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Enhancing Productivity in Line X Regulator Assy 2 through the PDCA Method (Plan, Do, Check, Action)

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***Abstract*: PT XYZ is a company that employs the Just In Time (JIT) production system, ensuring the precise and timely fulfillment of customer needs in accordance with the desired quantity. The motivation for this research stems from challenges within the production department, specifically related to the productivity of products on Line X Regulator Assy 2, which falls short of the company's set target. Consequently, the researcher will conduct a study titled "Improving Productivity of Part X on Line X Regulator Assy 2 with the PDCA (Plan, Do, Check, Action) method," with the aim of enhancing productivity to meet the planned targets set by customers. This final project research utilizes the PDCA 8-step method, encompassing theme determination, analysis of current conditions, target setting, analysis of causes, planning countermeasures, implementation of countermeasures, evaluation of results, and, finally, standardization and follow-up. The research findings indicate a productivity increase from 79 pcs/hour to 87 pcs/hour.**

***Keywords*: Productivity, PDCA, Kaizen.**

1. Introduction

A. Background

PT XYZ operates in the automotive manufacturing industry, with its production focus on manufacturing spare parts for window regulators in Line X Regulator Assy 2, catering to the assembly needs of four-wheeled Toyota vehicles. Various issues hindering the production process have been identified on Line X Regulator Assy 2, resulting in the company falling short of its predefined targets. Top management is actively working towards augmenting the production capacity of Line X Regulator Assy 2 to align with the targeted standards. This research employs the PDCA method to scrutinize discrepancies, proposing problem-solving strategies that directly influence the productivity of the production line.

In Figure 1, Line X Regulator Assy 2 is planned to produce 632 pcs/day with a cycle time of 1.378 minutes/pcs. However, the maximum production capacity is 574 pcs/day, leading to a cycle time of 1.518 minutes/pcs. The 58 pcs gap between the plan and capacity results in a productivity plan of 87 pcs/hour and actual productivity of 79 pcs/hour..

Based on the data presented in Figure 1, there is a clear need for improvement to enhance productivity. Therefore, it is imperative to eliminate waste, non-value-added movements (muda), or factors hindering the production process using the PDCA (Plan Do Check Action) method and the Seven Tools.

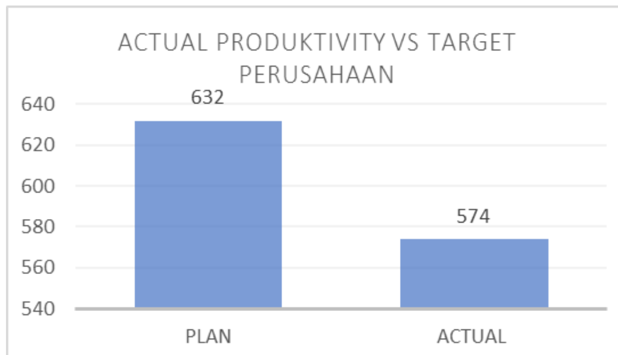

Fig. 1. Production plan and capacity diagram
(Source: Own Data Processing)

PDCA: 8 Steps:

The researcher will undertake eight improvement steps in implementing the PDCA method, serving as a means of enhancement. These steps include: 1) Determining the Theme, 2) Analyzing Conditions, 3) Setting Targets, 4) Fishbone Analysis, 5) Countermeasure Planning, 6) Countermeasures, 7) Evaluating Results, and 8) Standardization and Follow-up.

B. Problem Identification

The production standard target for PT XYZ is an actual production of 574 pcs/day or 90.8%, which needs to be increased to the planned production standard of 632 pcs/day or 100%. With the company's established production standard targets, an analysis of discrepancies is necessary to achieve these goals.

C. Problem Formulation

The problem formulation in this research involves identifying the types/methods of eliminating waste, non-value-added movements, or factors hindering the production process. Additionally, it aims to determine the root causes or reasons for not achieving the set targets.

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D. Research Objectives

The objectives and benefits of this research are to comprehend how to eliminate waste, non-value-added movements, or factors hindering the production process. It also aims to identify the steps or actions that need to be taken to address these issues at PT XYZ.

2. Research Methods

The study was conducted at PT XYZ in November 2023, and data were collected through observations of activities on Line X Regulator Assy 2.

1. Qualitative Data: This type of data comprises verbal sentences rather than numerical symbols. Qualitative data typically includes a general overview of PT Shiroki Indonesia and information on the factors causing problems in the production process on Line X Regulator Assy 2.

2. Quantitative Data: This type of data is presented in numerical form and can be directly calculated. Quantitative data includes the cycle time.

PDCA Method Analysis:

To achieve the desired results outlined in the research objectives, the PDCA method was employed to analyze the acquired data. The steps are as follows:

1. Planning Phase (Plan):

In this phase, improvement ideas are designed, assisted by the seven tools to prioritize key areas.

2. Implementation Phase (Do):

The formulated plan is gradually implemented. Control measures are taken during execution to ensure that the plan is carried out effectively and achieves the target.

3. Inspection Phase (Check):

This stage involves examining or scrutinizing the achieved results to assess if the implementation aligns with the scheme and plan. It also monitors the progress of the planned improvements.

4. Corrective Action Phase (Action):

The subsequent phase involves selecting actions that will have a positive impact on the company. Adjustments are made to minimize the impact that may occur after the improvement changes.

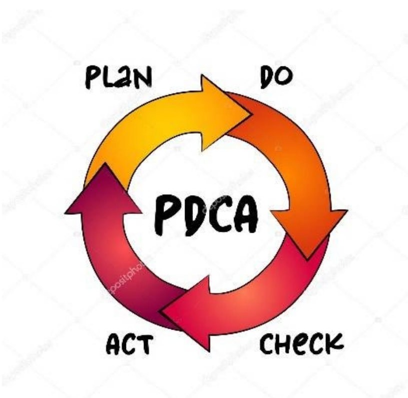

Fig. 2. PDCA Cycle
(Source:www.depositphotos.com)

3. Results and Discussion

A. Plan or Plan

1) Determining Theme

The process of determining the theme involves collecting production data for a specific period, as shown in Table 1, which displays actual production achievements. Figure 3 provides detailed data on the gap between output results and the target that has not been achieved.

Table 1
Actual production achievement data

Line x Regulator Assy 2	**TOTAL MP**	**WH**	**ACTUAL QTY**	**TARGET QTY**
	2	7.5	79	87
	PRODUCTIVITY		574	632

Based on the data from Table 1, the production on Line X Regulator Assy 2, operated by two manpower for 7.5 hours/day, has not yet reached the company's set target. Figure 3 below shows the gap in the number of Pcs per hour.

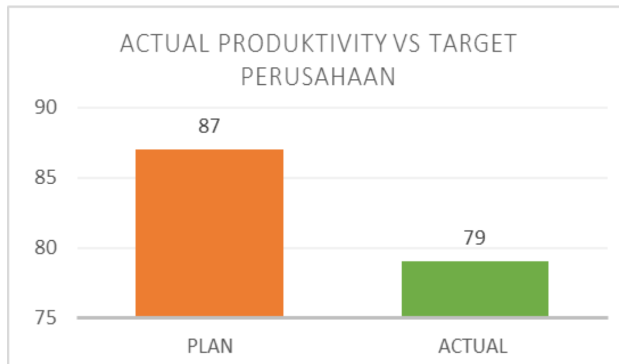

Fig. 3. Actual Productivity vs. Company Target
(Source: Own Data Processing)

In Figure 3, we have presented data that clearly shows a gap between actual output results and the plan set by the company on Line X Regulator Assy 2, amounting to 8 pcs/hour or 58 pcs/shift if production is carried out for one shift of 7.5 hours.

2) Condition Analysis

After the researcher identifies the problem and understands it, the next step is to conduct a condition analysis by directly reviewing the location to be analyzed. The process involves data collection, such as Flow Process production and Cycle Time, followed by data processing and problem analysis.

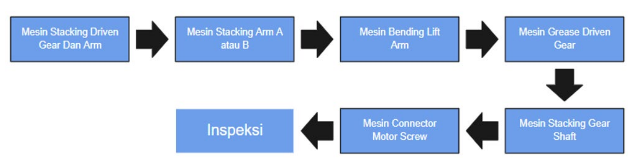

Fig. 4. Production Process Flow on Line X Regulator Assy 2
(Source: PT XYZ)

In Figure 4, the production process on Line X Regulator Assy 2 begins with the Stacking process on the Stacking driven gear machine, followed by the Stacking Arm A or B process until the final inspection. Table 2 shows the data gap between target and actual time.

Table 2
Target & Actual Data

Target	Actual
1,378 minutes/pcs	1,518 minutes/pcs
1.378 x 60 : 2 =4 1.34 Seconds	1.518 x 60 : 2 = 45.54 Seconds
87	79
There is a gap of 4.2 seconds or 8 pcs	

(Source: PT XYZ)

Table 2 contains target and actual data, showing the difference between target and actual data with a gap of 4.2 seconds or 8 pcs.

No.	Type Of Work	Time	Frequency	Total Time/Pcs
1.	Take & Throw Away Gray Roller Pin Box	6	400	0,02
2.	Take & Throw Away Lift Arm Bracket	12	60	0,2
3.	Take Box Lift Arm	5	60	0,08
4.	Take & Throw Box Gear	5	40	0,13
5.	Take & Throw Box Eq. Arm A	5	100	0,05
6.	Take & Thow Box Eq. Arm B	5	100	0,05
	TOTAL IRREGULER JOB			0,53

STANDARD WORKING TIME (IRREGULER) MP-2				
No.	Type Of Work	Time	Frequency	Total Time/Pcs
1.	Take & Throw Box Motor	4	18	0,22
2.	Human Production	10	100	0,1
3.	Scan & Attach Kanban	5	4	1,25
4.	Push FG from trolly to shutter F/G	120	32	3,75
5.	Change Box F/G	6	4	1,5
6.	Transfer F/G to Trolly	6	16	0,38
7.	Take & Throw Box Gear Shaft Pin	6	600	0,01
	TOTAL IRREGULER JOB			7,21

Fig. 5. Irregular Job Actual Data
(Source: PT XYZ)

In Figure 5, during the Irregular job process, there is a difference between mp 1 and mp 2, visible in mp 2 manually pushing f/g to the f/g shutter, causing a prolonged gap in both mp 1 and mp 2.

3) Setting Targets

Setting targets aims to determine the effectiveness level of the implemented problem using the SMART concept (Specific, Measurable, Achievable, Reasonable, Time-Based).

4) Fishbone Analysis

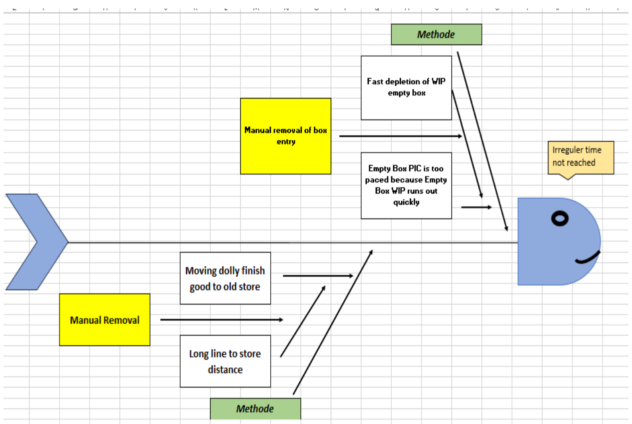

Fig. 6. Fishbone diagram

The Fishbone diagram is categorized into Man, Machine, Method, Material, and Environment.

The Fishbone diagram in Figure 6 reveals several root causes preventing the company's target on Line X Regulator Assy 2 from being achieved, including manually pushing f/g and creating time efficiency on the empty box by automatically fetching the empty box with a dolly transfer.

5) Countermeasure Plan

The next step is to implement countermeasures to address the root causes found in the Fishbone diagram by developing a plan based on the 5W + 1H concept. The following are the improvement steps for Line X Regulator Assy 2.

Table 3
5W + 1H

No.	What		Why	Who	When	Where	How
	Problem	Solustion					
1.	Actual production has not been achieved from the number of production plans	Utilization of transfer dolly to improve cycle time efficiency	to improve time efficiency when pushing the finish good	Departement EMD	01/08/2022	Line X Regulator Assy 2	Request ke EMD
2.	WIP empty box runs out quickly	Creating dolly transfer box autometic	In order to improve time efficiency and empty box PIC can do other work.	Departement EMD	01/08/2022	Line X Regulator Assy 2	Request ke EMD

(Source: PT XYZ)

B. Do Countermeasures

The subsequent step involves implementing counter measures through the improvement process. The following are the implementation details for Line X Regulator Assy 2.

1) Improvement in the Line X Regulator Assy 2 Area on Dolly Finish Good

Fig. 7. Manual dolly and transfer dolly
(Source: PT XYZ)

In the following image, the difference between a manual dolly and a transfer dolly (automatic) can be observed.

In Figure 8, the improvement involves transforming the manual dolly or manually pushing it into an automatic process. The goal is to make the production process more efficient, and operators no longer need to manually push it to the finish good shutter. Instead, when the part reaches the box capacity, they can push it towards the dolly, press the finish good button, and the transfer dolly will move accordingly, pushing it based on the part model.

Fig. 8. Encourage a good finish with manual dolly and transfer dolly
(Source: PT XYZ)

2) Improvement in the Line X Regulator Assy 2 Area on Automatically Supplying Empty Boxes

Fig. 9. Pick up empty boxes manually and automatically
(Source: PT XYZ)

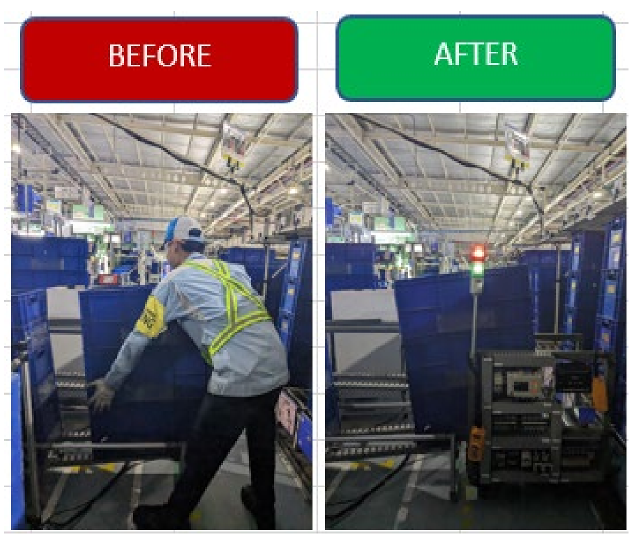

Fig. 10. Process of pushing to the shutter box with manual and automatic
(Source: PT XYZ)

In Figure 9, the manual and automatic retrieval of empty boxes are depicted. When the shutter where the empty box is located is empty, mp 2 can directly press the empty box button for at least 3 seconds, and the transfer dolly will automatically retrieve the box.

In Figure 10, with the presence of the transfer dolly, the process of automatically retrieving empty boxes can save time, allowing the empty box operator to perform other tasks.

C. Check Results Evaluation

The next stage is the check or results evaluation. The step involves comparing the conditions before and after the improvement, as shown in Figure 11.

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
November	79	79	79	79	79			79	78	79	79	77			79	79	79	79	79			79	78	79	79	79			78	79
December	87			87	87	87	87	87			87	87	87	87	87															

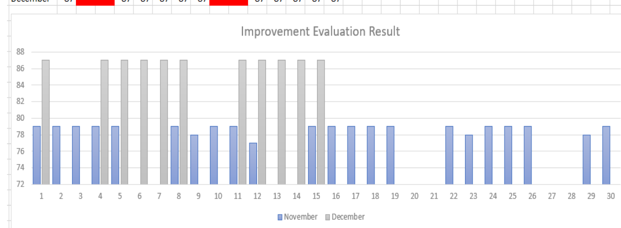

Fig. 11. Improvement evaluation results
(Source: PT XYZ)

In Figure 11, the evaluation results of the improvement made on Line X Regulator Assy 2 are displayed. Before the research related to productivity on November 1, 2023, it was 79 pcs/hour. After the research on December 1, 2023, productivity increased to 87 pcs/hour.

D. Action Standardization

The final step in the PDCA cycle is taking action through standardization. Based on the obtained improvement results, standardization is carried out to maintain the achieved improvement by creating Work Instruction Level 3 in the Line X Regulator Assy 2 area.

4. Conclusion

Based on the research conducted on the production process in the Line X Regulator Assy 2 area at PT. XYZ, the researcher can conclude:

1) The issue with the productivity of Line X Regulator Assy 2 has not met the customer's target. The desired plan is 632 pcs/day, while its maximum capacity is 574 pcs/day.
2) After the improvement, the cycle time process has been reduced by 8.4 seconds/hour or 8 pcs/hour, resulting in a production capacity of 87 pcs/hour or 632 pcs/day.
3) Time savings for the empty box operator are achieved with the presence of the transfer dolly.

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