THE IMPROVEMENT OF PIPELAYING PROJECT RISK BY USING RISK MANAGEMENT (CASE OF PT HAFAR DAYA KONSTRUKSI FOR PERTAMINA HULU ENERGI)

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ABSTRACT

The oil and gas industry has experienced remarkable volatility in the last decade, As for upstream oil and gas companies and contractors, there will be possibilities of shifting goals, time delays, loss of efficiencies, and cost impacts. It is a challenge for PT. HDK as upstream contractors to deliver their project and manage their risks appropriately. Safety stands out as a core value for the oil and gas industry, rooted in every process and operation decision. Meanwhile in oil and gas industry and the government are working together to improve the safety of offshore operations continuously, it is a challenge for PT. HDK is upstream contractors to deliver their project on track and manage their risks appropriately. The objective of this final project is to develop a project risk management in PT. HDK project PHE ONWJ LLE-LLB. This can benefit the contractor in managing, eliminating, and improving risk management for similar projects in the future under similar circumstances. The project risk management process referred to PMBOK (2017) using the qualitative-quantitative method. A total of seven stages of risk assessment is formulated, including plan risk management, identify risk, qualitative and quantitative analysis, risk response, risk implementation, and risk monitor. There are 50 risks found in PT HDK PHE ONWJ LLE-LLB project. Risk implementation as a mitigation plan has been developed to address the high and extreme rating score. There are a total of 14 risks that are given control improvement and nine action plans is designed throughout November 2020 - January 2021.

Key words: risk management, project risk, pipelaying, oil and gas

INTRODUCTION

The oil and gas industry faces its third price collapse in 12 years and has been hit unusually hard. As for upstream oil and gas companies and contractors, a survey of APM (2020) shown that there will be possibilities of shifting goals, time delays, loss of efficiencies, and cost impacts on offshore project moreover with the current COVID-19 pandemic. According to internal company reports, PT HDK lost time injury rate measures from year 2013 is improving each year. However, in 2017 it reached zero but peaked again in 2018. PT HDK aims to achieve zero lost-time injuries this year and maintain it for years to come for their continuous safety improvement. The objectives of this final project is to design and develop a project risk management in PT. HDK project PHE ONWJ LLE-LLB. This final project can benefit PT. HDK to manage, eliminate, and improve the risk management for similar project in the future. The risk management process that will be used is taking reference from PMBOK. Risk identification will be limited to operation, safety, and environmental risk by estimating probability and impact for qualitative analysis. In quantitative analysis, the weight ratio is developed to estimate the risk rating. Based on the risk assessment, there are 50 individual risks identified. Hereafter, for high and extreme rating score will be assessed for mitigation and monitoring with expectation to lower their risk rating level.

LITERATURE REVIEW

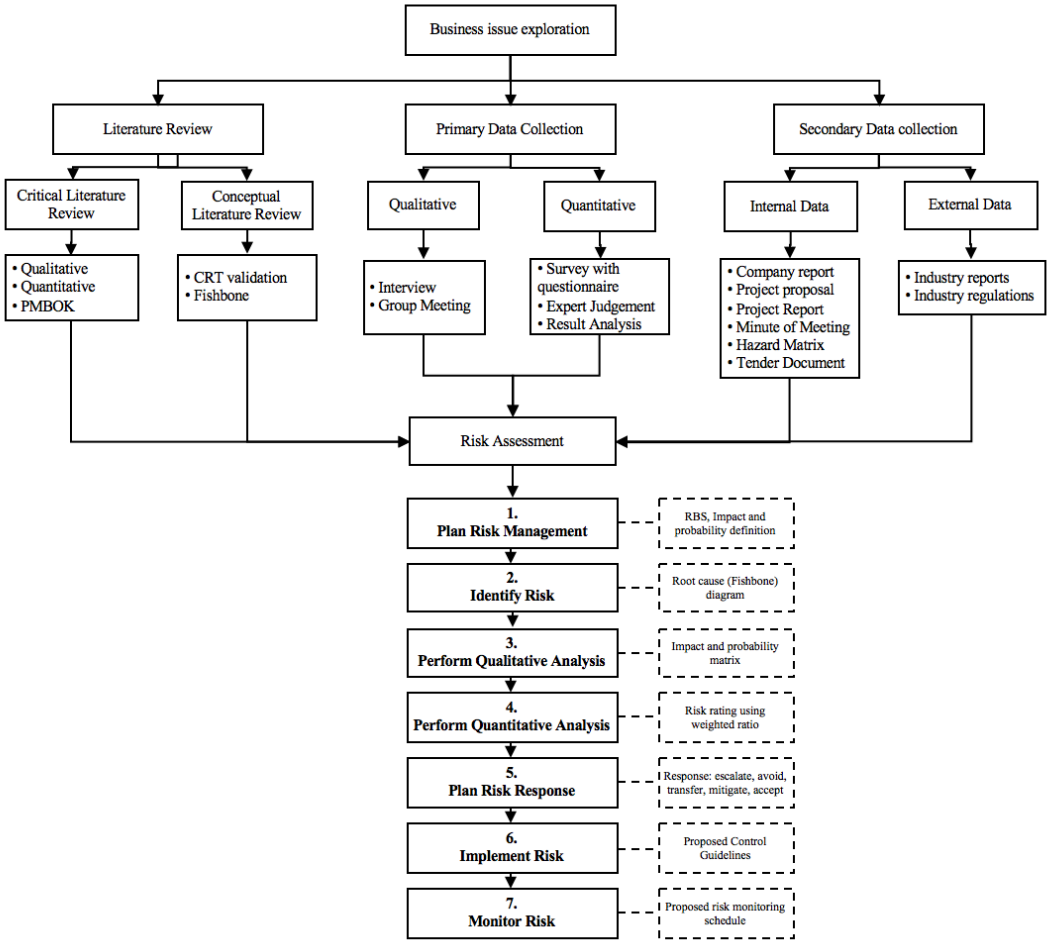
According to PMBOK Guide "*all projects are risky since they are unique undertakings with varying degrees of complexity that aim to deliver benefits. They do this in a context of constraints and assumption, while responding to stakeholder expectations that may be conflicting and changing. Organization should choose to take project risk in a controlled and intentional manner in order to create value while balancing risk and reward*" (2017:434). Based on PMBOK Guide, the project risk management consists of seven processes that interconnected and should be conducted continuously:

Plan Risk Management this stage is the process of defining how to handle risk management activities for a project. This process's key benefit is that it ensures that the degree, type, and visibility of risk management. The outcome from this stage is risk breakdown structure, risk impact and probability definition, and risk rating score.
Identify Risk this second stage is identifying individual risks and source of overall project risk and documenting their characteristics. The tools used is fishbone diagram to quickly find root-cause and reveal key relationship among variable
Perform Qualitative Risk In this stage, the process of prioritizing individual risks for further analysis or action is conducted by assessing their probability of occurrence and impact.
Perform Quantitative Risk Using numerical analysis to find a combined effect of identified individual project risks and other uncertainty sources on overall project objectives. Tools used is weighted risk rating that depends on the likelihood and severity of the impact score given and its employees weight ratio.
Plan Risk Response The process of developing options, selecting strategies, and agreeing on action to address individual and overall project risk exposure.
Implement Risk Response This process's primary purpose is to ensure that agreed-upon risk response executed as planned to address overall project risk exposure, minimize project threats, and maximize individual project opportunities by assigning risk mitigation hierarchy.
Monitor Risk The process of monitoring the implementation of agreed-upon risk response plans. The outcome of this process is the risk schedule register.

METHODOLOGY

The framework analysis that will be used in this final project is presented in figure 1. Literature review conducted to presents the current knowledge including substantive findings as well as theoretical and methodological contributions to the research question. Primary data collection used mixed methods of qualitative and quantitative, that includes interview, group meeting, survey and measurement of risk rating. Meanwhile, internal company data and external data are used as secondary data collection. The risk management process based on PMBOK Guide 2017 starts from the first step of plan risk management, identify risk, perform qualitative risk, perform quantitative risk, plan risk response, implement risk, and monitoring risk. PMBOK is used because of the relevancy to the project-based construction work PT HDK is doing with a more thorough risk management process (seven stages).

Figure 1. Conceptual Framework



FINDINGS AND ARGUMENT

In the first stage of risk management, PT HDK has defined that they conduct risk management by distributing the risk categories between three main activities: construction-installation risk, construction-execution risk, and marine risks, these further grouped into two categories of operational and safety, health, and environment (SHE). Under the three main activities, there are sub-categories of works that have their own individual risks. The risk breakdown structure method is developed to explore these sub-categories. Consequently, from the RBS, qualitative-quantitative analysis is performed.

Qualitative analysis is the process of prioritizing risk for further analysis or action by assessing and combining the probability of occurrence and their impact. At this stage, a group meeting was conducted between the project manager, HSE manager, head of engineering, head of procurement and logistic, and head of construction (Marine). A survey is distributed for each respondents with aim to measure each individual risk's impact level and probability level, resulting in risk rating.

Quantitative analysis uses numerical analysis to find a combined effect of identified individual projec risks and other uncertainty sources on overall project objectives. In designing the PHE ONWJ project, risk management attributes the agreed-upon weight ratio (Table 2.5) to each scoring. This measure is done by finding probability combined and impact combined, multiplying them

to generate a risk rating combined. To plan risk response, five alternative strategies may be considered: escalate, avoid/exploit, transfer/share, mitigate/enhance, accept. The combined result of stage one up to stage five is as shown in table 1.

Table 1. Stage 3,4, and 5: Qualitative, Quantitative, and Response Risk Result Analysis

No	Construction-Installation Work	Individual Risk	Risk Category	Risk Rating	Risk Response
1.	Mobilization - General Rig-Up (Personnel, equipment, marine-spread) [M1,5,2] [M1,5,3]	Covid-19 outbreak threat [M2,4,2]	SHE	20	Avoid, Mitigate
2.		Procurement and logistic delayed [M2,4,2]	Operation	20	Avoid
3.		Security Threats; trespassing, theft, social disturbance [M2,4,2]	Operation	3	Accept
4.	General Lifting on board Hafar-Neptune [M1,5,2] [M1,5,3]	Working under suspended load [M,2,6,2] [M2,6,3]	Operation	10	Accept
5.		Personnel injury (slip, trip and fall) [M,2,6,2] [M2,6,3]	SHE	15	Mitigate
6.		Drop object, lost of materials [M,2,6,2] [M2,6,3]	Operation	15	Mitigate
7.	Personnel transfer to/from barge by swing rope (Crew boat to PLB) [M1,5,2] [M1,5,3]	Man overboard (squeeze, struck, slip, trip, fall) [M2,5,2]	SHE	15	Mitigate
8.	Personnel transfer to/from platform by TORO [M1,5,2] [M1,5,3]	Equipment damage [M2,5,2]	Operation	8	Accept
9.		Personnel injury [M2,5,2]	SHE	8	Accept
10.	Personnel transfer to/from barge by TORO, Vessel Material Barge to Platform, Material Barge to PLB [M1,5,2] [M1,5,3]	Man overboard (squeeze, struck, slip, trip, fall) [M2,5,2]	SHE	10	Accept
11.	Small Boat Operation (Hercules) [M1,5,2] [M1,5,3]	Engine breakdown, boat capsized, drifting [M2,7,2]	Operation	10	Accept
12.		Man overboard (squeeze, struck, slip, trip, fall) [M2,7,2]	SHE	10	Accept
13.	PLB Hafar Neptune approaching platform for initiation pipeline-setup position (Activity inside 500m Safety Zone-Initiation) [M1,5,2] [M1,5,3]	Wire-catching subsea material, facility damage, engine failure [M2,8,2] [M2,8,4]	Operation	9	Accept
14.		Anchor cable over existing pipeline [M2,8,2] [M2,8,4]	Operation	9	Accept
15.	PLB Hafar Neptune approaching platform for initiation pipeline-setup position (SIMOPS-Activity inside 500m Safety Zone-Initiation Position) [M1,5,2] [M1,5,3]	Project schedule interrupted by operation activity [M2,8,2] [M2,8,4]	Operation	8	Accept
16.	Riser Clamp Installation [M1,5,2] [M1,5,3]	Personnel safety working over water, exposed to fall to water and structure [M2,9,2]	SHE	8	Accept
17.		Drop object [M2,9,2]	Operation	9	Accept

No	Construction-Execution Work	Individual Risk	Risk Category	Risk Rating	Risk Response
18.	Install snatch block and chain hoist at structure strong point above riser hanger clamp (Initiation Flexible Pipe) [M1,6,2]	Working at height and above water [M2,10,2] [M2,10,4]	SHE	6	Accept
19.	Pulling flexible pipe by using tugger winch (Initiation Flexible Pipe) [M1,6,2]	Failure of rigging equipment, property damage, wire sling cut off [M2,10,2] [M2,10,4]	Operation	12	Mitigate
20.		Man overboard (squeeze, struck, slip, trip, fall) [M2,10,2] [M2,10,4]	SHE	9	Accept
21.	Install flexible pipe to riser clamp (Initiation Flexible Pipe) [M1,6,2]	Lifting procedure, lifting operator incompetence, [M2,10,2] [M2,10,4]	Operation	6	Accept
22.		Working at height and above water [M2,10,2] [M2,10,4]	SHE	6	Accept
23.		Platform unplanned shutdown [M2,10,2] [M2,10,4]	Operation	6	Accept
24.	Normal laying flexible pipe (Normal Laying Flexible Pipe) [M1,6,2]	Weather and sea rough [M2,10,2] [M2,10,4]	Operation	6	Accept
25.	Tensioner (Pipelaying) [M1,6,2]	Tensioner over grip, tensioner loss grip [M2,11,4]	Operation	4	Accept
26.		Stuck by moving machinery [M2,11,4]	SHE	4	Accept
27.		Hand injury [M2,11,4]	SHE	4	Accept
28.	Laydown onboard end-fitting and swing crane to designate location close to riser clamp (Lay-Down end of Flexible Pipe) [M1,6,2]	Rigging equipment failure [M2,12,4]	Operation	6	Accept
29.		Bad weather [M2,12,4]	Operation	6	Accept
30.		Pinch point [M2,12,4]	SHE	6	Accept
34.	Riser Clamp Installation (Diving activity for Riser Clamp installations) [M1,6,2]	Vessel intrusion, drop object [M2,14,4]	Operation	15	Mitigate
35.		Decompression sickness, low visibility [M2,14,4]	SHE	15	Mitigate
36.		Marine biological hazard [M2,14,4]	SHE	10	Accept
37.	Installation Temporary Pig Launcher and Receiver LLE-LLB walk way [M1,6,2]	Drop object, lost of materials [M2,15,4]	Operation	6	Accept
38.		Man overboard (squeeze, struck, slip, trip, fall) [M2,15,4]	SHE	6	Accept
39.	Pre-Commisioning (Pigging-Hydrotest Dewatering swabbing, drying, N2 Purging) [M1,6,2]	Chemical usage-dye cause eye injury, regulatory violance, community issue [M2,15,4]	SHE	9	Accept
40.		Pressurize cylinder hazard [M2,15,4]	SHE	9	Accept

No	Marine Work	Individual Risk	Risk Category	Risk Rating	Risk Response
41.	Preparation-seafastening [M1,7,3]	Operation safety seafastening (slip, trip, fall struck, hot work, pinch point) [M2,17,3]	SHE	15	Mitigate
42.		Rigging work failure [M2,17,3]	Operation	15	Mitigate
43.	Towing/Anchored on clear area, Towing material barge and construction barge [M1,7,3]	Marine traffic accident (collision, grounded) [M2,18,3]	Operation	5	Accept
44.		Social disturbance (fisherman, community complain) [M2,18,3]	Operation	8	Accept
45.		Emergency response situation [M2,18,3]	Operation	8	Accept
46.		Bad weather [M2,18,3]	Operation	6	Accept
47.	Anchored Vessel [M1,7,3]	Mooring Failure (drop object, struck by mooring rope failure) [M2,19,3]	Operation	15	Mitigate
48.	Bunkering [M1,7,3]	Oil spill [M2,20,3]	SHE	12	Mitigate
49.	Food Supply [M1,7,3]	Un-hygiene food supply [M2,21,3]	SHE	12	Mitigate

For the construction-installation category, two extreme risks are directly related to the ongoing Covid-19 pandemic and three high risks related to pipe installation safety. In the construction-execution category, there are no extreme risks to be found and four high risks. These individual risks are related to equipment operation, health, and safety, with ratings ranging from 12-15. In the marine operation category, there are no extreme risks to be found and four high risks. These individual risks are related to equipment operation, health, safety, and the environment, with ratings ranging from 12-15

As agreed through convention, project risks in PT HDK PHE ONWJ LLE-LLB are managed by enhancing the implementation control for high and extreme risk. Implementation control as a mitigation plan is used and expanded into risk hierarchy: elimination, substitution, engineering control, administrative control, and personal protective equipment (PPE). There are seven risks that directly related to delay, exceeding cost, and safety improvement. Meanwhile seven others are for continuous safety improvement PT HDK is aiming. Table 2 summarize the risks and their improvement control:

Table 2. Stage 6: Implement Risk Response

Operation Risk Category

Risk No.	Risk	Elimination	Substitution	Engineering Control	Administrative Control	PPE
2.	Procurement Delay	- Eliminate materials from aboard	- Switch to local manufacturer	*Not Applicable*	*Not Applicable*	*Not Applicable*
6.	Drop object and loss of material	*Not Applicable*	*Not Applicable*	*Not Applicable*	- Dedicated supervisor for general lifting - Certification for Personnel	*Not Applicable*
19.	Failure of rigging equipment	*Not Applicable*	*Not Applicable*	- Provide personal and portable gas detector - Mooring analysis and anchor pattern	- Equipment inspection - Weather forecast - Authorized personnel only	*Not Applicable*

					- Sequence work plan	
34.	Vessel Intrusion	*Not Applicable*	*Not Applicable*	- CCTV installation	- PTW, L2RA - Toolbox meeting - Vessel restriction in dive area - Radio Announcement	*Not Applicable*
42.	Rigging work failure	*Not Applicable*	*Not Applicable*	*Not Applicable*	- Equipment inspection - Lifting gear certificate	*Not Applicable*
47.	Mooring failure	*Not Applicable*	*Not Applicable*	*Not Applicable*	- Pre-toolbox meeting - Approved lifting procedure	*Not Applicable*

Safety, Health, and Environment Risk Category

Risk No.	Risk	Elimination	Substitution	Engineering Control	Administrative Control	PPE
1.	COVID-19 Outbreak	- Remove batch of worker with positive case	- Self-quarantine before on board	*Not Applicable*	- PCR test - ERP procedure - Conduct SBTC	- Wear mask all time - Provide hand sanitizer
5.	Personnel Injury	*Not Applicable*	*Not Applicable*	*Not Applicable*	- Dedicated supervisor for general lifting - Certification for Personnel	*Not Applicable*
7.	Man overboard	- Abort transfer if wave exceed 1.5 m and wind 25 knots	*Not Applicable*	-Deck levelling	- Swing rope inspection - Personnel assistance	- Work life vest - Life buoy stand by
31.	Hot surface contact	*Not Applicable*	*Not Applicable*	*Not Applicable*	- PTW, L2RA - Toolbox meeting - Gas hydrocarbon test - Toolbox meeting	- Firefight equipment
35.	Decompression sickness	*Not Applicable*	*Not Applicable*	- Decompression chamber	- Check limit of visibility	*Not Applicable*

					- Weather monitoring	
41.	Operation safety sea-fastening	*Not Applicable*	*Not Applicable*	*Not Applicable*	- Dedicated supervisor - Certification for Personnel	*Not Applicable*
48.	Oil Spill	-Prohibit bunkering inside 500 m safety zone	*Not Applicable*	*Not Applicable*	- PTW, L2RA - Emergency drill - SOPEP - Bunker checklist - Engineer supervision	*Not Applicable*
49.	Un-hygiene food supply	*Not Applicable*	*Not Applicable*	*Not Applicable*	- Food inspection - Food and water supply scheduled - Food delivered in close container	- Caterers to wear mask all time

As shown in the table 2, most of the risks have administrative control as their mitigation plan. By enhancing and creating improvement in implementation control, thirteen of fourteen risks that has been identified as high to extreme risks can become medium risk. Meanwhile for risk number 41 of operation safety in seafastening, only additional control doesn't show significant decrease of risk rating. For this activity, it needs intensive control from the management team.

In the last stage of risk monitor plan consists of time schedule, department area, and human resource to perform the action plan. There are total of action 9 plan for construction- installation, for construction-execution, and for marine. The proposed implementation plan period is taking 3 months from November 2020 to January 2021 following the PHE ONWJ Project schedule. This plan cannot be monitor due to final project time constraint. The SOP/ health procedure is developed for personnel going on board starting in November 2020. This procedure includes appointing port hospital as a reference, providing rapid test kit, and adequate quarantine for personnel before going on board. CCTV installation, procedure of bunkering and food delivery inspection also started in November 2020. Meanwhile, procedure for general lifting, swing rope inspection, and equipment inspection will be conducted from November to January 2021 as per project work schedule.

CONCLUSIONS

Three categories of risks can emerge during a pipe-laying project: construction-installation risk, construction-execution risk, and marine operation risks. These risks consist of operation and safety, health, and environment (SHE) matter and not include financial and strategic risks. Based on the risk assessment, there are 27 individual risk related to operation category, and 23 individual risk related to SHE. There are two risks considered to have an extreme rating score, 12 risks with a high rating score, 32 risks with a medium rating score, and four risks with a low rating score. Project risks in PHE ONWJ LLE-LLB are managed by enhancing the implementation control for high and extreme risk rating. Implementation control as a mitigation plan is used for each category with high and extreme risk, further expanding into risk hierarchy, elimination, substitution, engineering control, administrative control, and personal protective equipment (PPE). As shown in the table 2, most of the risks have administrative control as their mitigation plan, and by doing improvement for their control thirteen out of fourteen risks that previously has high to extreme risk can be lowered to medium risk rating.

RECOMMENDATION

PT HDK shall start using risk management analysis following the PMBOK guide for their upcoming project. PMBOK is worthy because it allows companies to standardize and systemize risk analysis practices across departments. People on the development side can manage projects in the same manner as those on the distribution side. Next, PMBOK can help project managers to work with a regulated system beyond companies. Third, PMBOK discusses what works and served. The methods documented in the

project management community can assist those who are unsure of how to undertake risk management. PMBOK also examines what doesn't work. Further, it will prevent the failure of projects.

LIMITATION

The limitation of this final project is risk management is conducted to answer research question taking reference from PMBOK. Risk identification will focus only on pipe laying project, including operational, safety, health and environmental risk, and doesn't cover the financial and strategic risk. And the project risk assessment will take a case in project PHE ONWJ LLE-LLB, different project will have different risk management system.

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