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Increasing Company's Profitability through Achieving Crude Distillation Unit Production Target at PT. XXYZ, Indonesia

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ABSTRACT: PT XXYZ is an oil and gas industry company that is a downstream company, namely a company that processes crude oil into various products that are ready to be transferred to the market. Oil and gas companies, especially PT XXYZ, are certainly faced with various challenges that need to be faced related to future business continuity, in the form of the challenge of substituting fossil sources with environmentally friendly energy followed by rapid technological developments. PT XXYZ is also faced with the challenge of always being able to respond to changes in demand in the market and able to maximize the production until distributing it to customers. PT XXYZ has a problem in CDU production which is not achieving the monthly production target. The company has loss 103.5 million barrels of products that can be produced which is equal to losing 8 million USD. The production monthly target is determined based on STS documents. Several factors that can affect production are quality of materials, quantity, unplanned shutdown/slowdown, operational limitation, and low intake. Based on the root cause analysis using the Ishikawa Diagram method, it is concluded that the main problem that may be solved by PT XXYZ is related to the supply activities and material readiness. Inventory management at PT XXYZ not implementing a policy to be able to control stock and avoid losses in inventory. PT XXYZ experienced stockout on various materials and the safety stock level tends to be stagnant and all materials have the same safety stock value. By carrying out inventory management using the Q-model, the company has a standard and policy for each crude oil material, so as to reduce the risk of stockout and hopefully will maximize the needs of CDU production. PT XXYZ gains more profits by saving 56.4 million USD in inventory cost and able to achieve the production target with 95% of service level.

KEYWORDS: CDU production, Downstream business, Inventory Management System, Ishikawa Diagram, Oil and gas, STS document.

INTRODUCTION

In today's era, conventional business/company is facing more challenges to be able to survive to their business continuity in the future. Conventional businesses such as the oil and gas industry facing many challenges due to lessening world dependencies on oil as an energy resource. Shifting in fossil energy, changes in market demands, the rapid development of technology, and expensive oil prices will drive the company to be able to survive in competition company. PT.XXYZ as an oil and gas downstream business has an obligation to process the crude oil until become various products that will be directly deliver and distribute to the market. The fuel and other products always increase in demand all time, and it has become the company's duty to make sure and maintain its production with the aim to fulfill the daily/monthly target. The overall production analysis showed that PT. XXYZ still not achieving the production target stated in the STS documents. The company needs to figure out what critical factors that can affect the CDU production performance. Historical data and a company's business situation become the main data to map the business issue, find the root causes, and conclude it to determine what data needed to be used as processing data to find a business solution. With the use of management inventory control to overcome the problem, the company may use the result as their inventory policy which has been updated and developed to respond to the demands. A new method needed to be implemented to avoid a loss in sales or achieving maximum profits.

CONCEPTUAL FRAMEWORK

Conceptual framework according to *Smyth 2004,* the framework can help the researcher to explore the business issue by identifying the problem and generating a research question. This framework is explained about theory and factors related to the topics or issues. The factors are generated based on group discussion and obtained from the company's actual condition, perspective, and experience,

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especially in the refinery production activity. There are also theories that strengthen the factors in response to the issue of the unfulfillment target of CDU production. There are five factors that can influence the achievement of the CDU production targets in PT. XXYZ. The unfulfilled lifting product may happen due to an unplanned shutdown/slowdown capacity. This might happen due to a decrease in market demand which requires the company to slow down the production activity, or it can be affected by factors that make operations stop within 3-7 days. These factors might be happened due to uncontrolled corrosion, age of equipment, ad natural disasters such as fires (Shore, 2007). The other factors are feed's characteristics. The quality of raw materials (crude oil) can be seen from its characteristics such as unique molecular, chemical, and also physical properties (*Jukic, 2013*). This variation is caused by the different locations of crude oil with having a unique reservoir condition. The high sulfur or salt content will harm the operation due to corrosion, tool damage, poor quality of finished product, and can disrupt the product flow in the pipe. This condition will be evaluated and will be re-adjusting of production activity by the company even though it has to lower the production level/activity. The next factor is inventory limitation. Referring to *Andari,2016*, too many inventories (or raw materials) will harm the companies since they have to spend a lot of expenses, and invest capital in the inventorying process. On the other hand, the small number of inventories will also harm the company, because the production process will suffer and the distribution is also be disturbed. The ability to maintain raw materials and availability will ensure the good flow of the production process with good quality, proper time, and effective cost. The inventory control system is a system that contains operating policies for maintaining and controlling goods to be stocked. The system is responsible for ordering and receipt of goods which also considers the time of order placement, keeping track of what has been ordered, how much, and from whom. Managing inventory is one of the factors that can improve the company's profit by running an effective and efficient system through managed ordering requests, replenishment, and controlling stock. Multiperiod inventory systems are designed to ensure that an item will be available on an ongoing basis throughout the year. Usually, the activity of ordering items or raw materials is carried out several times a year which requires the system to know how much order quantity is needed, and the timing of the order. The multiperiod inventory system is typically divided into two types, which are fixedorder quantity models (also called economic order quantity EOQ/Q model) and fixed-time period models (periodic review system). The multiperiod system divides into fixed order quantity and fixed time period which differs and are distinguished based on the following points and assumptions (*Robert and Richard, 2015*):

Table 1.

	Q-Model	**P-Model**
Feature	**Fixed-Order Quantity Model**	**Fixed-Time Period Model**
Order Quantity	Q-constant (the same amount ordered each time)	q-variable (varies each time order is placed)
When to place order	R-when the inventory position drops to the reorder level	T-when the review period arrives
Recordkeeping	Each time a withdrawal or addition is made	Counted only at review period
Size of inventory	Less than fixed-time period model	Larger than fixed-order quantity model
Time to maintain	Higher due to perpetual record keeping	Efficient, because multiple items can be ordered at the same time
Type of items	Higher-priced, critical, or important items	Typically used with lower-cost item
AIL	Less than P-Model	More than Q-Model
Price of Items	More expensive items because of lower AIL	Less Expensive

RESEARCH METHODOLOGY

This research approach 'research onion' principal developed by (Saunders, 2019) where there are several layers that show how many processes we need to conduct to build and determine the research method which starts with philosophy and theory

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development until the deepest layers that show the process of data collection and data analysis. Theory development in this research isusing a deductive approach. The deductive approach is basically starting with the theory or academic literature, and designing a research strategy to make an implementation to overcome the business problems. The methodology that will be used for this research is using mix analysis which is qualitative and quantitative method. The purpose of the qualitative analysis is to gather the data of company perspective, experience, and also to evaluating the business process. Archival research is a quantitative method of data collection of company historical data, reviewing, and processing the data to be evaluated, and proposing a new solution for business problems.

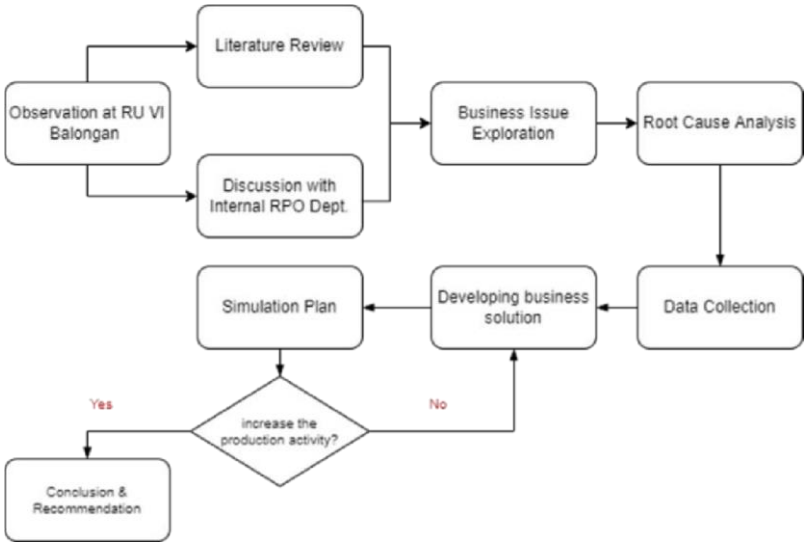

Figure 1.

The research design is a flow of the research and explain how the research is conduct start from observation until generating a solution and control phase. This research Design is implementing DMAIC concept (Define, Measure, Analyze, Improve, and Control). Defined process the activity is observation at RU VI including the activity of discussion with the internal department and also finding the related theory to be compared with the existing condition. Measuring stage is a process of a business issue exploration by finding the gap between production data and real production data and also finding the related factors and literature to the business topics or issue. the analysis stage is to find the root cause of the problem that is explained in general based on the company's view and also analyze the alternatives of solutions to the business issue. the improvement process is an activity of developing business solutions and making an implementation plan through simulation and theory verification. the control phase is to ensure if the production activity can achieve the target or not. The developing stage is a process that is carried out repeatedly until the solutions provided can effectively help the company deal with problems.

FINDINGS AND ARGUMENTS

This research uses SCOR model to explain briefly about the business process. SCOR is one of the PMS (performance management system) that commonly used by all industries, showing the six-management process such as *plan, source, make, deliver,* and *return (Thunberg,2016)*. In the planning process of CDU's production, company work with another party to deliver the marketing analysis, forecasting, and providing detailed STS documents of what PT.XXYZ should be accomplished. To achieving the target, PT.XXYZ must be preparing the change of production capacity, materials that needed to be process, workers, etc. For the procurement process of goods and services, PT. XXYZ also works with many parties' companies with each of company will contribute to support operation needed in Refinery work place. The flow activities in procurement start with the delivering production activity report that will receive by the procurement department and will be conduct another process until it makes order request to various suppliers. After the items arrives at Refinery, the ship of crude oil container will be transfer to the CDU as one of the important units to process

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crude oil in early stage/phase. This phase facing many problems which one of the problems is the company still don't have the policy in inventory management, refer to the stagnant or same number of safety stock level for each material, and many materials have a status below the safety stock level. After the process in Crude oil and transferred to the next process in refinery, the products will be delivered to the market and collaboration with other parties who will manage the distribution and marketed to customers. With realizing the business situation in PT.XXYZ, this research also conduct root cause analysis or Ishikawa Diagram to map the root of the problems and determine which causes that want to be solve based on the company capability.

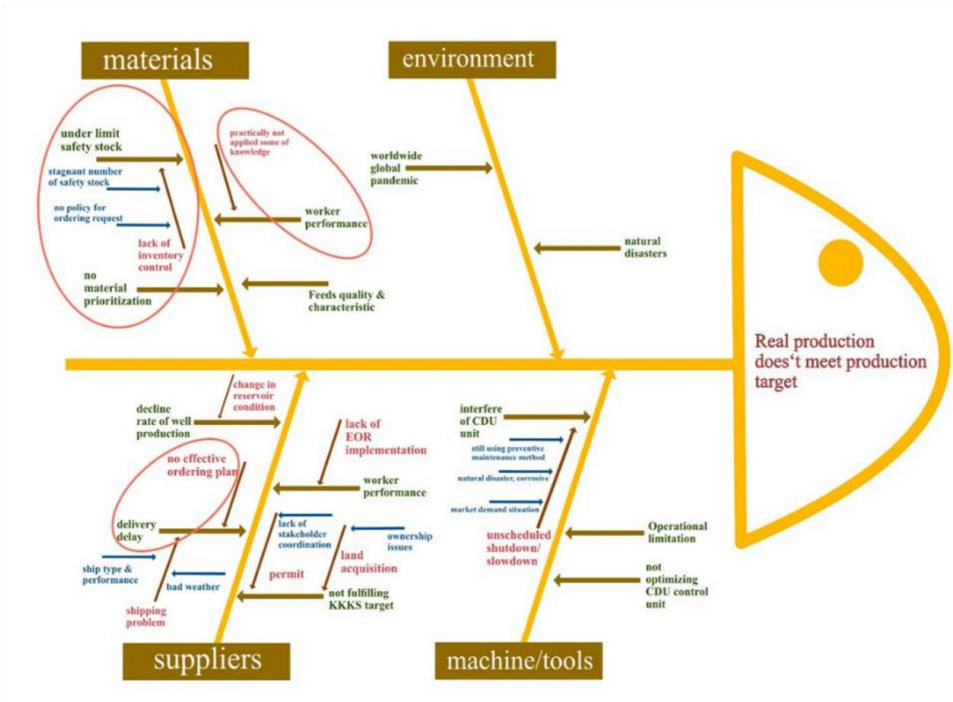

Figure 2.

From all the possibilities of the roots of problems, which considering the ability to solve by the related department, and the rest of the problems is the external factors and not internal responsibility, we conclude that the focus problem is on materials category which has a strong connection with the suppliers. Based on the review of the historical data in the company, The CDU production not reach the target due to limited stock of material where company often experiencing stock of quantity below the safety stock level. This material limitation is also evidenced by supply or order activity and final stock data on companies that continue to experience declines. The alternatives and solution is needed to overcome the problems that arise, especially to regulate the company's inventory policy.

The multiperiod inventory system, based on the policy, characteristic, it's concluded that Q-model is more appropriate and fit with the condition and situation experiencing by PT. XXYZ. The policies were considered based on the fluctuating demand condition, suppliers' condition, the principle of orders, and also considering the unwanted situation such as shutdown and slowdown capacity. Calculations using the Q-model on Super Heavy Crude and Heavy Crude oil are one way to carry out an inventory control system. The Q-model produces the optimum order quantity, safety stock, and the standardization of reorder point for each material which is calculated using the theoretical formula. There are limitations that the results of calculations and the resulting figures are representative results of four months of data. However, the processed data has a fairly high level of accuracy because the operation process, ordering activities, are obtained from the daily data so that there are over 122 data being processed. The following is a table of the results of the analysis and Q-model of the Super Heavy Crude Oi and Heavy Crude Oil:

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Table 2.

No	Raw Materials	Class	Safety Stock per day (MB)	Reorder-Point (MB)	Economic Order Quantity (MB)	Ordering Frequency per month
1	Duri	Super	15.60	102.4	375.32	2
2	Cinta	Heavy	4.11	39.0	168.56	3
3	V1250	Crude	149.35	258.9	159.56	3

Table 3

No.	Raw Materials	Class	Safety Stock per day (MB)	Reorder-Point (MB)	Economic Order Quantity (MB)	Ordering Frequency per month
1	SLC	Heavy	165.43	228.74	185.28	3
2	Cabinda	Crude	364.77	460.83	105.65	2
3	Rabilight		133.85	168.33	63.29	1
4	JMCO		26.52	31.02	85.55	2

Instead of using Total Inventory Cost (TIC) to evaluate the effectiveness and economical in inventory cost, based on (Mursyid et al, 2018), most of the research hasn't shown the sensitivity of changing the amount of ordering cost and holding cost to Average Inventory Level (AIL). The AIL is is the amount of inventory that was carried from time to time which is affected by number of quantities of order and company's safety stock. Here is the implementation of AIL calculation that will be compare with the AIL actual condition:

Table 4.

Material	Super Heavy Crude					
	AIL Actual	AIL Q-model	AIL P-model	Gap Q-model	Gap P-model	Category
Duri	347.95	203.26	131.41	144.69	216.537	Overstock
Cinta	137.97	88.39	72.930	49.58	65.045	Overstock
V1250	152.97	229.13	216.367	-76.15	-63.392	Understock

The AIL calculation can be assumed that the inventory or stock in Refinery Unit VI is overstocked or understocked. If the calculated AIL has a smaller value than the actual AIL, then the material at the company is experiencing overstock where the company excesses its expenses/invest in inventory. On the other hand, if the AIL calculation is higher than the actual AIL, the company will experience an understock of materials and inventories. Duri and Cinta are included in the overstock category where when using the P-model and Q-model the AIL value is smaller than the actual AIL while the V1250 material is included in the understock category where the actual AIL is smaller than the AIL calculation. This small actual AIL needs to be further investigation of service level of the V1250 material.

Table 5.

Material	Heavy Crude					
	AIL Actual	AIL Q-model	AIL P-model	Gap Q-model	Gap P-model	Category
SLC	360.67	258.07	332.48	102.6	28.193	Overstock
Cabinda	164.47	417.59	305.29	-253.12	-140.8	Understock
Rabilight	60.37	165.49	126.41	-105.12	-66.03	Understock
JMCO	35.72	69.2	87.756	-33.56	-52.03	Understock
BUCO	56.02	154.56	214.086	-98.54	-158.06	Understock
Klamono	4.95	30.85	29.78	-25.9	-24.83	Understock

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For heavy crude oil material, almost all materials are included in the understock category where the actual AIL is smaller than the calculated AIL. This small actual AIL can be assumed that the company does not purchase material excessively which is a good thing to increase company profit, another possibility is whether the production target can be met or not. Based on the calculation of inventory cost, the overstock material category with using the Q-model approach, can save inventory cost up to 65.4 million USD. The all-understock material after service level calculation, actually has a service level number below 80%. It can be concluded that if using the Q-model approach, it can save inventory cost, and able to achieve the production target with 95% of service level.

CONCLUSIONS

With an average loss of 103.51 million barrels that can be produce and equal of lossing 8 million USD, the researcher proposes a new implementation of a multiperiod inventory system (Q-model) to be applied by the company as their new inventory policy. A new policy to determine when to order, and how many quantities to order are able to minimize the risk of inventory stockout and updated the stock level of each material. Implementation of the Q-model with the limitation and availability of data has succeeded in increasing CDU production to reach the target of 100%. Besides that, other benefits of this Q-model are success to save the inventory cost up to 65.4 million USD and able to increase a service level up to 95% that can achieve the CDU production target at PT. XXYZ.

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