Implementation of Lean Project Management in Offshore Pipeline Installation Project

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Abstract: Project implementation is inseparable from the risks that can affect the project will go according to plan or not. Therefore, good project management is very important to avoid project problems such as delays. Project delays can be caused by unproductive activities and the elements involved. The un-producibility becomes something that does not have added value or in Lean Project Management known as Non-Value-Added Activities (waste). In the implementation of the Offshore Pipeline Installation Project undertaken by one of the oil and gas companies in Indonesia, there was a delay in the process, therefore a risk analysis of the causes of the delay is required with the Lean Project Management approach to identify waste by applying the Fishbone Analysis method and project risk analysis using the Fuzzy Failure Mode and Effect Analysis method that will prevent or detect the failure mode earlier. And to estimate the project, it is applied by using the Critical Chain Project Management (CCPM) method which will produce project optimization to meet the Lean Project Management criteria, namely eliminating invaluable activities in order to make the project more effective and efficient.

1 INTRODUCTION

The oil and gas industry have an important role in the mineral resources needed by the state for its people. With abundant oil and natural gas reserves in Indonesia, facilities are needed to support these natural resources. One of the infrastructures that are widely used for natural resources is using subsea pipelines. Therefore, this company carried out the offshore pipeline installation project in order to maintain the company's basic production and to obtain additional production. This project is basically to install a new pipeline and to replace the damaged pipeline.

In its implementation, the Offshore Pipeline installation project undertaken by this company was delayed, but in the end, the project could be completed on time. Seeing the various things that happened and the number of methods used in project planning, this paper will identify an offshore pipeline development project planning with the concept of Lean Project Management. This paper discusses the risks of pipeline project delay and optimize it. Many methods can be used to analyse the delay of a project, one of the mare using fishbone diagram which functions as a method for analysing the causes of project delays that are divided into several causal indicators, namely machine, material, and method workers (Khotimah, 2019). By using the fishbone method to analyse project waste and using the CCPM method to plan schedules to avoid Student Syndrome and Parkinson's Law Effects, it allows the writer to optimize and streamline project planning to be more effective and efficient.

2 METHODOLOGY

The flow work in this study conducted by stages based on the following steps. The first step is data and reference materials collection from textbooks, journals, previous research etc. During this stage a comprehension study of Lean Project Management, Critical Chain Project Management are also conducted for optimization project.

2.1 Data Collection

The flow and procedure of the research were carried out in the following stages. This stage includes efforts in understanding offshore pipeline studies, the use of the CCPM method and the collection of data needed to complete this paper. The data required include:

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- Details of project activities based on existing schedule in accordance with project contract.
- Data analysis of the main problems of the project.

2.2 Identify Waste using Fishbone Diagrams

Identification of waste is done by using fishbone diagrams made from project's data analysis of the major problems and then discussed with expert judgment. Expert judgment is a major source of information that can provide vital input to project managers, who must ensure that projects are completed successfully, on time, and on budget (Szwed, 2016).

2.3 Managing Variation for Optimization of Project Scheduling using the CCPM Method

This scheduling begins by creating a network in accordance with project data that has been obtained. Then determine where the critical path is located. Critical Chain Project Management (CCPM) is a TOC tool used for planning and project management. It can be used both in one-project and multi-project structures where resources are being used in several projects simultaneously (Izmailov, 2016).

2.4 Risk Control

In this risk control precautions are taken to reduce the impact of the occurrence of risk variables that are in the red zone, while in the green zone risk control is not carried out because the impact can still be tolerated. Efforts to minimize this risk are carried out by implementing steps directed at the results of the assessment of data obtained from the risk analysis process. This is done by developing options and determining actions to increase opportunities and reduce threats to project objectives. Risk analysis have been used in many areas namely risk analysis for gas platform (Silvianita et al 2016).

3 RESULTS

3.1 Project Overview

Projects are one-time activities, with limited time and resources to achieve predetermined outcomes, for example products or production facilities (Soeharto, 1999). This project requires to maintain the company's production base and obtain additional production. This project is basically to install new pipes and to replace pipes that are already damaged. The project is located in the working area of one of the oil and gas industries which is located about 80 - 200 km northeast of Jakarta. The replacement pipe that will be replaced is 8 "NPS Gas Line from Platform X to Platform Y.

Table 1: Pipe Description.

Year 2018				
No	**Pipeline Name**	**Size (inch)**	**Length (Km)**	**Repair Strategy**
1.	B – A	12”	1	Full
2.	E – C	10”	7.2	Full
3.	D – E	8”	7.2	Full

3.2 Data Collection

In this stage, data collection was obtained from the results of Major Problem reports that occurred in the project. Then the data is validated with interviews with an expert that related to the causes of waste in this study which is Offshore Pipeline Installation project.

3.3 Work Breakdown Structure

Work Breakdown Structure shows overall project activities that used as a basis for determining volume of work, duration of activity and also used as a scheduling guide. Below is the table of activities on Offshore Pipeline Installation project as follows:

Table 2: Work Breakdown Structure of Offshore Pipelines Installation Project.

Activity	Duration (Days)
Basic Engineering	210
Project Management Team (PMT)	129
Detail Engineering	113
Coated Pipe 10”	251
Pipe Bend	250
Crossing Material	274
Riser Clamp dan Riser Fabrication	49
Survey	8
Preparation	79
Pipeline Laying	8
Mobilization	26
Riser Installation	14
Instalasi Crossing	14
Precommissioning	8
Certification	33
Final Acceptance	22

3.4 Project System

A project that is experiencing delays is certainly due to factors that influence waste (Hapsari, 2014). A project that is experiencing delays is certainly due to factors that influence waste. Waste in the project is actually something that must be considered in the sustainability of the project. Project system have been carried out by understanding the project and discussions with the implementer to identify the waste that is likely to arise in project implementation.

3.5 Waste Identification using Fishbone Diagrams

Lean is an often-used adjective in business these days, but there's some confusion over its exact definition. In essence, the goal of Lean is to maximize value while minimizing waste (Eby, 2017). Identification of waste or known as Non-Value-Added activity aims to determine the waste that occurs in the project. The identification process is done by using fishbone diagrams and *If-Then* formulations so that the project implementer can take appropriate corrective and preventive actions for future projects where there is the potential for waste to occur so that excessive waste can be avoided. Based on fishbone diagrams below, it can be seen the types of waste that most often appear in Offshore Pipeline installation projects from 8 waste that have been defined by Womack and Jones (1996) are Waiting and Unnecessary Motion.

Waiting, which is a condition where project activities have been delayed so that the delayed activity can result in delays in project implementation.

Unnecessary Motion, which is the movement that is not necessary, where the movement of unproductive workers that should not need to be done in the implementation of the project.

From Figure 1, the Fishbone Diagram above can be seen as the causes of waste generation in the project. It contains 9 failure modes and 20 causes that have been classified based on factors causing waste. Those are Man, Material, Method, also Tools and Machine. The causes of waste then processed into *If-Then* formulation to further know possible actions that implementer can take to minimize waste with preventive or corrective steps.

3.6 Managing Variations

The variations contained in the project is considered as uncertainty, therefore the project executor needs to adjust the existing variations by estimating. In this project, the variation made estimation is time. The aim is that the project executor can estimate the time needed during implementation.

Identification of waste in the project system project analysis found that the most influential waste in the project is waiting and unnecessary motion. By knowing the waste, then the scheduling improvement recommendations will be made with the Critical Chain Project Management (CCPM) as follows.

3.7 Critical Chain Project Management

All projects are carried out in a dynamic environment. This is an inherent characteristic of project activities which duration cannot be estimated precisely. Estimate Activity Durations is the process of estimating the number of work periods needed to complete individual activities (PMBOK, 2013). Among other factors, the accuracy of the estimation depends on the level of uncertainty. Variation problems must be addressed early in the development schedule. Safety time must be included in the project and must ensure its robustness. Time analysis have been used in many areas such as in graving dock project (Silvianita et al, 2018).

Table 3: Work Breakdown Structure with CCPM.

Pipeline Installation	
Summary Task	**CCPM Duration (Days)**
Basic Engineering	91
Project Management Team (PMT)	105
Coated Pipe 10”	126
Pipe Bend	125
Crossing Material	137
Riser Clamp dan Riser Fabrication	25
Survey	4
Preparation	40
Pipeline Laying	7
Mobilization	4
Riser Installation	13
Crossing Installation	7
Precommissioning	4
Certification	16
Final Acceptance	11

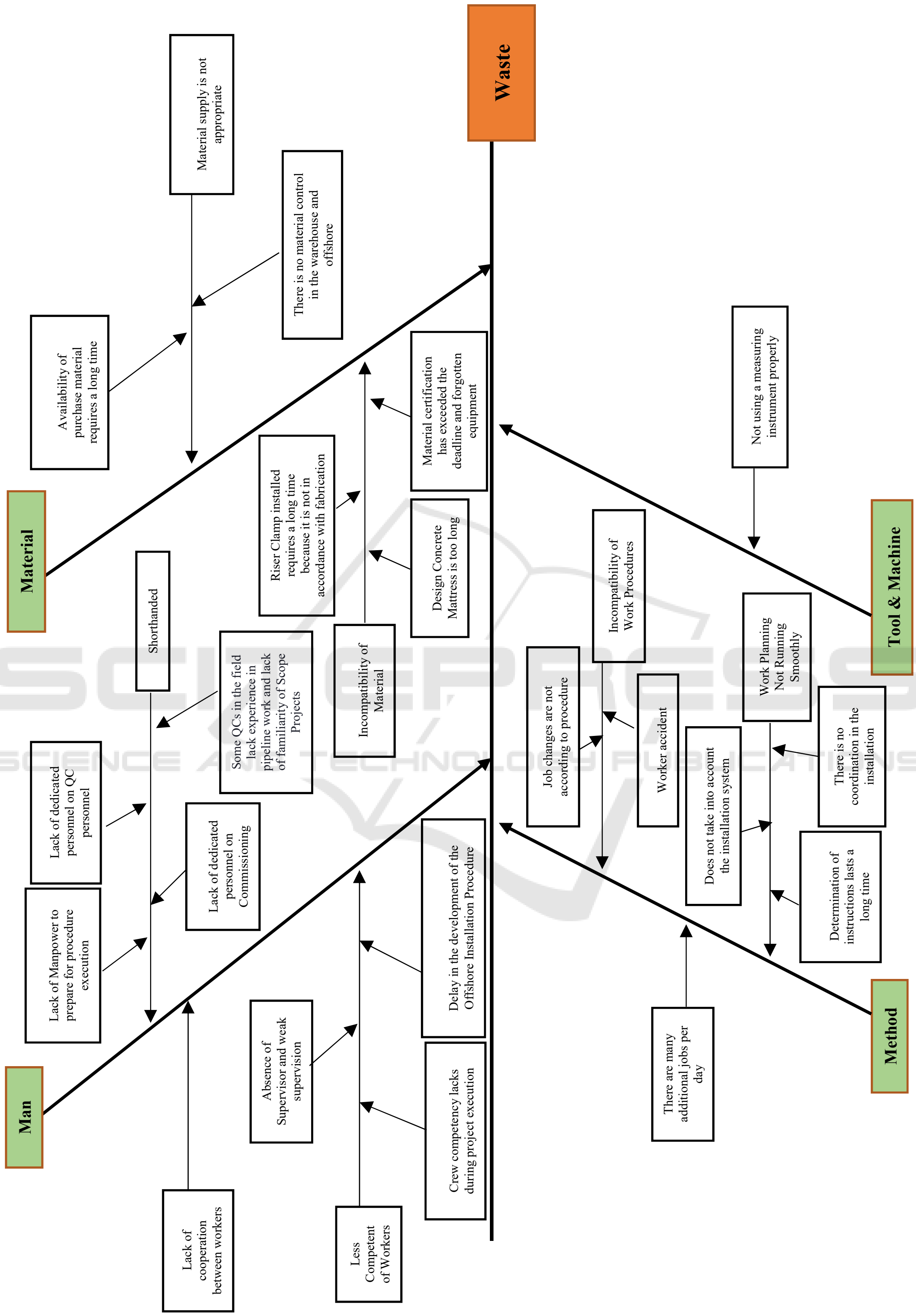

Figure 1: Fishbone Diagram of Waste.

However, the addition of time will increase the overall project duration, so that the lowest possible amount of safety time must be added to the schedule. CCPM controls several problems by including buffers in the project schedule (Leach, 2000). In this case, the CCPM adds a safety factor to the activity by solving several factors that impact human actions in the project environment. By applying the CCPM method to project scheduling, it is expected that problems that occur in the project, such as student syndrome and Parkinson's law effects can be avoided.

3.8 Network Planning

In the initial stage, the Work Breakdown Structure (WBS) is defined as a predecessor and successor between activities.

Table 4: Network Activities.

Activity	Predecessor	Successor
Basic Engineering	START	A3,B2,B3,C1
Project Management Team (PMT)	C1	D2
Detail Engineering	A1,C1	C3
Coated Pipe 10”	START	B4
Pipe Bend	A1	B4
Crossing Material	A1	C4
Riser Clamp dan Riser Fabrication	B1,B2	C5
Survey	A1	A2,A3,C2
Preparation	C1	C4
Pipeline Laying	A3	D1
Mobilization	B3,C2	C6,C7,D1
Riser Installation	B4	C6,C7
Instalasi Crossing	C4,C5	D1
Precommissioning	C4,C5	D1
Certification	C5,C6,C7	D2
Final Acceptance	A1,D1	END

3.9 Buffer Management Analysis

This analysis is used to monitor the schedule that already exists in Network Planning when the project is executed. The application of the CCPM method only requires supervision on the Project Buffer, in contrast to some other scheduling methods that must be monitored throughout the entire project activity. This Buffer Management is useful for maintaining the reliability of the project schedule but does not change the critical trajectories that exist.

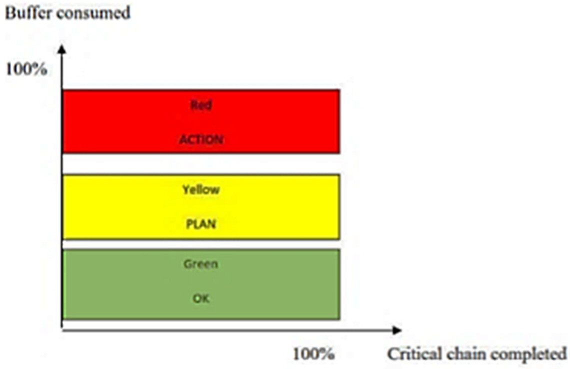

Figure 2: Buffer Distribution Area (Valikoniene, 2014).

Buffer Size =

$$2 \text{ x } \sqrt{\left(\frac{S_1 - A_1}{2}\right)^2 + \left(\frac{S_2 - A_2}{2}\right)^2 + \cdots + \left(\frac{S_n - A_n}{2}\right)^2} \quad \text{(Eby, 2017)}$$

Based on calculations and analysis, it has been found that the amount of project buffer is 82.4 days. From these results, will be divided equally based on buffer distribution area.

Table 5: Buffer Use.

Buffer Region	Range	*Project Buffer (Days)*	Used Duration (Days)
Green	0 % - 33 %	82	< 27,06
Yellow	34 % - 67 %	82	27,06 - 54,94
Red	68 % - 100 %	82	> 54,94

4 CONCLUSIONS

Based on the result of the analysis, it can be concluded that the delay of the offshore pipeline installation project was caused by 9 failure modes and 20 causes. And non-value-added activities or waste that arises in offshore pipeline installation projects based on 8 types of waste are waiting and inappropriate processing. Activities that do not added a value or waste that appears in offshore pipeline installation projects based on 7 types of waste are waiting and unnecessary motion. The application of the CCPM method, the acceleration of work time in scheduling is 183 days and when the project buffer has been used for more than 59 days or has entered the red zone, the project implementer must take action.

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