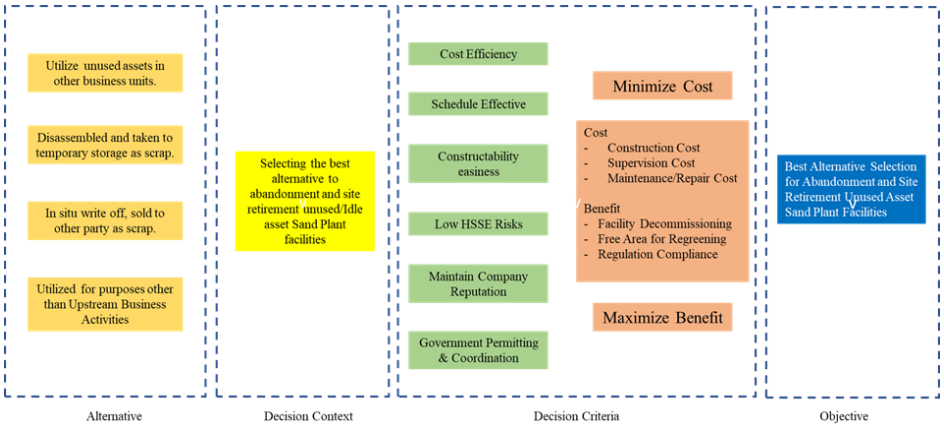

Figure 1. Value-Focused Thinking

The secondary data the authors collected and utilized were data coming from article, journal, company regulations and other online source data. When conducting secondary data collection, it is essential to properly cite and attribute the original sources of the data to ensure ethical research practices. Additionally, researchers should consider the relevance and limitations of the data in relation to their research objectives and critically evaluate its suitability for their study.

As a first step, author defined structure decision makers as a result of discussion with experts who were involved directly to project execution at PT PERTAMINA Hulur Rokan with good amount of experience.



Figure 2. Decision Makers Abandonment and Site Retirement Facilities

Following the definition of the hierarchy, the next step is to collect data from subject respondents regarding the relative weighting of each criterion in relation to the others and each alternative in relation to the others based on attributes. Each subject-matter expert is surveyed as part of the data collection process. The author met with them and went through each alternative's résumé before demonstrating how to fill out the survey data.

It is important to exercise Problem Analysis begins with defining the problem, it must be cleared object. The statement of the problem is: Unuse assets without a future utility plan is the main issue, The Problem Analysis (PA) is conducted to define the problem described on the following table.

	Specifiying Question	Is	Is Not	What is Distinctive About
Identify	What is the problem	Unuse asset (idle) without future utility	Active asset and inactive asset with future utilitity plan	Iddle asset is part of past problems and burdens for pertamina
	What is the impact of the problem	1. Budget expenses for annual tax, supervision cost 2. Potential HSSE risks	Duri field Operational Cost	NA
Location	Where is the problem occure	Is occoured in Duri Oil Field	Is not observed for other idle assets	The land area of the sand plant will be restored and reforestation will be carried out by planting trees
When	When the problem occurred	Is first observed in 2021	Could be not reported before 2021	Initiative for abandonment and site retirement was started in 2021
How Much	How Much Overhead Idle Asset	Is lead to expense overhead cost average Rp. 500.000.000 / year	NA	NA
	Trend	Increasing	NA	NA
Possible Causes : 1. There is other technology for solid handling 2. Decline oil production of Duri field 3. The facility have lack of maintenance			The Most Possible Cause: **Unused assets (idle) without future utility because they are replaced with new efficient technologies.**	
Verivication: By 5 - WHYs		**Unuse asset without future utility plan**		

Figure 3. Problem Analysis Sand Plant Facilities

Based on Kepner Tregoe Problem Analysis (PA) and verification is conducted by 5-Whys Root Cause Analysis, can be concluded that the root cause of unused asset without future utility plan is because the sand plant facilities has been replaced with new efficient technology, because there is no plan for reuse in the future, the facility will be proposed for abandonment & site retirement.

FGD took place involving subject matter experts to conduct VFT. The criteria and sub-criteria are Project Cost and benefit. The scope of this project is only related to decision making to find the best scenario for Selection for Abandonment and Site Retirement Unused Asset Sand Plant Facilities.

Alternative solutions to be considered must be looked at from many aspects, a large company in formulating various alternative solutions of course must consider technical and non-technical aspects, of course all aspects considered must also be in the corridor of legal standing, the technical aspects to be considered are considerations of equipment integrity, operational equipment, aspects of direct costs and indirect costs, aspect strategy procurement and contracting with business partner, while non-technical aspects are company reputation, aspect coordination with government

agencies, and also aspects of the social impact arising from these activities, from the consideration mentioned above already identified 4 (four) alternatives to solve the problem, The alternative solutions that will be proposed are:

1) Utilize unused assets in other business units, This alternative refers to government regulations through SKK Migas Guidelines PTK-040/SKKMA0000/2018/SO, the purpose of this alternative is to utilize unused assets owned by upstream oil and gas companies from one business unit to another. who have different business legal entities, for example the assets of Pertamina Hulu Rokan located on the island of Sumatra are reused in the Pertamina EP company located on the island of Java.
2) Disassembled and taken to temporary storage as scrap. This alternative refers to government regulations through SKK Migas Guidelines PTK-040/SKKMA0000/2018/SO, the purpose of this alternative is to dismantle unused assets and then store them in the company's Warehouse and record them as scrap, this alternative also confirms that the unused assets are deprived of operational benefits, either part or all their operating benefits, so these assets cannot be used operationally in the future.
3) In situ write off, sold to other party as scrap. This alternative refers to government regulations through SKK Migas Guidelines PTK-040/SKKMA0000/2018/SO, The purpose of this alternative is to sell unused assets directly to third parties, this alternative also emphasizes that the location of selling these assets is in the original location where the assets are placed, all dismantling costs and shipping costs for these assets are the responsibility of the buyer, this alternative gives the buyer freedom to develop the demolition work method and all demolition costs are the responsibility of the asset purchaser.
4) Utilized for purposes other than Upstream Business Activities. This alternative refers to government regulations through SKK Migas Guidelines PTK-040/SKKMA0000/2018/SO. The purpose of this alternative is to provide an opportunity for unused assets in the upstream oil and gas industry to be used for activities other than the oil and gas industry, such as for example these assets can be used for social activities, activities that can encourage environmental care activities, this alternative also allows assets is given to government agencies for their operational support.

The key to determining attributes in this study is to be the most important thing in the alternative determination stage business solutions that were studied were explored deeper by reconstructed value trees as divided the attributes into two categories, the Cost and the Benefits which will then be followed by the sub-category below. In the benefits category, there will be two subcategories, that are the Facility demolition/clear area and regulation compliance. In the facility demolition process, the schedule, HSSE risks and ease of construction will be emphasized, then in government regulation it will be associated with company reputation and permitting process.

Tabel 1. Decision Criteria Abandonment Site Retirement

No	Attribute	Description
1	Schedule	The estimate time and duration to execute the project until finish and financial closing project, The schedule is the important thing because will be part of measurable project success.
2	Constructability	Ease of construction implementation by minimizing disruption to operational activities and manageable operational risks. in the implementation of construction must comply with Serious Injury Fatality Prevention (SIFP) field guide and Managing Safe Work.
3	HSSE Risks	The risk of disruption to the HSSE aspect is very high, because this facility is in an active working area, this project involves a lot of field workers and various types of heavy equipment.
4	Permitting	This work involves a large number of permits issued by state institutions, involving permits at the central ministry level, provincial level permits and district level permits, permits are very important because the permit issuance process is very long.
5	Reputation	Pertamina as a state company has a very good reputation in terms of operations and compliance with government regulations, business considerations are always related to a reputation that has been good and has been built for a very long time, Pertamina will try to maintain this reputation as part of the shareholder's mandate.
6	Cost	Required budget for procurement & construction. The cost will be taken capital expenditure (Capex) for non-related business of current year, and include on annual cost recovery from GOI

RESULT AND DISCUSSION

The weighting for criteria or attributes has been discussed during focus group discussion which involved the experts. The discussion group participants were asked to give their opinion, their understanding of each alternative that will be presented with each criterion or attribute. then give weight to each criterion or attribute that is adjusted to current conditions in managing unused asset sand plant facility to be abandonment and site retirement. During the discussions, consistency of attributes/criteria and rating was reviewed to ensure consistency. The author had expected that perfect consistency would be difficult to achieve as some of the group discussion members, and on some occasion the consensus of numerical rating was made by voting.

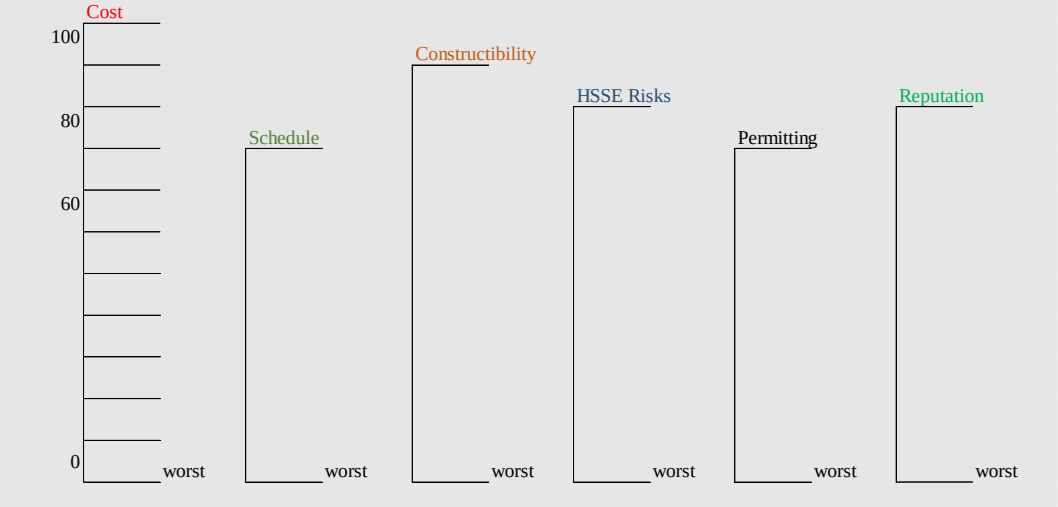

Figure 4. Weighing of each Attributes or Criteria

Table 2. The Aggregate Score for The Alternative 1

No	Criteria	Alternative 1		
		Score	***Weight***	***Total***
1	Cost	1	0.204	0.204
2	Schedule	1	0.143	0.143
3	Constructability	3	0.184	0.551
4	HSSE Risks	5	0.163	0.816
5	Permitting	3	0.143	0.429
6	Reputation	5	0.163	0.816
Total Aggregate Score				2.96

Table 3. The Aggregate Score for The Alternative 2

No	Criteria	Alternative 2		
		Score	***Weight***	***Total***
1	Cost	3	0.204	0.612
2	Schedule	3	0.143	0.429
3	Constructability	3	0.184	0.551
4	HSSE Risks	5	0.163	0.816
5	Permitting	3	0.143	0.429
6	Reputation	5	0.163	0.816
Total Aggregate Score				3.65

Table 4. The Aggregate Score for The Alternative 3

No	Criteria	Alternative 3		
		Score	***Weight***	***Total***
1	Cost	5	0.204	1.020
2	Schedule	5	0.143	0.714
3	Constructability	1	0.184	0.184
4	HSSE Risks	1	0.163	0.163
5	Permitting	3	0.143	0.429
6	Reputation	1	0.163	0.163
Total Aggregate Score				2.67

Table 5. The Aggregate Score for The Alternative 4

No	Criteria	Alternative 4		
		Score	***Weight***	***Total***
1	Cost	3	0.204	0.612
2	Schedule	3	0.143	0.429
3	Constructability	3	0.184	0.551
4	HSSE Risks	3	0.163	0.490
5	Permitting	1	0.143	0.143
6	Reputation	3	0.163	0.490
Total Aggregate Score				2.71

Decision Alternative Results

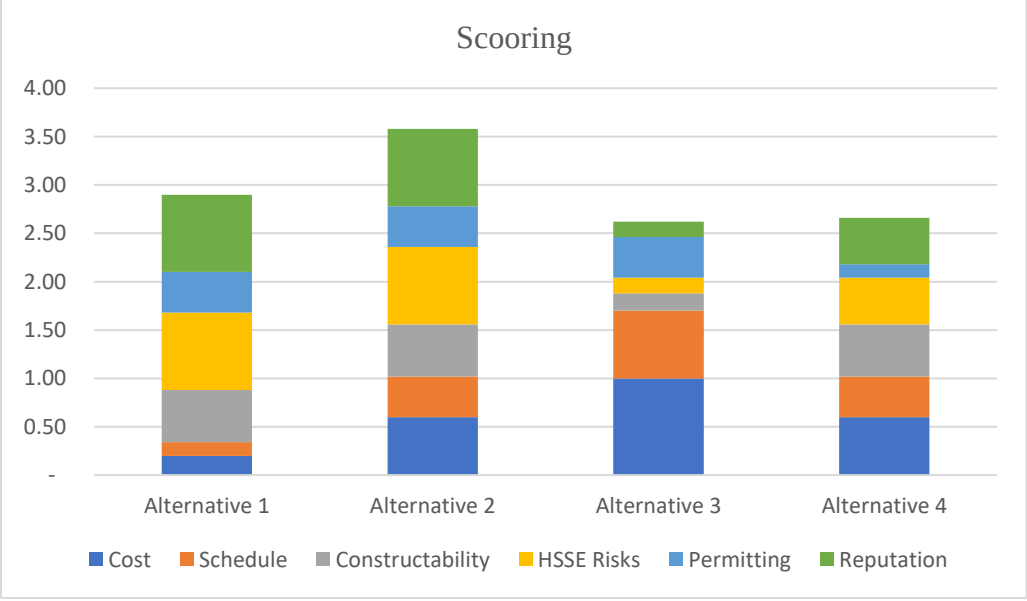

Figure 1. Aggregate Scoring for Alternative Against to Criteria

CONCLUSION

Based on Kepner Tregoe Problem Analysis (PA) and verification is conducted by 5-Whys Root Cause Analysis, can be concluded that the root cause of unused asset without future utility plan is because the sand plant facilities has been replaced with new efficient technology, because there is no plan for reuse in the future, the facility will be proposed for abandonment & site retirement.

By involving the experts and the affected team in the Focus Group Discussion enables the author to be more effective in analyzing, assessing, and determining problem solving. Focused Group Discussion is very effective in exercising the Simple Multiple Attribute Rating Techniques (SMART) and helps the decision maker to understand the trade between quantitative attribute (cost) and qualitative attributes (benefit), then by the sensitivity of the analysis which makes the chosen alternative more robust.

Based on value focus thinking (VFT) there are 4 alternative business solutions to support abandonment & site retirement activities, these 4 alternatives are in accordance with government regulations SKK Migas Guidelines PTK-040/SKKMA0000/2018/SO, The Alternative are mentioned below are Utilize unused assets in other business units, Disassembled and taken to temporary storage as scrap, In situ write off, sold to other party as scrap, Utilized for purposes other than Upstream Business Activities.

Determination of the best alternative from various considerations that have been analyzed. Based on the provisional decision of Simple Multiple Attribute Rating Technique (SMART) exercises which has been done to see the advantages of each alternative when traded with cost and benefits, and it is found that alternative 2 Disassembled and taken to temporary storage as scrap is the ultimate one as the most attractive alternative.

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