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Re-engineering the Business Process of Slickline and Electric Line Operation

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ABSTRACT

A strategy to save cost related to oil exploration process is discussed in this paper. The focus is to reduce the cost in slickline and electric line operation in order to maintain the business continuity, where this conclusion was obtained by looking at the comparison between the costs incurred during previous operations with the costs incurred at this time by comparing the results of operations obtained as well as comparisons with oil and gas prices both before and after 2018. This concrete step to be taken is a method for lean management because there is a cost suppression in it. The context of its implementation is through Business Process Re-engineering which of course will implement appropriate method steps to be taken. The method steps taken are to implement Value Stream Mapping which in its preparation includes an analysis of the slickline and electric line operation work steps carried out, including by compiling; Product family or operation work steps, Current state map of both operations and Design future state map of Wire Line operation proposal and 5S theory process as completeness. The proposed strategy enable to reduce costs by combining slickline and electric line operations in one unit or one service company, then reducing the number of workers involved and making work more efficient, by reducing the Rig up and Rig process, Down PCE (Pressure Control Equipment), reducing the repetition of the work intervention process.

INTRODUCTION

As a source of export earnings and also as a fulfillment of domestic energy needs, oil and gas energy is currently still a source of energy supporting economic growth in Indonesia. The accelerated growth of development, especially in the industrial sector as well as supporting materials for procurement in this country, makes the increase in energy use quite a large portion compared to the increase in other uses, which reached 7% in the last 10 years. For the current operating conditions, the costs for the production process are very expensive, and this is not limited to the Oil and Gas industry, namely with the cost of lifting from the earth including maintenance, this operation process certainly requires large costs, especially when compared to the acquisition cost. obtained is not economical or not in accordance with forecasts from existing sources. Considering that the condition of mature oil and gas wells is coupled with instruments or accessories that have been installed for a long time so that it requires no small maintenance costs. Therefore, the author tries to analyse in order to get a solution about reducing the cost of an existing business process.

In the Oil and Gas industry, slickline and electric line operations take up a fairly large portion compared to other operating methods carried out in the field, therefore slickline and electric line operations play an important role in maintaining the stability of oil and gas production targets at PT. XYZ. Where the slickline operation is used in terms of oil field maintenance or intervention using a single strand wire, while the term electric line operation is a well intervention where the wire is used as a conductor wire connection. Where its function is to ensure the feasibility of an oil and gas well can still produce optimally. This makes it a very critical element, so that periodic maintenance scheduling and monitoring of the condition of the oil and gas wells must be carried out for a certain period of time to anticipate damage that occurs. With the periodic maintenance operation process, the author analyses these two operations which then gets findings for optimization by reviewing the engineering process.

One of the elements to carry out maintenance of oil and gas wells is the slickline and electric line, which generally use slickline and electric line units, both portable and directly in one package with a barge or rig unit as a place to intervene. In the following calculations, it can be concluded as a comparison and triggers why there is a need to reduce costs for the two operations, where there is a difference in the number of days for Break Even Point (BEP) for oil and gas wells between BEP for one oil well made before 2018 and one oil well. made after 2018. There is a difference due to the price difference between them. For more details, see Table 1.

Table 1. Comparative analysis of Break Even Point cost calculation for one oil and gas well.

No	Description	Cost / Price / Gain of well	
1	Price for one well	2,000,000	USD
2	Slickline Cost	1,250.00	USD
3	Electric Line Cost	10,000.00	USD
4	Well Testing Cost	15,000.00	USD
5	MMscfd to MMbtu	1,040.00	USD
6	Gas price before 2018	7	USD/MMbtu
7	Oil price before 2018	70	USD/bbl
8	Gas price after 2018	6	USD/MMbtu
9	Oil price after 2018	35	USD/bbl
10	Expected Gas production in gas well (economical well threshold)	3	MMscfd
11	Expected Oil production in oil well (economical well threshold)	200	bbl/day
12	Cost per well	2,026,250	USD
13	Break even point before 2018 in gas well	92.78	days
14	Break even point before 2018 in oil well	144.73	days
15	Break even point after 2018 in gas well	108.24	days
16	Break even point after 2018 in oil well	289.46	days

Comparative analysis of Break Even Point cost calculation for one oil and gas well, taken from part or fraction of operational cost calculation from slickline and electric line, where the range of costs is taken from operational costs for one oil and gas well with a comparison of the price of one oil well made before 2018 with one oil well made after 2018, so it is clear the difference for BEP from the type of each well made.

From the aforementioned, Business process re-engineering of slickline and electric line operations in an effort to reduce costs at PT. XYZ is discussed. In general, this article analyses existing business processes, namely by implementing business process re-engineering at every potential, but the emphasis as a limitation is on slickline and electric line operations. While the specific purpose of this journal is to see the potential cost reduction from implementing business process re-engineering, this is also done by looking at the value of each ongoing contract, both electric line (E/L) and slickline (S/L). Thus, it can be concluded that this business process re-engineering can really reduce operating costs through current expenses, especially for electric line (E/L) and slickline (S/L) operations. As a continuation, the author analyses the potential steps that must be taken when implementing business process re-engineering to reduce operating costs.

Operation of the term Electric Line is an operation in an intervention well where the wire used is as a conductor wire connection; the conductor itself is protected by a protective wire or armors in transmitting electrical energy. The main concern in the oil field for well intervention operations in this type of operation is the measurement of depth, especially during perforation operations. The depth accuracy on the Electric Line is higher than on the slickline which is the reason for recording wells and perforations properly by the electric line unit. Through this electric line, we can send sensor data to the surface in real time which will be an advantage for recording wells properly. Power line operations involve well recording, perforation and well repair services. Electric Line is used for well logging, which involves the use of a sensory device designed to provide some information about the properties of the well. The perforation itself is to provide communication between the borehole and the formation through pipes, casing and cement.

Whereas Slickline is a term used in oilfield maintenance or intervention i.e. wires of several sizes, composition lengths are used to perform several types of services in the wellbore. The basic use of the slickline is to manipulate tools such as pipe gauges and flow control devices. Similar to the Electric Line operation, this Slickline operation uses a single strand wire to run various tools into the wellbore which has the purpose of maintaining wells, both oil wells and gas wells. Operation of this tool can also be used with a slickline truck for onshore performing slickline operations. While in the offshore and delta using ships, barges and rigs. The length of the wire used varies, depending on the depth of the well and this can be ordered according to specifications or the type of operation, for example wells that have levels or contain Hydrogen Sulfide (H2S) then specifications can be ordered for H2S, while the length can be ordered up to 35,000 feet. This tool is used to lower and raise or intervene downhole tools used in the maintenance of oil and gas wells to the appropriate depth from the borehole.

In use, this work is connected by a drum when rolled from behind the slickline unit to the slickline sheave wheel, a grooved circular wheel and a certain size according to the specifications and thickness of the wire being supported and serves to direct it to the path of another sheave wheel which will allow the slickline to enter the wellbore. oil and gas. This slickline unit is used to lower equipment or intervene downhole into oil or gas wells to perform maintenance on various types of downhole accessories. Slickline units are an integral part of the machining and finishing industry. The operation provides an economical way to regulate and control well fluid flow and clear the tubing/pipeline flow path of obstructions such as sand, loose scale/pipe lining and paraffin.

The use of Value Stream Mapping has been widely sptread. Fernando and Noya (2014) discusses about Optimizing of Production Lines with Value Stream Mapping and Value Stream Analysis Tools. Reducing the number of waste in the production process is one of the main goals in every company. Lean is one of several ways to reduce waste in the running process of a production. This lean approach generally aims to increase the value of a product or service to customers (customer value) by increasing the ratio of the value of useful activities or having added value (value added ratio) to the level of waste (waste) continuously (Gaspersz & Fontana, 2011). In the results of this study, the method used to reduce the presence of waste in PT. Bonindo Abadi is a Value Stream Analysis Tools (VALSAT) and Value Stream Mapping (VSM). Where the VSM method or procedure is used to see the state of the map condition in the company. This waste reduction step is done by using one of the tools from VALSAT, namely Process Activity Mapping (PAM). The amount of non value added (NVA) obtained in the production process of PT. Bonindo Abadi is 90.17% and value added (VA) is 0.04%. then the opinion step for improvements made is to reduce the amount of time for NVA activities or eliminate them.

The basic steps process from the implementation of the concept of the Value Stream Mapping (VSM) method which was incorporated into the realm of lean philosophy, namely in 1995, where the concept of VSM was illustrated in a set of technical methods which is also a step to identify and record all waste from each work steps, so that it can be used as a reference material for each step in removing all activities contained in the waste of a business process (Hines & Rich, 1997). Starting from the beginning of the method from the VSM step flow, there are at least seven VSM methods which are briefly summarized by Hines and Rich (1997), in the summary including, process activity mapping, supply chain response matrix, production variation funnel, quality filter mapping, mapping demand amplification, decision point analysis, and mapping of physical structures. However, the flow of steps or methods of disclosing and visualizing this relationship is limited between the nature of information and physical flow in the perspective of the value stream (Lacerda, Xambre, & Alvelos, 2016). In different versions of VSM where this has been suggested by Rother and Shook (2003) in providing solutions to this problem, including to distinguish the activities or steps of the business processes that are classified as VA and NVA so that the flow of information and physical with lean strategies that systematically in an effort to eliminate all activities that are in waste and continuously improve from the user's perspective.

On the other hand, from Table 1 can be inferred that the breakeven period for the oil and gas well in the PT XYZ is significantly getting longer before and after 2018. The company urgently needs strategy to maintain its financial performance. One of the strategies come-up from the discussion with the management is how to reduce the cost in operating the slickline and electric line. From academic perspective, there are limited number of articles about how to reduce the cost related to the slickline and electric line operation. From the limited number, several articles about this issue are presented by Bargawi, Dean, Clemens, and Whitmire (2008), Foster, Clemens, and Moore (2001), Larimore and Fehrmann (1998), Larimore, Fehrmann, and White (1997), Larimore, Goiffon, and Bayh (1996), Loov and Billingham (2014). These articles discuss about the cost reduction issue in the operating slickline or electric line however from this limited number, the articles about cost reduction in this area using Lean and Business Process Re-Engineering perspective has not been found yet. So, this issue will be one of the contribution of this article.

RESEARCH METHOD

In an effort to conduct business process re-engineering at PT. XYZ, the author performs several steps as a research method as shown in Figure 1.

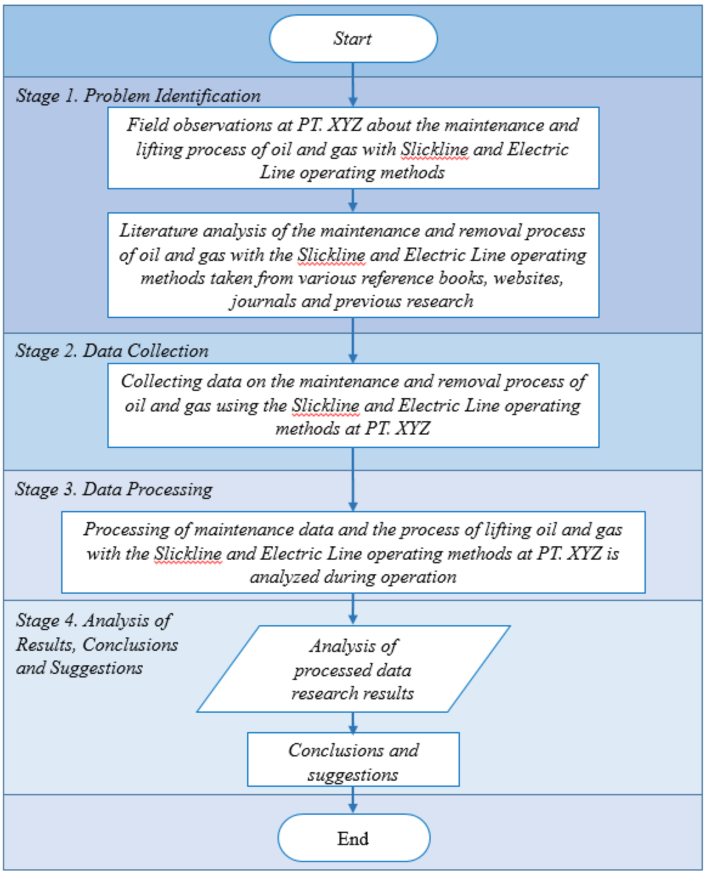

Figure 1. Research flowchart.

The initial stage when going to do the optimization, the authors identify the problem through analysis of the business process of the current operation. After getting points that will be raised as a discussion for improvement, the author takes the next step by conducting a literature study of the analysis of maintenance and oil and gas removal processes with the slickline and electric line operating methods taken from various reference books, websites, journals and previous research. To collect data as an analysis of this writing, the authors conducted field observations at PT. XYZ about the maintenance and process of lifting oil and gas with slickline and electric line operating methods that are currently running.

The second stage is to collect data about the maintenance and removal process of oil and gas with the slickline and electric line operating methods at PT. XYZ. In this stage, the author conducted several interviews with the team that carried out the business process. The third stage, the authors perform data processing, maintenance and removal of oil and gas with the slickline and electric line operating methods at PT. XYZ and analyzes during business process operations.

The fourth stage is analysing the results of the processed data research, after which conclusions are drawn as to what concrete steps should be taken as the objectives of analyzing the business process. After the conclusion is obtained, the next step is to give suggestions or recommendations for business process re-engineering as an optimization effort at PT. XYZ.

This data collection is data collection to support the research conducted. In conducting this research, the use of data taken to be used is primary and secondary data. The method for collecting the data is as described below:

A. Primary Data

This research data obtained from interviews and direct observations on Slickline and Electric Line jobs at PT XYZ. As for the observation aids, namely by using a laptop, mobile phone and reporting documentation on the I-ServeWell system.

a. This interview was conducted by means of question and answer to TADM which handles Slickline and Electric Line contracts as well as several employees at PT XYZ. Interviews were conducted by asking questions and analyzing any problems that occurred in the implementation of routine contracts in the company in general and specifically in Slickline and Electric Line operations.
b. Observation is done by direct observation at Slickline and Electric Line operations. Then the data that can be collected include the number of workers, the number of machines, processing time in Slickline and Electric Line operations.
c. Discussion, together in determining waste in Slickline and Electric Line operations, both with TADM itself as the contract maker and several other workers based on the experience of the workers themselves.

Apart from that, there are some data needed to complete this research, as for the date as described below:

a. Work process flow
   The work process flow (flow process chart) is made based on the Slickline and Electric Line operating processes of each type of work for the maintenance and removal of oil and gas with these operating methods.
b. Working time
   Working time is obtained from taking working time data from each worker in the Slickline and Electric Line operations and this data obtained from I-ServeWell data is used to see the cycle time of the process.
c. Production output data
   Slickline and Electric Line operation data is obtained from the results of operations and daily reports in the I-ServeWell data system as monitoring by PT. XYZ in ensuring the running of the business cycle in the company.
d. Data on number of workers
   Data on the number of workers were obtained from observations in the field during Slickline and Electric Line operations as well as I-ServeWell data which recorded the number of workers in carrying out the work.

e. Cycle Time
Cycle time is the time when the work and all activities obtained during the operation of Slickline and Electric Line as well as a report in the I-ServeWell data that records the amount from the beginning to the end of the work.

f. Available time
It is available time obtained from Slickline and Electric Line operating hours as well as I-ServeWell data which records the amount of available time in a day or cycle for the maintenance and removal process of oil and gas with this operating method.

B. Secondary Data

This secondary data is obtained from references that can assist in research that is being carried out in the form of information or actual conditions through research on sources of information in the form of journals, books, archives and documents or company data both hardware (hardcopy) and software (softcopy), reports related to the problems studied from the I-ServeWell data that recorded all activities at PT. XYZ. Where the data obtained from the company is data on the results of Slickline and Electric Line operations, the flow of the maintenance process and the process of lifting oil and gas with this operating method, including data on the number of workers for the job, as well as data on the number of machines used, as well as the turnaround cycle from time to time. processing.

In this preparation, a tool is taken as a solution, namely Value Stream Mapping (VSM), where VSM is one way to make improvements in Lean Management to visualize the steps where this business process takes place from the beginning to the end of completion for a job, which in it explains about what the customer wants, which can be seen from the well intervention program flow, as shown in Figure 2.

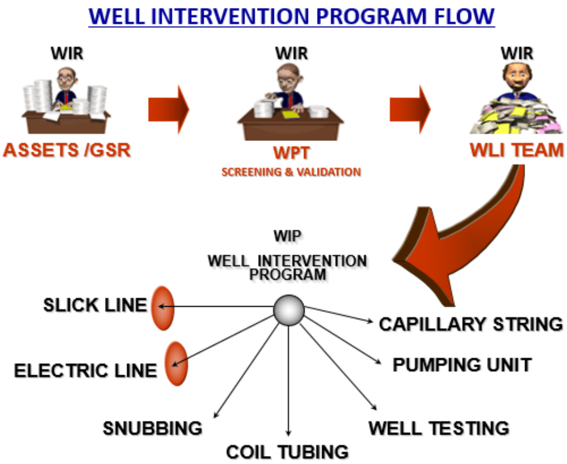

Figure 2. Well Intervention Program Flow

For the flow above is a standard step that has been running in determining and taking steps to complete work through the existing team, including:

1. GSR (Geoservice and Reservoir) as one of the departments that owns or manages assets of the company's existing wells.
2. WPT (Well Performance Team). As a team that screens and validates the work requested by the GSR Team which will then be carried out by the WLI team.
3. WLI (Well Intervention) as the executor of his work.

C. Current State Map Value Stream Mapping

The data that has been taken and processed will be used as the basis for making the VSM current state map. Making the current state map value stream mapping is used to identify and determine the processes that occur in Slickline and Electric Line operations. In addition to knowing the current processes, the current state map also aims to find out the entire flow of information that occurs during these processes.

In the current state map value stream mapping to find out activities that do not add value to Slickline and Electric Line operations which are considered to cause waste, namely by making Process Activity Mapping (PAM). Almost all work processes in Slickline and Electric Line operations are manual work. PAM helps to identify value added and non-value added activities which are considered as waste. To complete the waste identification results, direct observations were made on the Slickline and Electric Line operations.

D. Design Future State Map Value Stream Mapping

While the data for the Design Future State Map Value Stream Mapping is taken and processed which will be used as a step to improve existing business processes by entering or making a work step that will erode non-value added from existing activities where the basic reference is on the current state map. value stream mapping.

E. 5S Concepts

5S (Seisi, Seiton, Seiso, Seiketsu, Shitsuke) is a systematic approach to improving the work environment, products, and processes by involving employees on the production line or factory floor as well as in the office (Gasperz & Fontana, 2011). 5S is used to eliminate waste and a determination to organize, clean, maintain, and maintain the habits necessary to do a job well (Santos et al, 2006). The 5S technique is a systematic approach to improving the work environment, processes, and products by involving employees on the factory floor or production line as well as in the office.

According to Suwondo (2012) "5S Work Culture", is a science that really needs to be studied, in the development of a company or organization (University, School, party, etc.), to achieve effectiveness and efficiency, create highly disciplined people, respect time, hard worker, conscientious, success oriented, not hedonistic, frugal and unpretentious, likes saving and investing, oriented to integrity and other positive things. When translated into Indonesian, the 5 ways to handle the location of doing business become 5 R's where the meaning is as explained below (Imai, 1986):

1. **Seiri**, making things where our workplace is easy to choose which ones can be used and which are not used so that useless things are eliminated. Where it can be a location to do a business, it becomes short, concise or concise, where you only store materials or tools as needed.
2. **Seiton**, everything is stored in its place as easy to take and easy to find when going to use.
3. **Seiso**, makes the state of all tools, tools, instruments and others easy to use and always neat or shiny free from dirt. Creating a location situation around doing work to create conditions for the place and work environment to always be neat or shiny free from dirt. Making the place always neat or shiny free from dirt is not only cleaning but also needs to be done for inspection and maintenance steps or methods.
4. **Seiketsu**, adding ways to make things always slick or shiny free from dirt on individuals is also continuously carried out on the implementation of the 3 things above so that everything is in order can also be a reference to always be done. The implementation of the seiketsu method can make the environment in which we work always awake.
5. **Shitsuke**, making obedient individuals by always doing the 5 S steps in a manner according to normal rules. So that it can make each individual act or take steps according to the rules and can transmit to anyone about doing the good thing.

In supporting the Well Intervention work, slickline and electric line operations are two things that work almost always side by side or a sequence of work, where both before and after the work will be carried out alternately. These two jobs are sometimes carried out after other main work is done such as coil tubing, snubbing, drilling and so on. Slickline and electric line work currently takes up a very large portion so that it requires handling or operating steps that can be more profitable.

RESULTS AND DISCUSSION

Slickline operations that are currently running by analyzing or judging from the business process, several steps can be taken in an effort to reduce financing, where it can refer to work or business processes in almost similar operations, namely electric line where the sequence of work is almost the same so that it can be done several times. elimination step in some part of the business process or operation. Here are some steps that we can analyze the business processes in both operations, both slickline and electric line operations, including the following:

1. Slickline operation;
    a. Integrated Meeting for Crew
    b. Preparation;
        - Open Work Permit.
        - Pre-job Meeting.
        - Check WHSIP.
        - Perform UMV function test.
        - Perform TRSV function test.
    c. Rig Up PCE Equipment's;
        - Rigged up Line PCE
        - PCE pressure test

d. Running tools;
        - Open the well.
        - Running In Hole (RIH) of tool string
        - Pull Out Of Hole (POOH) tool string
    d. Rig Down PCE Equipment's
        - Rig Down PCE
        - Well Hand over to Production Team.
        - Close Work Permit

2. Electric line operation;
    a. Integrated Meeting for Crew
    b. Preparation;
        - Open Work Permit.
        - Pre-job Meeting.
        - Check WHSIP.
        - Perform UMV function test.
        - Perform TRSV function test.
    c. Rig Up PCE Equipment's;
        - Rigged up Line PCE
        - PCE pressure test

e. Running tools;
        - Open the well.
        - Running In Hole (RIH) of tool string
        - Pull Out Of Hole (POOH) tool string
    d. Rig Down PCE Equipment's
        - Rig Down PCE
        - Well Hand over to Production Team.
        - Close Work Permit

By analyzing the business processes of the two operations mentioned above, several steps can be taken to reduce costs in both operations, which of course can be implemented with lean management so that it will completely eliminate waste in the business process. In carrying out this operation, a support means is needed that can accommodate all the main equipment and supporting equipment in completing this operation. Specifically for wireline work in the swamp field, currently supported by 12 (twelve) barges or wireline boats equipped with slickline or electricline units, with a summary in Table 2.

All of the above support means in their procurement, some use separate work contracts and some are in a package with work tools used to intervene wells.

In the second step of working on both the slickline and electric line operations, the Well Intervention Team has made a work plan that is incorporated in the RKAP which is also used as a benchmark for the success of the work implementation. This can be seen from the number of comparisons between planning and realization. Table 3 explains the comparison between the two things, namely planning and realization. This table data is taken from planning and realization data from 2015 to 2020, while 2021 runs until 2023 is still calculated with the estimated workload based on the RKAP.

Table 2. Support barge (working barge) or wireline boat

Slickline boat (SL)	Wireline boat/ barge (SL + EL)	Multi Purpose barge (SL + EL + CT)	CT barge (SL + CT)	SN barge (SN + SL)	Well Test (Testing + SL)
4 (Nes 3, Nes 6, Nes 7 & ELSA-01)	3 (Nes 4, Nes 5 & SH-7)	2 (SH-6 & Delta Biru)	1 (ELSA-07)	1 (ELSA-08)	1 (Adimas-02)

Table 3. Estimated workload

Planning and Realization of Slickline & Electric Line Operation							Refer to RKAP 2021		
Year	2015	2016	2017	2018	2019	2020	2021	2022	2023
Plan	5449	4998	3958	3609	4284	4437	2908	2908	2908
Realization	5651	4892	4964	4340	4585	3312	2908	2908	2908

With the data above, it can be analysed that the workload carried out in a period of one year is very large which of course will consume a very large budget. The use of the budget will of course run out in less than 3 years as the budgeted period for each contract, both from the slickline contract and the electric line.

In the current period, it can be seen that the planning and realization of the needs of this wireline operation (slickline + electricline) underwent several revisions along the way, so that the difference in the numbers in the next table can be seen. Furthermore, as in the period from 2015 to 2020, it can be seen that with a significant amount of work, this will certainly create very large costs or expenses. The number of comparisons between Planning and Realization costs of Slickline & Electric Line Operation can be seen in Table 4.

Table 4. Planning and Realization cost of Slickline & Electric Line Operation

Year	Plan	Realization
2015	$63,981,230	$66,353,080
2016	$84,189,369	$82,403,840
2017	$82,074,277	$102,934,995
2018	$73,498,082	$88,385,059
2019	$31,811,052	$34,046,142
2020	$42,009,468	$31,357,980

From the description of the cost table between the planning and realization cost of slickline & electric line operation above, it appears that the costs incurred for the two operations are very large. Therefore, the authors carried out several further analyzes in order to obtain accurate data so that they could carry out a comprehensive and targeted analysis in order to make efforts to reduce slickline & electric line operating costs at PT. XYZ in the future. From the picture below, you can see a comparison of these costs is shown in Figure 3.

As previously explained, it can be seen directly that the amount of costs required for operations from year to year for both operating costs is very large. Based on the data obtained, based on significant planning and very expensive costs, the authors carried out analysis and steps to carry out business process re-engineering from Slickline and Electric Line operations as an effort to reduce costs at PT. XYZ.

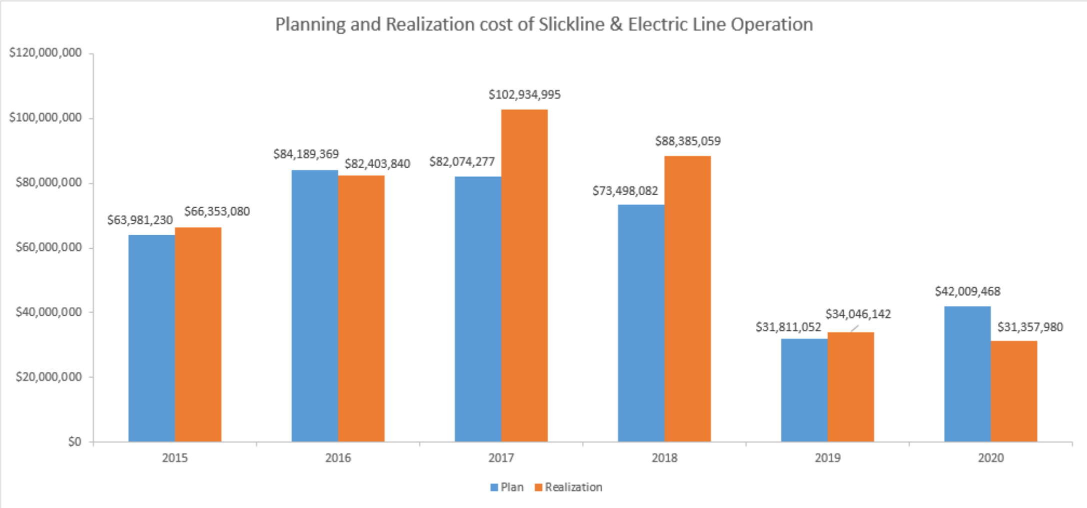

Figure 3. Chart of Planning and Realization cost from Slickline & Electric Line Operation

The data above as explained earlier that the data was taken from 2015 to 2020, while for a comparison of why the operating costs of Slickline and Electric Line are very expensive, this is seen from the calculation of costs incurred for 3 years (1095 Days) of contracts in these two operations (Slickline and Electric Line) which can be seen in table 5 for Owner Estimate (OE) of slickline operation for 3 years.

Table 5. Owner Estimate (OE) slickline operation for 3 years.

Description	Days	Unit Rate (USD/day)	Subtotal (USD)
A. Equipment			
Slickline equipment for jobs: Well monitoring, Support LWO, DHSV replacement, Plugging and un plugging, Fishing Tools, Logging and Mechanical WSO	1095	$403.81	$442,171.95
Sub total A			$442,171.95
B. Personnel			
Daylight personnel	1095	$855.86	$937,166.70
Night personnel	1095	$855.86	$937,166.70
Sub total B			$1,874,333.40
Daily rate		$2,115.53	
Est TCV 1 S/L			$2,316,505.35
Est TCV 5 S/L			$11,582,526.75

From the table above, it can be seen that the normal slickline operating costs are $2,316,505.35 for one slickline unit, but based on the current contract, 5 units are needed, which is to fulfill the very massive operational needs as stated in the company's work plan and budget. . From the calculation of the normal costs, steps are taken to add up the needs in its operation so that it can fulfill the plans that have been made, thus it can be seen that the total needs are:

$$C_{sl} = C_{usl} . \Sigma_{sl} \quad \text{.......} (1)$$

Where:

C_{sl} = Contract Slickline per 3 years

C_{usl} = Cost per Unit Slickline

Σ_{sl} = Total slickline as requiered

Then:

Csl = 2,316,505.00 x 5

Csl = $11,582,526.75 per 3 years

In the completion and maintenance steps of a well, another operating unit called Electric Line is needed, where the required cost can be seen in the Owner Estimate of the Electric Line operation for 3 years as contained in table 6, where the table describes what types of work are required. carried out when using the Electric Line operation, the description of the type of work can be seen.

With the calculation of the cost requirements that must be incurred based on the Owner Estimate of both the Slickline and Electric Line operations, it can be seen how large the cost needs to be incurred. Where the cost as already stated that its use is for a period of 3 years, or the work contract will be re-submitted if the contract value has expired even though the time has not reached 3 years.

By looking at the cost per each operation, it can be calculated that the costs of the two operations based on the Owner Estimate (OE) of both Slickline and Electric Line operations are as follows:

Wire Line operation costs (Slickline and Electric Line):

$TC_{wl} = TC_{sl} + TC_{el}$ .... (2)

Where:

TC_{wl} = Total Cost Wire Line per 3 years

TC_{sl} = Total Cost Unit Slickline per 3 years

TC_{el} = Total Cost Unit Electric Line per 3 years

Then:

$TC_{wl} = \$\ 11{,}582{,}526.75 + \$\ 34{,}607{,}193.60$

TC_{wl} = \$ 46,189,720.35 per 3 years

Table 6. Owner Estimate (OE) of Electric Line operation for 3 years.

No	Type of service	Quantity	Unit	Est. No. of job for TTH + 1 OFF	Unit Price	Sub Total
1	Service charge					
	Service charge	1	ea	2763	0	-
2	Depth charge					
	Depth charge	3500	m	2763	$0.90	$8,703,450.00
3	Perforation 3-1/2" or 3-3/8" (6 spf)					
	Meterage charge	15	m	4	$380.00	$22,800.00
4	Perforation 2 7/8", scalloped, 6 spf, 60 deg, Deep					
	Meterage charge	4	m	286	$380.00	$434,720.00
5	Perforation 2-1/2", scalloped, 6 spf, 60 deg					
	Meterage charge	4	m	451	$380.00	$685,520.00
6	Penetration					
	Meterage charge	4	m	151	$380.00	$229,520.00
7	Perforation 2-1/8", exposed, 6 spf, 0 or 45 deg					
	Meterage charge	2	m	34	$380.00	$25,840.00
8	Perforation 2", scalloped, 6 spf, 60 deg, deep penetration					
	Meterage charge	4	m	911	$380.00	$1,384,720.00
9	Perforation 1-11/16", exposed, 4 spf or 6 spf, 0 deg					
	Meterage charge	2	m	126	$380.00	$95,760.00
10	Orienting tool					
	Flat charge per succesfull run	1	run	28	$10,640.00	$297,920.00
11	Real time P/T gauge while perforating					
	Flat charge per succesfull run	1	run	25	$380.00	$9,500.00
12	Anchor tool					
	Flat charge per succesfull run	1	run	6	$228.00	$1,368.00
13	Puncher					
	Shot charge	1	m	120	$228.00	$27,360.00
14	Dynamic Underbalance System					
	Design charge per well	1	ea	26	$380.00	$9,880.00
15	Cased hole neutron log					
	Survey charge (Sigma mode)	800	m	12	$3.80	$36,480.00
	Survey charge (Corbon oxygen mode)	250	m	12	$7.60	$22,800.00
16	RST WFL					
	Survey charge per station	5	ea	9	$760.00	$34,200.00
17	PLT					
	Survey charge	3000	m	37	$0.38	$42,180.00
18	Sand Detection Logging					
	Survey charge	2000	m	12	$0.91	$21,840.00
19	GR-CCL logging					
	Flat charge per run	1	run	12	$380.00	$4,560.00
20	Setting Service (Bridge Plug)					

	Flat charge per setting	1	run	425	$11,400.00	$4,845,000.00
21	Cassing Patch Setting					
	Flat charge per setting	1	run	308	$16,000.00	$4,928,000.00
22	Thru Tubing + Setting tool					
	Flat charge per successful run	1	ea	12	$2,660.00	$31,920.00
23	Dump Bailer					
	Meterage charge per run in hole	2	run	67	$7,220.00	$967,480.00
24	Chemical cutter for all sizes tubing					
	Flat charge per succesful run	1	run	4	$11,400.00	$45,600.00
25	Tubular jet cutter for all sizes tubing					
	Flat charge per succesful run	1	run	5	$798.00	$3,990.00
26	Multi Arm Imaging Calliper Tool					
	Survey Charge	1200	m	8	$0.38	$3,648.00
27	CBL/VDL					
	Meterage charge	2000	m	259	$0.38	$196,840.00
28	Dowhole Tension					
	Flat charge per run	1	run	2	$76.00	$152.00
29	Mono cunductor jar					
	Flat charge per run	1	run	2	$228.00	$456.00
30	Stringshot					
	Detonation charge (per shot)	4	ea	3	$228.00	$2,736.00
31	Electricline roller					
	Flat charge per run	1	run	3	$1,520.00	$4,560.00
32	Depth Determination					
	Flat charge per run	1	ea	5	$380.00	$1,900.00
33	Mast Utilization					
	Monthly rental	1	month	36	$10,500.00	$378,000.00
34	Costumer Instrument Services (CIS)					
	Flat charge per run	1	run	28	$5,320.00	$148,960.00
35	Incomplete Operation					
	Flat charge	1	ea	102	0	-
36	Personnel					
	Daylight personnel	4	days	1095	$1,250.86	$5,478,766.80
	Night personnel	4	days	1095	$1,250.86	$5,478,766.80
Grand Total					$34,607,193.60	

With the results of the Owner Estimate calculation for slickline and Electric Line operations for the above 3 years, the authors conclude to submit this Business Process Re-engineering (BPR) proposal as a step to reduce costs for Slickline and Electric Line operations and also as an optimization step at PT. XYZ. The next step is to collect data about business processes or work steps on Slickline and Electric Line jobs to make it easier to analyze the type of work or work steps that can be re-engineered according to current conditions.

After collecting the data mentioned above, the next step is to perform data processing, where for this data processing the compiler performs the analysis using Value Stream Mapping (VSM) as a completion step after conducting a waste analysis and first and then doing lean management, namely by eliminating or eliminate all things that are analyzed as waste in the analyzed business processes.

The following are the steps in the preparation of Value Stream Mapping (VSM) of Slickline and Electric Line jobs or operations:

1. Product family or Slickline and Electric Line operation steps.
2. Current state map of Slickline and Electric Line operations
3. Design future state map of Wire Line operation.

After the analysis is done and the data is collected, the next step is compiling a product family or working steps for slickline and electric line operations.

A. Product family

In the existing business process series, in table 7 the following is the process data from the product family from the slickline and electric line which are currently being carried out, in general the product family types from the two operations include integrated meetings for all crew, preparation, rig up PCE equipment's, running tools, rig down PCE equipment's. this can be seen through the table 7 for the process.

Table 7. Product family slickline and electric line

Product	Process				
	Integrated Meeting for all Crew	**Preparation**	**Rig Up PCE Equipment's**	**Running tools**	**Rig Down PCE Equipment's**
Slickline	√	√	√	√	√
Electric Line	√	√	√	√	√

The preparation of the flow of steps from making a current state map of slickline and electric line operations, where this aims to see which parts or processes we can take for lean management steps. This lean approach generally aims to increase the value of a product or service to customers (customer value) by increasing the ratio of the value of useful activities or having added value (value added ratio) to the level of waste (waste) continuously (Gasperz, 2007). The steps in capturing the current state include; information flow, material flow, lead time and process time. The steps can be seen in Figure 4 regarding the Current State Map - Value Stream Mapping Slickline and electric line.

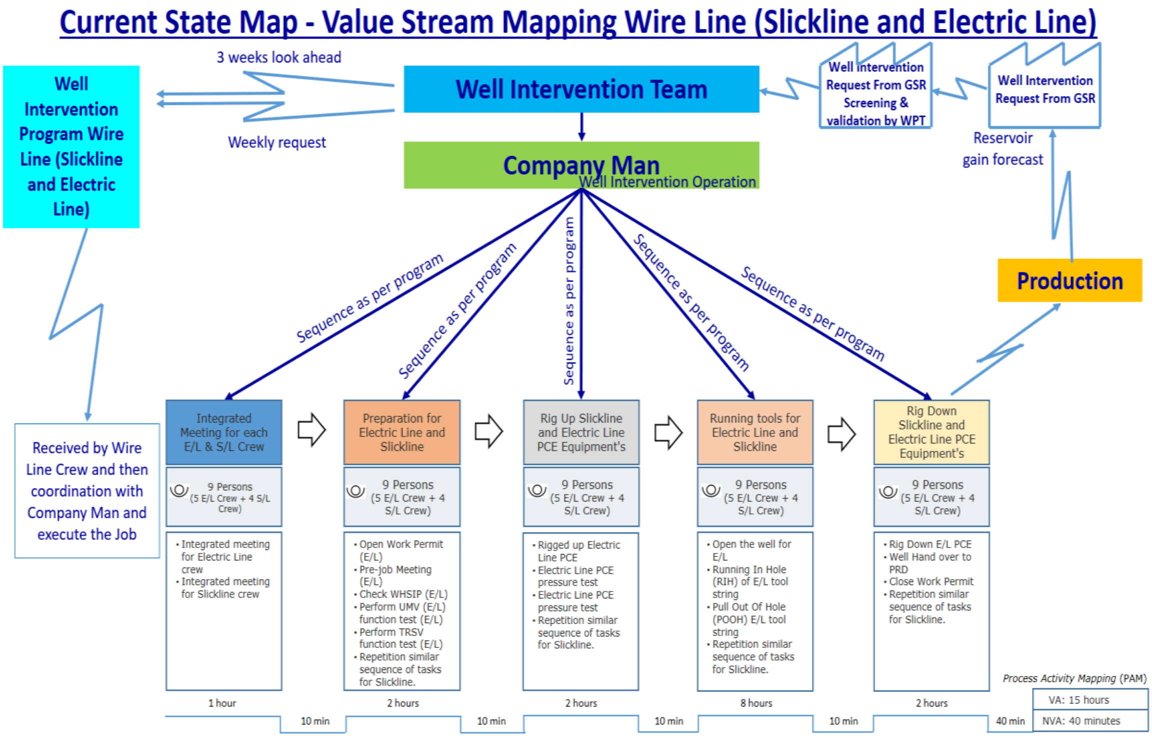

Figure 4. Current State Map - Value Stream Mapping Slickline and Electric Line

Analyzing the series or business process steps of the two work methods above, both slickline and electric line, the authors draw conclusions and take lean management steps in order to reduce costs from slickline and electric line operations as outlined in the Future State Map - Value Stream Mapping where for both work methods when analyzed in terms of Product family or Slickline and Electric Line operation steps and also viewed from the Current state map of both operations, it is very possible to do lean management steps in order to reduce costs at PT. XYZ.

From several work steps or existing business processes, it was found that for work steps that could become waste or have the potential to be removed from the sequence of work steps, they are:

1. Efficient work, by reducing the Rig up and Rig down PCE (Pressure Control Equipment) processes for both Slickline and Electric Line operations.
2. Reducing the repetition of the work intervention process between Slickline and Electric Line operations.

After doing the two things above, both in terms of the Product family or the work steps of Slickline and Electric Line operations and also from the Current state map of both operations, the following is the Design of the future state map of Wire Line operations as a step to determine the waste disposal process from the operation so that the lean management step or the cost suppression step of both operations can be carried out properly so that a lot of profit can be achieved for the company.

The following is the design of the future state map of the Wire Line operation as shown in Figure 5, where there is a workflow or business process that has been removed or the process re-engineered.

Based on the results of the analysis of the Current State Map Value Stream Mapping above, it can be compared with the Future State Value Stream Mapping proposal on Wire Line operations (Slickline and Electric Line) where there are several changes both in terms of business processes and other elements to support the implementation of these operations, which aims to find out what parts are still waste so that lean management steps can be taken.

The next step in order to reduce operating costs, the compiler conducted interviews with several related Engineers to obtain the costs incurred during the operation including the Owner Estimate for Wire Line operations (Slickline and Electric Line) which had been previously submitted. Changes in work steps as well as changes in the supporting elements of the operation can of course result in business processes and costs in them.

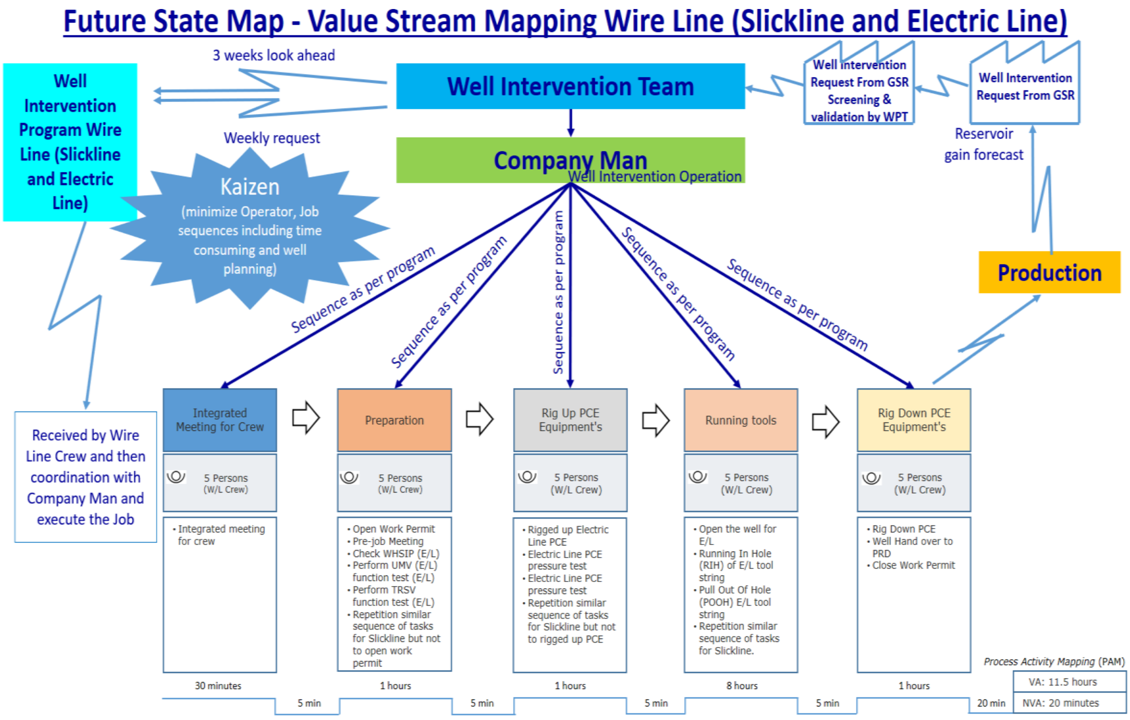

Figure 5. Future State Map - Value Stream Mapping Wire Line

As the title and purpose of this thesis are to make efforts to suppress operational costs, it is necessary to compare the costs incurred, both current costs and with plans for submitting operational costs in the future, where this has been attempted through the initial step, namely by analyzing and then issuing proposal for Business Process Re-engineering (BPR) of the current business process. With the aim of efforts to reduce costs, as a comparison to these steps, look at the Owner Estimate for Wire Line operations (Slickline and Electric Line) where with this comparison of course a cost calculation step will be taken which will be used as a cost reduction proposal for the operation.

After analyzing the business processes and costs incurred by Wire Line operations (Slickline and Electric Line) where these two operations can be taken, Business Process Re-engineering (BPR) steps can be taken, namely by taking lean management steps including cost efficiency through the Owner Estimate price proposal in the calculation in table 8.

After recalculation from the Owner Estimate proposal above, it can be seen that the costs required for both operations in the next 3 (three) years are $35,986,893.60. From the data above, it appears that the Owner Estimate proposal is lower than before, so it can be calculated that the operating costs to be carried out later, both Slickline and Electric Line can be more efficient so as to reduce costs incurred by PT. XYZ to Slickline and Electric Line operations. The previous Owner Estimate was $46,189,720.35 per 3 years minus the Owner Estimate proposal for both operations in the next 3 (three) years amounting to $35,986,893.60, then the efficiency or cost reduction that can be done if this Owner Estimate proposal is approved by the authorities is $10,202,826.75 or by 22% for 3 years.

After the analysis is done and the data is collected, the arrangement is included in the analysis results to then take steps or strategies in implementing the lean management process, so that efforts to reduce costs for both operations, namely slickline and electric line operations at PT. XYZ can be done well. In the identification step of the various potentials or opportunities that exist through the business process, there are several work steps or business processes that repeat between the two types of work. Both slickline and electric line operations contain sequences or steps that are very similar even though they are not the same in execution, so this can be included in the type of work that will be used as material for improvement in optimization efforts at the company.

Table 8. Owner Estimate (OE) proposal for Slickline and Electric Line operations for 3 years

No	Type of service	Quantity	Unit	Est. No. of job for TTH + 1 OFF	Unit Price	Sub Total
1	Service charge					
	Service charge	1	ea	2763	0	-
2	Depth charge					
	Depth charge	3500	m	2763	$0.90	$8,703,450.00
3	Perforation 3-1/2" or 3-3/8" (6 spf)					
	Meterage charge	15	m	4	$380.00	$22,800.00
4	Perforation 2 7/8", scalloped, 6 spf, 60 deg, Deep					
	Meterage charge	4	m	286	$380.00	$434,720.00
5	Perforation 2-1/2", scalloped, 6 spf, 60 deg					
	Meterage charge	4	m	451	$380.00	$685,520.00
6	Penetration					
	Meterage charge	4	m	151	$380.00	$229,520.00
7	Perforation 2-1/8", exposed, 6 spf, 0 or 45 deg					
	Meterage charge	2	m	34	$380.00	$25,840.00
8	Perforation 2", scalloped, 6 spf, 60 deg, deep penetration					
	Meterage charge	4	m	911	$380.00	$1,384,720.00
9	Perforation 1-11/16", exposed, 4 spf or 6 spf, 0 deg					
	Meterage charge	2	m	126	$380.00	$95,760.00
10	Orienting tool					
	Flat charge per succesfull run	1	run	28	$10,640.00	$297,920.00
11	Real time P/T gauge while perforating					
	Flat charge per succesfull run	1	run	25	$380.00	$9,500.00
12	Anchor tool					
	Flat charge per succesfull run	1	run	6	$228.00	$1,368.00
13	Puncher					
	Shot charge	1	m	120	$228.00	$27,360.00
14	Dynamic Underbalance System					
	Design charge per well	1	ea	26	$380.00	$9,880.00
15	Cased hole neutron log					
	Survey charge (Sigma mode)	800	m	12	$3.80	$36,480.00
	Survey charge (Corbon oxygen mode)	250	m	12	$7.60	$22,800.00
16	RST WFL					
	Survey charge per station	5	ea	9	$760.00	$34,200.00
17	PLT					
	Survey charge	3000	m	37	$0.38	$42,180.00
18	Sand Detection Logging					
	Survey charge	2000	m	12	$0.91	$21,840.00
19	GR-CCL logging					
	Flat charge per run	1	run	12	$380.00	$4,560.00
20	Setting Service (Bridge Plug)					
	Flat charge per setting	1	run	425	$11,400.00	$4,845,000.00

21	Cassing Patch Setting					
	Flat charge per setting	1	run	308	$16,000.00	$4,928,000.00
22	Thru Tubing + Setting tool					
	Flat charge per successful run	1	ea	12	$2,660.00	$31,920.00
23	Dump Bailer					
	Meterage charge per run in hole	2	run	67	$7,220.00	$967,480.00
24	Chemical cutter for all sizes tubing					
	Flat charge per succesful run	1	run	4	$11,400.00	$45,600.00
25	Tubular jet cutter for all sizes tubing					
	Flat charge per succesful run	1	run	5	$798.00	$3,990.00
26	Multi Arm Imaging Calliper Tool					
	Survey Charge	1200	m	8	$0.38	$3,648.00
27	CBL/VDL					
	Meterage charge	2000	m	259	$0.38	$196,840.00
28	Dowhole Tension					
	Flat charge per run	1	run	2	$76.00	$152.00
29	Mono cunductor jar					
	Flat charge per run	1	run	2	$228.00	$456.00
30	Stringshot					
	Detonation charge (per shot)	4	ea	3	$228.00	$2,736.00
31	Electricline roller					
	Flat charge per run	1	run	3	$1,520.00	$4,560.00
32	Depth Determination					
	Flat charge per run	1	ea	5	$380.00	$1,900.00
33	Mast Utilization					
	Monthly rental	1	month	36	$10,500.00	$378,000.00
34	Costumer Instrument Services (CIS)					
	Flat charge per run	1	run	28	$5,320.00	$148,960.00
35	Incomplete Operation					
	Flat charge	1	ea	102	0	-
36	Personnel					
	Daylight personnel	4	days	1095	$1,250.86	$5,478,766.80
	Night personnel	4	days	1095	$1,250.86	$5,478,766.80
Grand Total					$34,607,193.60	

In the business process of the two operations, there are several steps that are indicated to be similar in completion, therefore as an optimization effort, it will be used as a decision-making step in the discussion step. Here are some steps that we can analyze the business processes in both operations, both slickline and electric line operations, including the following:

1. Slickline operation;
   a. Integrated Meeting for Crew
   b. Preparation
   c. Rig Up PCE Equipment's
   d. Running tools
   e. Rig Down PCE Equipment's
2. Electric line operation;
   a. Integrated Meeting for Crew
   b. Preparation
   c. Rig Up PCE Equipment's
   d. Running tools
   e. Rig Down PCE Equipment's

The research on business processes or sequences above, there are some of them that fall into the category of repetition in the steps or business processes, so that they can be used as findings that become waste that can be optimized. From all the results of this study, the researcher included it in the chapter of data collection and processing which in the separation of the data was included in the preparation of Value Stream Mapping (VSM) of the work or operation of Slickline and Electric Line including:

1. Product family or Slickline and Electric Line operation steps.
2. Current state map of Slickline and Electric Line operations

3. Design future state map of Wire Line operation.

From the three steps mentioned above, the researcher found things, including being able to make any steps that can be taken in an effort to reduce Slickline and Electric Line operating costs as an effort to reduce costs at PT. XYZ as further deepened in the discussion as the next step.

In this discussion step, which is a step in determining what steps will be taken as a decision to make the company able to reduce the costs of the two operations which, if seen, consume a significant amount of the company's budget. From the entire series of analyzes, some of which include waste, including:

1. Step Rig up PCE (Pressure Control Equipment) for both Slickline and Electric Line operations.
2. Step Rig down PCE (Pressure Control Equipment) for both Slickline and Electric Line operations
3. Number of workers involved from both Slickline and Electric Line operations.
4. Slickline and Electric Line operation process.

From the four major steps above, the researcher took lean management steps as an effort to reduce operating costs, where in the steps it can be seen that in the separation of the data it is included in the preparation of Value Stream Mapping (VSM) from work or Slickline and Electric Line operations, which is as determined by each business. the process in the Product family or Slickline and Electric Line operation steps first, then a framework or chart is made in the form of a Current state map of the Slickline and Electric Line operations so that it can be seen how much potential optimization is in eliminating existing waste, then finally create a framework or chart in the form of Design future state map of Wire Line operation so that it can produce maximum optimization in research

CONCLUSION

After analyzing the flow of steps from the Well Intervention work, especially the work or operation of Slickline and Electric Line, the researcher concludes in the step of cost suppression at PT. XYZ, among others, is doing the preparation of Value Stream Mapping (VSM) of the Slickline and Electric Line work or operations with the first step, namely grouping the Product family or Slickline and Electric Line operation work steps, then secondly grouping the Current state map from Slickline and Electric operations. Line and thirdly design the future state map of Wire Line operations. After doing the three things mentioned above, it can be concluded that there are some potential wastes to be taken for lean management so that the cost suppression on Slickline and Electric Line operations can be carried out. This step is based on an analysis where the Rig up and Rig down PCE (Pressure Control Equipment) steps for both Slickline and Electric Line operations have the potential to be reduced, then reduce the number of workers involved and several repetitions of the Slickline and Electric Line operation processes also have the potential to reduce flow. steps of work at the time the work intervention is carried out. By analyzing several activities in the Well Intervention work process, especially the Slickline and Electric Line work or operations, the researcher took several steps in an effort to reduce operational costs through the business process re-engineering of the slickline and electric line operations combining slickline and electricline in 1 (one) unit or 1 (one) company service, reduce the number of workers involved, and efficient work, by reducing the Rig up and Rig down PCE (Pressure Control Equipment) processes, reducing the repetition of the work intervention process.

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