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Value Stream Mapping (VSM) Implementation as an Effort to Reduce Delays in the Procurement Process at PT. DI

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A B S T R A C T

PT. DI is a company engaged in the oil and gas business, to support smooth production, a good procurement process is needed, procurement is an activity to obtain goods and services in a transparent, effective and efficient manner. Based on 2017 data, there were 148 procurements with a value of less than 2.5 billion carried out by PT. DI, from this data there were 24% of procurements whose completion was far from the target. Of the 148 procurements carried out, procurement with code A4100000121 had the highest delay rate of 32 days. The delay in the A4100000121 procurement activity made the oil production process, therefore it is necessary to identify waste as an effort to reduce the delay time. The method used is Value Stream Mapping, this method is used to identify processes that contain waste so that existing waste can be eliminated. The results of this study are a decrease in the time between the Current State VSM and the Future State VSM with a total time of 39425 minutes for the Current State VSM and 23085 minutes for the Future State VSM so that the time will decrease by 16340 minutes.

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1. INTRODUCTION

One of the oil and gas companies engaged in upstream business activities is PT. DI. These organization consists of five departments, namely field manager, admin and support manager, operation manager, exploration manager and finance manager. One of the important activities in a company is the procurement of goods. Procurement is an activity to obtain goods or services in a transparent, effective and efficient manner according to the needs and desires of its users. Procurement of goods at PT. DI is coordinated by SCM (Supply Chain Management). SCM (Supply Chain Management) is part of the admin and support manager. SCM is responsible for procurement (procurement of goods), logistics, inventory assets and customs. SCM at PT. DI focuses on the procurement of goods and services. The process of procuring goods and services starts from the user asking for a Procurement Request, which is a form that contains the needs of the user, then SCM makes a Request For Quotation (RFQ), namely a request for price quotes to vendors, the vendor selection process, and the issuance of PO/SO, namely orders that are shown to vendor.

The procurement process at PT. DI is divided into large tenders and small tenders, based on finance value. Small tenders are tenders with a value of less than 2.5 billion while large tenders are tenders with a value of more than 2.5 billion. Based on data in 2017 there were 148 procurement processes with a value of less than 2.5 billion carried out by PT. DI, from this data there were 43% of procurements that were completed beyond the target time set by the company, 24% of procurements completed were less than the target , and 33% of the procurement completed according to the company's target date. The targets set by SCM include the target time for the procurement process carried out in the SCM (Supply Chain Management) Department starting from the PR request until the issuance of the PO / SO. This target time is intended so that the process of procuring goods / services can be completed according to user requests. Delays in the procurement process can result in production delays and not achieving production targets.
Based on the 2017 procurement data, it shows that the procurement of goods and services with number A4100000121 has the highest level of delay, namely 32 days, so an analysis is needed to find out what factors are causing the delay and a proposed value stream mapping (VSM) is made as an effort to reduce this delay (Abdulmalek & Rajgopal, 2007). According to (Womack, 2011) Value Stream Mapping is an effective way to find waste and show process improvements. VSM is important to use because it is able to identify waste processes in company systems.

In relation with these problems it is necessary to make improvements in the hope that the A4100000121 procurement process at PT. DI can be completed according to the target time set by the company, which is for 75 days so that the production process can run smoothly. Improvement is done by analyzing the causes of the long procurement time using a fishbone diagram to determine the causes and consequences of a problem. According to (Utomo, 2020), a fishbone diagram is a diagram that depicts lines and symbols that show the relationship between the causes and effects of a problem, then corrective action is taken.

Then in accordance with the purpose of this study, to reduce the risk of delays in the procurement of goods and services A4100000121 at PT. DI, an effort is made to reduce lead time using the lean manufacturing concept. The impact from VSM approach will eliminate time for part preparation in automotive spare part center (Purba et al., 2018).

2. LITERATUR REVIEW

According to (Yansen & Bendatu, 2013) the creation of a current state value stream mapping is used to identify and find out what processes are happening. In addition, it can also be used to determine the flow of information during the process. The VSM method is said to be one of the methods that applies a visualization image that is most efficient in describing the current state of a system, and is able to identify a long-term vision and be able to develop a company plan to achieve the desired goals (Grewal, 2008). Research by Setiawan et al., (2021) confirmed that VSM can serve as a complementary approach that capable of improving results in many areas.

In this context, lean thinking concepts have gained a lot of attention in the past decade in terms of identifying and removing wastes from manufacturing and many service industries. (Joosten et al., 2009). Particularly, the implementation of lean thinking concepts in manufacturing has turned out to be a more enduring advancement of earlier research works (Tyagi et al., 2014). VSM is a powerful tool that enables the visualisation and understanding of the flow of material and information through the value chain. It is used to provide a global vision of the activities involved in the production process, and so, it enables the identification of wastes sources (Trimarjoko et al., 2020). Lower production costs, faster response time to the customer and higher quality of products are therefore outputs that can be expected when applying VSM to a production process (Lacerda et al., 2016). The developed method of Value Stream Mapping is capable of systematically visualizing, analyzing, and optimizing multistage manufacturing processes from a quality assurance viewpoint (Haefner et al., 2014).

The procedure model consists of four consecutive phases: preparation, quality value stream analysis, quality value stream design, and implementation (Natakusuma et al., 2018).

3. RESEARCH METHOD

The research steps used in solving problems in procurement A4100000121 include the stages of problem identification, review of previous studies relevant to the case in this study, data collection and processing, VSM analysis and fishbone diagrams.

Data collection was carried out through direct observation, literature study, and interviews. (Bar-Ilan, 2001). The data that has been obtained is divided into two, namely primary data and secondary data. Secondary data collected is in the form of goods and services procurement data in 2017. Primary data collected is in the form of data to recapitulate the time of the procurement process: (a) Direct Observation: through direct observation, data is obtained in the form of recapitulation of the procurement process time. The time data obtained is taken using the stop clock method or stopwatch which is then recapitulated, but not all processing times can be done directly (Khanghahi & Azar, 2018). In addition to using the downtime for data collection, it is obtained by calculating the time required based on the date stated in the letter or document, (b) Literature Study: this technique is done by reading and studying literature that is in accordance with the problems in the company, literature in the form of books, journals, and papers of experts (Snyder, 2019), (c) Interview: interviews were conducted by giving several questions to the procurement department employees to determine the time for the procurement of goods A4100000121, in which the processing time could not be obtained through direct observation (Bampton & Cowton, 2002). In addition to knowing the processing time, interviews were also conducted to obtain other complementary data related to the procurement of goods and services A4100000121.

Data Processing

Data processing was carried out using two methods. Value Stream Mapping method and fishbone diagram: (a) Value Stream Mapping: VSM is used to identify waste in the procurement process A4100000121. Current State Value Stream Mapping is used to identify waste in the procurement process A4100000121, while the Future State Value Stream Mapping is a suggestion for improvements to the procurement process A4100000121. (Yansen & Bendatu, 2013), (b) Fishbone Diagram: identification of the factors that cause the problem is done by making a fishbone diagram to identify the factors that cause the process time target for procurement of goods and services has not been fulfilled. A4100000121. (Utomo, 2020). The fishbone diagram was made based on the results of interviews with employees in the procurement department at PT. DI.

4. RESULT AND DISCUSSION

To know the flow of information during the process. The VSM method is categorized to be one of the methods that apply a visualization image that is most efficient in describing the current state of a system, and is able to identify long-term visions and be able to develop company plans to achieve the desired goals. Current State Value Stream Mapping is made based on the identification of value added activity and non value added activity in the process of procuring goods and services A4100000121. As shown in the following table.

Table 1. Identification value added time a non value added time

Flow process of procurement A410000121			
No	Process	Time (min)	Category
1	User prepare PR/MSR & Form HPS/OE	4800	VA
2	Waiting for survey	3360	NVA
3	User info ke SCM	480	NVA
4	SCM checking the documents	3360	NVA
5	SCM make RFQ based on PR	1140	VA
6	SCM send RFQ to vendor via email	10	NNVA
7	Waiting the offers letter	8640	NNVA
8	SCM open offers letter and make a bidtabulation	480	VA
9	SCM give bidtabulation to finance	15	NVA
10	Finance approve the bidtabulation	480	NVA
11	SCM give bidtabulation has approve to user	60	NVA

Flow process of procurement A410000121			
No	Process	Time (min)	Category
12	User review bidtabulation	3360	NNVA
13	SCM make a negoitation to vendor which is as a winner	480	VA
14	SCM send letter negoitation	10	NVA
15	SCM negoitation with vendor	8160	NNVA
16	SCM give an information to user by email	10	NVA
17	User review the negoitation	1440	VA
18	SCM make a BAHP	1440	NVA
19	SCM approved BAHP	480	NNVA
20	SCM send BAHP to user for approve	5	NVA
21	User approved BAHP	960	NNVA
22	SCM send BAHP to legal	5	NVA
23	Legal approve BAHP	480	NNVA
24	SCM send BAHP to finance	10	NVA
25	Finance approve BAHP	480	NNVA
26	SCM send BAHP to Jakarta management	10	NVA
27	Jakarta Management approve BAHP	480	NNVA
28	SCM anouncement the winner to all vendors	420	NNVA
29	SCM send the winner letter to all vendors	15	NVA
30	Vendor give a letter and rebutted	960	NVA
31	SCM evaluating the rebutted	1920	NVA
32	SCM send result of evaaluation to vendor	480	NVA
33	SCM make an anauncement to vendor	420	NNVA
34	SCM send a letter as not a winner to vendor who participate	10	NVA
35	SCM make Letter of Intent to win vendor	480	VA
36	SCM sent the letter	5	NNVA
37	SCM make PO/SO	2400	VA
38	SCM send PO/SO to Jakarta Management	15	NVA
39	Jakarta Man approve PO	1920	NNVA
40	SCM send PO has been approve to vendor	5	NNVA

Note :

- VA = Value Added
- NVA = Non Value Added
- NNVA = Necesary Value Added

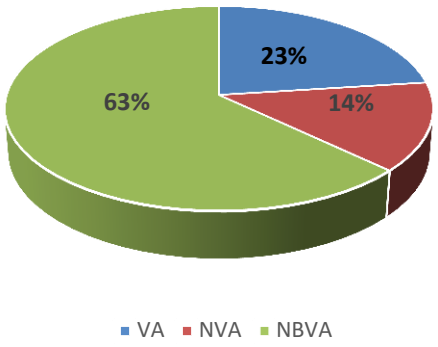

Fig. 1. Comparing VA and NVA

The time needed in the process of procurement of goods A4100000121 is 50945 minutes if converted into days is 107 days. The procurement process has been delayed for 32 days from the target set by the company, which is 75 days. This process shows that the percentage of value added time is 23%, non value added time is 77%, with the details of necessary but non value added by 63% and non value added by 14% with total value added time in procurement A4100000121 of 11520 minutes, while The total non-value added time is 39425 minutes. Value added time is an activity that provides added value to the company, non value added time is an activity that does not provide added value to the company, while necessary but non value added time is an activity that does not provide added value to the company.

Then the planner asks for information on the availability of material stock to the logistics department. After the logistics section checks the availability of material, the logistics section will immediately inform the planner.

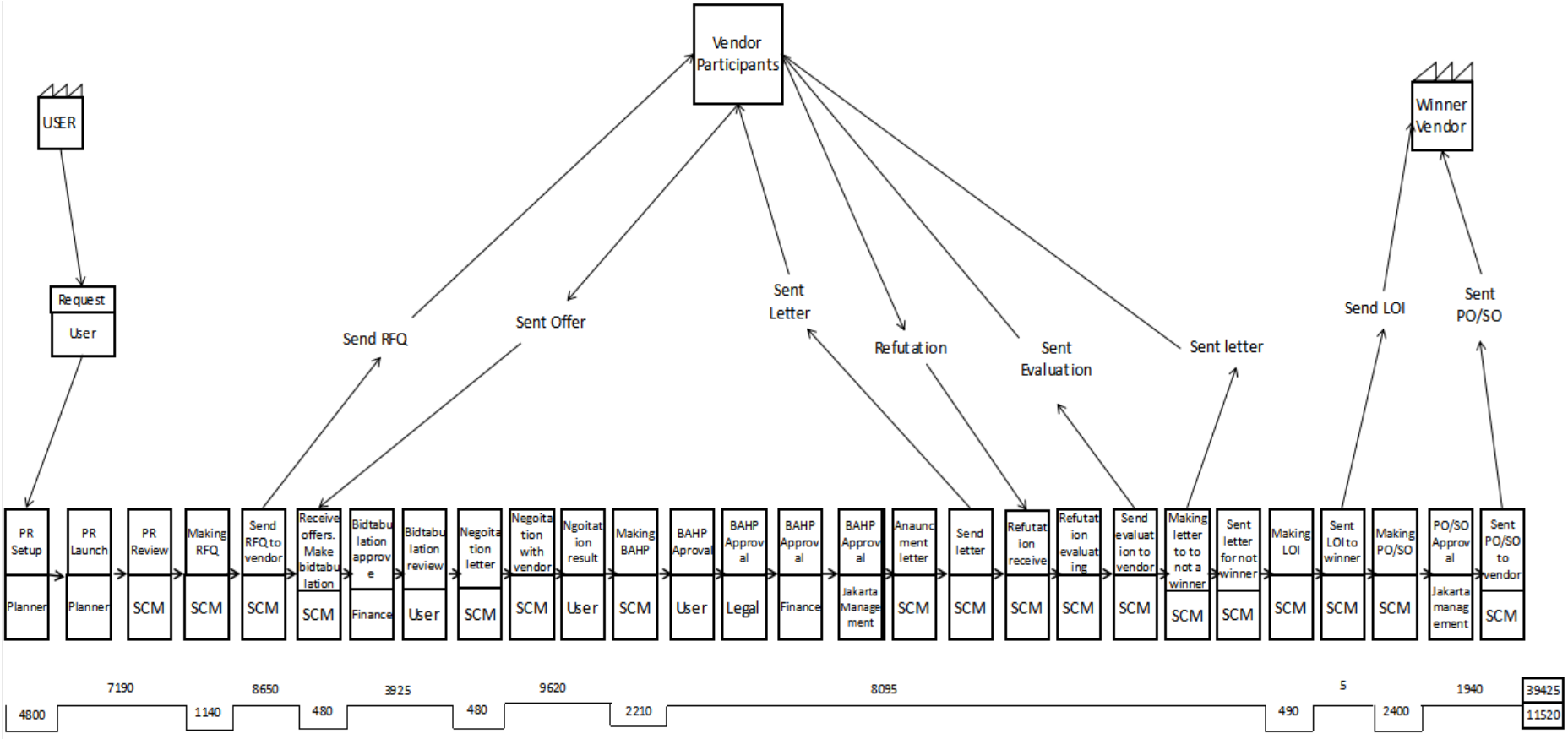

Fig. 2. Current state value stream mapping on A4100000121 procurement

After obtaining information on the availability of goods, the planner asks for approval to Field Management (company leaders in the field). Furthermore, SCM will carry out an RFQ (Request for Quotation) process, which is a request for a price quote to a vendor or provider of goods / services. Then the vendor sent by the RFQ will make a Quotation / offer that contains the price offered at the time of procurement of goods / service. After the vendor sends a price offer letter, SCM will open the offer in front of the finance company and make bidtabulation.

Fig. 2 shows the entire process flow and information contained in the procurement process A4100000121 starting from the user requesting a Purchase Request (PR) by attaching the request form and budgetary. After the bidtabulation is made, the bidtabulation is signed by the finance department. After the signature process is complete, bidtabulation is sent to the user for review. After the user reviews all bids in the bidtabulation sent, SCM makes a negotiation letter that is sent to the vendor appointed as the potential winner. After that the vendor makes a negotiation offer letter addressed to SCM.

After the SCM receives the negotiation offer letter sent by the vendor, the SCM informs the user about the results of the negotiations carried out. After the user reviews the negotiation results, the SCM makes a Minutes of the Auction Results (BAHP). After the BAHP is created, the BAHP must be signed by the user, legal, finance and Jakarta Management. After the BAHP is signed, SCM makes a winner announcement letter to all vendors. After all vendors receive a winner announcement letter, the vendor is given the opportunity to object. After the refutation period runs out, SCM makes a non-winning letter addressed to all vendors who have participated in the procurement of the goods / services. After all vendors receive a non-winner statement, SCM then creates a Letter of Intent (LOI) addressed to the winning vendor. After the vendor receives the LOI, SCM makes a PO (Purchase Order) or SO (Service Order). After the PO / SO is made, the PO / SO is signed by Jakarta Management. After the PO / SO has been signed, SCM sends the PO / SO to the winning vendor.

4.1 Waste identification on procurement A4100000121

According to (Adriyanto. W, 2015) waste is any activity that does not provide added value in the process of transforming input into output along the value stream. Waste identification is obtained through interviews with procurement employees at Supply Chain Management.

4.1.1 Waste of Processing

The approval process in SCM is a type of waste over processing, because this process requires documents to be approved to pass through many parts of the company so this process is less efficient because it does not provide added value and requires a long time. The PR review process carried out by SCM is also included in the waste of processing activity because this activity is in the form of checking the completeness of documents but this activity takes a long time. The negotiation process with vendors is also included in waste of processing activities, because this activity takes a long time and requires a lot of resources. The process of reviewing offers by users is also a type of waste of processing because this process does not provide added value for the company, this process only checks whether the offer given by the vendor is in accordance with what the user wants.

4.1.2 Waiting

Waiting is a type of waste because it is waiting for the next process. The activity of waiting for offers from vendors is included in the type of wasteful waiting activity because it takes a long time, and during the process of waiting for offers from vendors, SCM employees are unemployed. In addition, the activity of waiting for PR documents, HPS / OE after being reviewed is also a type of waste, because the review process is quite long, and the review process does not provide more benefits to the company.

4.2 Waste Procurement A4100000121 causes

The Fishbone diagram is a tool for identifying

various potential causes of a problem and analyzing the problem. The fishbone diagram is made based on the results of interviews with employees of the procurement department at PT DI. The following is a fishbone to describe the root causes of the problem of waste occurring in procurement A4100000121.

1. Approval BAHP process

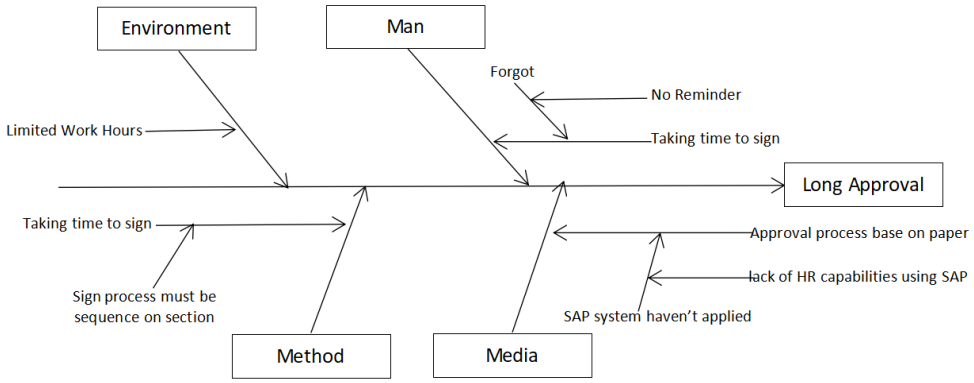

Fig. 3. Fishbone diagram of approval process

2. Document request review process by SCM

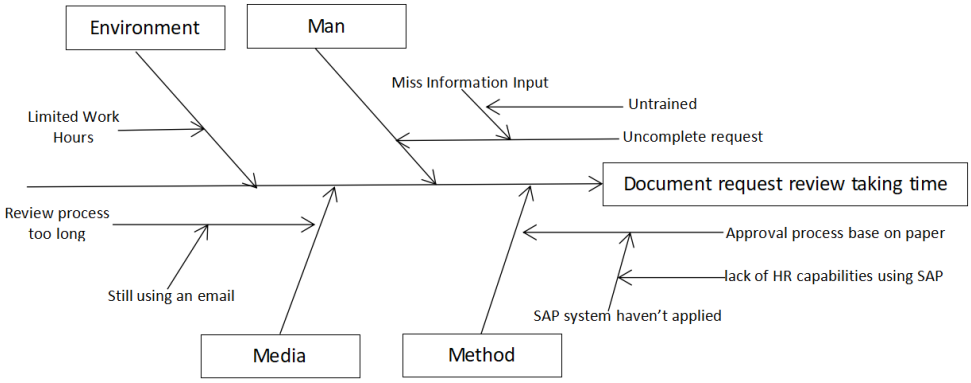

Fig. 4. Fishbone diagram of Document request review process

3. Offering review process by user

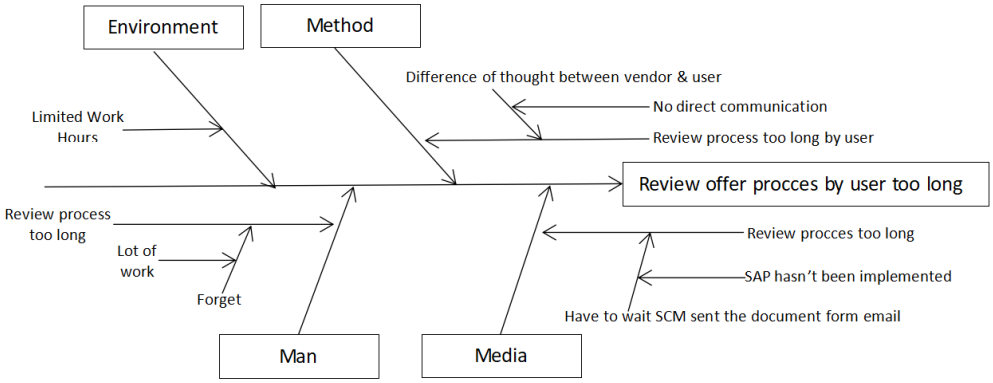

Fig. 5. Fishbone diagram of offering review process

4. Negoitation process

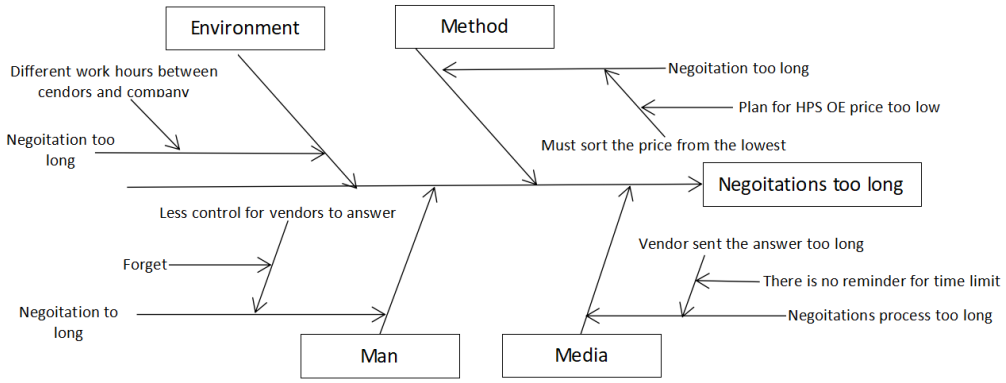

Fig. 6. Fishbone diagram of negoitation process

5. Waiting for the procurement document review

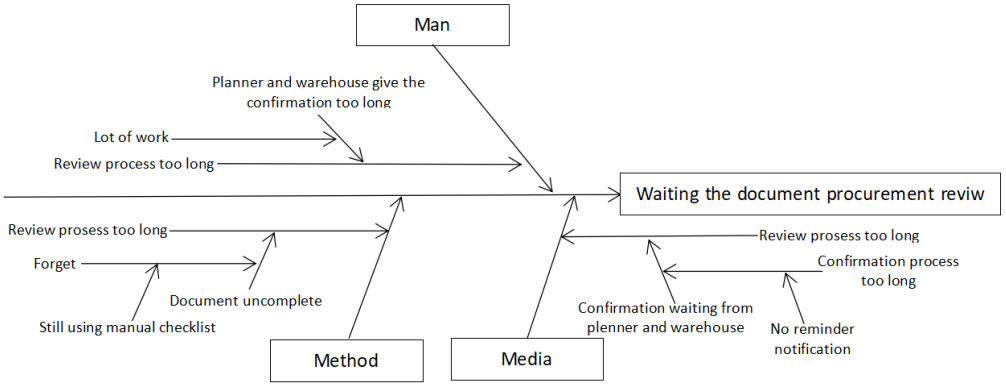

Fig. 7. Fishbone diagram Waiting for the procurement document review

6. Waiting for offers from vendor

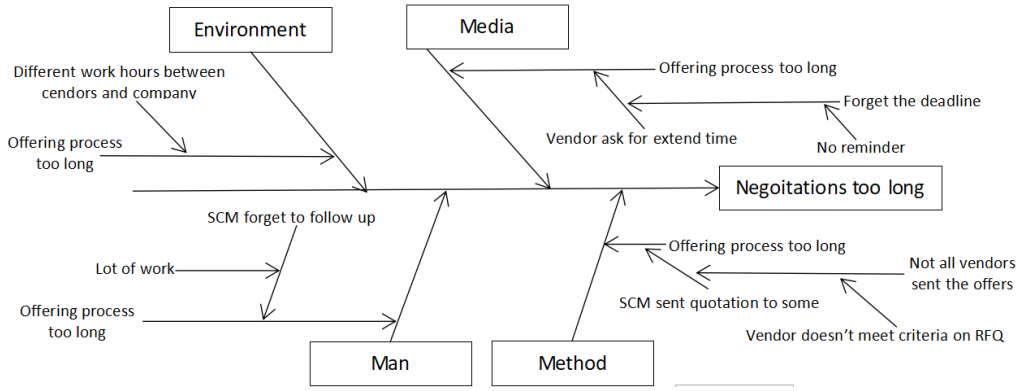

Fig. 8. Fishbone diagram of waiting for offers from vendor

Of the six existing wastes, most of the problems occur because of many things, in Man, the negligence factor occurs because of frequent forgetting and a lot of work piling up so that many jobs are late. Then on the environment, the influencing factors are the limited working hours of employees and the difference in working hours between company X and vendors. In Method, the influencing factor is that the procurement process is required to be signed by many parties. Furthermore, in the media, the influencing

factor is that the processes carried out in procurement activities are still manual and have not used an effective system. Thus, it is necessary to make suggestions for improvement in order to eliminate existing waste so as to shorten the time of the procurement process, especially in procurement A4100000121.

4.3 Proposed Improvement of Procurement A4100000121

This section describes the proposed improvements that are expected to reduce or even eliminate waste which is used as the basis for making future state value streams for procurement mapping A4100000121. This improvement proposal is obtained from the identification of the fishbone diagram, the detail can see in Table 2.

Table 2. Identification improvement for procurement A4100000121

No	Waste	Improvement proposed
1	Approval BAHP document process	Approval BAHP process can use SAP system that integrated with all part in the company
2	Review document request process by SCM	Give a training to user, so they can't in document completed, further to reduce user risk, make a checklist document
3	Offers review by user	With SAP or Procurement Checkpoint give the offers result to all part concerned
4	Negoitation process	Optimization SAP system to control form company to vendor and giving a reminding time limit notification
5	Waiting document request review	Optimization SAP system so that planner process for availability request process to warehouse is easier
6	Waiting offers from vendor	Follow uo process with SAP system that all vendor as a participant can receive a notification of time limit of tender

4.4 Future State Value Stram Mapping A4100000121

Future State Value Stream Mapping is a proposed improvement of current state value stream mapping by eliminating activities that are considered waste. Future State Value Stream Mapping is based on the proposed improvements that have been made.

A4100000121 procurement process starts from the process the user requests a Purchase Request (PR) until the issuance of a PO / SO. In the future state value stream mapping, changes are made to the document approval process, namely using the SAP system so that documents do not need to be signed manually and at the same time are able to reduce document waiting time, another change is to speed up the time it takes SCM to review request documents by providing training to the user regarding the request document and provides a checklist form so that the user does not make a mistake in sending the request document so that the document review process by SCM can be done more quickly.

To overcome the length of time that user reviews bids, it can be done by using a procurement checkpoint system so that users can review bids more quickly and no longer have to wait for SCM to send bids. Based on the length of the negotiation process in the procurement process A4100000121 is given a suggestion to optimize the SAP system in order to facilitate control of the company over the vendor. Based on the length of the process of waiting for the review of request documents proposed by the user, so that a proposal is given to optimize the SAP system so that the process of the planner in requesting stock availability information to the warehouse section can be easier, no need to use a manual system via email.

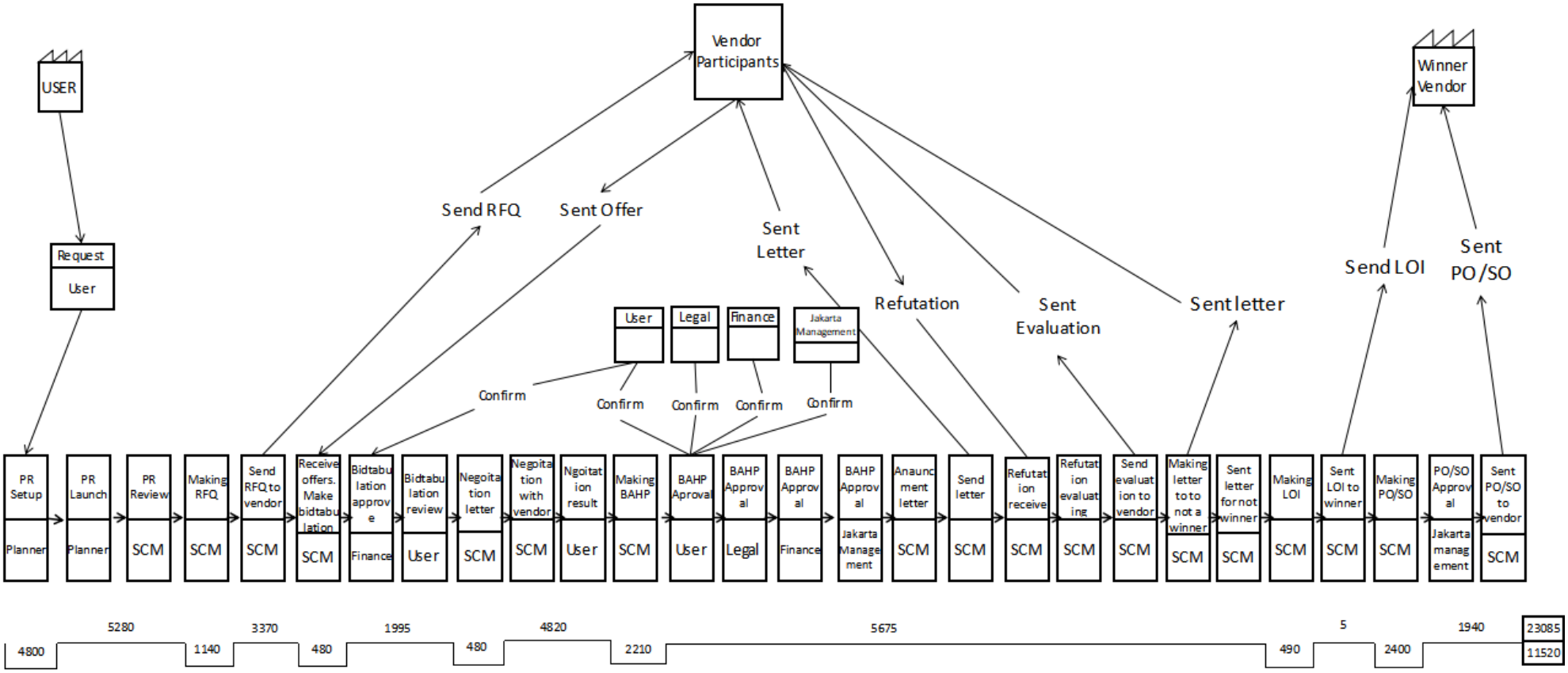

Fig. 9. Future State Value Stream Mapping A4100000121

To overcome the long process of waiting for offers from vendors, it is recommended that the company use the SAP system to send notification reminders regarding the time limit given to vendors regarding price quotes. The total time in future state value stream mapping in the procurement process A4100000121 shown in Fig. 9 is 34605 minutes if converted into days is 73 days, 2 days faster than the company's initial target of 75 days.

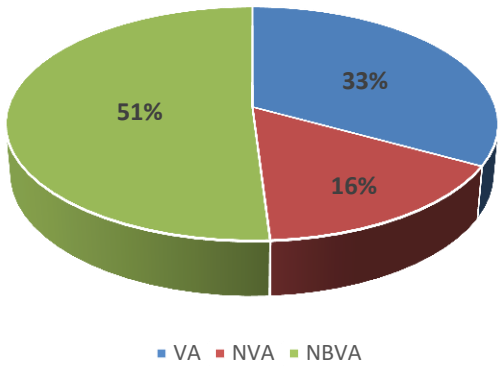

Fig. 10. Comparing VA and NVA

In the future state value stream mapping condition, it shows that the total percentage of value added time in procurement A4100000121 is 33%, while the percentage of total non value added time is 67% with details of non value added time of 16% and necessary non value added time of 51% with The total value added time is 11520 minutes, while the total non value added time is 23085 minutes. Value added time is an activity that provides added value to the company, non value added time is an activity that does not provide added value to the company, while necessary but non value added time is an activity that does not provide added value to the company.

4.5 The difference between Current State Value Stream Mapping and Future State Value Stream Mapping in procurement A4100000121

This section explains the difference between Current State Value Stream Mapping and Future State Value Stream Mapping in procurement A4100000121 which includes the percentage of value added time, percentage of non-value added time, total value added time and total non value added time.

Table 3. Diference of current state VSM with future state VSM on procurement A4100000121

Type of value	Current State Value Stream Mapping	Future State Value Stream Mapping
Value added time percentage	23%	33%
Non value added time percentage	77%	67%
Total value added time	11520 min	11520 min
Total non value added time	39425 min	23085 min

The total percentage of value added time in the Future State Value Stream Mapping condition has increased from the Current State Value Stream Mapping condition, from 23% to 33%, an increase of 10% with a time of 11520 minutes, the time for value added time does not change because of value added Activity is an activity that provides added value to activities so that changes are not necessary.
The total percentage of non value added time in the Future State Value Stream Mapping condition has decreased from the Current State Value Stream Mapping condition, from 77% to 67%, it has decreased by 10% with the total time in the Current State Value Stream Mapping condition of 39425 minutes to become Future State Value Stream Mapping is 23085 minutes so it has decreased by 16340 minutes.

5. CONCLUSION

There are two types of waste in the A4100000121 procurement process, namely waste of processing and waste of waiting, which are included in the waste of processing activities, namely approval, PR review conducted by SCM, negotiation process, review of bids made by users. Meanwhile, what is included in the waste of waiting activity is waiting for PR documents, HPS / OE to be reviewed and waiting for vendor offers. The solution given to overcome this waste is by providing training to users, creating checklist forms and optimally implementing SAP in the company.

The condition of the current state value stream mapping procurement A4100000121 there is a total percentage of value added time of 23%, non value added time of 77% with details necessary but non value added of 63% and non value added of 14% with total value added time on procurement A4100000121 of 11520 minutes, while the total non-value added time was 39425 minutes.

While in Future State Value Stream Mapping A4100000121 there is a percentage of value added time on procurement A4100000121 of 33%, while the percentage of total non value added time is 67% with details of non value added time 16% and necessary non value added time of 51% with a total value added time is 11520 minutes, while the total non-value added time is 23085 minutes. In the Future State Value Stream Mapping condition, it decreased by 16340 minutes. Thus the effort to reduce lead time is quite successful by using the lean manufacturing concept to reduce the risk of delays in the procurement of goods and services A4100000121 at PT. DI.

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