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Analytic Hierarchy Process (AHP) To Select The Best Service Contract Model In MNS Laboratory To Support CEOR Project

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ABSTRACT

Resources support from the 3rd party contractor is essential in MNS Laboratory operation. The use of 3rd party to support laboratory activities is intended to optimize cost, maintain resources efficiency, and provide world class laboratory service. The contract model used will significantly affect laboratory performance as measured in terms of cost, turn-around time (TAT), quality of data and reporting, and level of customer satisfaction. Selecting a fit-for-purpose contract model for MNS Laboratory operations is very important to help MNS Laboratory to have a strong resources base. Analytic Hierarchy Process (AHP) method is used in selection process with four key criteria. They are *Cost, Turn-Around Time (TAT), Organizational Capability and Industrial Relation*. Brainstorm with stakeholder is conducted to obtain data for pair-wises comparison and AHP software from BPMSG is used to formulate data. In the final process, the *Lump Sum with Modification* contract model is selected as the best alternative.

Keywords: cost, customer, data quality, industrial relation, organizational capability, turn-around time (TAT)

I. INTRODUCTION

PT. Global Energy Indonesia (PT GEI) is a subsidiary of Global Energy Corporation which operates the Rokan block for over 90 years. PT GEI operates under a PSC with the Government of Indonesia (GOI) represented by SKK Migas (Special Task Force for Upstream Oil and Gas Business Activities). More than 11 billion barrels of oil have been produced from Sumatra fields with application of advanced technologies to increase oil recovery from mature reservoirs such as water flood, steam flood and chemical injection. PT. GEI is known as the largest oil company contractors in Indonesia until 2018. Since 2019, its position as top crude producer was taken over by Mobil Cepu Limited. Currently, PT GEI contributes about 40% of national oil production.

MNS Laboratory is one of laboratory units under PT GEI which is located in Minas Riau. MNS laboratory is responsible to provide laboratory services to all teams in South area, such as Operations, Engineering, Assets, HES, hydrocarbon transportation, environmental etc.

a. Routine service

   Routine service is the general service that is provided MNS laboratory to support base business operations, such as oil and gas analysis for plant performance monitoring, water and produced water for environment compliance, field sampling and onsite testing, chemical quality control, and

   corrosion product analysis. The number of resources need for this service type is typically fixed and does not change much.

b. Project supports

   Special laboratory service from MNS Laboratory which is dedicated for supporting a project. In this service type, MNS Laboratory will allocate special additional resources that are designed to meet with project's need. Several projects that have been successfully supported by MNS Laboratory are the Light Oil Steam Flood (LOSF) pilot project in 2000s, Inter-well tracer test in 2000s, Surfactant Field Trial (SFT-2) project from 2013 until 2015, and Hydrocarbon Impacted Soils (HIS) remediation from 2015 until 2020. The last two projects required quite lots of resources from the MNS laboratory.

SPECIFIC PROBLEM

In its operating activities, MNS Laboratory is run by employees and contractors. Two contract agreements with two Laboratory Service contractors have been implementing since 2018 where contractors provide a number of qualified personnel to conduct daily laboratory works under supervision of MNS Laboratory. Both contracts are lump sum type where MNS Laboratory pays a fixed payment to contractors on monthly basis. Currently MNS Laboratory is facing some business issues related with its operations, organization capability and upcoming Rokan block transition to new operator. Some critical issues are described as below:

1. High cost and inflexible contract due to lump sum contracts based where MNS Laboratory has to pay a fixed payment to contractor even though when work volume decreases. In the beginning, the lump sum contract seemed giving benefits to MNS Laboratory. Planned and actual of samples volume were matched. But, when samples volume started decreasing in 2018, MNS Laboratory lost its benefit

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since MNS Laboratory has to pay the same cost. On the other hand, MNS Laboratory has to pay on-call request if asks contractors to work on weekend or holiday.

2. Cost for facilities, instrument, consumables and utilities are still under MNS Laboratory's responsibility. This condition causes high cost in practice. Since lump sum covers manpower cost only, MNS Laboratory has to absorb all other operating costs such as parts, consumables, utilities etc. This condition requires MNS laboratory to allocate more budget and manhours to handle non-core works such as material procurement, inventory, develop maintenance service contract, calibration etc. From the cost structure and allocation data, additional cost for consumables and parts that is not covered by contract is about 33% of total cost. Beside of tangible cost, MNS Laboratory also allocates lots of intangible cost such as allocation of employees' manhours for:
   - Maintaining instrument integrity and operability
   - Coaching and mentoring contractors
   - Conducting instrument calibration and verification
3. PT GEI's concession on Rokan block will expire in August 2021 and it will increase the uncertainty of services contract continuity post end of contract.
4. Potential of losing talented people because some employees will reach their retirement age on August 9, 2021 and some skillful contractor's employees potentially will move to other companies which offers more attractive numeration.
5. Data transfer from PT GEI to the next operator has to fulfil CVX policy regarding the intellectual property and data protection, so possibly not all data that is currently stored in database repository can be all transferred to new operator.
6. New operator has a plan to implement Chemical Enhanced Oil Recovery (Chemical EOR) technology to boost up oil production in Minas field. This plan will require lots of resources, and optimum and economic laboratory services will play a critical role.

The objective of this research is to determine what is the best service contract method for MNS Laboratory based on Analytical Hierarchy Process (AHP) decision making method. The model of decision-making process that will be built later is expected to be implemented in the Chemical EOR project and also laboratory base business service. Based on the research objectives, the following research questions are stated to have structured and systematic thinking for problem solving and decision-making processes:

a. What is the cause of high cost and inflexibility in implementing the current service contract?
b. How to find the best solution in order to obtain the more effective and efficient service contract that is suitable for MNS Laboratory operation, especially to be used in supporting CEOR project?

II. METHODOLOGY

The conceptual framework provides theoretical structure of assumptions, principles, or theory to support analysis in selecting the service contract model in MNS Laboratory. Conceptual framework for this research is divided into six steps as described on figure 1 below:

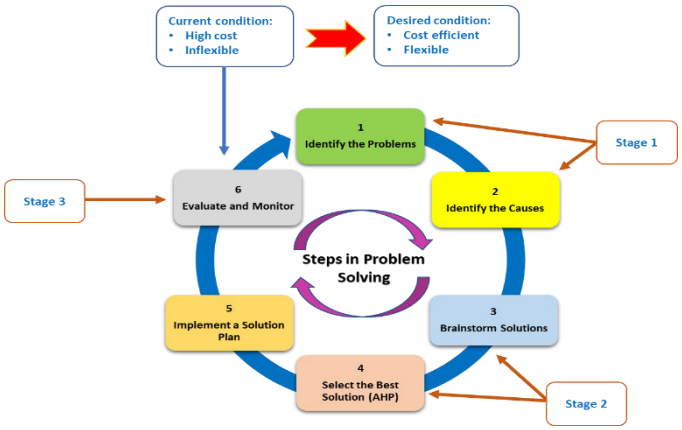

Figure 1 Conceptual Framework of 3rd Party Service Contract Model Selection

ALTERNATIVES

Problem analysis has been conducted on the business issue exploration stage of this research, using the RCA tools which are the group brainstorming, Pareto diagram, and Cause-Effect diagram. Group brainstorming is used to identify the issues related to current contract implementation (as criteria in AHP), Pareto diagram is for clustering the issues and Cause-Effect diagram is for identifying the causes of each criteria (as sub-criteria in AHP).

TABLE 1. SUMMARY OF BRAINSTORM WITH STAKEHOLDERS

No	Category	Short Description	Total issue or concern	%
1	Cost (CAPEX and OPEX)	Cost	14	38.9%
2	Organizational Capability (OC)	OC	7	19.4%
3	Turn Around Time (TAT)	TAT	4	11.1%
4	Quality	Quality	1	2.8%
5	Data and Information protection	IP	1	2.8%
6	New operator's policy	Policy	2	5.6%
7	Legal	Legal	2	5.6%
8	Industrial Relation	IR	3	8.3%
9	Leadership	LDR	1	2.8%
10	Safety	Safety	1	2.8%
		TOTAL	36	100.0%

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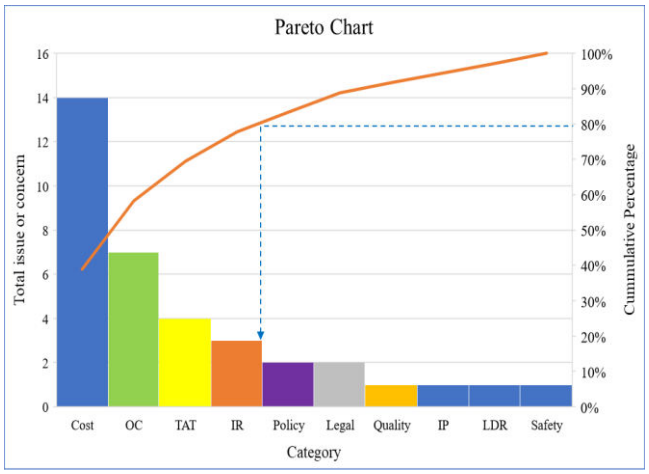

Figure 2. Pareto Chart of Issues related to Existing Service Contract

In this project, 80% of cumulative issue is to be resolved and it makes the ratio of 80/40. By using 80/40 ratio, four main factors that play critical roles in the existing service contract are identified, they are:

a. Cost
b. Organizational Capability (OC)
c. Turn Around Time (TAT)
d. Industrial Relation (IR)

Those four factors become criteria in AHP decision-making process to evaluate the best alternative solution of service contract model in MNS Laboratory. A Cause-Effect diagram is used to identify sub-factors that affect to each factor:

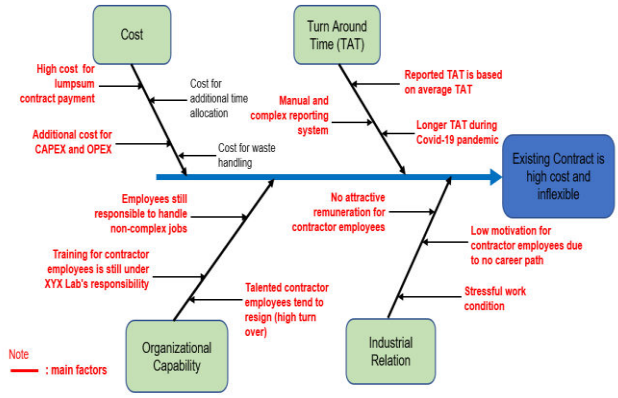

Figure 3. Cause and Effect Diagram of the Existing High Cost and Inflexibility Contract

Alternatives are identified by using Value Focused Thinking process, as described below:

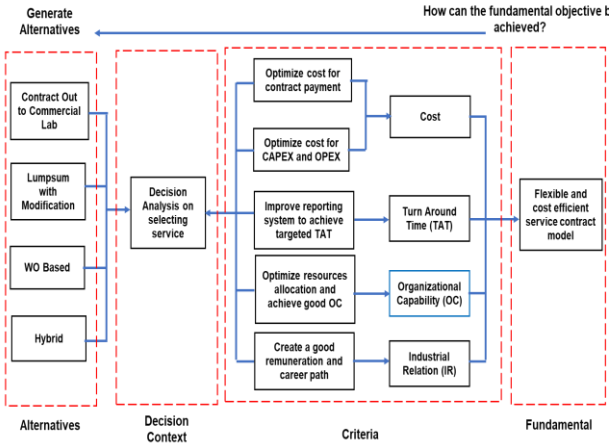

Figure 4. Value Focused Thinking Process (Criteria and Alternatives)

From the Value Focused Thinking (VFT), four alternatives are selected to be analyzed using Analytic Hierarchy Process (AHP), they are:

a. Contract out to commercial laboratories
b. Lumpsum with modification
c. Work Order (WO) based
d. Hybrid

III. RESULT

The AHP process are started by developing a hierarchy tree. Criteria, sub-criteria and alternatives are used in this stage. The AHP hierarchy tree for this project can be seen on Figure 5:

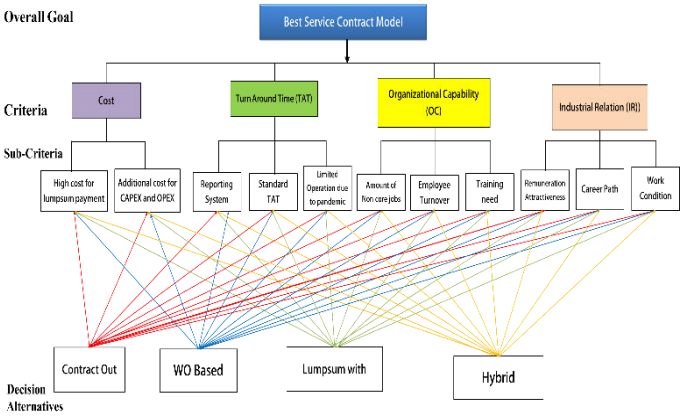

Figure 5. AHP Hierarchy Tree

The next step is to make pair-wise comparisons between criteria, sub-criteria and alternatives. To make pairwise comparison, a serial discussion and surveys were conducted to get the judgments of the importance intensity of one element comparing to another element. Eight stakeholders were interviewed to give the judgments how many times more important or dominant one alternative to another alternative based on a specific criteria and sub-criteria. Similar technique was applied when determined the importance intensity for alternatives. The Saaty's scale of preferences and AHP calculator from BPMSG (www.bpmsg.com) were used

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in this project. Consistency ratio (CR) must less than 10% (≤ 0.1) to have a trustworthy result

TABLE 2. SUMMARY OF AHP CALCULATION

Criteria	Cost		TAT			OC			IR			Tota
	0.508		0.075			0.265			0.152			1
Sub-criteria	Lumpsum cost	Additional cost	Reporting system	Standard TAT	Speed during limited operation	Amount of non-core jobs	Employees turn over	Training need	Remuneration attractiveness	Career path	Work condition	
	0.3406	0.1674	0.0487	0.0054	0.0209	0.1688	0.0278	0.0684	0.1111	0.0286	0.0123	1

No.	Alternatives	Cost		TAT			OC			IR			Tota
		Lumpsum cost	Additional cost	Reporting system	Standard TAT	Speed during limited operation	Amount of non- core jobs	Employees turn over	Training need	Remuneration attractiveness	Career path	Work condition	
1	Contract Out	0.0167	0.0931	0.0025	0.0003	0.0011	0.0906	0.0161	0.0449	0.0053	0.0013	0.0006	0.272
2	Lumpsum with modification	0.1894	0.0228	0.0102	0.0014	0.0042	0.0198	0.0018	0.005	0.0322	0.0081	0.0035	0.298
3	WO based	0.0463	0.0434	0.0313	0.0032	0.0131	0.0488	0.0079	0.0143	0.011	0.0023	0.0011	0.222
4	Hybrid	0.0882	0.0082	0.0047	0.0005	0.0026	0.0096	0.0021	0.0042	0.0626	0.0168	0.0071	0.206

Based on the final AHP calculation in table 2, the best alternative solution is ***the Lump Sum with Modification*** **with score of 0.2983**. The second rank is *the Contract Out* with score of 0.2725, then followed by *the Work Order (WO) Based* with score of 0.2226, and the last is *the Hybrid* model with the lowest score of 0.2066. After obtaining the best alternative, the next important step is to conduct Potential Problem Analysis (PPA). Based on Kepner Tregoe (1965), PPA is a systematic method for determining the future course of action or of a plan to anticipate those things which might go wrong. It involves the formulation of actions that will prevent potential problems from occurring and actions that will minimize the effects of those threats if they still occur. The problem causes are rated according to their likelihood of occurrence and the severity of consequences. Preventive actions are set up and contingency plans are developed. The process will help the decision maker to create a smooth and streamlined execution process.

IV. DISCUSSION

Decision making is an essential aspect of human life, so there is no dimension that is free from decision making. Regardless of the complexity of the mental process of decision making, each individual determines the problem and wants the results according to their desires. Decision making is a complex process, and many factors influence it such as biological, physiological, psychological, and socio-cultural environment. The use of AHP as a decision-making method has proven to be effective in processing qualitative and quantitative data which are interrelated determining factors in the Multi-criteria Decision-Making process. The process of collecting data with good techniques will determine the final result. For this reason, the selection of participants or stakeholders must be strictly in accordance with the objectives that will be reached so that the pair-wise comparison process can be carried out comprehensively. Currently, the use of mathematical equations, computer software, and theories from various branches of science (such as mathematics, statistics, economics, sociology, etc.) has made the decision-making process more advanced. One of the AHP tools that can be obtained for free is the AHP calculator from Klaus D. Goepel, founder of Business Performance Management Singapore (BPMSG). The use of the AHP calculator from BPMSG in this research is very helpful in performing complex computation that involve many criteria and criteria. The use of the AHP calculator also reduces the potential errors that occur when calculations are done manually. Another benefit of using AHP calculator is quickly identify inconsistency when the consistency ratio (CR) > 10%, so that pair-wise survey repetitions can be done immediately. In this research, the author uses linear scale from Saaty (1997) with judgement scales from 1 to 9. Other experts have conducted research and study to challenge the Saaty's judgement scale. Harker and Vargas (1987) have simulated a quadratic and a root square scale. But, since they only used one simple example only, it seems not enough to conclude the superiority of the 1–9 linear scale. In total, there are seven scale types that have been developed by experts based on the AHP theory created by Saaty.

V. CONCLUSION

Based on brainstorming with stakeholders, some issues related with the existing 3rd party contract implementation have been identified. The major issues which have significant impacts to MNS Laboratory operation are *Cost, Turn-Around Time, Organizational Capability, and Industrial Relations*. Therefore, it is very important for MNS Laboratory to have a cost efficient and flexible contract to enable the organization to deliver better services, especially for upcoming Chemical EOR project. Four alternatives have been identified to solve the problem, they are: Contract Out to Commercial Lab; Work Order Based Contract; Lump Sum with Modification Contract; and Hybrid Contract. The best alternative solution based on AHP calculation is to develop a Lump Sum with Modification contract model. PPA process is then conducted to identify potential problem, set up preventive actions and develop a mitigation plan. The last action is to develop an implementation plan that comprises the detailed of designate roles and responsibilities, timeline, budget and resources allocation, metrics, and contingency plan.

VI. RECOMMENDATION AND IMPLEMENTATION PLAN

Based on research that has been done, the author recommends some action items to ensure the development of Lump Sum with Modification contract can be executed smoothly and in timely manner, such as:

1. Follow the preventive action and mitigation plan that is recommended in PPA to reduce the risks that will potentially disrupt the project goals. Pay more attention on potential problems which have high score in likelihood and degree of impact.

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2. Obtain support and approval from leadership, and regularly update them with the project progress.
3. Work with Contract team to conduct market intelligent to obtain more detailed data about job market in oil and gas industry. The job market data is very important in contract development because it will determine how much the company has to pay for competent labor according to the required specifications.
4. Work with Supply Chain Management (SCM) to conduct market surveys to obtain the market prices of chemical and consumables which are needed by MNS Laboratory operational, so that MNS Laboratory can prepare a realistic budget for contract development.
5. Work with contract owner to utilize other contracts to cover the MNS Laboratory operational need when the new contract is still in the development stage.
6. Since the business solution has an intersection between the two operators in the Rokan block, it is necessary to develop a detailed schedule for its implementation plan. Collaboration with the transition team is absolutely necessary so that the plan can be proceeded smoothly after the block ownership is transferred to new operator.

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