LINE BALANCING IN SAS LINE 6 THROUGH CYCLE TIME OPTIMIZATION

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ABSTRACT

SAS department is currently facing high expense in terms of Labor Dependent Cost (LDC). As observed during Gemba walk, the operators have a long waiting time from the previous process to the next process.

With this, Jishuken workshop was conducted to verify the actual happening in the production and applied necessary lean improvement by implementing the following items:

1. Cycle time optimization
2. Process combination
3. Line re-layout
4. Machine re-qualification
5. Documents update and roll out.

After the implementation, the waiting time for some processes was reduced and at the same time, re-layout was also implemented in the line.

1. 0 INTRODUCTION

Upon GEMBA walk and visits in SAS Production Shopfloor, there was **OPERATORS AND SOME PROCESSES THAT WERE IDLE DUE TO UNAVAILABILITY OF UNIT FROM PREVIOUS STATION/S in Line 6.**

Line 6 is a **One-Piece Flow** line.

1.1 The Sub-major Heading

Line 6 was set to be the pilot line which usually took a total of 510 seconds for the parts to be assembled. The breakdown was:

369 seconds = actual working time
141 seconds = waiting time

1.1.1 Second Level Subheading

Processes with long idle time:

Pin Cutting and O-ring Insertion – 5.06s	Bracket Assy 1 – 7.18s
Glue Plus Tube Insertion – 8.34s	Bracket Assy 2 – 6.99s
Connector Assy – 7.98s	Body Grommet Repo – 8.49s
Terminal Crimping WSS – 6.98s	Line Marking 1 – 6.98s
Terminal Crimping EPB – 6.99s	Line Marking 2 – 6.75s

Above are the contributor station with long idle time.
See Figure 1:

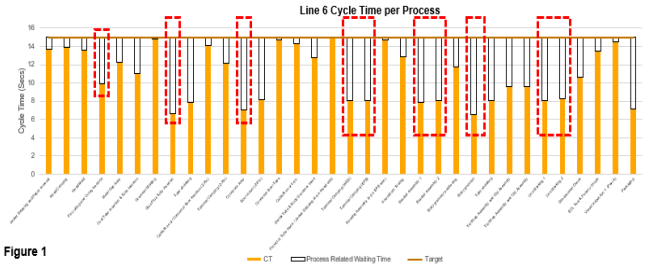


Figure 1

As shown in Figure 1, there were unbalanced cycle time per station which was causing the long waiting time. From that, the station was subject to time study with a high possibility of process combination.

1.1.2 Second Level Subheading

Based on the initial computation, the possibility of 10% headcount reduction was one of the targets to be achieved.
See Figure 2:

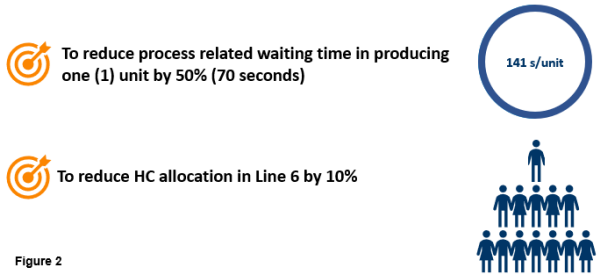


Figure 2

2. 0 REVIEW OF RELATED WORK

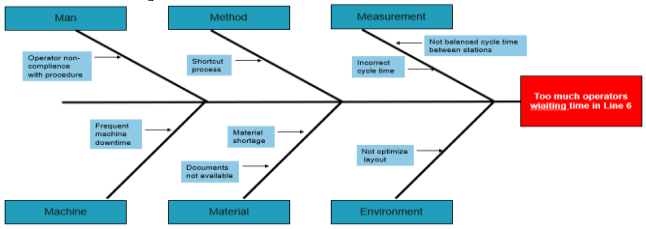
There were a lot of "muda" or wastes that contributed to the problem (LDC) that needed to be addressed:

1. **Slider hanger** – used by means of transporting the parts from one station to another. However, the actual scenario is not really utilized according to what is expected according to the design.
2. **Line station –** defined as an execution process to assemble the parts according to the material flow and with assigned one operator for each of the station without considering the defined cycle time.
3. **Tools and equipment** – most of it was designed for manual operation that results to longer cycle time.

3.0 METHODOLOGY

The following methodology was applied in addressing the problems observed during the Jishuken workshop and other improvement tools to find the root-cause of the problem.

Fishbone analysis:



Defined potential root-cause through Fishbone diagram. Matrix validation was used to verify the potential root cause.
See table 1:

Category	Potential Causes	Verification Method	Result	Conclusion
Man	Operator non-compliance with procedure	Conduct line observation	Operator are compliance based on standard work instruction	NOT VALID
Method	Shortcut process	Conduct line observation	Operator are doing process based on standard work instruction	NOT VALID
Measurement	Incorrect cycle time	Check cycle time per process	Actual cycle time per process is within the target	NOT VALID
	Not balance cycle time within process	Performed JISHUKEN analysis	There are unbalanced cycle time per process	VALID
Machine	Frequent machine downtime	Check machine downtime history	No frequent/recurring machine downtime recorded	NOT VALID
Material	Material shortage	Check material availability	No material shortage recorded	NOT VALID
	Documents are not available	Check documents posted in line	All necessary documents needed are available and posted within the process	NOT VALID
Environment	Not optimize layout	Check layout	Layout are according to the process flow	NOT VALID

Table 1:

Through 5 Why's, the root-cause was validated.
See table 2:

Verified Causes	Why 1	Why 2	Why 3	Why 4	Why 5	Why 6
Not balanced cycle time within stations	Different cycle time per stations	Some stations have shorter cycle time as compared with other stations in Line 6	Cycle time for some stations have been shortened thru time	Improvements were implemented resulting to shorter cycle time but incurred idle time	No re-assessment conducted after implementation of improvement	No JISHUKEN implementation in SAS

Technical root cause: Different cycle time per stations

Systemic root cause: No JISHUKEN implementation in SAS

Table 2:

Through 5 Why's, it was identified that multiple issues could be addressed through Jishuken workshop.
See illustration 1:

The below seven lines were the defined processes that were possible to be combined from two to one headcount allocation, because of long waiting time.

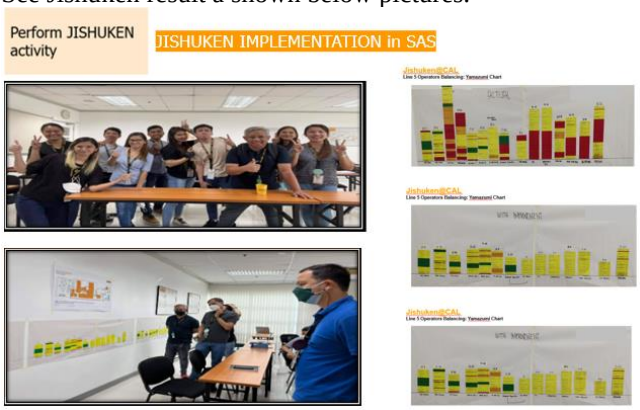
Summary of Experimental Combinations

Illustration 1:

4.0 RESULTS AND DISCUSSION

The opportunity of improvement was defined to start at Line 6 as the pilot line. The team decided to use Jishuken workshop approach for everyone to collaborate and understand the current situation. Supervisors, down to the operators, including all sections under SAS were invited to participate in the workshop.

See Jishuken result a shown below pictures.



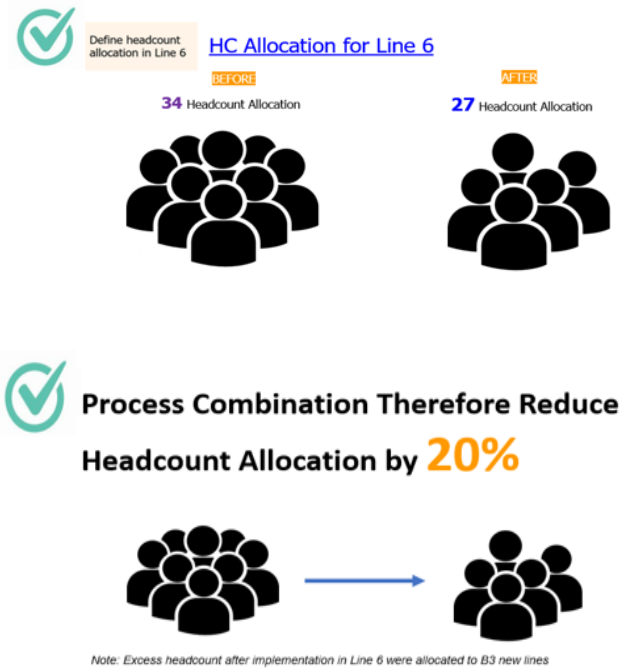
The results were presented to the managers from production, quality, planning and process/maintenance team, support and agreed to implement the defined activity to the line as final improvement.

Aside from improved waiting time (cycle time), there were 14 stations that were successfully combined and was reduced to seven stations. This re-layout resulted to additional available space in the area that the employees can use for team meetings.

See picture & illustration 1:

Picture & illustration 1:

Therefore, the overall result of this workshop was 110% based on the initial target defined.



5.0 CONCLUSION

The overall observation in SAS was that there was a lot of processes to be improved. However, one of the less expensive improvements was the cycle time optimization, that would reduce the waiting time.

Moreover, giving time to study all processes/stations would result to finding the best and unique solution for each process that will lead to continuous improvement, such as having less headcount with same output.

Through workshop, finding solution would be much easier when everyone is contributing unique ideas and sharing their first-hand experiences and knowledge.

6.0 RECOMMENDATIONS

No.	Action Items:	Responsible:	Date:	Status:
1	Jishuken Workshop	G, Orbin	Nov. 2022	Done
2	Information and roll out	G. Orbin	Jan. 2023	Done
3	Implementation of combine process	K. Dumdum	Feb. 2023	Done
4	Alignment of combine station	K. Dumdum A. Marquez	Feb. 2023	Done
5	Line re-layout	G. Orbin	Feb. 2023	Done
6	Fabrication of Slider hanger (4pcs)	G Orbin	Jun. 2023	Done

7.0 ACKNOWLEDGMENT

To the author's fellow SAS colleagues who helped so much on the success of this project and to all the workshop participants:

1. Redmond Ritualo
2. Arllan Punzalan
3. Recah Lastimosa
4. Aleli Marquez
5. Karen Ann Pagaspas
6. Kenneth John Dumdum
7. Jovielane Dela Cueva
8. Joemar Caida
9. Raymark Alcaraz

8.0 REFERENCES

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2. Donald R. White, "The Electron Microscope" in **Physical Methods of Testing**, Control Technologies Inc., N. Sauer (ed.), **1992**, pp 4.22-4.23

3. M. Greenwood, P Oredsson Art of writing Heatmont

9.0 ABOUT THE AUTHOR

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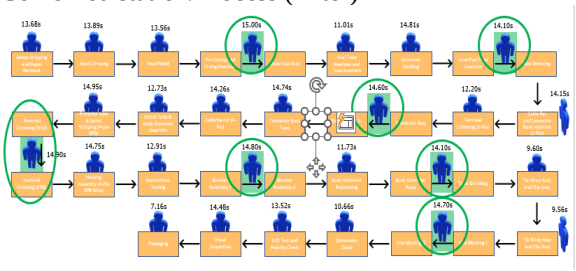
Team Manager in BPO
Escalation Supervisor
Account Executive
Process Engineer

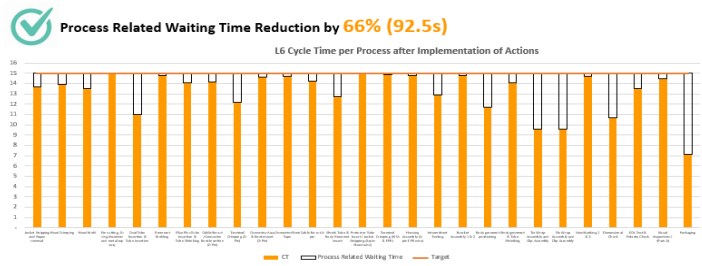
10.0 APPENDIX

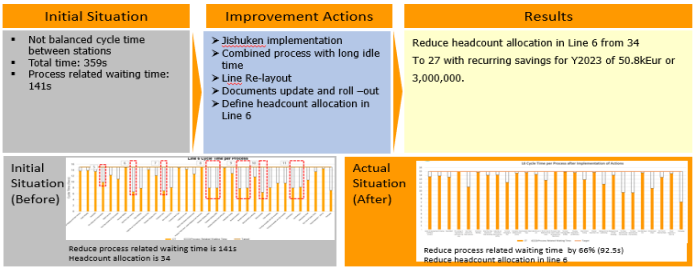
Unbalanced cycle time (Before)

Combined station/Process (After)



Achieved Result





Other Pointers:

WHEEL SPEED SENSOR (WSS) *– a sender device used for reading the speed of a vehicle's wheel rotation; consists of a toothed ring and pick up.*

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ELECTRONIC PARKING BRAKE (EPB) *- an advanced version of a conventional parking brake or handbrake.*

JISHUKEN *– Kaizen activity to identify gaps and opportunities and to increase productivity.*

WAITING TIME *– time lost due to work stoppages in which machine and/or employees are ready and available but cannot be productive.*

CYCLE TIME – *amount of time it takes to complete one task or process from start to finish.*

GEMBA walk *– comes from Japanese word meaning "the real place" or the place where value is created. The idea behind is to go to actual place where the work is done, such as production shopfloor, to understand what's going on.*