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Workflow Redesign To Eliminate Waste And Reduce Service Time At The Local Automobile Station

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Abstract

Customers bringing their automobiles for maintenance services at one local automobile service station experience long waiting times. The service station normally is overwhelmed with complaints from customers due to understaffing, lack of standard work procedures, and staff training, which lead to poor service quality. It is the goal of this study to analyze and redesign the service workflow of this service station in order to reduce service time and meet industry standards. Fish-bone diagram, 5s Activities, as well as ECRS, are used to not only analyze the root cause of delays and customer complaints but also reduce and eliminate waste in the service procedure. A new service workflow has been introduced by reducing the number of steps to serve customers from 30 to 15. The standard time for the whole procedure is calculated based on the proposed procedure, which is reduced from 77 minutes to 52 minutes.

Keywords
Workflow redesign, ECRS, Lean technique, Waste reduction, Customer satisfaction

1. Introduction
The case study service station is a car maintenance service center that sells all kinds of auto parts, servicing all brands of cars. The primary services are suspension repair, brake repair, engine repair, engine oil change, and others. There are an average of 527 cars coming in for the service per month, or 17 cars per day, of which an average of 45% engine oil change, 17% brake repair, 15% suspension repair, 12% tire change, and 11% other services. Business can provide multiple services. The major problem of this service station comes from employees, who do not have sufficient knowledge and information. This leads to delays in work processes and increasing customer complaints. Upon collecting customer complaint statistics for 3 months, it is discovered that there are 14 complaints about staff unprofessionalism, 35 complaints about delayed service, and 3 complaints about non-standard work causing the service center to lose credibility. Service center also loss revenue from delayed work processes by losing the opportunity to acquire additional customers because the car that receives the previous service is not finished yet. Technicians are not enough to provide service and customers can't wait. For this reason, we would like to reduce time and non-value-added workflows in order to increase customer satisfaction. Therefore, lean concept is applied as a process improvement guideline. This study will focus on the services that people use the most at this service center, which is the process of an engine oil change. The goals of this study aim to reduce times and steps of the engine oil changing process.

2. Literature Review

Waste reduction with ECRS technique is one of the most popular lean tools to reduce waiting time and unnecessary processes. To improve and make work processes more efficient, Ketsa (2016) used the ECRS technique to reduce work time and steps. Datoh and Chutima (2021) used 7 wastes, fishbone diagram and ECRS to identify non-value-added activities in the process and apply it to VSM to reform into a better shape. Suhardi et al. (2018) used ECRS to identify wastes by separating value-added and non-value-added activities in the production process. The result is that the lead time is reduced by 4.79%. Pertiwi and Astuti (2020) studied production line optimization by improving working methods in the washing machine assembly line by using the ECRS technique to solve bottlenecks in the process as well as fishbone diagram to find a root cause. Kanoksirirujisaya (2022) analyzed the ECRS technique to find ways to reduce time and defects in the product inspection process.

Luesak and Sanguanpang (2017) aimed to reduce the time and the defect of the process by implement work study, time study, cause and effect diagram and ECRS technique, the study can increase the process efficiency to be 73.29 percentage.From the research referenced above. It can be seen that using the ECRS technique can reduce time and work steps and applying the fishbone diagram could help finding the root cause of the problem.

3. Methods

This study aims not only to analyze the factors that delayed the engine oil changing process but also to find ways to improve work efficiency by reducing time and work steps. The tools used in this study include fish bone diagrams to identify the root causes of problems that slow processes, ECRS techniques to eliminate wasted and useless steps, and 5s tools to better manage the workspace.

The engine oil change process is examined to determine causes of the delay, as shown in Figure 1.

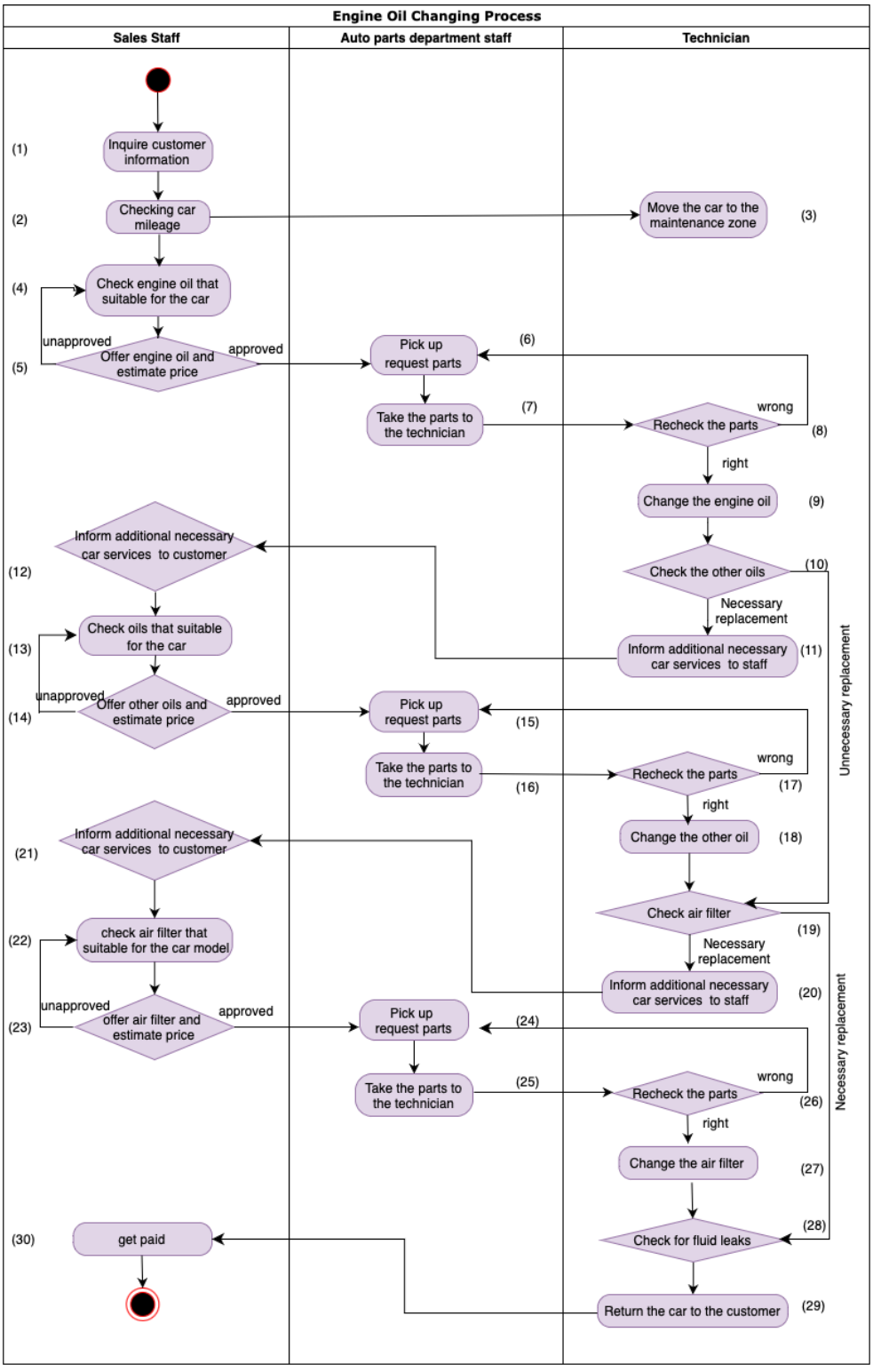

Figure 1. Engine oil changing process

3.1 Fishbone Diagram

The fishbone diagram is used to analyze the root of process delays. Observations and brainstorming with the manager showed that four key factors contributed to the delayed work process, as shown in Figure 2.

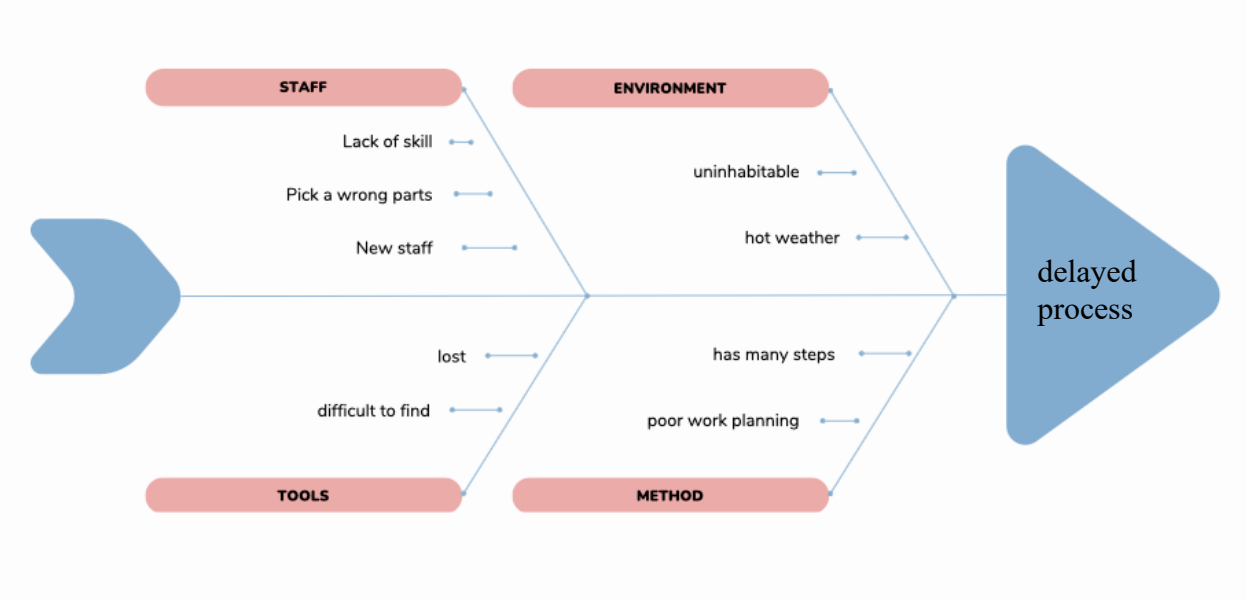

Figure 2. Fish bone diagram

The four key factors can be analyzed as the following.

- The first factor is staff, who lack service skills due to being new staff and untrained. In addition, because there are so many different kinds of vehicle components causing auto parts staff to pick up the wrong parts and staff feel tired because they have to walk often from working at many steps in which the staff factor can solve problems by organizing meetings to guide work to meet standards and organize training to improve skills and knowledge necessary for work.

- The second factor is the unsustainable environment due to working space and hot weather, whose environmental issues can solve by rearranging the work area with 5S activities to make the work area clean and livable. And provide enough fans for the working stations of technicians and staff.

- The third factor is tools. The tools are unavailable due to their loss Implemented measures to separate each technician's toolbox and be under the responsibility of that person. And, to avoid loss, store tools in the right place before get off work.

- The fourth factor is the work process factor, which has many steps and repetitions due to poor work planning. The main reason for the delay in work processes is that there are redundant and unnecessary work steps. Therefore, the lean concept of waste reduction is analyzed to identify waste and use it to improve processes. It is recommended to eliminate unnecessary and wasted steps based on ECRS principles.

3.2 ECRS

ECRS, composing of eliminate, combine, rearrange and simplify, is used to analyze and improve the oil changing process as follows.

3.2.1 Eliminate

The technician must recheck the parts they received from the auto parts staff in steps 8, 17, and 26. This wastes time at work and is a redundant process. From the consideration, it is found that if the staff has trained to have the skills and knowledge of auto parts. Pick up the right parts and thoroughly inspect them. The technician does not need to check again. This step can be eliminated.

Steps 11,20 are processes that the technician will inform additional necessary car service to staff and the staff will offer the price to the customer. These steps be eliminated because they are redundant and unnecessary steps.

3.2.2 Combine

Steps 4,5,12,14,21,23 are the processes of inquiring about the customer's service needs and offering the price. These steps, which are redundant, also make customers unsatisfied with the service because customers have been asked too many times. Before the improvement, the sale staff has to inquire about the customer's service needs for 3 times and offers the price for 3 times, thus these 6 steps can be combined into a single step.

Steps 6,7,15,16,24,25 are the processes of picking up auto parts and taking them to the technician at the maintenance zone. These are repetitive processes with excessive movement due to the frequent need to pick up parts and take parts to the technician. Moreover, the auto parts storage area is far from the maintenance zone, causing the staff to make frequent unnecessary travel during the work service.

Steps 13,22 are steps to check the compatibility of parts to the specifications of cars. This also can be combined to a single step.

3.2.3 Rearrange

Switching steps in the workflow can help reducing steps and simplify work, leading to work error reduction.

3.2.4 Simplify

Step 2 is a process that asks for and records customer information. If the customer has used the service at this service center in the computer system there will be a customer name and telephone number including the vehicle registration is already in the system. Asking returning customers is a redundant process. This can be simplify by checking the customer's information in the system by searching for the vehicle registration number first. If there is a history in the system, there is no need to ask again. If no information is found, then ask for the customer's information

To check for parts that are suitable for each car model in steps 4,13,22, including the parts picking process in steps 6,15,24, which are performed by sales staff and parts department staff. The parts are available in many models and styles. There is a high chance of selecting the wrong part or picking up the wrong part and having to replace it, resulting in wasted time and excessive movement. In this step, the work will be change by allowing the technician to carry out the selection of suitable parts. Because technicians have more expertise in parts and will see the correct auto parts model from the car. To reduce the mistake of picking up the wrong parts.

3.3 5s Activities

The working area is full of unnecessary items that make it unlivable. Tools are disorganized, causing the difficulty to pick up and use. To solve the issue, the station can implement the 5s activities as follows.

Seiri: Organizing the working space by removing unnecessary items such as used oil tanks and defective tools.

Seiton: Rearranging tools to be easy to pick up and use.

Seiso: Cleaning tools and accessories of working space.

Seiketsu: Create standards and maintain orderliness according to the standards.

Shitsuke: Making habits execute the 4s as a habit for a clean workplace environment.

4. Results and Discussion

According to the results of applying the ECRS technique to the initial engine oil changing process, non-value-added processes were eliminated. The improved process was summarized as shown in Figure 3. The overall workflow was combined, rearranged, and simplified. Thus, the improved process of engine oil changing offers time and resource efficiency.

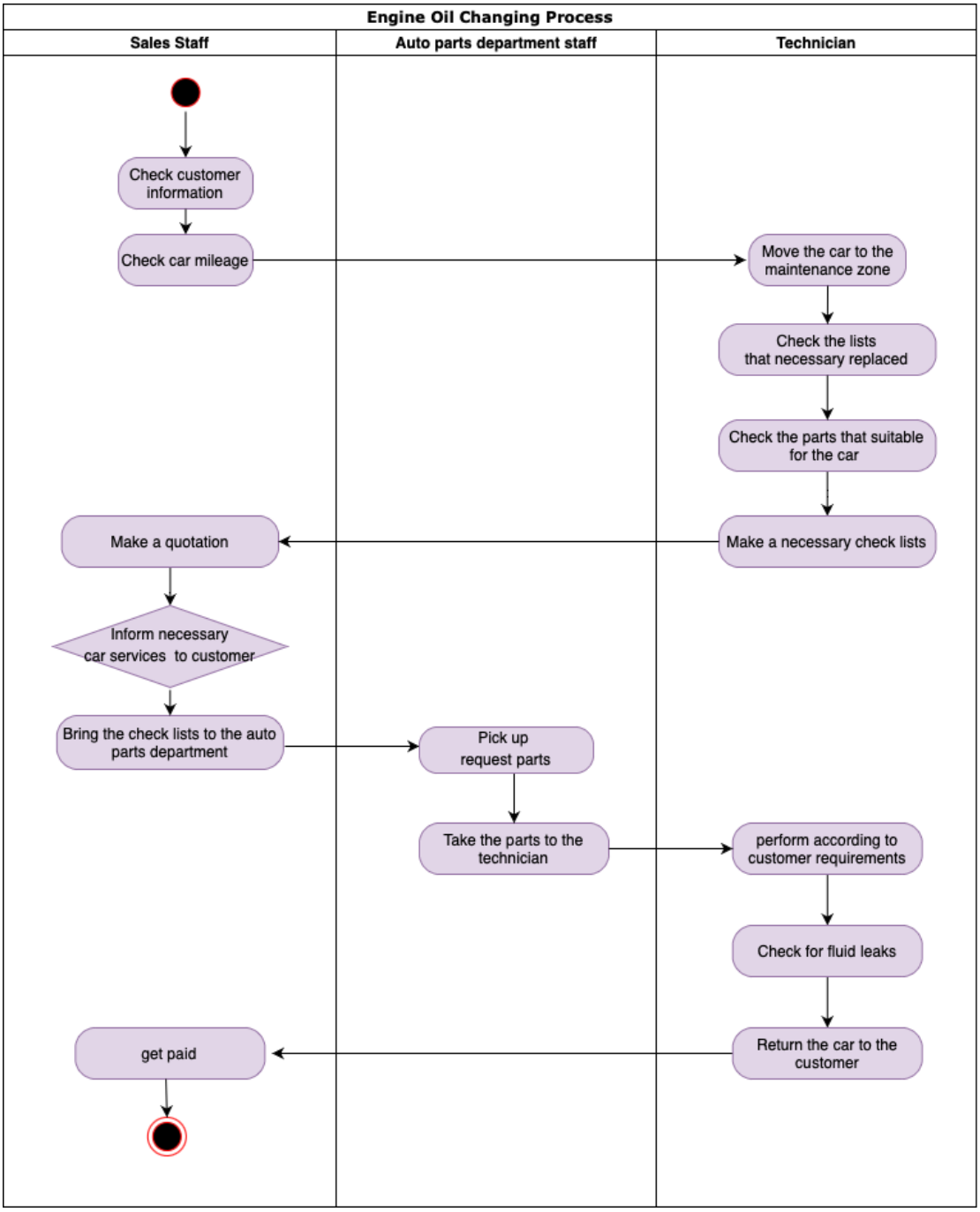

Figure 3. Engine oil changing process after applying the ECRS technique

Moreover, the working station and the overall atmosphere of the station were more workable since the station was organized and applied the keys of 5S activities. Hence, time spent on searching and preparing tools was reduced as shown in Figure 5.

Figure 4. Working station before 5S Improvement

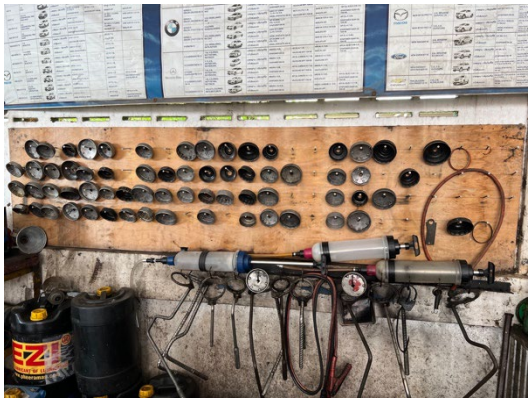

Figure 5. Working station after 5S Improvement

The application of both 5S activities and the improved process of engine oil changing discovered that 15 steps were reduced from the initial steps of 30. Moreover, the time required for each service was declined to 52 minutes from 77 minutes which enable the station to establish a time requirement for engine oil changing at 60 minutes.

5. Conclusion

The goal of this study was to reduce steps and process time. After improving the process by implementing fishbone diagrams, 5s activities and ECRS principles to analyze waste, it was discovered that the main cause of the delay was due to staff's lack of skills and redundant work processes. When a new work process was implemented, it was discovered that the work process was reduced from 30 steps to 15 steps, representing a 50% reduction, and the time spent on work was reduced from 77 minutes to 52 minutes. corresponding to 32%

References

Datoh, S and Chutima, P., Engine Oil Change Lead-Time Reduction Using Lean Management in A Commercial Vehicle Service Centre, *International Scientific Journal Of Engineering And Technology*, Vol. 5, No. 2 July-December 2021

Pertiwi, A. F. O., and Astuti, R. D., Increased Line Efficiency by Improved Work Methods with the ECRS Concept in a Washing Machine Production: A Case Study." *Jurnal Sistem Dan Manajemen Industri*, vol. 4, no. 1, 2020

Kanoksirirujisaya, N., Reducing waste in frozen crab stick product inspection process by applying ECRS technique *International Journal of Health Sciences*, 6(S4), 1506–1523.

Kanoksirirujisaya, N., et al., Waste reduction in parts manufacturing processesHard disk drives (HDDs) by ECRS techniques, *Journal of Industrial Technology and Innovation*, 1(1) (2022) 246564

Kasemset, Ch., et al., Application of ECRS and Simulation Techniques in Bottleneck Identification and Improvement: A Paper Package Factory , *Proceedings of the Asia Pacific Industrial Engineering & Management Systems Conference,* 2014

Suhardi, B., et al., Minimizing Waste Using Lean Manufacturing and ECRS Principle in Indonesian Furniture Industry. *Cogent Engineering*, vol. 6, no. 1, Cogent, 2019

Luesak, P., and Sanguanpang, S., Process Improvement of Separating Seeds Roselle Using ECRS Technique *Naresuan University Engineering Journal,* Vol.12, No.2, July - December 2017, pp 41-54

Ponpakdee, S.,Waste Reduction in Bottled Water Production Process *Ladkrabang Engineering Journal*, Vol. 38 No.3 September 2021

Suganthini, R., et al., Lean Tools Implementation for Lead Time Reduction in CNC Shop Floor of an Automotive Component Manufacturing Industry *Indian Journal of Science and Technology*, Vol 9(45), December 2016

Nallusamy, S.,and Ahamed, M. A., Implementation of Lean Tools in an Automotive Industry for Productivity Enhancement - A Case Study, *International Journal of Engineering Research in Africa,* vol. 29, pp. 175-185, Mar. 2017

Burawat, P., "Productivity Improvement of Carton Manufacturing Industry by Implementation of Lean Six Sigma, ECRS, Work Study, and 5S: A Case Study of ABC Co., Ltd." *Journal of Environmental Treatment Techniques*, vol. 7, no. 4, 2019,

Burawat, P., "Productivity Improvement of Highway Engineering Industry by Implementation of Lean Six Sigma, TPM, ECRS, and 5S: A Case Study of AAA Co., Ltd." *Humanities and Social Sciences Reviews*, vol. 7, no. 5, 2019

Gamboa, P., and Laksono, M., Singgih Waste Minimization in a Concrete Block Company Using Lean Six Sigma, ECRS, and TRIZ Methods, *Proceedings of the Second Asia Pacific International Conference on Industrial Engineering and Operations Management, Surakarta, Indonesia,* September 14-16, 2021.

Miranda, F. A. A., "Application of Work Sampling and ECRS (Eliminate, Combine, Re-Lay out and Simplify) Principles of Improvement At To1 Assembly." *ASEMEP National Technical Symposium*, 2011.

Ishijima, H.,The "5S" approach to improve a working environment can reduce waiting time: Findings from hospitals in Northern Tanzania. *TQM Journal,2016.*

Biography

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