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DESIGN OF PERFORMANCE MANAGEMENT SYSTEM USING PERFORMANCE PRISM FOR OIL AND GAS PROJECT: CASE STUDY BKP OFFSHORE BROWNFIELD PROJECT

Yosephus Bani Perwira[a] & Dermawan Wibisono[b]
[ab]Institut Teknologi Bandung, Bandung, Indonesia.
Corresponding email: yosephus_bani@sbm-itb.ac.id

Abstract

Current performance management for project execution in the Company is measured with the strategy and process on how to achieve the target based on technical guidelines. Critical decision-making mostly depends on management's experiences. The Company's position as State-Owned Enterprises in Indonesia receives high expectations from stakeholders. The complexity of the business has made the development of the Performance Management System (PMS) for oil and gas project, is important as basis and guideline to overcome the issues. This paper aims to design an appropriate PMS and identify important Key Performance Indicators (KPI) that can be implemented during the execution of oil and gas project. The design was developed from specific literature Performance Prism and previous project's lessons learned, which elaborated the various stakeholders point of views, combined with cascading process in employee levels and presented the linkages using weight ratio. The questionnaire was addressed to various stakeholders who were involved in the project execution. There were 31 respondents who selected 90 KPIs and gave ratings on current performance. The weight ratio of defined criteria, sub-criteria and KPI was calculated using Analytical Hierarchy Process. The scoring system was conducted using the Objective Matrix and Traffic Light System to evaluate the performance. Findings of this paper provide totally 61 KPIs as leading indicators that are useful to design PMS. These KPIs to be implemented from early stage of new project or on-going project in the Company. Further benchmarking to the other sister companies within subsidiary is required to identify the best KPI approach.

Keywords: Key Performance Indicator, Oil and Gas, Performance Management System, Performance Prism.

1. Introduction

The Company as the subject of this paper is a subsidiary of Parent Company as Indonesia's State-Owned Enterprises (SOE) in oil and gas upstream business, which is located in Mahakam Delta, East Kalimantan. The oil and gas reserves of the Company were initially found in 1967. As a mature field in Indonesia, the average production of the Company nowadays still becomes one of the main oil and gas producers in upstream business in Indonesia that contributes to the fulfillment of national energy. Most of the fields have been produced for more than 50 years, as well as various production facilities.

The main strategy in the Company to maintain the production is having continuous development on new and existing facilities which are located at swamp and offshore fields. The

case study in this paper BKP Offshore Brownfield Project is part of the development at the existing surface facilities in the Company by performing modification and improvement with the installation of new equipment to gain more production from existing offshore platform. The preparation of the project execution is started by developing various contracts for material procurement and service in terms of Engineering, Procurement, Construction and Installation (EPCI). Since the preparation phase, the project progress has faced several issues, mainly because the contractual process was longer than the initial plan. Consequently, the contracts have not been awarded yet. The procurement of material has not started yet and contractors and suppliers to execute the project have not been selected by tender process. Those conditions could jeopardize the overall project completion target.

As of now, the performance measurement of the project in the Company is measured with the strategy and process on how to achieve the main target based on technical guidelines on project management, which derived from Parent Company: On Time, On Budget, On Scope and On Return (OTOBOSOR). The management of the Company always sees the success of the project when they are able to complete the project as per planned, within allowable budget, as per scope of work and receive expected return value as per project economics calculation. But, there are only limited guidelines or research to improve the execution of the project. The critical decision-making process mostly depends on project manager or management's practical experiences and based on financial measures, that might not be sufficient to face the competition in the recent oil and gas industry. The position of the Company as part of SOE in Indonesia receives a lot of expectations from internal and external stakeholders, not only the one relating to the project but also to the public and other community.

The complexity in oil and gas upstream business has made the Performance Management System (PMS) an important tool to achieve continuous improvement and business sustainability. It is necessary to deliver performance that can be measured as a whole system and assess it by prioritizing the importance of combining the overall stakeholders point of views into strategic framework. The PMS sets performance expectations for the organization and motivates the stakeholder to perform best ways to achieve the goals. The PMS also provides organizations with complete and proficient management process to perform performance evaluation (Fatima et al., 2019).

This paper is performed as a part of research with an effort to design an appropriate PMS and identify important Key Performance Indicator (KPI) that can be implemented during the execution of oil and gas project. This paper will also analyse the interrelation between stakeholder satisfaction, stakeholder contribution, strategy, process and capability by integrating all of KPIs and then identifying the leading indicators as priority in order to achieve the successful project execution.

2. Literature Review

As the high competition in the industries recently, resulted in the significant rise of the interest in performance management. The competitive advantage has become the main objective of the organizations. Organizations have made various scenarios to achieve and then manage the competitive advantage throughout the business (Kaplan and Norton, 1996). Detail and comprehensive performance measurement in the organizations are very important for the organization transformation and enable it to be compared with each other on the basis of standard information, identification and application of best practices (Mbugua et al., 1999). Many definitions of PMS created by some researchers could all be used as reference to achieve better performance in the organizations, groups or individuals in order to achieve objectives, standards and skills that have been set by the organizations. Several most well-known PMS frameworks developed by previous researchers are Knowledge-Based Performance Management

Systems (KBPMS) (Wibisono, 2006), Performance Prism (Neely et al., 2001), The Balanced Scorecard (BSC) (Kaplan and Norton, 1996), Key Performance Indicators model (KPI) (CBPP, 1990), SMART Performance Pyramid (Cross and Lynch, 1989) and Malcolm Baldrige National Quality Award (MBNQA)/Malcolm Baldrige Criteria for Performance Excellence (MBCfPE) Quality (USA Trade Department, 1987). The MBNQA, BSC and Performance Prism were among the most widely used by the business organizations in the world.

MBNQA was recognized not only as a quality management model but also as a descriptive holistic business model. It has changed into the main structure for business excellence (Oackland and Marosszeky, 2006). The MBNQA builds performance excellence to be used by organizations to improve the overall business performance that resulted in delivery of ever-improving, adding value to customers and stakeholders, creating effectiveness and capabilities and contributing to organizational sustainability. The assessment to be performed in the MBNQA model consists of seven criteria, i.e. leadership, strategic planning, focus on customer, measurement, analysis and knowledge management, focus on workforce, focus on operations and the results.

The BSC is a well-known performance management model created by Kaplan and Norton from Harvard Business School. The model has been implemented by various international organizations to support their productivity measurement. The BSC provides management of the organizations with the framework that translates organizations' vision, mission and strategy into measures which organized in four perspectives. The BSC uses those perspectives with the strategy as the main foundation. The four perspectives are financial perspective, customer perspective, internal business process perspective and learning and growth perspective. Additional general perspectives have been identified by other researchers, such as competition, employee, and also application of specific performance and supplier for construction.

Performance Prism was described as the second generation of performance management framework by its researchers. It performs a performance measurement approach that started from the stakeholder. The Performance Prism concept came from a prism building which has five facets: the top is stakeholder satisfactions and the bottom is stakeholder contributions. The other three sides are strategies, processes, and capabilities. The prism building also deflects the light which comes from one side to another. It shows the complexity of the prism in the form of interactions from the five sides. Identifying in detail the stakeholder satisfactions and stakeholder contributions will lead the organization to select appropriate decision-making strategies, processes and capabilities (Neely et al., 2001).

The success of the project means different things to various stakeholders. A project that may seem successful to the organizations, may be completely unsuccessful for its contractors, suppliers or communities. The perception of successful project execution may even vary according to management point of views (Cox et al., 2003). There is a substantial difference between the perception of management executives and project management teams about KPIs. Therefore, it is not surprising that various stakeholders think differently while measuring the project performance.

The Parent Company has followed the technical guidelines of project management, Project Management Body of Knowledge (PMBOK), for the implementation of oil and gas project within its subsidiary. PMBOK is an essential reference for designing and evaluating the execution of the project and becoming the most widely used guideline in project management (PMI, 2017). However, there were some international critics related to the appropriate approach based on working cultures, resources and regulations. For the application in the Company for instance, there are a lot of concerns and expectations from various internal and external stakeholders, especially with the position of the Company as part of Indonesia's SOE in oil and gas upstream

business. These stakeholder's perspectives have not been formulated in detail and positioned in the last knowledge area in the guideline. This is the gap of requirements which need more comprehensive analysis.

Nowadays, the implementation of PMS is very important for most companies in various industry sectors including oil and gas. The most discussed topic by the industry practitioners is related to how to implement the existing PMS concept from the available literature. Therefore, in order to solve the business issue raised in this paper and fill the gap of requirements, the reference of existing PMS is used as the basis to analyse and design the appropriate PMS for the successful oil and gas project.

3. Methodology

This paper was conducted through a detailed review of those PMS literatures to find the right framework in identifying the business issues faced by the Company while managing the works, especially during the execution of the project. All the concerns and expectations from various stakeholders were analysed in detail. After comparing the PMS from the literature, the design of performance management using Performance Prism is selected in this paper, with the main concept to have comprehensive analysis of the all stakeholders point of views who are involved in the execution of the project and directly related to Company performance and success. The stakeholder becomes the main priority of this paper to support the position of the Company as part of SOE of oil and gas upstream in Indonesia. The methodology for this paper is shown in Figure 1. The case study of BKP Offshore Brownfield Project in the Company was explored to define the PMS applicable for oil and gas project.

3.1 Data Collection

Data collection was initiated with stakeholder identification in the execution of BKP Offshore Brownfield Project. List of stakeholders was gathered through the expert judgement of personnel in the Company and author who are directly involved in the oil and gas project, and selected based on its close coordination with Company as the main project executor. It resulted into 4 main criteria of stakeholders: Government, Parent Company, Company and Contractor/Supplier.

Primary data using questionnaire and secondary data using Company data and lessons learned from previous project documents were gathered to determine the list of potential KPIs, which are important for the execution of the project. It was developed based on five interrelated facets of Performance Prism framework as shown below:

1. Stakeholder satisfaction: who are the stakeholders and what are their needs and wants?
2. Stakeholder contribution: what are the contributions from the stakeholders to fulfil their need and want?
3. Strategy: what are the strategies to satisfy their needs and wants?
4. Process: what are the processes necessary to deliver the strategies?
5. Capability: what are the capabilities needed to enhance the processes?

The list of 110 potential KPIs were addressed and combined with the evaluation of current performance ratings using five point Likert scales questionnaire. The sub-criteria were formed based on those five facets of the Performance Prism framework. Specific for stakeholder Company, the analysis was performed in more detail because it is the main stakeholder during the execution of the project. Stakeholder Company knows every detail part of the project since the initiating, planning, executing, monitoring and controlling, and closing. The KPIs of Company Management are cascading in detail into lower levels who play important roles during

the project timeline, which are stakeholder Company Office Personnel and Company Site Personnel. The linkages in the Company structure is shown in Figure 2.

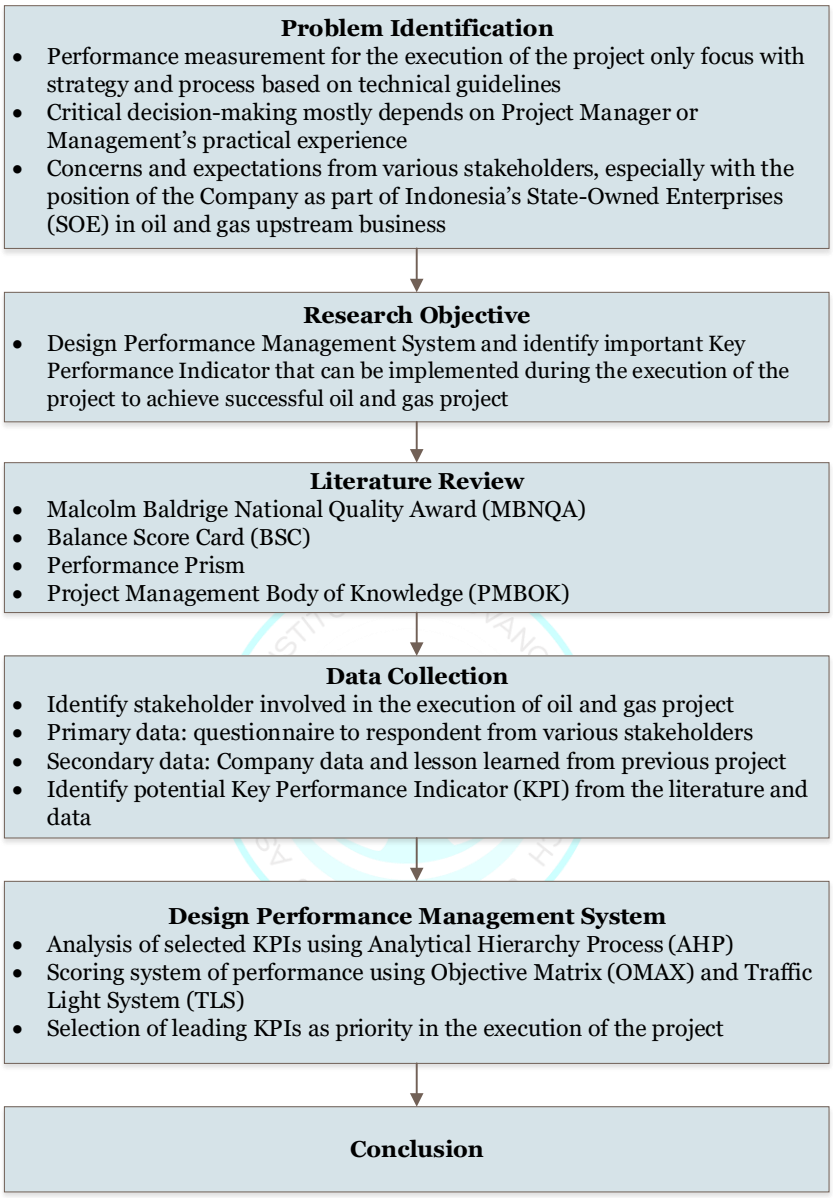

Figure 1: Research Methodology

The were 31 respondents who chosen based on the involvement in the execution of the oil and gas project from various stakeholders, 10% from Government Representative, 16% from Parent Company, 58% from Company with different level such as Management, Project Manager, Senior Engineer, Middle Engineer and Site Specialist, and 16% from Contractor Representative. There were 29% respondents who have more than 20 years of experience in oil and gas, 58% respondents with 10-20 years of experience and 13% respondents with 5-10 years of experience. 77% respondents came from Projects Division, 10% from Business Development and Planning and the rest from Production and Supply Chain Management Division.

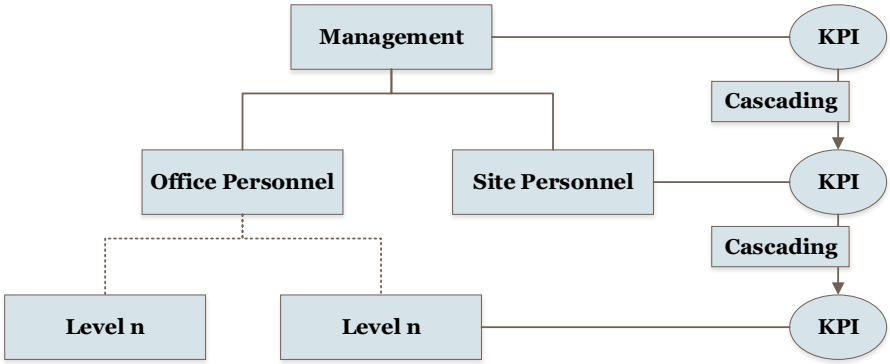

Figure 2: Vertical and Horizontal Linkages of Stakeholder Company

3.2 Data Calculation

A set of totally 90 KPIs were selected by respondents from the questionnaire. The hierarchy tree was developed based on the data collection and KPIs selection to show the interrelation of the criteria, sub-criteria and KPI. The method of Analytical Hierarchy Process (AHP) was used to describe the degree of importance from those criteria, sub-criteria and KPI. The pairwise comparisons were performed for those criteria, sub-criteria and KPI based on the expert judgment. The calculation of consistency ratio (CR) was conducted for all judgments. According to Thomas L. Saaty, the CR were kept acceptable if the value is less or equal to 0.1. If the CR is more than 0.1, then it is necessary to revise the judgments. From the questionnaire, the respondents also performed the evaluation of current performance of selected KPI using five point Likert scales. Appendix A shows the selected KPIs which are proposed to be used for new PMS. The weight ratios after hierarchical interrelations and performance evaluation scores are presented as well.

The further scoring analysis was conducted using Objective Matrix (OMAX) and combined with Traffic Light System (TLS). OMAX is the performance measurement method to monitor the organization productivity based on defined criteria. TLS is the performance measurement approach which categorized based on traffic light colours: red means that performance is below the target and requires immediate improvement, yellow means that performance has partially achieved or the value is close to the target and green means that target performance has been achieved and could be used as leading KPIs for the organizations success. Appendix B summarizes the result of scoring analysis using OMAX and TLS.

3.3 Validation and Benchmarking

Validation and benchmarking were excluded in this paper. Validation of the proposed KPIs might be required to be addressed to the PMS experts or researchers from the other oil and gas upstream companies by perform similar methodology in this paper, following the Performance Prism literature. Benchmarking might be done internally and externally. Internally by identifying previous Company's achievement indicators. Externally to the other sister companies within subsidiary in order to identify the best KPI approach.

4. Analysis

4.1 Design Performance Management System

An initial list of 110 potential KPIs were gathered from expert judgment in the Company and author perspective, lessons learned of previous project and several literatures related to oil and gas project. Those potential KPIs were developed based on the 4 main criteria of stakeholders.

Each stakeholder has five sub-criteria which was developed based on five facets of Performance Prism: satisfaction, contribution, strategy, process and capability. Specific for stakeholder Company Management as explained in the previous section, it was cascaded into 2 sub-criteria Company Office Personnel and Company Site Personnel to have more detailed analysis.

Through the questionnaire to chosen respondents, the list of 90 KPIs were selected. The relative importance of criteria, sub-criteria and KPI was identified using AHP approach. For stakeholder criteria AHP, it resulted that the Company has the highest weight ratio 0.569. Company becomes the main stakeholder because it handles every detail part of the project from the initiating up to closing. The cascaded Company Management which are Company Office Personnel and Company Site Personnel has similar weight ratio 0.284. Stakeholder Contractor/Supplier becomes the second highest weight ratio 0.237, because they are the main partner of the Company for the supply and delivery of materials and services as per project scope of works. Parent Company is the stakeholder with weight ratio 0.128, who act as the investor, who reviews and approves the Final Investment Decision (FID) of the project proposed by the Company. While the stakeholder Government with weight ratio 0.066, has the role as the main regulator who setting-up the short term and long term plan of the oil and gas business in Indonesia. The result of those weight ratios in the criteria would be important to know the priority of the stakeholder.

The AHP for sub-criteria five facets of Performance Prism, the highest weight ratio 0.412 is stakeholder satisfaction and 0.314 for stakeholder contribution. In-line with the concept of Performance Prism, prioritizing both satisfaction and contribution in detail will lead the stakeholders to select the right strategy, process and capability. The weight ratio 0.129 is the strategy that should be put to ensure the wants and needs of the stakeholders are satisfied. The weight ratio 0.083 is the process that should be put to allow the strategy to be delivered. The last weight ratio 0.062 is capability that is required to operate and enhance the process. Capability is also considered as an important management concept that combines people, practice, infrastructure and technology to enable the execution of the organization process (Neely et al., 2002). During the analysis, the sub-criteria five facets and their weight ratios were similarly applied to each stakeholder criteria.

The AHP approach for 90 selected KPIs was conducted in detail for each stakeholder criteria and sub-criteria. The pairwise comparison was performed mainly based on the result of performance evaluation scores gathered from questionnaire. The weight ratios and performance scores summarize in Appendix 1. The further result of scoring analysis using OMAX and TLS in Appendix 2 shows that the current performance scores of selected KPIs were obtained in the green and yellow area. There was no performance score in the red area. For selected KPIs in the green area which have score 4.00 and above, means that target performance has been achieved. Those KPIs in the green area were proposed as leading indicators for the design of PMS for oil and gas project. The remaining KPIs obtained in yellow area with scores between 2.00 and 3.50, which means that performance has partially achieved or close to the target. Particularly for KPIs in the yellow area with score 3.5 were added into part of leading indicators, because the value was close to the target.

4.2 Leading Key Performance Indicators

Table 1 shows the result of totally 61 KPIs as leading indicators. These are the most potential KPIs which are selected to be used in the development of a new PMS for oil and gas project. The weight ratios of the KPIs after the assessment of hierarchical interrelations are presented in detail. From the table, the KPIs from each stakeholder have been distributed, which the KPIs of stakeholder Company are the most selected. It relates with the position of the Company as the main project executor who knows every detail of the project from the beginning until the end.

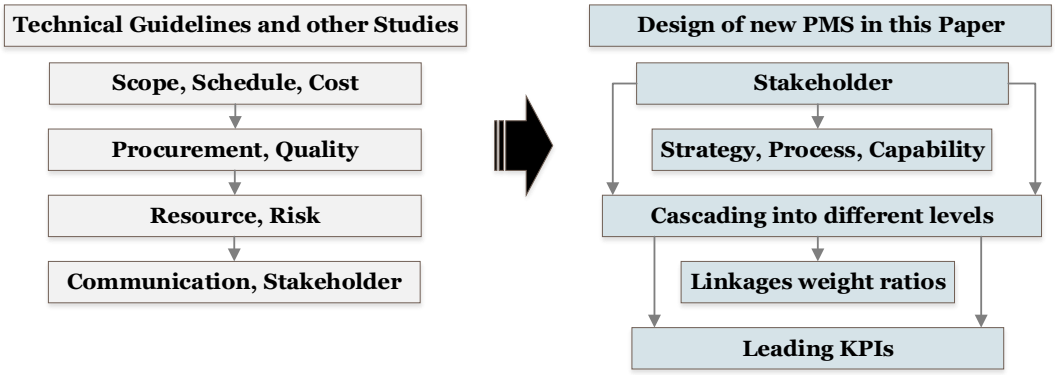

Figure 4: The Summary Concept of this Paper

The result of this paper shows in Figure 4, that stakeholders play important roles in the project success and shall be positioned as the primary thing in the development of the project, not in the last part as defined in technical guidelines and other studies. Also, the cascading process in different employee levels and the linkages weight ratio are important to determine the effects among KPIs in different levels and to define the improvement priority that should be considered from the KPIs in the same level.

Table 1 List of Leading KPIs including its Weight Ratio

Stakeholders	Weight Stakeholder	Performance Prism	Weight Prism	Leading KPI based on Scoring System	Symbol	Weight KPI
Government	0.066	Stakeholder contribution	0.314	Work program and budget approval	GO-4	0.623
		Strategy	0.129	Work prioritization through short term and long term plan	GO-8	0.444
				Alignment of the project goals based on government program	GO-9	0.111
Parent Company	0.128	Stakeholder satisfaction	0.412	Health, Safety, Security and Environment (HSSE) excellence	PC-1	0.633
				Implementation of Good Corporate Governance (GCG)	PC-2	0.260
		Stakeholder contribution	0.314	Yearly budget (RKAP) review and approval	PC-4	0.608
				Project's POD and FID review and approval	PC-5	0.272
		Strategy	0.129	Creating appropriate project review approach	PC-7	0.581
				Designing implementation of HSSE and GCG culture	PC-8	0.309
		Process	0.083	Issuance of working guidelines: STK, TKO and TKI	PC-10	0.539
		Capability	0.062	Prompt coordination with subsidiaries	PC-13	0.548
				Improve working culture for innovation	PC-14	0.241
Company Management	0.569	Stakeholder satisfaction	0.412	Zero fatality during project execution	CM-1	0.693
				Effective and efficient project execution	CM-2	0.211
				Optimization of working duration and budget	CM-3	0.096
		Stakeholder contribution	0.314	Create positive working environment	CM-4	0.400
				Prompt response/provide solution during problem findings	CM-5	0.400
				Perform performance appraisal and award for employee	CM-6	0.200
		Strategy	0.129	Designing good approach for HSSE and GCG	CM-7	0.429
				Creating system to review the project execution properly	CM-8	0.429
				Strengthening employee collaboration through gathering activity	CM-9	0.143
		Process	0.083	Detailed project controlling and monitoring	CM-10	0.500
				Routine management visit at project location	CM-11	0.250
				Routine discussion with personnel at office and site	CM-12	0.250

Stakeholders	Weight Stakeholder	Performance Prism	Weight Prism	Leading KPI based on Scoring System	Symbol	Weight KPI
Company Management	0.569	Capability	0.062	Improve communication with personnel	CM-13	0.429
				Improve organization working culture for HSSE and GCG	CM-14	0.429
				Improve technical excellence of personnel through training program	CM-15	0.143
Company Office Personnel	0.284	Stakeholder satisfaction	0.412	Project team productivity achievement	CO-1	0.581
				Project completion as per scope of works	CO-2	0.309
		Stakeholder contribution	0.314	Quick problem solving of outstanding issues	CO-4	0.333
				Accelerate technical analysis and procedure issuance	CO-5	0.333
				Ensure the implementation of Company specification during execution	CO-6	0.333
		Strategy	0.129	Perform good communication with all stakeholders	CO-7	0.525
				Create method to accelerate project execution	CO-8	0.334
				Regular coordination meeting with project team	CO-9	0.142
		Process	0.083	Identify all stakeholders involved in the project execution	CO-10	0.571
				Detailed project controlling and monitoring	CO-11	0.286
		Capability	0.062	Improve technical skill	CO-13	0.539
				Improve soft skill	CO-14	0.297
Company Site Personnel	0.284	Stakeholder satisfaction	0.412	No lost time injury	CS-1	0.581
				Project completion as per Company's target	CS-2	0.309
		Stakeholder contribution	0.314	Perform good implementation of HSSE requirement	CS-4	0.400
				Perform good communication with site team and Contractor/Supplier	CS-5	0.400
				Prompt response/solution during problem findings at site	CS-6	0.200
		Strategy	0.129	Create method to accelerate project execution	CS-7	0.400
				Implement good HSSE behavior at site	CS-8	0.400
				Perform good communication with site team and Contractor/Supplier	CS-9	0.200
		Process	0.083	Daily project controlling and monitoring	CS-10	0.500
				Daily coordination with project site team and Contractor/Supplier	CS-11	0.250
				Last minute risk assessment before start the work	CS-12	0.250
		Capability	0.062	Improve communication of site team	CS-13	0.557
				Improve awareness to HSSE for site team	CS-14	0.320
Contractor/Supplier	0.237	Stakeholder satisfaction	0.412	Project completion as per target (on time, on budget, on scope)	RR-1	0.623
		Stakeholder contribution	0.314	Prompt response/solution during problem findings at site	RR-4	0.444
				Perform good communication with Company	RR-5	0.444
		Strategy	0.129	Regular coordination with Company's project team	RR-7	0.587
				Implement and fulfillment of HSSE obligation	RR-8	0.324
		Process	0.083	Daily coordination with project site team and Company	RR-10	0.539
				Implementation of work instructions and procedures	RR-12	0.297
		Capability	0.062	Improve awareness to HSSE for Contractor/Supplier personnel	RR-13	0.539
				Improve communication of Contractor/Supplier personnel	RR-14	0.297

4.3 Implementation Plan

The list of leading KPIs as the result from this paper will be implemented to the on-going project in the Company, particularly to the case study BKP Offshore Brownfield Project, which is currently in the initiating phase of contractual agreement for the material procurement and service. The detail of KPIs will be carefully implemented into the project progress with the priority as defined through weight ratios.

The leading KPIs also proposed to be implemented to the other on-going project in the Company, which has similar technical scope of works. The result of the paper will be proposed as well to be implemented from the early stage of the new project in the Company, which is planned to be executed as part of new Plan of Development (POD) in the following years.

5. Conclusion

The findings of this paper provide the list of leading KPIs based on stakeholder points of views who are involved in the execution of the oil and gas project. Based on review of literature and Company data, 110 KPIs were initially proposed under 4 main criteria stakeholders and its sub-criteria, which are reflected from five facets of Performance Prism. The analysis of collected

responses via questionnaire has selected 90 KPIs. The further evaluation of current performance of the Company has resulted in the list of 61 leading KPIs.

As highlighted, stakeholders shall be positioned at the top of the project development. Referring to the Performance Prism concept, identifying in detail the stakeholder satisfactions and stakeholder contributions will lead the organization to select appropriate decision-making strategies, processes and capabilities. Stakeholders play important roles in the project success. Also, the cascading process in different employee levels and the linkages weight ratio are important to determine the priority of leading KPIs during the execution of the project. These leading KPIs could be considered as an important factor for the basis to create model for evaluating the performance in the oil and gas sector, especially for the Company as part of SOE and the backbone of national oil and gas production. These KPIs could also be used as preliminary tools to support the development of oil and gas upstream business in Indonesia, to achieve better performance, be more competitive and sustainable, and become a world class company.

As the recommendation for future research, the validation of the proposed KPIs listed in this paper might be required to be addressed to the experts from the other oil and gas upstream companies by perform similar methodology with this paper. The benchmarking might be done internally by performing identification of the previous KPIs as the leading achievement in the Company. External benchmarking might also be required to the other sister companies within subsidiary in order to identify the best application of the KPIs.

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