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VALUE STREAM MAPPING AND SIX SIGMA METHODS TO IMPROVE SERVICE QUALITY AT AUTOMOTIVE SERVICES IN INDONESIA

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Research paper

Abstract: *Automotive service industry currently holds an important role in helping to increase customer satisfaction. Various strategies are carried out to win the competition for increasing customer satisfaction. Quality service combined with the right instruments can be used to increase customer satisfaction and loyalty. Customer satisfaction is the key to success in the manufacturing and service industries. Service quality is an important attribute and it is a key factor in service industries. Improving lead time service in automotive Toyota dealer service industries is the focus of this research. Value Stream Mapping succeeded in identifying problems that were happening as an impact of waiting for services, washing processes, and length of service processes. The DMAIC (Define, Measure, Analyze, Improve and Control) method assisted by tools of quality successfully analyzed and gave recommended corrective actions to reduce the lead time of Express Maintenance Service from 120.06 minutes to 64.00 minutes or improved 53% per service cycle, and succeeded in increasing the capability of the service process from 1.96 sigma to 3.80 sigma. Quality of service can be improved to get customer satisfaction, increase company profitability, and increase the competitiveness of companies in maintaining the sustainability of the industry in the future.*

Keywords: *Service Quality, Lead Time, Value Stream Mapping, DMAIC*

1. Introduction

Global competition in the increasingly stringent industry requires business people to get effective strategies to meet customer satisfaction. Customer satisfaction is a

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feeling of consumers for the product or service that has been used (Kuhlang et al. 2011). Customer satisfaction can be formed if the organization might be able to provide product characteristics or attributes following customer expectations (Pyzdek, 2003). Thus, it can be interpreted that customer satisfaction is one of the important attributes in the industrial world, especially the service industry. Based on this fact, the service industry must be able to identify important elements and be able to make improvements to receive intended customer satisfaction. The automobile services industry in Indonesia is a type of automotive industry or commonly referred to as a dealer that provides sales, repair, and sales for four-wheeled vehicle parts. The results of a survey conducted by JD Power 2018, Jandhagi et al. (2011) in Indonesia found an important finding namely low customer satisfaction caused by scheduling appointments via digital channels that are very low, with a percentage value of 7% of customers who schedule their service appointments via its website or through smartphone applications. An automobile service company is a service industry that serves sales, maintenance, repair, and supply of vehicle part services. The service operation branch also provides spare parts and workshops that provide special maintenance and repair services for vehicles. It consists of three main divisions, which are Sales Department, Service Department, and Spare Parts Department. The key element in determining the level of service quality is after-sales customer satisfaction. The quality of after-sales services provided by car dealers has a great influence on customer satisfaction to maintain long-term relationships with their customers and many businesses. Have changed their strategic focus to emphasize customer retention (Rego et al. 2013).

The high after-sales service lead time in automobile services in Toyota dealers in Indonesia is 120.06 minutes in one service cycle, higher than the lead time charged at 60 minutes. It is a problem that must be resolved so that customer satisfaction, which is an important attribute in the service industry can be met. By mapping the after-sales service process in automotive services Toyota dealer using Value Stream Mapping, it is expected that the actual conditions of current service processes can be identified and found, which processes are causing the high after-sales service lead time that occurs. By assisting various tools of quality in the Six Sigma method, it is also expected to be able to provide analysis and recommendations for corrective actions so that the quality of service is in line with expectations and can be improved. It is believed that good service quality will result in customer satisfaction and will have an impact on the reuse of products and services that have been used and help improve company's image through product information and services to other customers (Gijo et al. 2012, Thompson, 2005, Lam et al. 2004, Venkamteswaran and Padmanaban, 2018).

Six sigma is a systemic and structured method with DMAIC stages (Define, Measure, Analyze, Improve, and Control) that has been proven effective in identifying, measuring, analyzing, and providing recommendations for improvement of problems that occurred (Causevic & Golub, 2019). Researched at Portugal Automotive industry using DMAIC (Define, Measure, Analyze, Improve and Control) cycle for process improvement could decrease 0.98% on the indicator of work-off generated by the production system, the financial impact could save over 165,000 € per annum (Costa et al. 2017). Omar & Mustafa (2014) stated that the adoption of Six Sigma does not only mean a process improvement but it is a business strategy that uses a systematic approach to increase productivity, corporate financial benefits, and customer

satisfaction (Pucheta et al. 2019). Other research in automotive that selected as observed machine DMAIC could reduce the machine breakdown time from 111 became 85 minutes/month and breakdown quantity from 4.7 became 3.5 times/month and increase the availability value from 90.8% became 96.0% and the impact was increasing OEE (Overall Equipment Effectiveness) value from 87% became 92% (Rozak et al. 2020).

In the United Kingdom 2012, the Six Sigma method had succeeded in reducing the waiting time from 24 minutes to 11 minutes or more than 50% of Pathology Department service processes in the healthcare industry (Hussain et al. 2014). Other studies had also successfully revealed that the implementation of Six Sigma can improve the attitude of health workers better (53%), compared to government employees (18%) (Sethi et al. 2018). Based on the facts from previous studies, it is proven that the implementation of Value Stream Mapping and Six Sigma combined with other tools of quality successfully resolve various problems and succeeded in enhancing customer satisfaction and company profits.

2. Literature Review

Customer satisfaction is the lifeblood of every company, so customer satisfaction is one important element in improving the performance of a company or organization (Nagi & Altarazi, 2017). Customer satisfaction can be formed if the customers get what is expected from a product or service they use (Croft & Kovach, 2012, Pyzdek, 2003). Customer satisfaction is a comparison between the actual performance in products and the expected performance (Caesaron & Simatupang, 2015). Customer satisfaction is a response from the comparison of product performance with several standards before, during, and after consumption (Minh & Huu, 2016, Srivasnavar & Bhatnagar, 2013, Barrios & Jimenez, 2016). Especially in the service industry, customer satisfaction is closely related to the level of service quality in which there is a direct interaction between the system, the operator, and the customer, where process the customer can feel directly the quality of services which at the same time can provide an assessment of the quality of the service without passing through other stages of the process.

Service quality is the main process in the service organization/industry that prioritizes the achievement of service quality that meets or even exceeds customer expectations (Barrios & Jimenez, 2016). Other research stated that the success of industry without exception a service industry is very dependent on human resources and processes owned so that in the service industry the improvement of human resource competencies and continuous process improvement are important factors as well as determinants of the industry to gain its success (Vijay, 2014). Identification of ongoing process conditions including in the service industry which aims to find opportunities for continuous process improvement is an important activity so that quality of service that can meet customer expectations can be realized. Some various methods and tools can help identify the ongoing process to get the opportunity for improvement as intended. This research seeks to combine Value Stream Mapping and Six Sigma methods with the help of other tools of quality in identifying, measuring, and analyzing the processes that occur in automotive after-sales services in Indonesia, it is hoped that the processes currently running can be identified and

opportunities for improvement can be found in efforts to improve quality services that can meet or exceed expectations and certainly increase customer satisfaction.

The identification of ongoing process conditions is very important in the strategy of quality improvement in the industrial world both in the manufacturing and service industries. Especially in the service industry, the quality of service that can be felt simultaneously in the process becomes very important to always be identified and evaluated quickly and effectively so that the quality of service and the image of the organization in customer perspectives can be maintained. Value Stream Mapping is a device that has been widely used by various industries including the service industry in identifying and analyzing the conditions of ongoing processes to find opportunities for further improvement. Value Stream Mapping can optimize the power sources by eliminating non-value of added activities to improve productivity and sense of competitiveness (George, 2003).

Value Stream Mapping is a successful method that is used internationally, usually applied in a single project that has a high innovative impact and is developed towards continuous improvement with a systematic process management approach (Kuhlang et al. 2011). The Value Stream Mapping method has successfully identified the operational conditions through the study of takt time and succeeded in reducing the process lead time from 7.6 to 3.2 days or a 73% reduction in the automotive industry cycle time in India (Chang & Wang, 2007). Value Stream Mapping has also succeeded in identifying bottleneck processes and reducing waiting time by up to 27% (Otim & Grover, 2006). Referring to the various studies, it can be understood that the Value Stream Mapping method is very effective in identifying ongoing processes to obtain opportunities for improvement and can improve the productivity and quality of processes and products in both manufacturing and service industries.

Six Sigma is a comprehensive, flexible and measurable system for achieving, maintaining, and maximizing increasingly competitive business success. Six Sigma is a quality improvement approach that is systematically effective for improving organizational performance based on the use of various statistical analysis techniques (Pande & Holpp, 2002). In general, Six Sigma has two meanings, namely Six Sigma as a philosophy for continuous improvement in reducing defective products and Six Sigma as a technical tool in measuring the number of defects per 1 million products produced. Six Sigma in technical methods has a statistical. Approach orientation to the calculation of product defects. The goal is to reduce the variance process by eliminating the entire defects interfering with customer satisfaction (Peng & Wang, 2006). For the service industry, Six Sigma is a business improvement methodology that maximizes shareholder value by achieving the fastest rate of increase in customer satisfaction, cost, quality, processing speed, and investment capital (Haviana & Hernadewita, 2019).

Six Sigma is a version, philosophy, strategy, and a set of tools to improve process and service quality, for services-based industries, where customer needs are the main focus, and their needs often seem unpredictable (Ebrahimi & Keykavossi, 2018). Six Sigma is a systemic and structured method with DMAIC (Define, Measure, Analyze, Improve, and Control) steps. It has been proven effective in identifying, measuring, analyzing, and providing recommendations for improvement that have a focus on reducing the variety of processes and products that can increase customer satisfaction, profitability, and competitiveness of the company (Elbireer et al. 2011,

Jona than, 2013, Trimarjoko et al. 2019). The researches showed that most service organizations in the UK have been implementing Six Sigma for more than three years. The company's average sigma quality level is around 2.8 around 98,000 Defects Per Million Opportunities (DPMO). Management commitment and involvement, customer focus and Six Sigma integration with business strategy are important factors in implementing Six Sigma (Syafwiratama et. al. 2016). The implementation of the Six Sigma method can reduce shipping delays and lead time in the small and medium scale industries in the United Kingdom and increase the sigma level from 1.44 to 2.09 Sigma (Otim & Grover, 2006). The application of the Six Sigma method proves that the average waiting time for maternal and child hospital services decline from 6.89 days to 4.08 days and the standard deviation dropped from 1.57 days to 1.24 days. In this way, the hospital will serve pregnant women faster, reducing the risk of perinatal and maternal death (Omar & Mustofa, 2014).

The combination of Value Stream Mapping and Six Sigma methods can reduce the lead time of a delivery process at the automotive dealers in Mexico from 50,499.5 minutes (35.06 days) to close to 30,240 minutes or even 20,160 minutes or down 60.17% (Parasuraman & Grewal, 2000). Other research in India using Value stream mapping and Six Sigma methods showed that lead time has been reduced by 14.88%, processing time 14.71%, and waste of material movement 37.97%. As proposed in the model, WIP (Work In Process) inventories have decreased by 17.76% and labor 17.64%. Furthermore, it will generate 161,800 Rupees profit per year. And get a net savings of 145,560 Rupees per year (Shahin, 2006). Referring to these studies, it shows that Six Sigma methods in the service industry combined with other methods are very effective in identifying, analyzing, and improving processes and products to get better service quality and also able to increase the profit and competitiveness of the industry by 37.97%. Referring to these studies, the Six Sigma method in the service industry combined with other methods is very effective in identifying, analyze and improve processes and products to get better service quality and can increase the profitability and competitiveness of the industry.

3. Case Study

Automotive Toyota dealers service in Indonesia have a problem with high after-sales service lead time is 120.06 minutes in one service cycle, which is higher than the lead time charged by 60 minutes for a type of Expres Maintenance service. By combining Value Stream Mapping and Six Sigma based on other tools of quality, it is expected that the problem of high after-sales lead time in the automotive Toyota dealer services industry can be identified and get improvement recommendations so that the problem can be solved effectively and efficiently. The proposed implementation framework is an integrated approach of Lean and Six Sigma and is shown in Figure 1. It is based on the traditional five phases of the DMAIC Six Sigma improvement model: (Define, Measure, Analyze, Improve, and Control). Each phase of the DMAIC: Define, Measure, Analyze, Improve and Control methodology utilizes several Six Sigma tools to improve the mobile order fulfillment process. In this study, both qualitative and quantitative data were collected from multiple sources. Qualitative data were obtained from direct observations in the field and unstructured interviews with team leaders, experienced team members, and systems experts, while quantitative data were obtained from the company’s historical records. Several tools

and techniques, such as a Pareto chart, Value Stream Mapping (VSM), cause-and-effect analysis, process capability analysis, a control chart, and 5W + 1H analysis, were used through the DMAIC (Define, Measure, Analyze, Improve and Control) methodology. All statistical analysis of data (at a 5% level of significance) and graphical presentations were performed using Minitab statistical software.

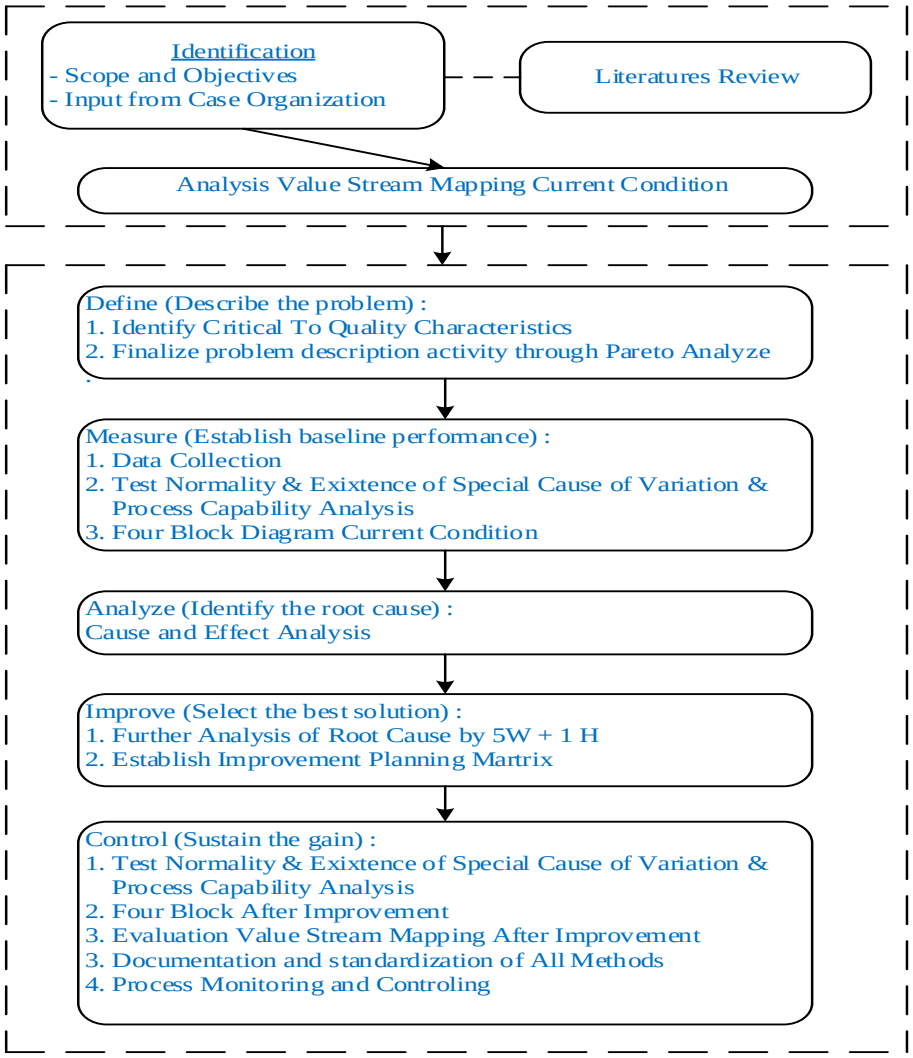

Figure 1. Implementation Framework

Value Stream Mapping has been widely used in various companies both manufacturing and services that are useful for knowing the condition of the ongoing process and very effective in knowing which of all sub-processes (workstations) are bottlenecks and have an impact on current problems. These conditions are termed as current stage conditions, while Value Stream Mapping can also be reused in mapping a series of processes after repairs called Future Stage conditions so that with the improved results Value Stream Mapping can also be identified.

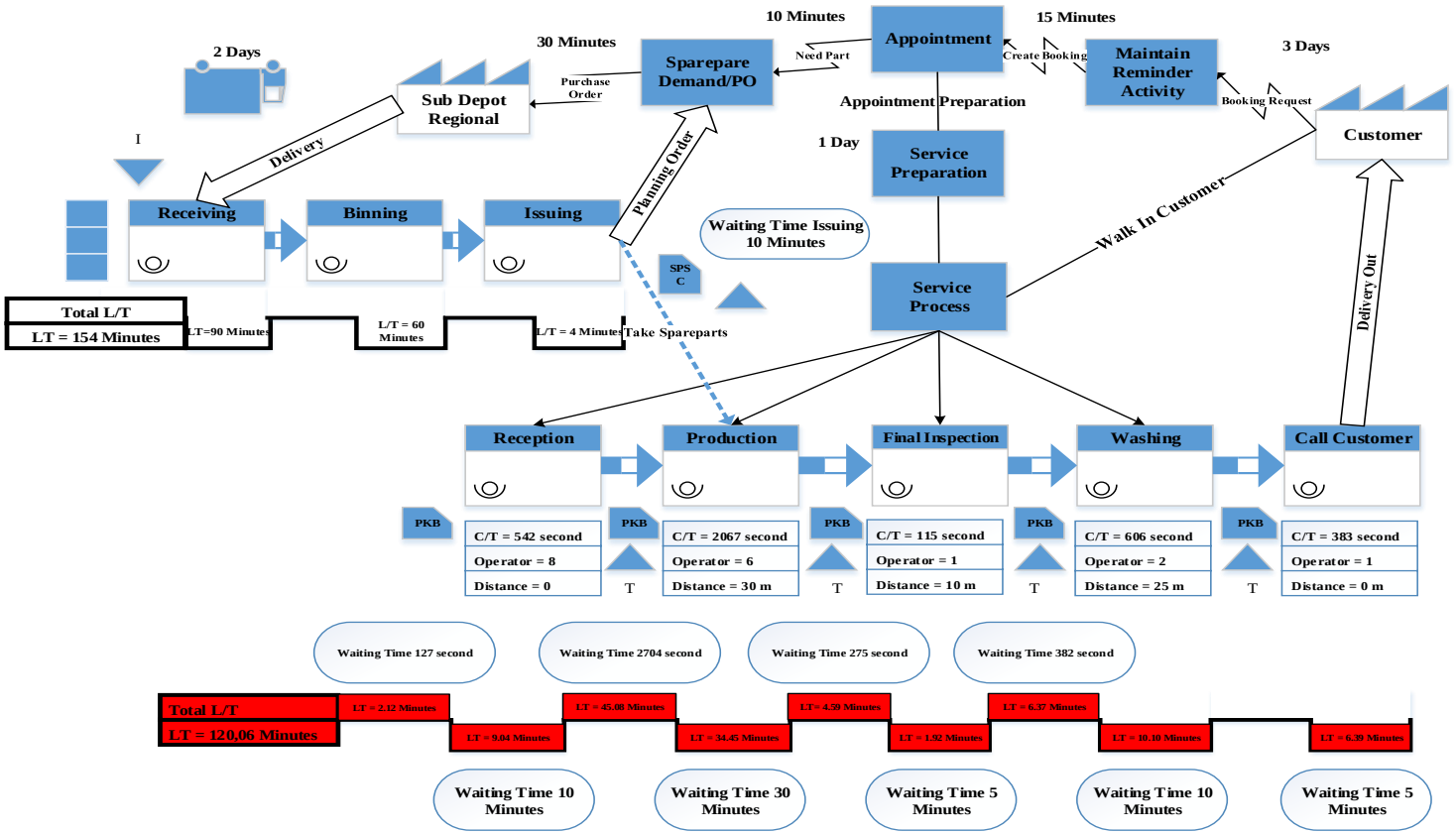

Figure 2. Value Stream Mapping Current Condition

Figure 2 explains Value Stream Mapping (VSM) that illustrates the current condition of the process that is ongoing (before improvement). The condition was analyzed to find out which workstations were causing the high lead time. Based on Value Stream Mapping current condition as obtained in Figure 2, the average lead time process in the automotive Totota dealer services industry was a minimum of 46 ~ 65 minutes, a maximum of 263 ~ 389 minutes with an average of 120.06 minutes for a type of Express Maintenance service. Its condition exceeded the company's target of 60 minutes, using Value Stream Mapping The Value Stream Mapping for general description can be explained in Table 1.

Table 1. Evaluation of the actual time of overall workstations current condition

Order Type Service	Count (Valid)	Work Process (minute)										Total Lead Time
EM (Express Maintenance)		Waiting Receptionist	Process Receptionist	Waiting Service	Process Service	Another Job Order	Waiting Final Inspection	Process Final Inspection	Waiting Washing	Washing Process	Call Customer	
	TimeActual	2.12	9.04	45.08	34.45	0.00	4.59	1.92	6.37	10.10	6.39	120.06
	Target	0.00	10.00	0.00	30.00	0.00	0.00	5.00	0.00	10.00	5.00	60.00
	Evaluation	X	V	X	X	V	X	V	X	X	X	X

Note : *X: unable to meet the target.*
V: able to meet the target.

Referring to the evaluation of each workstation contained in the Express Maintenance (EM) process, in this case, the process of handling after-sales customer complaints in the automotive Toyota dealer services, the results showed that up to 80% were not able to meet the target of the company so that the overall total lead time was not be fulfilled. Therefore, further analysis is needed to get the total lead time following the company's target. The application of the Six Sigma method is based on theoretical studies that had been found and had been proven effective in solving problems in various industries both manufacturing and service industries. Six Sigma with its structured stages will be used in solving the problem of high after-sales/express maintenance lead time in the automotive. Services industry in this study. The Six Sigma analysis used in this study was:

3.1. Define phase

The define stage was the first stage. In this stage, the problem description activity was carried out, determining Critical to Quality (CTQ) and the target to be achieved. From the data collection and mapping process with Value Stream Mapping, it is known that the problem that occurred was the high after-sales lead time on average of 120.06 minutes of the specified target was 60.0 minutes. As for the data obtained, we floated in the Pareto diagram to find out the Critical to Quality that occurred, while the Pareto diagram is shown in Figure 3. Based on the Pareto diagram in Figure 3 it explained that 80% of the longest Express Maintenance lead time was on the waiting service 49.15 minutes or 56%, washing process 12.27 minutes difference to the target or 14% and process (service) 10.45 minutes, so based on the Pareto diagram Critical To Quality of this research was as many as 3 types, i.e. waiting for

service, service process, and washing process. The target to be achieved in this research was lead maintenance Express Maintenance service time of 60.0 minutes.

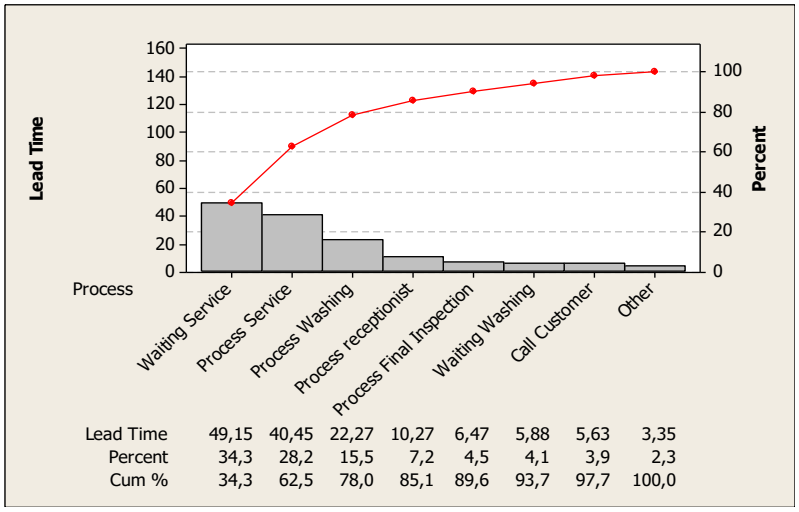

Figure 3. Pareto Diagram analysis of the Express Maintenance process

3.2. Measure phase

Measure phase was the second stage. In this step, the capability of the express maintenance process was calculated, aimed to find out the current condition of the process under this study. From data collection which had been obtained, to be then calculated the capability of the process as follows:

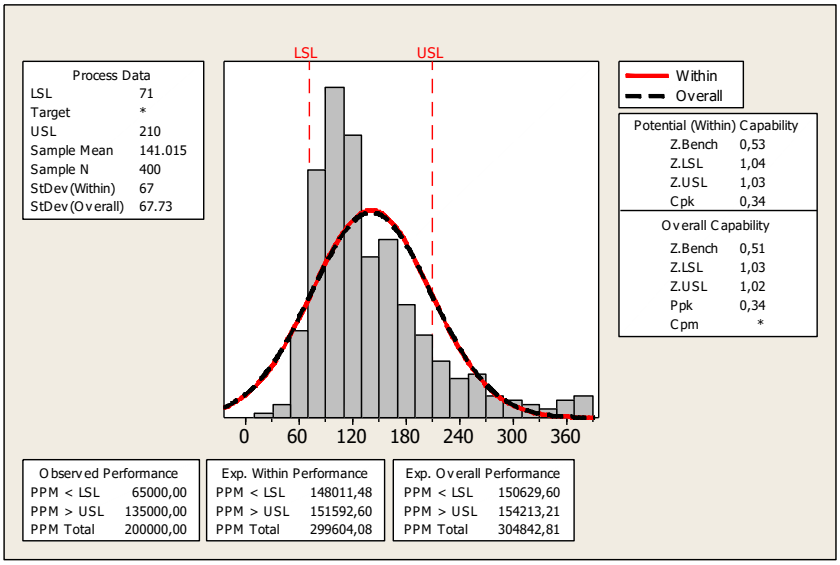

Figure 4. The Capability Process of Z bench St Express Maintenance

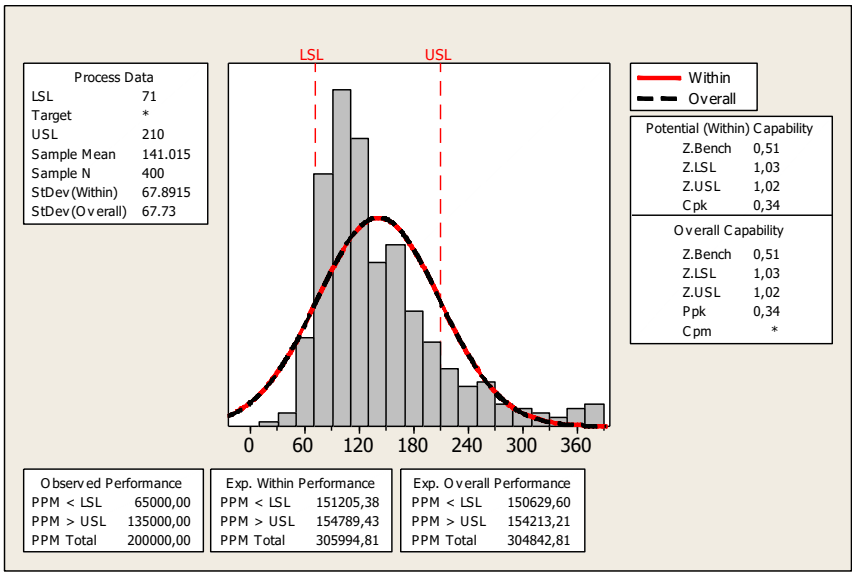

Figure 5. The Capability Process of Z bench Lt Express Maintenance

From the calculation of Z bench St (sigma level) and the value of Z bench Lt, it can be plotted into four block diagrams as an illustration of improvement direction from the control and technology side, by calculating Z shift with the following result from calculating and converting Defect Per Million Opportunity (DPMO) to sigma level 1.96 Sigma. So that the capabilities of the running process can be plotted in the four-block diagrams in Figure 6, as follows.

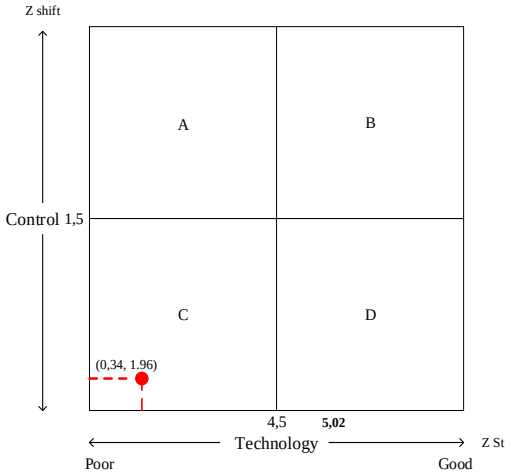

Figure 6. Four block diagram current condition

Figure 6 explains that the condition of the sigma level of the ongoing process in terms of control is good but in terms of technology is still very bad. So that effective improvement is needed to get a better sigma level.

3.3. Analyze phase

Referring to Value Stram Mapping Define and Measure phases It is known that the high lead time Express maintenance (EM) was caused by 3 processes, namely: waiting for service, service process, and washing service. By using the Cause-effect diagram, the problems of processes were analyzed to get what was the dominant cause of the 3 processes. The Cause-effect diagram of the problem is shown in Figure 7 below:

The maintenance process was caused by:

1. Equipment Factor

The condition of the equipment used by Express Maintenance mechanics was only 40% in good condition and suitable for use, 24% was damaged, 7% was lacking and 29% was missing or not yet used. Utilizing the tools which were broken and lacking was temporarily displaced by stalls Express Maintenance 1 and 2 tools whereas, for devices that did not exist, EM had not used them. They still used standard tools that were periodically serviced.

2. Material Factors

The rapidity of providing spare parts for regular service. For the procurement stock of spare parts, consumers still often waited due to the availability of spare following periodic service manuals.

3. Management Factors

The length of time Express Maintenance service takes place was because mechanical mechanics received work orders that had complaints either Express Maintenance booking or Express Maintenance Walk-in (direct coming). Express Maintenance work should have as few complaints as possible due to the distribution of improper mechanical task dividers for cars coming in for service and the lack of digging information from the booking service staff.

4. Environmental Factors

EM mechanics should look for cars that needed to be serviced in the service parking area because cars were mixed with other cars which were not included as the Express Maintenance (EM) service customers. Moreover, when the car park was full, it was placed in another parking area, making it more difficult for mechanics to find the cars. The fact that an indicator to search the cars was only a periodic service indicator without a sign or special identity of Express Maintenance also made it hard to identify the cars.

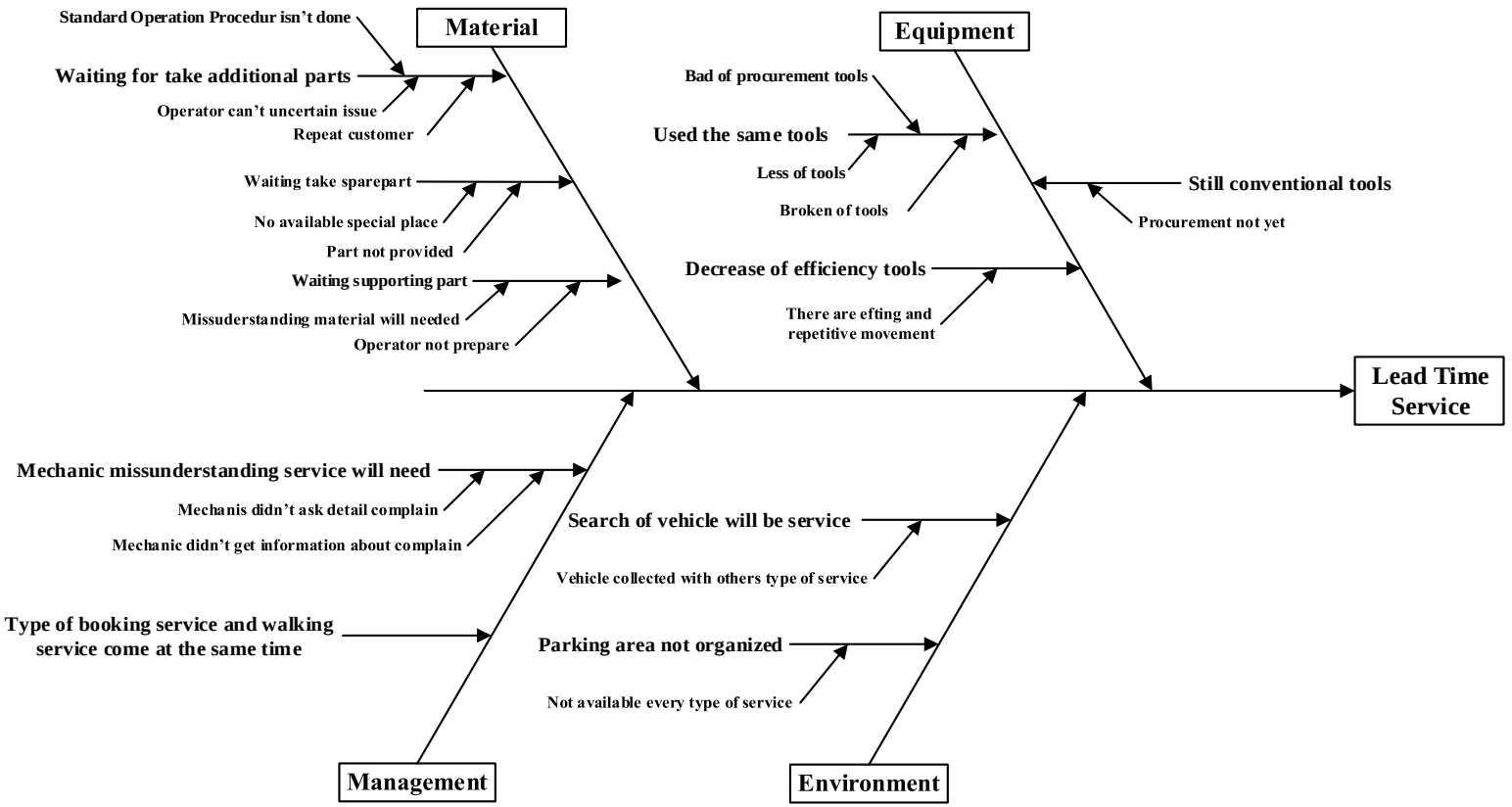

Figure 7. Cause and Effect Diagram Analysis

3.4. Improve phase

Activities in this stage were to determine the proposed improvement of the root of the causes that have been carried out at the Analyze stage by conducting a brainstorming using 5W + 1H and the Improvement Matrix Plan of the service process and washing process that becomes the problem in this study. A large amount of lead time in services at the dealer had been found. It might likely occur due to the long duration of handling throughout the service process, and many miscommunication errors. Thus, it will be one of the main points for improvement in the next step of the DMAIC improvement cycle. With the following improvements: The improvement in the production area or service process aimed to reduce the service process time from the actual time before repairing 34.45 minutes while the expected target is 30 minutes. The improvement steps taken by the Small Group Activity Express Maintenance team (SGA EM) were as follows: *Failure1:* Provide Special Parking Wait Express Maintenance Service. *Failure 2:* Provide Parts with Standard Operation Procedure (SOP) Pre-Picking Rack. *Failure 3:* Provide Material with Standard Operation Procedure Pre-Picking. *Failure 4:* Loss of manpower with the addition of Man Power. By carrying out the corrective footsteps as mentioned above, it is expected that the high maintenance lead time of 120.06 minutes can be reduced to the target of 60.00 minutes per service cycle.

3.5. Control phase

The control stage was the last in the Six Sigma method, where this stage the process capability (sigma level) calculation was conducted again after the improvement. Observation activities as in the measuring stage were still applied. Sigma level could be calculated by using Minitab software that could also by calculating Z shift with the following result from calculating and converting Defect Per Million Opportunity (DPMO) to sigma level 3.80 Sigma.

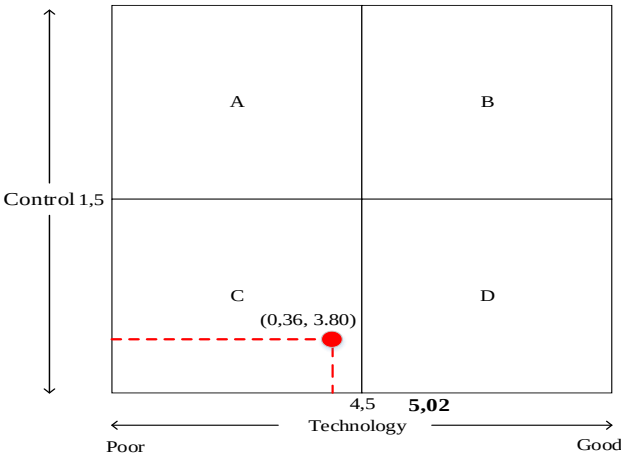

Figure 8. Four block diagram after improvement

Figure 8 shows the results of improvement in this study. It has better results than the conditions before the improvement. Then, to get the stability of the Express Maintenance process, the documentation of improvement was made into a work

standard in the form of 1. Making a Work Squance Sheet (WSS), was a written work procedure that was a detailed job in detail. 2. Stick Work Squance Sheet (WSS) in areas related to WSS attached to areas that had been improvised, placing Work Squance Sheet (WSS) in a location that was visible and readable by officers in their respective areas. 3. Socializing Work Squance Sheet (WSS) socialization and improvement programs were conducted when the regular All Small Group Activity (SGA) meetings are held every month. Also, it was socialized at the machine shop roll call, which was routinely held on Tuesday and Thursday. Every morning roll call, each Smal Group Activity can report the progress of the repairs that have been made. Furthermore, to find out the lead time analysis of the Express Maintenance process after improvement, this mapping was carried out again after the improvement using Value Stream Mapping in Figure 9.

Figure 9 explains Value Stream Mapping (VSM) that illustrates condition after improvement process. Figures 2 and 9 Value Stream Mapping are the same, both the flow process and the location map, only the difference is that the results of the lead time have been made improvements to the work process. Value Stream Mapping (VSM) shows the condition of the process that is being Express Maintenance after a repair, as for the general description can be explained in Table 3:

Table 3. Evaluation of the overall actual time of work stations at After Improvement

Order Type Service	Count (Valid)	Work Process (minute)										Total Lead Time
		Waiting Receptionist	Process Receptionist	Waiting Service	Process Service	Another Job Order	Waiting Final Inspection	Process Final Inspection	Waiting Washing	Washing Process	Call Customer	
EM (Express Maintenance)												
	TimeActual	1.57	7.53	13.00	23.70	0.00	3.63	1.25	5.46	3.45	4.45	64.00
	Target	0.0	10.00	0.00	30.00	0.00	0.00	5.00	0.00	10.00	5.00	60.00
	Evaluation	X	V	X	V	X	X	V	X	V	V	

Note : *X: unable to meet the target.*
V: able to meet the target.

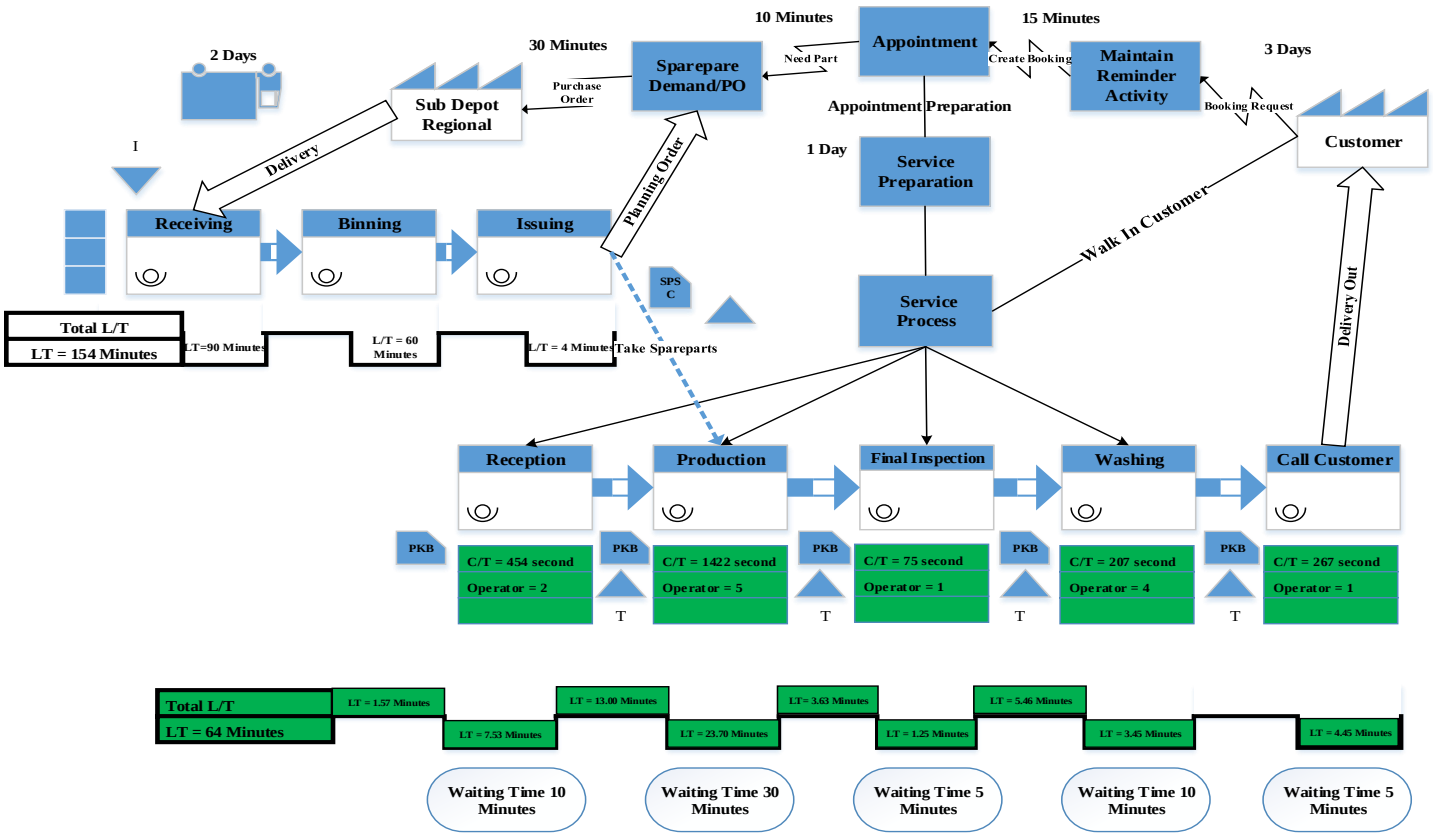

Figure 9. Value Stream Mapping After Improvement

Table 3. Evaluation of the overall actual time of work stations at future conditions. Based on the results of the Current Stream Mapping mapping, three dominant factors are causing the Express Maintenance service duration of the vehicle flow, namely: waiting service 13.00 minutes, washing process 3.45 minutes, and service process 23.70 minutes with an average completion process reaching 64 minutes. The state map after improvement was created to show the condition after repair. Improvements in processing time and waiting time resulted from the dominant length of work for the Express Maintenance service, namely the washing process, service process, and cycle time service. The improvement state map that has been created will be a reference for the current state map which requires corrective action to achieve the next future. All of this is done continuously to achieve the ideal conditions of Express Maintenance services.

4. Result

The combination of Value Stream Mapping and Six Sigma used in this study proved effective and succeeded in reducing the lead time of Express Entertainment services in the automotive services in Toyota dealer. That would be seen by reviewing the results of the comparison of the Four Block Diagrams, before and after improvements to the car service that can experience an increase in terms of technology. Thus, it means resolving the problem using the Define, Measure, Analyze, Improve and Control (DMAIC) method in the automobile Totota dealer service succeeded in increasing the process capability from 1.96 to 3.80 sigma, mapping process using Value Stream Mapping analysis was seen to be able to reduce the length of service time and waiting time of each process in the car service with a total lead time to 64.0 minutes from 120.06 minutes or can reduce the Express Maintenance service lead time by 53%.

5. Conclusion

This study aims to improve car dealer services by reducing the Express Maintenance lead time in the automobile Toyta dealer services. For this reason, it is necessary to know the stages of the process that results in dealer service issues ranging from acceptance to submission back to the customer and can be analyzed and prevented from occurring problems. Value Stream Mapping helps to define key process stages to make improvements to the problems that occur in each stage of the process. This research uses an integrated Value Stream Mapping (VSM) and Six Sigma mechanism that tries to unravel the problem that is happening the Express Maintenance service in the automotive Toyota dealer services industry in Indonesia, namely a high lead time of 120.06 minutes from the management target of 60.00 minutes. By assisting the Value Stream Mapping method, it was able to identify which part of the series of processes caused the problem and managed to find out the total lead time that was running at 120.06 minutes and after repairing the value stream it was also found that the total lead time Express Maintenance decreased to 64.00. Six Sigma method with DMAIC (Define, Measure, Analyze, Improve and Control) steps were also carried out in this study with the help of other tools of quality such as Pareto diagrams, process capability with four block diagrams, Cause-Effect diagram analysis of 5W + 1H also and succeeded in measuring, analyzing, repairing and

controlling the process of Express Maintenance so that total lead time of the process can be derived as above and can raise the sigma level of the Express Maintenance process from 1.96 sigma to 3.80 sigma. In general, Value Stream Mapping and Six Sigma methods in this study reinforce previous studies, namely increasing sigma level, which is marked by decreasing total lead time Express Maintenance so that the quality of service can be improved to get customer satisfaction, increase company profitability, increase the competitiveness of companies in maintaining the sustainability of the industry in the future.

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