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Implementation of Just in Time (JIT) System on Line 7 to Enhance Productivity at PT Fuji Seat Indonesia

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A R T I C L E I N F O

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A B S T R A C T

PT Fuji Seat Indonesia is a manufacturing company of automotive parts for four-wheeled vehicles, the products produced are car seats. PT Fuji Seat Indonesia has 7 production lines to assemble 4 types of car seat models but in the process of preparing production materials in Line 7 there is often a problem of material shortages, causing waiting time due to the unavailability of materials needed for production. Building on the background provided, this study aims to identify the causes of material shortages in Line 7, explore strategies to minimize or eliminate these shortages, and evaluate whether the Just in Time method can effectively address the material shortage issues in Line 7. According to the research findings, PT Fuji Seat Indonesia utilizes the Just in Time method to enhance production process productivity, particularly through the adoption of a pull system. The improvements include the implementation of a one-piece flow system, focusing on a production pattern for each model. As a result of these enhancements, productivity on Line 7 increased from 53.8 units per hour to 56 units per hour (+2.3 units per hour), and production efficiency rose from 93.4% to 97.4% (+4%).

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INTRODUCTION

1. Background

PT Fuji Seat Indonesia is a manufacturer of automotive components for four-wheeled vehicles, specifically producing car seats. The company operates seven production lines to assemble four different car seat models. However, the material preparation process frequently encounters issues with material shortages, leading to delays as production waits for the necessary materials. Below is the data regarding production downtime related to the material preparation process from 2023 to 2024.

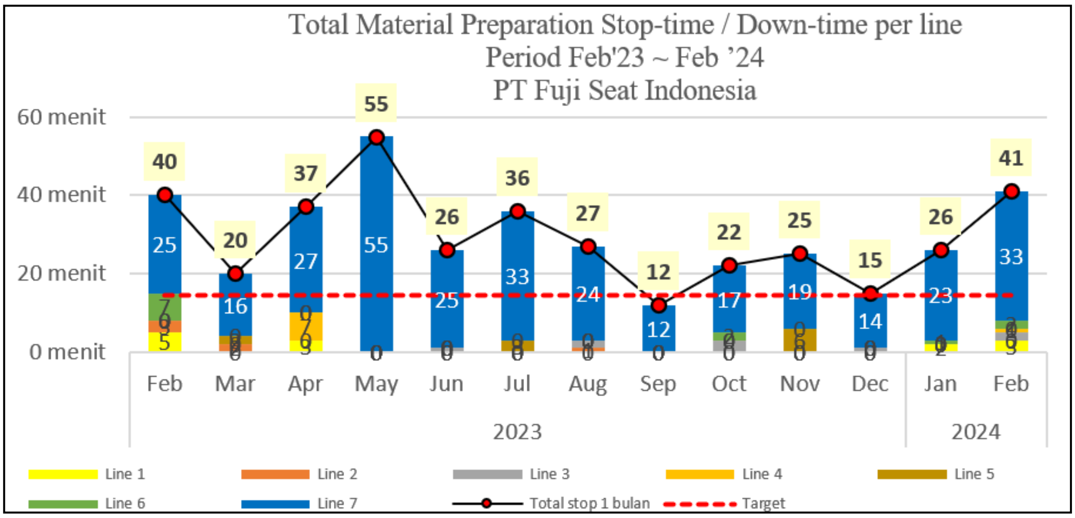


Figure 1. Total Downtime in the material preparation section.

Figure 1. Illustrates the total downtime during the material preparation process across seven lines from February 2023 to February 2024. It is evident that the target of 14.5 minutes per month was not met.

Tabel 1. Aggregate downtime for material preparation per year across all production lines.

No.	Line Persiapan Material		2023										2024		Total (menit)	Rata-rata (menit)
			Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb		
1	Line 1	Jumlah waktu stop (min)	5	0	3	0	0	0	0	0	0	0	0	2	3	13	1,00
2	Line 2	Jumlah waktu stop (min)	3	2	0	0	0	0	1	0	0	0	0	0	0	6	0,46
3	Line 3	Jumlah waktu stop (min)	0	0	0	0	1	0	2	0	3	0	1	0	2	9	0,69
4	Line 4	Jumlah waktu stop (min)	0	0	7	0	0	0	0	0	0	0	0	0	1	8	0,62
5	Line 5	Jumlah waktu stop (min)	0	2	0	0	0	3	0	0	0	6	0	0	0	11	0,85
6	Line 6	Jumlah waktu stop (min)	7	0	0	0	0	0	0	0	2	0	0	1	2	12	0,92
7	Line 7	Jumlah waktu stop (min)	25	16	27	55	25	33	24	12	17	19	14	23	33	323	24,85

Source: Production Report 2023-2024, PT Fuji Seat Indonesia.

Table 1. Presents the total downtime for one year in the material preparation process across seven lines from February 2023 to February 2024. The highest downtime was recorded on Line 7, with a total of 323 minutes.

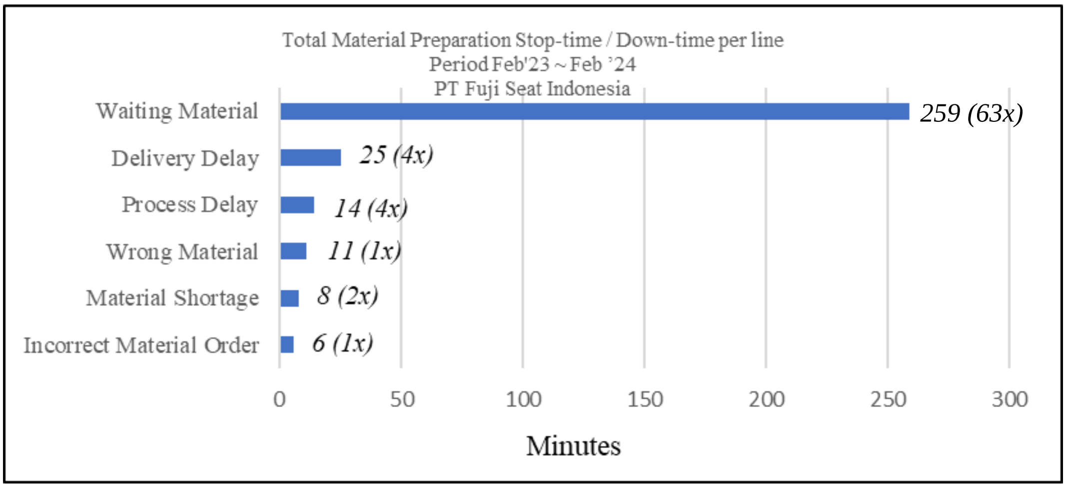


Figure 2. Overview of root cause downtime on Line 7 in the material preparation process.

Figure 2. Provides a comprehensive analysis of the issues causing downtime on Line 7 for one year in the material preparation process, specifically from February 2023 to February 2024. It is evident that the most significant issue on Line 7 was waiting for materials, which occurred 63 times and resulted in a total downtime of 259 minutes.

The data indicates that Line 7 experiences the highest production downtime in the material preparation process, totaling 323 minutes. The primary issue contributing to this downtime is waiting for materials, accounting for 259 minutes, which hampers production productivity. Consequently, the author plans to analyze the problem using the 5 Why analysis and the 5W-1H method, followed by developing the PDCA method to implement the Just in Time strategy aimed at enhancing production productivity on Line 7.

2. Formulation of Problem

Based on the background explanation provided, the problem formulation for this study focuses on identifying the causes of material shortages on Line 7. It aims to explore strategies to reduce or eliminate these material shortages and to determine whether the Just in Time method can effectively address the issue of material shortages on Line 7.

a. Objectives

Based on the outlined research limitations, the objective of this study is to identify the causes of material shortages on Line 7. It also seeks to explore methods for reducing or eliminating these shortages and to assess the effectiveness of the Just in Time method in addressing the material shortage issue on Line 7.

LITERATURE REVIEW

1. Definition of Just in Time

Just In Time (JIT) is a model in which companies produce goods only as needed, without relying on existing inventory and avoiding inventory costs. Each step in the process is designed to fulfill the requirements of the subsequent step. Production only occurs when there is a signal for the next phase of the process that indicates a need for manufacturing (Maliki et al., 2022). This approach is crucial for manufacturing firms as it has significant implications for cost management, emphasizing the principle of producing only when necessary—essentially, manufacturing only as required, at the right time, and in the exact quantities needed. The primary aim of this system is to enhance productivity while minimizing waste (Maliki et al., 2022).

Just In Time (JIT) was initially introduced by Taiichi Ohno within the production system of Toyota Motor Company in Japan. Ohno defined Just in Time as ensuring that the parts needed for assembly arrive at the end of the assembly line precisely when required and in the appropriate quantities. Supply Chain Management identifies two key distinctions:

a) The Push system occurs when a company produces goods in large volumes to achieve economies of scale, which are then distributed to consumers. This method typically involves production in lots. The Lot System refers to a production pattern where a group of supplies or batches is produced under uniform conditions and in a predetermined quantity, which is usually more than one (Figure 2.1).

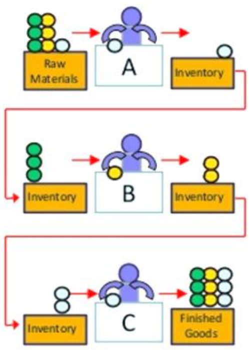


Figure 3. Production System Utilizing Lots/Batches/Groups

Disadvantages of the Lot systems are:

- Long Lead time (waiting time)
- Required to maintain inventory materials (WIP) work in process.
- Adjustment lead time when there are changes from customers.

b) The pull system is utilized when a business aims to attain a high level of process efficiency. In this approach, there is no goods or services are produced until there are orders from customers for the company's products. This typically employs the One-Piece Flow System, which involves completing each production task sequentially. Work is done on one product until it is finished, followed by the next product, and so forth (Figure 4).

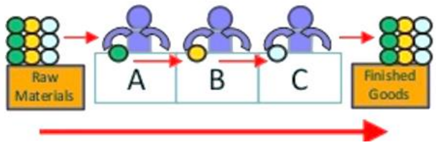


Figure 4 One Piece Flow production system

The advantages of One-Piece Flow system are:

- Reduced lead times (Shorter waiting time).
- No requirement to maintain inventory materials (WIP) Work in Process.
- Immediate adjustments can be made when there are changes from customers.

In essence, a pull system involves producing goods and services and enhancing product value only when there is customer demand, eliminating the need for inventory. This system begins by estimating the required production quantities and then works backward to identify the amount of goods to be produced, along with the necessary raw materials, resources, and labor. This concept forms the foundation of Just in Time (JIT) production.

2. Just in Time Concept

According to Hendrayanti et al. (2022), Just in Time (JIT) management is recognized for its ability to reduce costs and waste while enhancing business efficiency and profitability. The key principles of the Just in Time concept as follows:

a. Emphasis on simplicity and on-time.
b. Maintaining high-quality standards
c. Eliminate non-added value activities through ongoing improvement initiatives.

3. Objectives and Advantages Just in Time

According to Dahtiah & Setiawan (2020), the implementation of the Just in Time (JIT) system offers several objectives and advantages, including:

a. Eliminate wastes. The implementation of the Just in Time system within the company aims to remove activities that do not enhance the value of the products manufactured.
b. Importance of Employee Engagement, Active participation from all stakeholders, such as managers and employees, is essential for the organization's operations within the Just in Time framework. Empowering employees is important to achieve the system's objective of enhancing the company's efficiency and productivity, given their substantial impact.
c. Reduce or completely remove defective products. Defective items could bring challenges for businesses by leading to delivery delays and the need for rework to replace them, ultimately disappointing customers. By

minimizing product spoilage rates, the efficiency of produced goods will improve.

d. Enhance productivity, defined as the ratio of output to input in a production process over a specified timeframe. Inputs consist of management, labor, production costs, equipment, and time, while outputs encompass production volume, product sales, revenue, market share, and product losses.
e. Increase productivity, which is the ratio of output to input in a production process over a defined time period. Inputs involve management, labor, production cost, equipment, and time. Outputs consist of production levels, product sales, revenue, market share, and instances of product damage.

4. Characteristic Just in Time

According to Tias (2020), the main characteristics of companies that have implemented the Just in Time (JIT) system include:

a. High Quality

Companies that have implemented the JIT system aim to achieve a quality standard that enable them to minimize inventory and shorter lead times. The JIT system focuses on eliminate non-value-added activities and encourages employees to participate in for continuous improvement. In other words, the company believes it is preferable to manufacture high-quality products at a slightly increased production cost rather than to create low-cost goods that lack quality.

b. Minimal Inventory

In JIT system, Inventory is considered as a waste since it requires storage costs and other additional costs. The inventory level is optimized, just sufficient to support the production process until the next stage of work. Once runs out, it will be replenished to ensure an uninterrupted workflow.

c. Flexible production lines

Manufacturing systems incorporate adaptable production configurations and equipment to minimize the frequent movement of goods, reducing the need for storage. Frequent product movement is often seen as a non-value-added activity that does not contribute additional value.

d. Organizational Structure Change that leads to Product

JIT System concept requires that each part of the manufacturing process has its own dedicated service area, allowing for early detection of any deviations

a. Just in Time Requirement:

In applying the Just in Time (JIT) method, there are conditions that must be fulfilled by the company to adopt this JIT method. These conditions according to Indriyastuti (2011) are:

a. Factory Organization: The JIT system organizes the production layout based on products, positioning all necessary processes for manufacturing a product in one location. Prior to establishing a JIT layout, the company must identify the processes needed for product processing.

b. Team trainings or up-skilling
c. The JIT system originated in Japan, so companies must be prepared for transformation, including their workforce. Employees receive training on managing the transition from the previous system to the JIT system. This training covers the fundamentals of JIT, its requirements, and the advantages and disadvantages of implementing JIT.
d. Streamlining the workflow
e. The new production line can be designed to optimize the production process, balance the process, and address initial challenges. However, achieving this is not that easy, maintaining high discipline in executing the implemented processes is crucial.
f. Kanban Pull-System: The Kanban system is information system that uses signs and cards to manage production. This system ensures that the necessary materials align with the quantity and specifications of orders.

5. Productivity Measurement

Measuring labor productivity is an effective method for enhancing overall productivity. The results from these measurements serve as a benchmark to assess future improvements in labor productivity by comparing them to existing standards, which can help boost productivity in subsequent work. The choice of reference or benchmark to be used will depend on the specific type or factors influencing the inputs and outputs of the respective company or organization.

According to Hasibuan (2016) Proposes a method for assessing work productivity as follows:

Labor Productivity = output ÷ input
Productivity per capita = O ÷ N x H

Description:
O= output or result
N= Hours/day of actual work
H= Number of laborers

According to Sinungan (2017), in general, the measurement of work productivity means a comparison that can be divided into three very different types:

a. Evaluating current performance against previous performance does not indicate whether the current performance is satisfactory; it merely illustrates the level of increase or decrease and the magnitude of these changes.
b. Compare the performance of a process (such as an individual task, department, or overall process) against other processes. Such measures will reflect relative success.

c. Compare current performance against established targets. This is the most effective method to direct focus towards goals and targets.

Preparing this comparison, it's important to take into account the organizational level and the comparison of productivity indicators. There are two distinct levels of comparison, such as total productivity and partial productivity:
Total Productivity = Total Output ÷ Total Input
Partial Productivity = Partial Output ÷ Partial Input

METHODOLOGY

1. Participatory and quantitative observation methods

In the participatory observation method, several approaches will be applied for research at PT Fuji Seat Indonesia, as outlined below:

1. Observation: In this study, researchers utilized direct observation techniques in the field to obtain data directly. The collected data includes production quantities, cycle time information, inventory levels, and data of production line stoppages / downtime.
2. Interview: During the interview process, researchers engage in two-way communication by asking questions and receiving answers from both workers and leaders on-site. The goal is to identify existing issues by comparing data with actual conditions, thereby uncovering the true nature of the problems.

2. Five Why Analysis Method

The 5 Why method is used to investigate and identify the root cause of issues. According to Taiichi Ohno, in a manufacturing or production setting, when mistakes occur, individuals often blame one another, despite the fact that errors are unavoidable. The most effective way to address these issues is to identify the root cause and take corrective action. The 5 Why Analysis offers a structured, evidence-based approach to problem-solving, aiming not only to reduce errors but also to eliminate them entirely. It emphasizes finding long-term solutions to waste disposal challenges rather than merely focusing on waste reduction (Murugaiah et al., 2010).

3. Definition of Plan, Do, Check, Action (PDCA)

Dr. W. Edwards Deming introduced the Deming cycle (also known as the Deming Wheel), which emphasizes that quality can be managed through a continuous improvement process. The PDCA (Plan-Do-Check-Action) framework is utilized to enhance the performance of manufacturing processes within a company. Implementing the Deming cycle leads to the standardization of product quality across the entire organization, and this model is continually applied to facilitate ongoing process improvements within the cycle of continuous improvement.

According to Fitriani (2018), the PDCA cycle, often referred to as the PDCA cycle, is an effective strategy for enhancing any process situation. The standards established can be further improved and refined in future PDCA cycles. The PDCA cycle serves as more than just a problem-solving tool, it is fundamentally a method for ongoing process improvement. During the implementation of Kaizen, the PDCA cycle necessitates the definition of various standards, including process standards, system standards, and work instruction standards. All tasks must be measured and executed according to these established standards.

Once any improvement has been made, it must be standardized to ensure consistency, allowing for further enhancements. The PDCA cycle consists of four stages, which are:

1. Planning: The First step is to create a plan. This involves outlining a specification plan, clearly defining technical parameters or quality standards, and ensuring that subordinates recognize the significance of product quality. Additionally, quality control should be implemented consistently and continuously.
2. Implementation: The prepared plan will be executed in stages, beginning with smaller tasks and distributing responsibilities evenly based on each employee's capacity and skills. Throughout the implementation process, oversight is necessary to ensure that all plans are carried out effectively, enabling the achievement of objectives.
3. Inspection: Inspection or evaluation involves assessing whether the implementation aligns with the plan and tracking the progress of the intended improvements. By comparing production quality against established standards, defect data is obtained through research, allowing for an examination of the underlying causes of any defects.
4. Improvement: The step four, Take Corrective Action if Necessary (Action). If needed, adjustments are made based on the outcomes of the analyses mentioned earlier. These adjustments include standardizing new processes to prevent the same issues from arising again or setting new goals for further improvements.

The PDCA cycle is frequently referred to as the Shewhart Cycle, named after Walter Shewhart, who introduced it several decades ago. Over time, the PDCA analysis method became known as the Deming cycle due to W. Edwards Deming's efforts to popularize and broaden its application. Nevertheless, Deming continued to call it the Shewhart Cycle in honor of Walter A. Shewhart, who is often regarded as the pioneer of statistical quality control. Eventually, Deming modified PDCA to PDSA (Plan, Do, Study, Act) to more accurately reflect his recommendations. Regardless of the terminology used, PDCA remains an essential tool for ongoing improvement.

RESULT AND DISCUSSION

1. Production Quantity

Line 7 carries out the production process for car seats for the Grandmax model of the Daihatsu brand, for the amount of production on this model it can be said to be stable because every month the average production amount is the same. The following is data on the amount of production on Line 7 obtained from the production department in the field:

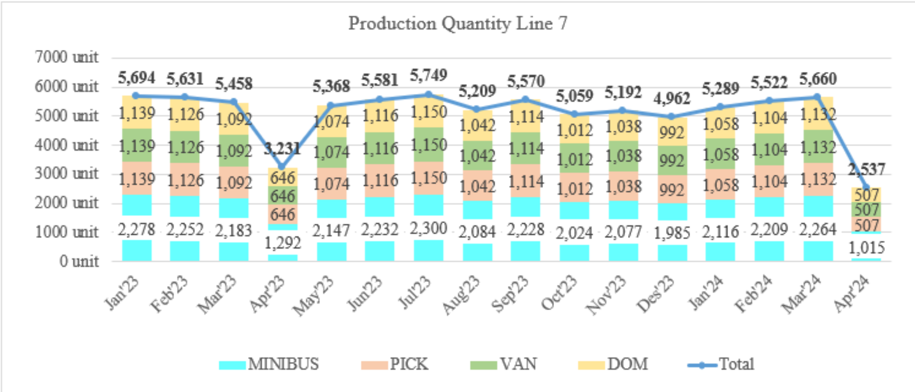


Figure 5. Explains the Total Number of Monthly Seat Units Produced

In Line 7, which is an average of 5,400 units per month with the most models being Minibus.

2. Inventory Quantity

Inventory is one of the key elements in a business, as it helps maintain a balance in the production process and supports the achievement of company objectives. According to Jacobs and Chase (2018), inventory is a necessary resource for conducting production and operational activities. To meet customer demand for material supplies, Line 7 establishes the following stock quantities.

Table 2. Material stock standard data of Line 7

Type	Total Quantity Stock (per *shift*)	Average Production Quantity, 1 Month	Average Production Quantity, 1 Shift	Minus	Remark
DOM	25 set	1085 unit	25 set	0 set	O
VAN	25 set	1085 unit	25 set	0 set	O
PICK	25 set	1085 unit	25 set	0 set	O
MINIBUS	**25 set**	**2170 unit**	**49 set**	**24 set**	**X**
Total	**100 set**	**5425 unit**	**123 set**		

Table 4 illustrates that the current stock standard is 25 sets per shift, while the production requirement for the Minibus type is 49 sets per shift, resulting in a deficit of 24 sets. Another contributing factor is the production mechanism, which uses the lot system as shown in Figure 5 for the Minibus model, there is a machine setup process that places production orders at the end of the queue, leading to material shortages when customer orders are uneven (with more Minibus models ordered initially). Below is the sequence of production lots currently in use:

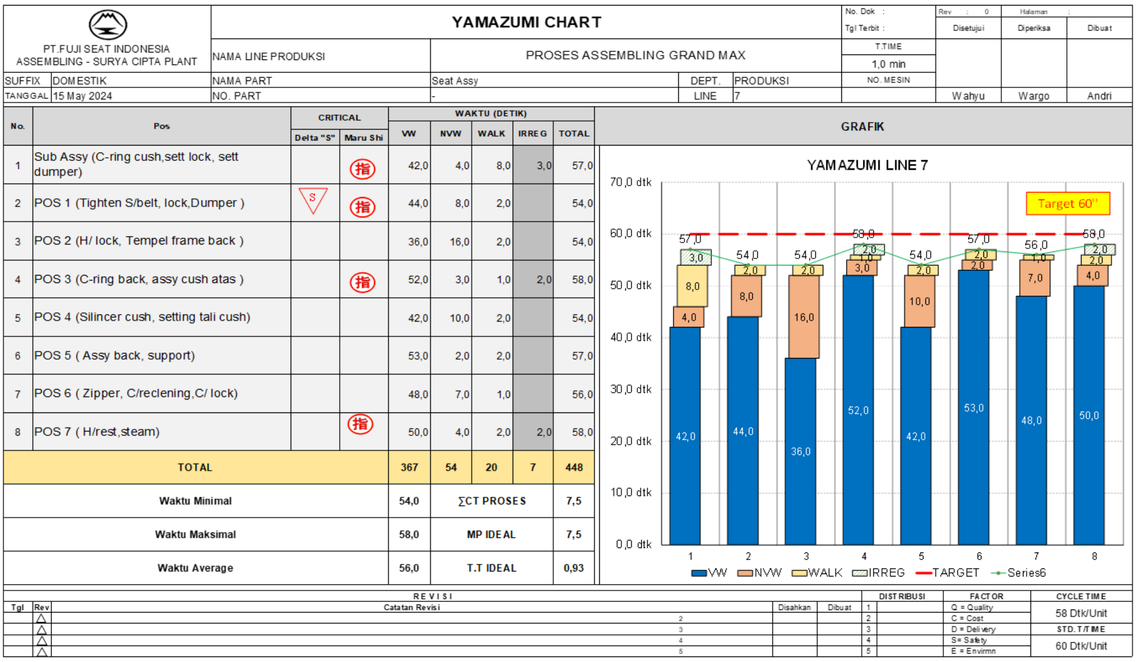
Table 3. Production Queue of Line 7

LOT Queue	Production Time	Minut e	TYPE	C/T	STANDAR PACKING	PROD. QUANTITY	DANDORI MACHINE	07:20	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30
1	07:20 ~ 09:50	150	DOM	6.0	5 set	25 set	No	1 ~ 25 set																		
2	10:05 ~ 11:50	110	VAN	4.4	5 set	25 set	No							1 ~ 25												
3	12:35 ~ 14:05	90	PICK	3.6	5 set	25 set	No											1 ~ 25 set								
4	14:20 ~ 16:10	110	MINIBUS	4.4	5 set	25 set	Yes (10')	Order Customer = potential problem															1 ~ 25 set			

The conclusion is that using a lot system cannot adjust the needs of customer demand

3. Cycle Time

Cycle time is the time it takes for a process to produce a output, with the work including value-added and non-value-added work. In other words, cycle time is the time it takes a worker to complete a process, with the time measured including running time or manual labour. (Damayanthi & Hidayat, 2020). The following is the process cycle time data in Line 7 resulting from direct collection in the production area.



No.	Pos	CRITICAL Delta "S"	Maru Shi	VW	NVW	WALK	IRREG	TOTAL
1	Sub Assy (C-ring cush,sett lock, sett dumper)		指	42,0	4,0	8,0	3,0	57,0
2	POS 1 (Tighten S/belt, lock,Dumper)	S	指	44,0	8,0	2,0		54,0
3	POS 2 (H/ lock, Tempel frame back)			36,0	16,0	2,0		54,0
4	POS 3 (C-ring back, assy cush atas)		指	52,0	3,0	1,0	2,0	58,0
5	POS 4 (Silincer cush, setting tali cush)			42,0	10,0	2,0		54,0
6	POS 5 (Assy back, support)			53,0	2,0	2,0		57,0
7	POS 6 (Zipper, C/reclening,C/ lock)			48,0	7,0	1,0		56,0
8	POS 7 (H/rest,steam)		指	50,0	4,0	2,0	2,0	58,0
	TOTAL			367	54	20	7	448
	Waktu Minimal			54,0	∑CT PROSES			7,5
	Waktu Maksimal			58,0	MP IDEAL			7,5
	Waktu Average			56,0	T.T IDEAL			0,93

Figure 6. Production Cycle Time of Line 7

In the figure 6 The production process time at each station, staffed by 8 workers, has a standard takt time of 60 seconds, with a target time of 58 seconds per process. The total time results are as follows:

- Variable Work (VW) time, representing core tasks: 367 seconds
- Non-Variable Work (VW) time, indicating auxiliary tasks: 54 seconds
- Walking time: 26 seconds
- Irregular job time: 7 seconds

Therefore, the total time needed to produce one unit of the Grandmax model seat is 448 seconds. The data indicates that there are no bottlenecks in the Line 7 process, and the target of 60 seconds per cycle has been met.

4. Production Time

PT Fuji Seat Indonesia has approximately the same time perception as other companies engaged in manufacturing according to the figure below.

Figure 7. Time Concept PT. Fuji Seat Indonesia

The following provides an explanation of Figure 4.5:

1. Available Time refers to the total time that is available in one shift.
2. Working Time/hours, is the time available in a shift that is used for work.
3. Rest /Breaktime, is the time for rest in one shift.
4. Production Time, is defined as the time spent on actual work or production, excluding any non-production time.
5. Non-Production Time, is the time not to do production, for example, done for machine settings, changing dies/molds, etc.
6. Process Time is the effective production time reduced by any loss time.
7. Loss Time, refers to the duration during which products are not being produced within the production time. Loss time is categorized into two types: Idle Time, which is the period when planned production activities are not being executed:
   a. Trial
   b. Treatment
   c. Education
   d. Other activities: Line Stop, is the time when there is no production due to interruption
   e. Material shortages
   f. Machine or Tool breakdown
   g. Network interference
   h. Process problems due to product quality or operator skills

PT Fuji Seat Indonesia operates with 16 hours of working time each day, aiming for an efficiency target of 97% to 100%, which establishes a standard product output of 56 to 57.5 units per hour. Below are the results regarding productivity conditions in Line 7 prior to improvements and measurements of work.

a. Input = Production time: 16 hours/day
b. Output = Number of seats produced: 860 units/day

Productivity Result: $\frac{860\ unit}{16\ jhours} = 53{,}8\ unit/hours$

Production Efficiency: $\frac{53{,}8\ unit}{57{,}5\ unit} \times 100 = 93{,}4\%$

The initial calculations indicate that the efficiency target of 97% was not met due to an average line stoppage/downtime of 24.8 minutes (as shown in Table 4.1). Below is the data regarding the line stoppage time on Line 7 for the one-year period from February 2023 to February 2024.

Tabel 4. Summary of Line Stop data of Line 7

No	Problem penyebab stop proses	Waktu Stop	2023											2024		Total Waktu Stop
			Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
1	Waiting Material	Min	11.9'	24.9'	16.9'	18.9'	22.9'	20.9'	22.9'	10.9'	25.9'	19.9'	20.9'	16.9'	24.9'	259.0'
2	Delivery Delay	Min	1.3'	2.3'	1.6'	1.9'	1.9'	1.9'	2.1'	2.2'	1.7'	1.9'	1.5'	1.9'	2.5'	25.0'
3	Process Delay	Min	0.5'	1.5'	0.8'	1.1'	1.1'	1.1'	1.3'	1.4'	0.9'	1.1'	0.7'	1.1'	1.7'	14.0'
4	Wrong Material	Min	0.2'	1.2'	0.5'	0.8'	0.8'	0.8'	1.0'	1.1'	0.6'	0.8'	0.4'	0.8'	1.4'	11.0'
5	Material Shortage	Min	0.3'	0.7'	0.7'	0.7'	0.6'	0.1'	0.8'	0.9'	0.4'	0.6'	0.5'	0.4'	1.1'	8.0'
6	Inccorect Material orde	Min	0.2'	0.6'	0.6'	0.6'	0.5'	0.0'	0.7'	0.8'	0.3'	0.5'	0.4'	0.3'	1.0'	6.0'
Total Time stop line / Month			14.4'	31.2'	21.1'	24.0'	27.8'	24.8'	28.8'	17.3'	29.8'	24.8'	24.4'	21.4'	32.6'	323.0'
Average Time stop line / Month			24.8'													

Resource: Line Stop report. Line 7 year of 2023-2024, PT. Fuji Seat Indonesia

Table 4. Presents the Line Stop time for Line 7. From the data provided, it can be concluded that the longest line stoppage on Line 7, totaling 259 minutes, is attributed to delays in waiting for materials.

5. 5w-1h Investigation Findings Using the 5W-1H Method

The following are the analysis results obtained from applying the 5 Why and 5W-1H tools to identify the issues encountered in the material preparation process on Line 7.

	5 Why	*5W-1H*					
	Problem Description:	**What problem occurred**	**Why did the problem occur?**	**Where did the problem occur?**	**When did the problem occur?**	**Who was involved in the problem?**	**How did the event occur?**
	Preparation Material Operator *Line* 7 waiting material	**What (Apa)**	**Why (Mengapa)**	**Where (Dimana)**	**When (Kapan)**	**Who (Siapa)**	**How (Bagaimana)**
Why #1:	Material Stock for *Line* 7Shortage	Material Shortage	Initial Stock does not meet requirement	Preparation Material Line 7	In the Middle Production time	Material Preparation Line 7 by WHS team	When an order released by the customer but the material stock is empty
Why #2:	Increased material requests for picking from Line 7 exceed the available stock.	Fluctuation Customer orders	adjustments in market sales orders	Customer Daihatsu	Mid - end of the current month	PPIC ordering with marketing	communication gaps between customers and users
Why #3:	The timing of material requirements does not align with the output results	The output capacity does not align with the requirements	A production plan involves differents orders	Line 7	When the orders are un- balance	Production and PPIC	The preparation process delays,it waits for materials.
Why #4:	Discrepancy between the production mechanism of Line 7 and the customer's request.	The order mechanism different production types	Lot determination has been in place from the beginning	*Line* 7	When the orders are un- balance	Production and PPIC	the initial determination mechanism
Why #5:	The production mechanism of Line 7 utilizes raw lot 1 during a single production shift, whereas customer demand varies with each cycle.	Production uses a lot system, but the customer does not.	The lot in Fuji Seat is standardized and inflexible	*Line* 7	When customer orders are unbalanced (model)	Production and PPIC	When customer orders are unbalanced (model). it leads to issues.

figure 4.6 Analysis result Why Analisis method

Figure 8. Illustrates the Findings from the Investigation Regarding

Figure 8. Illustrates the findings from the investigation regarding the issue of material delays in the preparation process on Line 7, due to a mismatch between demand and stock levels, resulting in material shortages. The root cause of this problem is the discrepancy in the production mechanism of Line 7, which affects product output. Therefore, an improvement plan must be developed to address the issues faced in production on Line 7.

6. Repair Planning with the Method PDCA Improvement Planning with the PDCA Method

To effectively address the issue at hand, a clear plan must be established, outlining the timeline and the individuals responsible for implementing the countermeasures, along with their completion status. Below is the improvement plan for activities conducted on Line 7 utilizing the PDCA method.

PDCA Register

Project: Problem Solving Shortage Material Sub Assy | Leader: Nurhuda | Cycle #: 1

Process: Line 7 (Assembly Grandmax) | Prepared by: Andri Rahman | Updated: -

ACT 100% | PLAN 100% | CHECK 100% | DO 100%

PDCA phase	Activity	PIC	Due date	Activity time (day)	Completion %	Status	Keterangan
	What?	Who?	When?	Expected in hours	%	Open/ Closed	
				296	100%		
PLAN	Production Sub-Assembly System Integration	Heri	20-May-24	20	100%	Closed	
PLAN	Production Order Data Visualization	Juwarmin	20-May-24	10	100%	Closed	
PLAN	Creation of Kanban & Barcode System	Muadz	21-May-24	14	100%	Closed	
PLAN	Adjustment of Material Position on Racks	Mat Yani	22-May-24	40	100%	Closed	
Do	Network Cable Installation	Ricky	23-May-24	2	100%	Closed	
Do	Kanban Creation	Muadz	24-May-24	40	100%	Closed	
Do	Device Installation in Material Rack Area	Haikal	24-May-24	40	100%	Closed	
Do	Modification of Material Racks	Sulis	25-May-24	14	100%	Closed	
CHECK	Data Integration Check with Actuals	Andri	26-May-24	5	100%	Closed	
CHECK	Process Standardization Check	Nurhuda	27-May-24	5	100%	Closed	
CHECK	Data Synchronization Check for Parts In & Out	Heri	28-May-24	5	100%	Closed	
CHECK	Coordination with PIC & Involved Divisions	Andri	29-May-24	2	100%	Closed	
CHECK	Monitoring Trial Simulation Results of System U	Juwarmin	30-May-24	5	100%	Closed	
ACT	Just-In-Time Implementation	Andri	04-Jun-24	40	100%	Closed	
ACT	Creation of New Production System Documentati	Mat Yani	02-Jun-24	21	100%	Closed	
ACT	*Developing Standard Operating Procedures*	Sulis	03-Jun-24	21	100%	Closed	
ACT	Training on the New Production System	All Mp	03-Jun-24	12	100%	Closed	

Figure 9. PDCA Sheet of Improvement Activity Plan

Figure 9. Explains the plans that will be implemented, specifying who will carry out the activities, the duration required for the improvements, and the deadlines indicated in the PDCA form. This allows for monitoring the progress of the improvement planning alongside its actual implementation. The results shown in the figure indicate that all activities have been completed on schedule, from May 2024 to June 2024.

7. JIT Implementation

To address the issues, present on Line 7, the team designated in the PDCA form has carried out the implementation of improvements on Line 7. Below is a summary of the eight improvement implementation activities conducted and the results obtained to realize the Just in Time method, as referenced in Table 4.2 below.

Table 5. Describes the Improvement Activities Carried Out on Line 7

Tabel 4.2 Improvement Implementation

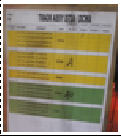
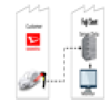
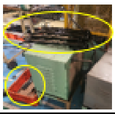
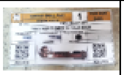
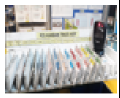
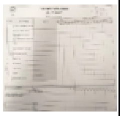
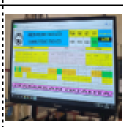
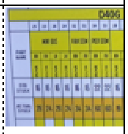
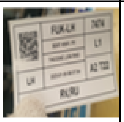
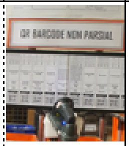
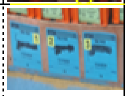
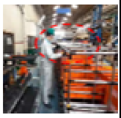
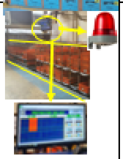
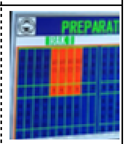
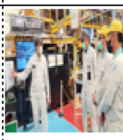
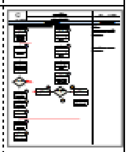
No	$M Factors	Problem	Evidence	Improvement	Evidence	Result	Evidence
1	Methods	The production plan employs raw lots for each shift, which does not align with Line 7's requirements.		Integrate the Line 7 production system to ensure the production plan is consistent		The production system should match Line 7's output with the customer's needs in terms of quantity and timing	
2	Methods	There are excess parts and minimal stock in the material storage area		Kanban is developed as a work instruction and for material distribution, featuring a QR code for system scanning (monitor in and out product results)		There is a stable turnover of materials between demand and stock levels	
3	Methods	Production outcomes are recorded in the hourly production report		A visualization for monitoring material inflow and outflow is established, with stock levels indicated through kanban scanning		Low stock levels will be identified promptly, eliminating the need for manual documentation by using the kanban scanning process.	
4	Methods	The operator can only view the label and part number for material specifications, lacking a visual representation due to similar specifications.		Implement a barcode system that displays an image of the material sample when the operator scans the label.		This will enable operators to easily identify specifications in case of errors in placing the material on boxes or racks	
5	Material	Material stock is maintained for 8 hours or one shift, but the material identity is unclear		Adjust the stock based on customer requirements and label each box as well as the parts rack		The available stock will align with customer orders, ensuring clear identification.	
6	Material	The box lacks identification, making it hard to differentiate the model.		Each box is labeled according to that month's circulation number and the customer's daily orders		The stock quantity, managed by kanban, aligns with production demand.	
7	Machine	There is no alert system for low or empty parts, Increase the risk of incorrect retrieval		Visual monitors for material placement have been installed, along with alarms for abnormal signals		Operators are directed to pick goods based on customer orders.	
8	Man	Slow response occurs when materials run low or are empty, affecting the leaders and PICs for Line 7.		Training on managing minimal materials and promoting the Line 7 production instruction data integration system is essential.		Develop an SOP/rule for handling minimal materials to serve as a standard work reference	

Table 5. Describes the improvement activities carried out on Line 7 with the aim of increasing productivity, with a summary of the improvements:
Method Aspect: 4 improvements (system integration, system scan, stock control, kanban)
Material Aspect: 2 improvements (material rack, part label)
Machine Aspect: 1 improvement (abnormality signal)
Human aspect: 1 improvement (procedure/SOP)

The following outlines the results of productivity conditions on Line 7 following improvements and the assessment of work productivity post-implementation:

a. Input= Production time: 16 hours/day (unchanged from before the implementation)
b. Output= Number of seats produced: 896 units /day (up from 890 units/day)

Productivity Result: $\frac{896\ unit}{16\ hours} = 56\ unit/hour$

Production Efficiency: $\frac{56\ unit}{57{,}5\ unit} \times 100 = 97{,}4\%$

The calculation results indicate that the target of 97% was met, largely due to the elimination of delays caused by waiting for materials. Consequently, the increase in productivity on Line 7 can be quantified as follows:

a. Output per hour: 56 – 53,8 = +2,3 unit/jam
b. Output per day: 896 – 860 = +36 unit/day
c. Production Efficiency: 97,4 – 93,4 = +4%

With these results, it is evident that productivity on Line 7 has improved and meets the anticipated targets.

8. Production System Integration

To facilitate the implementation of the Just in Time system, improvements must be made to the production system's flow, transitioning from a production lot system to a one-piece production flow. This transition is described as follows:

a. The previous production method operated on a lot system, meaning that when a customer placed an order for 1 unit, the system would produce a batch of 4 units (lots), as depicted in the scheme provided in Figure 10.

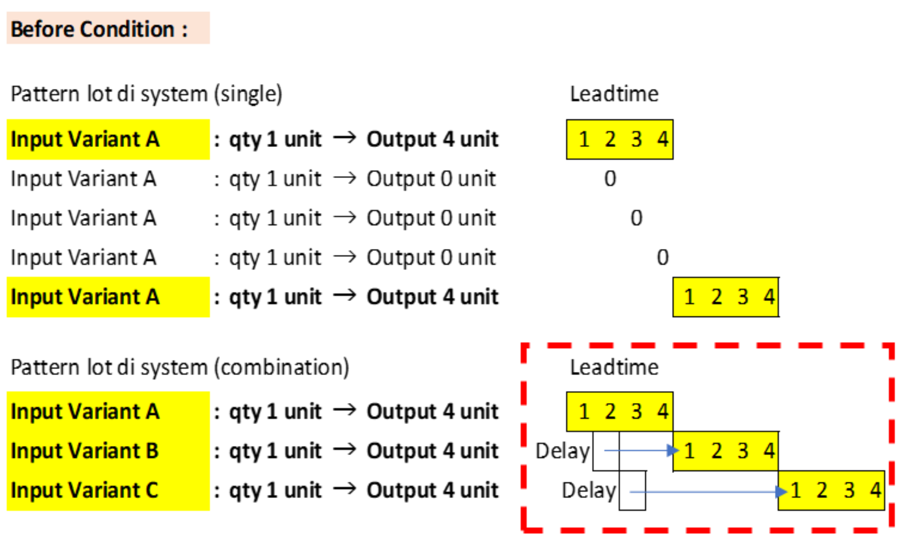


Figure 10. Production system using lots on Line 7

The disadvantages of using this Lot system are:

• Long lead time when changing to the next model.
• Generation of excess inventory.
• Changes in customer order patterns can disrupt the production cycle and material needs.

b. Following the improvements, the production method now employs the One-Piece Flow system, aligning the production pattern directly with customer orders, as shown in the scheme in Figure 11.

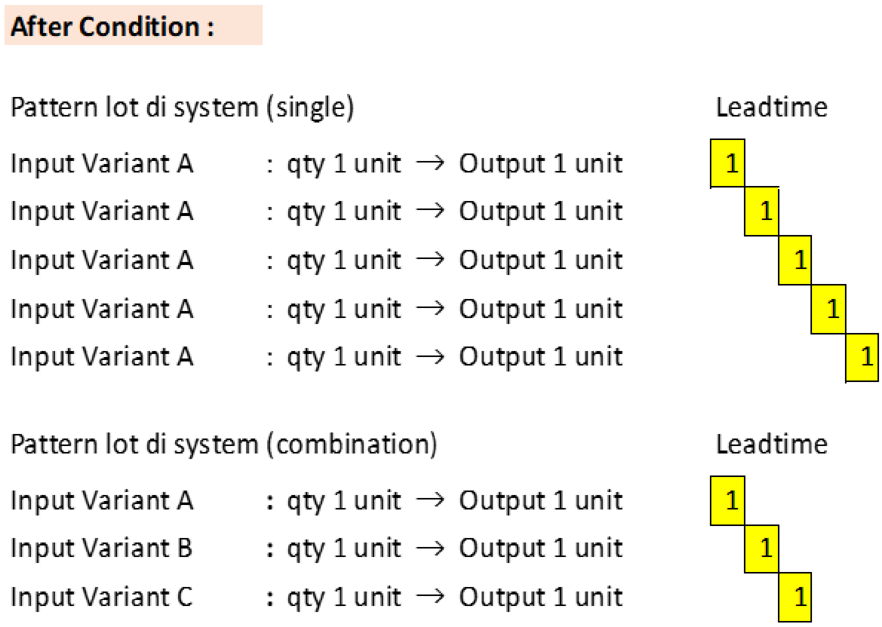


Figure 11. Production system One Piece Flow at Line 7

The advantages of using the One-Piece Flow system are:
• Shorter lead times when switching to the next model.
• Elimination of inventory buildup.
• Changes in customer order patterns do not disrupt the production cycle or material requirements.

To support the implementation of this system, enhancements in technology are also being made by developing a direct online data integration program as illustrated in the scheme below.

A. Previous production flow (Items No. 1 to 5 that require improvement)

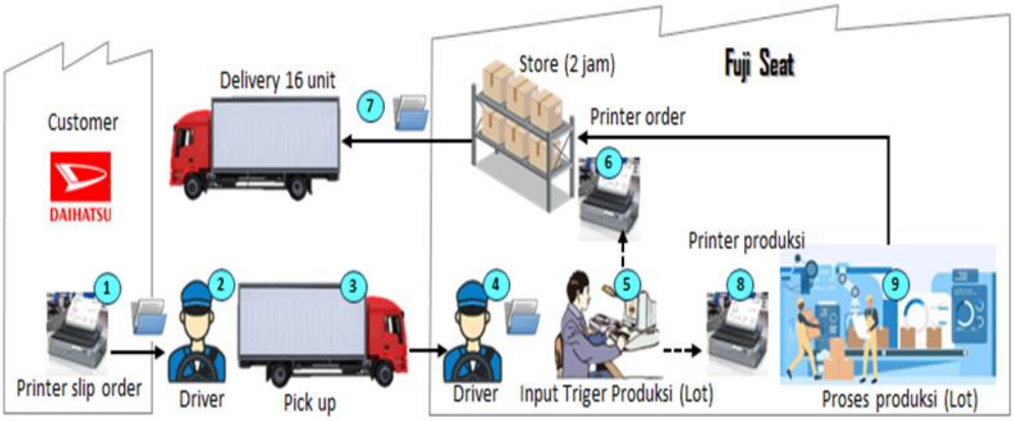


Figure 12. Production flow before Improvement

Figure 12. Explains the production flow before improvement in the following order:

a. Customer prints out the order slip (fill in the slip quantity, model, delivery time).
b. The slip is carried by the driver.
c. The truck goes to PT Fuji Seat Indonesia to pick up the product.
d. Driver gives the order slip to the receiving department.
e. The operator inputs the order slip into the programme as an instruction for product delivery and production process in lot quantities.
f. The input data will print the product order data to be sent.
g. The operator prepares the product in the warehouse area for delivery to the customer as many as 16 units.
h. The input data will print the order of the model to be produced with the number of lots.
i. Perform the production process according to the input data and the finished product is flowed to the Warehouse area for storage, as a replacement for the product that has been sent previously.

Production flow after improvement (No. 1~2 which has been improved)

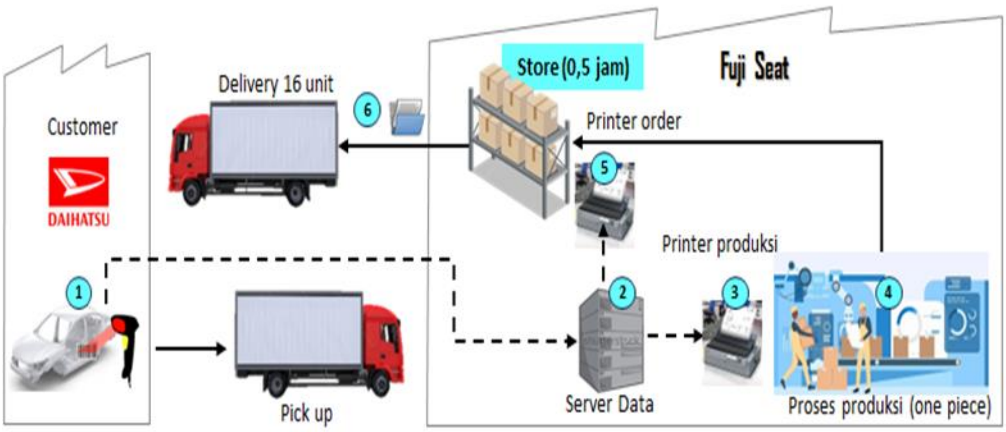


Figure 13. Production flow after Improvement

Figure 13. Explains the production flow after improvement (system integration) in the following order:

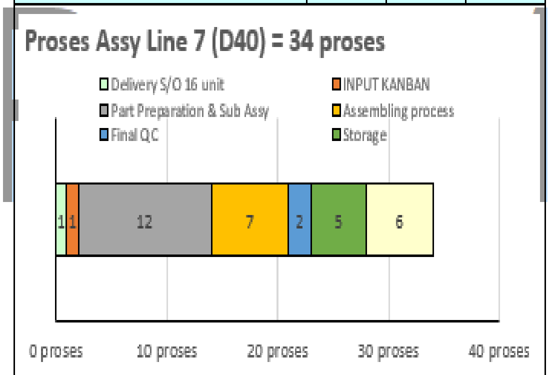
1) Customers scan the car body and the data is directly sent to PT Fuji Seat Indonesia as an order reference.
2) Scan data is received on the PT Fuji Seat Indonesia server to be managed as product delivery instructions and production per 1 unit.
3) The incoming data will print the order of the model to be produced according to the Customer's production directly.
4) Perform the production process according to the data sent by the customer and the finished product is flowed to the warehouse area for delivery to the customer.
5) The operator prepares the products flowing from production to be set up according to the customer's production order.
6) Delivery of products to the customer as many as 16 units/cycle.

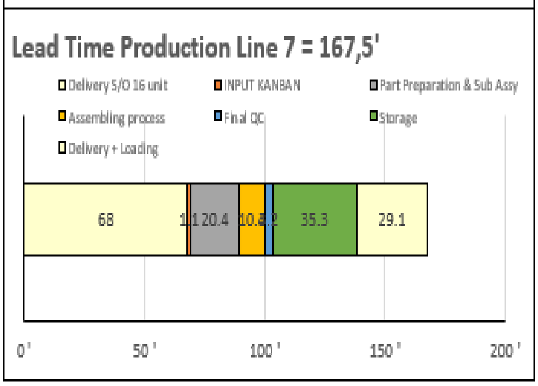
The advantages obtained by integrating the system are as follows:

BEFORE

Production Line 7

Ket	Proses	L/T (min)	L/T (jam)
Delivery S/O 16 unit	1	68	1.13
INPUT KANBAN	1	1.1	0.02
Part Preparation & Sub Assy	12	20.4	0.34
Assembling process	7	10.4	0.17
Final QC	2	3.2	0.05
Storage	5	35.3	0.59
Delivery + Loading	6	29.1	0.49
Total	**34**	**167.5**	**2.79**

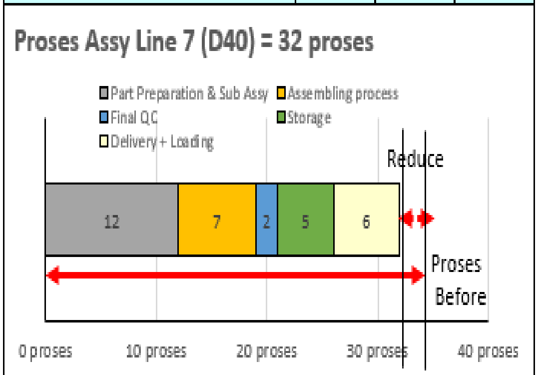




AFTER

Production Line 7

Ket	Pos/Unit	L/T (min)	L/T (jam)
Delivery S/O 16 unit			
INPUT KANBAN			
Part Preparation & Sub Assy	12	20.4	0.34
Assembling process	7	10.4	0.17
Final QC	2	3.2	0.05
Storage	5	35.3	0.59
Delivery + Loading	6	29.1	0.49
Total	**32**	**98.4**	**1.64**



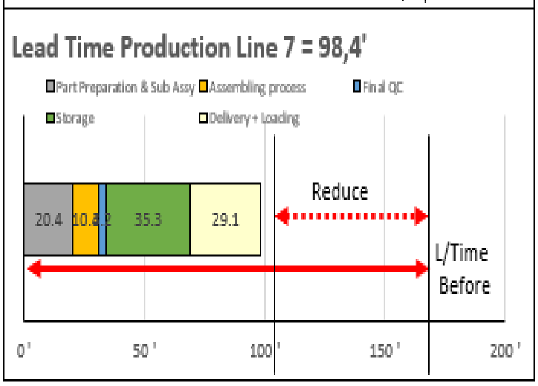


Figure 14. Lead time comparison at Line 7

Figure 14 Shows the comparison of lead time on Line 7 before and after the improvement, with the explanation below:
1. Total process of Line 7: 34 processes - 32 processes = -2 processes/cycle.
2. Process lead time at Line 7: 167.5 minutes - 98.4 minutes = -69.1 minutes/cycle.
3. Order slip input operator at Line 7: 1 person→ 0 person = -1 person/shift.

With the achievement of the results of all the improvements made above, effective and efficient productivity in Line 7 was successfully achieved and the improvements made had an impact on increasing unit output per hour, accelerating production process lead time, reducing input operators, reducing finished product stocks, as summarised in the table below.

Table 6. Recapitulation of Results Before and After Improvement

No	Before Improvement	After Improvement	Result	Description of improvement
1	*Output* 53,8 *unit*/hour	*Output* 56 *unit*/hour	+2,3 *unit*/hour	*Reduce stop line* 30 min/day (effective)
2	Production Efficiency 93,4%	Production Efficiency 97,4%	+4%/day	
3	Operator *input* 1 person	No operator *input*	-1-person input	System Data Integration (Efficiency)
4	System *lot* (4 unit/*lot*)	Production per 1 *unit*	*On Customer Demand*	
5	*Driver* Slip Delivery 1 person	*Online* production data	*Auto print* di PT. Fuji Seat Indonesia	
6	Product Stock 2 hours	Product Stock j 0,5 hour	Stock Reduce 1,5 hour	
7	Total 34 process	Total 32 process	-2 process	
8	*Lead time* 167,5 minutes/*cycle*	*Lead time* 98,4 minutes/*cycle*	-69,1 minute/*cycle*	

In the next step, the improvement activities implemented on Line 7 will also be applied to Lines 1 - 6. This approach is part of a broader improvement plan aimed at enhancing productivity at PT Fuji Seat Indonesia.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research, the author concludes that the cause of material shortages on Line 7 at PT. Fuji Seat Indonesia is due to a mismatch between the quantity of orders from customers and the amount produced, leading to material shortages. Additionally, discrepancies arise from the production pattern that utilizes a lot system, which does not align with the model patterns ordered by customers.

To address the issue of material shortages, a change in the production pattern was implemented, shifting from a lot system to a one-piece flow system. This adjustment ensures that customer orders precisely match what is produced at PT. Fuji Seat Indonesia.

By implementing the Just in Time method, productivity at PT. Fuji Seat Indonesia has improved, with product output increasing from 53.8 units per hour to 56 units per hour (+2.3 units per hour) and production efficiency rising from 93.4% to 97.4% (+4%). This improvement is a direct result of resolving the material shortage issues on Line 7.

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We would like to express our sincere gratitude to everyone at PT Fuji Seat Company for their support who dedicated their time and effort to collaborate with us throughout the research process. This article would not have been possible without their collaboration, professionalism and everyone involved. Thank you for your partnership and for believing in the importance of this research. We look forward to future collaborations and continued success together.

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