CURRENT SENSOR CAPACITY INCREASE IMPROVEMENT

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ABSTRACT

Assembly Manufacturing in Allegro Microsystems Philippines Inc. is always working on the capacity improvement in the line. The team had checked on what package needed attention to resolve the ongoing increase in volume requirements. Based on the capacity profiles, Current Sensor has the highest critical capacity starting from September 2023 onwards given the target volume of 700K. Based on the data it's already beyond the 94% which IE already tagged this as critical level. Stations with low capacity are coming from Overmold and MTFS station.

For us to effectively resolve and come up with the solutions we used Lean tools and methodologies, such as Pareto Charts, Process Mapping, Spaghetti Diagrams, Pain Points and Gemba Walk. Utilization of these tools and methodologies help us get through to the heart of the issue and come up with effective solutions or improvements to cater to the current problem that we have, which is the low capacity.

In our Pain Points checking, we found out what were the causes of the concerns and what affects the low capacity of the two stations. We have identified several downtimes that directly affect the output and utilization of our machines. There were downtimes contributed mainly by production and some activities coming from maintenance.

After the team classified the cause for the low capacity of the declared stations, our team instantly works on the needed improvements or counter measures.

Improvements or countermeasures were made since the Lean execution, and these were sustained by the team. Thus, the improvement has been standardized and documented. Significant improvements were implemented and noticed positive outcome. Such as

a.) Overmold capacity increase from 571K to 606K or 6.21% capacity improvement
b.) Overmold machine utilization increase to 1.83%
c.) MTFS Capacity increase from 673K to 715K or 6.27K capacity improvement
d.) MTFS UPH increase to 3.13%
e.) MTFS machine utilization increase to 3.04%
f.) Total Projected annual savings approximately Php 600K
f.) FY25 possible annual gain in capacity increase PhP 771K to Php 919K

1. 0 INTRODUCTION

1.1 Background of the Study

Our company's theme for this Fiscal year is "One degree at a time", Allegro Microsystems Philippines upholds its commitment to continuously improve in all aspects and this includes the Improvement in capacity.

Based on the IE capacity profiles, Current Sensor has the highest critical capacity starting from September 2023 onwards given the target volume of 700K. (Fig 1)

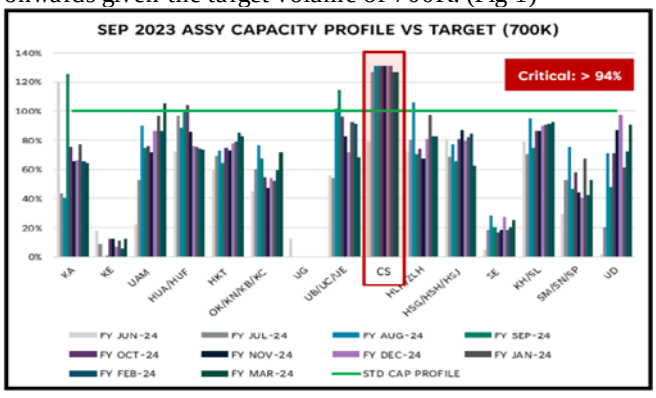


Fig. 1. OE Capacity Profile showing CS as the critical package

CS Machine Capacity vs Volume Requirement- Among the four CS Stations, Overmold and MTFS have the lowest capacity.

To support our Current Sensor target capacity of 700K, we need to work out the capacity of the two stations where Overmold and MTFS are bottleneck stations. (See Fig. 2) Current Overmold capacity is at 571K, a gap of 129k. Current MTFS capacity is at 673k, a gap of 27k.

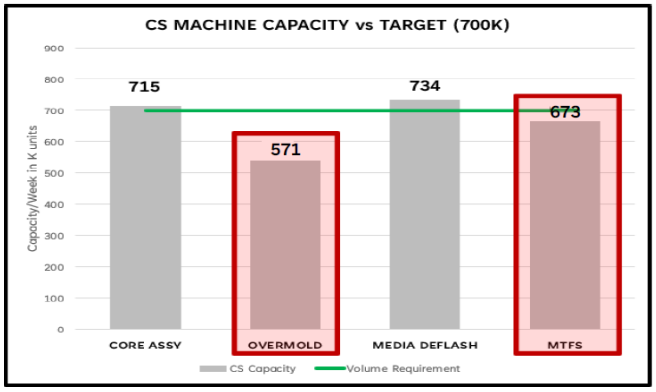


Fig. 2. Overmold and MTFS Stations with the Lowest Capacity at CS

Based on Pareto Diagram for overmold as shown on Fig 3, the highest downtime contributory is the planned downtime. Breaking this down for the planned downtime, production has the highest downtime with 26.33% contribution. Production downtimes were mainly due to Wait qual, Scheduled cleaning, In qual and Breaktime. These were the activities that contributed to the low utilization and eventually lower the capacity of overmold machines.

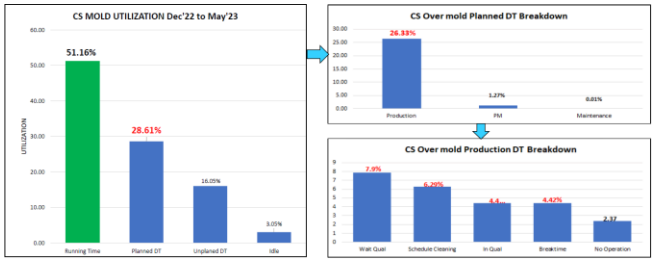


Fig. 3. – CS Mold Utilization data Pareto Diagram

On the other hand, Pareto Diagram for MTFS as shown on Fig 4, the highest downtime contributory is the planned downtime. Breaking this down, production has the highest downtime with 10.42% contribution. Downtime from production was contributed by set up production, wait qual, In qual and breaktime. Also, for maintenance, it's more on the machine cleaning. These are the activities that impacted the utilization and eventually lower the capacity of MTFS machines.

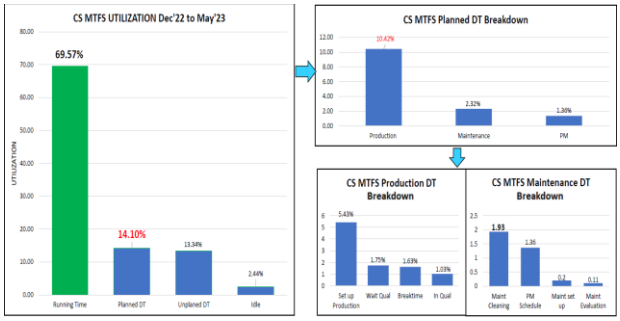


Fig. 4. – CS MTFS Utilization Data Pareto Diagram

1.2 Objective

Our goal on this project is to increase our Current Sensor Capacity, especially in the two stations with the lowest capacity profile. Our drive is to increase Overmold capacity from 571K to 641K by Sept 2023, hitting 54% of the gap or a 10.9% increase in capacity. Also to increase MTFS capacity from 673K to 700K by Sept 2023, hitting 100% of the gap or a 4% increase in capacity

1.3 Scope

The scope of the project will cover Overmold and MTFS stations only.

2. 0 REVIEW OF RELATED WORK – NOT APPLICABLE

3.0 METHODOLOGY

Our team used several Lean methodologies to pinpoint the problem and work out possible improvements. We did the Gemba walk and from there, we performed process mapping, pain points and brainstorming. With these activities, we are able to determine the root cause of the problem.

Fig. 5. – Different Lean Methodology

3.1 Root Cause Determination

Using Pain Points to determine the problem (Fig 6) the team identified four possible causes of low capacity of Overmold station. Identified problem or pain points here are (1) Long Mold cleaning material preparation, (2) Long cleaning time duration (3) Long duration of machine qualification (4) Under-utilized machines due to breaktime without staggered support

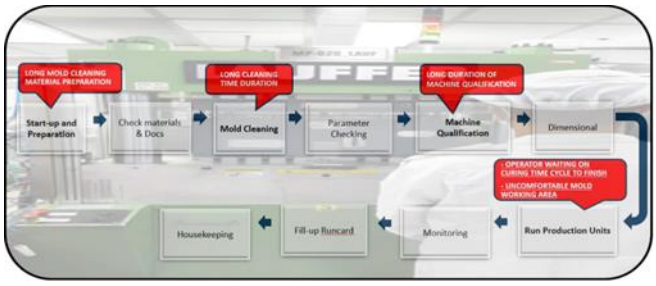


Fig. 6 – Pain Points Diagram for Overmold Station

Using the same tools for determining the problem at MTFS (Fig 7), the team identified four possible causes of low capacity at this station. Identified problems were (1) Frequent transferring of Trays to Empty tray racks & improper stacking at pushcart handlebar, (2) The number of sample size during regular visual monitoring is 5 tubes (170 units), this done every 30 mins (6X per lot) which is 2.5X more to the required sample size stated in SPE-0000144. (3) During start of shift machine qualification, the machine stays idle until the inspection of qualification samples is completed (4) Current PLC sensor delay settings is 100 mm/s causing the Trim Singulation tool to be idle for 6 sec per strip.

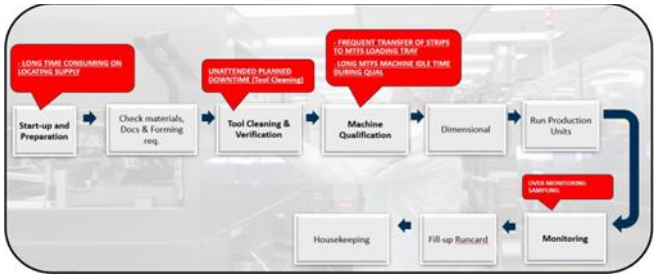


Fig. 7 – Pain points Diagram for MTFS Station

3.1 Root Cause Improvements

Based on the identified problems, the team created improvements that could help resolve identified root causes.

Table 1. Overmold
Problem and Improvement Actions

No.	Problem	Improvement
1	Long Material Preparation time for Mold Cleaning	Provide proper locations and labels on worktable for needed materials & implement advanced preparation of materials – to be done by previous shift operator
2	Long mold cleaning time which consumes average of 1.6 hours or 96 mins per cleaning.	Reduce set curing cycle time parameters to minimum allowable time
3	Under-utilized machines due to breaktime without staggered support	Utilize multi-function and execute additional multi operators at Overmold.

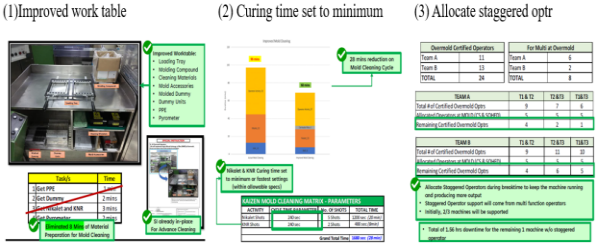


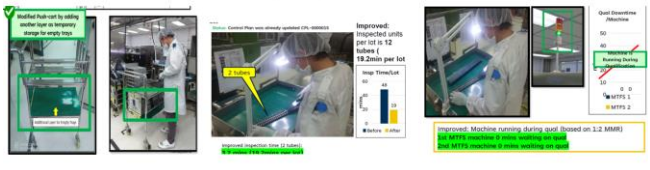
Fig. 8 – Kaizen actions for Low Capacity at Overmold

Table 2. MTFS
Problem and Improvement Actions

No.	Problem	Improvement
1	Frequent transferring of Trays to Empty tray racks & improper stacking at pushcart handlebar	Provide additional layer on the existing current sensor pushcart where the empty trays will be place while waiting for the in-process lot be move out
2	The number of sample size during regular visual monitoring is 5 tubes (170 units), this done every 30 mins (6X per lot) which is 2.5X more to the required sample size stated in SPE-0000144.	Re-align the sample size based on guidelines stated in SPE-0000144 to 204 units
3	During start of shift machine qualification, the machine stays idle until the inspection of qualification samples was completed	Remove waiting time by implementing no waiting of qualification result. Requirement: Machine should be in running condition during shift transition

4	Current PLC sensor delay settings is 100 mm/s causing the Trim Singulation tool to wait with 6 sec per strip.	Optimized sensor delay settings of lead frame pusher and pick and place which results increase in UPH

(1) Modified pushcart (2) Realigned sample size (3) Implement no waiting qualification



(4) Optimized sensor delay setting

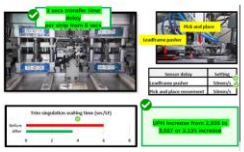


Fig. 9 – Kaizen actions for Low-capacity issue at MTFS

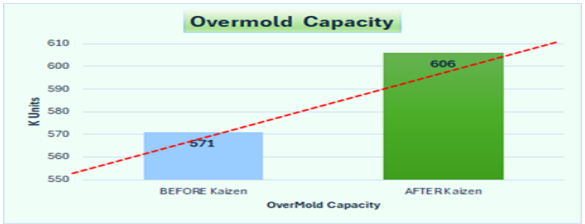
4.0 RESULTS AND DISCUSSION

The end of mind of this project is to improve the capacity of the current sensor line.

With the team's collaboration of ideas and hard work, the team managed to improve the Overmold and MTFS capacity. Overmold capacity increase from 571K to 606K or 6.21% capacity improvement and its utilization increase to 1.83%. (Fig 10)

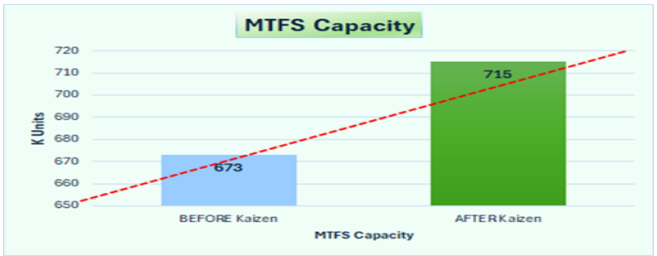
MTFS Capacity increase from 673K to 715K or 6.27K capacity improvement. UPH also increased to 3.13% and machine utilization increased to 3.04%. (Fig. 11)

Total Projected annual savings approximately Php 600K and FY25 possible annual gain in capacity increase PhP 771K to Php 919K. (Fig. 12)



	Current	Validated	% change
UPH	1590	1590	0%
MACHINE UTILIZATION	77.19%	78.60%	1.83%
Breaktime factor	93%	97%	
Yield rate	99.32%	99.32%	
Working hours	168	168	
FINAL MACHINE UTILIZATION	71.79%	76.24%	
CAPACITY (per week) per machine	190K	202K	
Available Machine	3	3	
CAPACITY (per week) available machine	571K	606K	6.21%

Fig. 10 – Overmold Capacity Improvement after Kaizen Result



	Before Kaizen	After Kaizen	% change
UPH	2,935	3,027	3.13%
Machine Utilization	50.95%	52.50%	3.04%
Breaktime Factor	90.00%	90.00%	
Yield Rate	99.32%	99.32%	
Working Hours	168	168	
Final Machine Utilization	45.85%	47.25%	
Capacity (per week) per machine	224K	238K	
Available Machine	3	3	
CAPACITY (per week) available machine	673K	715K	6.27%

Fig 11 – MTFS Capacity improvement after Kaizen Result

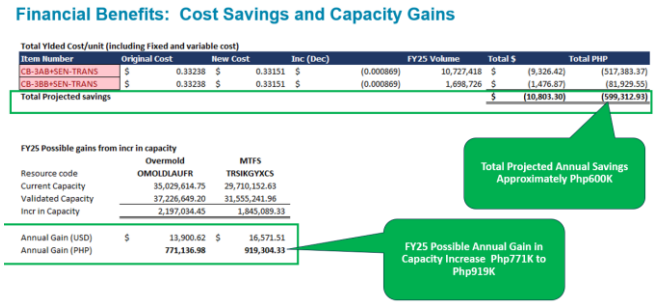


Fig. 12. – Financial Benefits after Kaizen Results

5.0 CONCLUSION

Through this project, the team were able to conclude that OVERMOLD and MTFS low utilization are the main factor why we have LOW CAPACITY for Current Sensor.

Machine capacity increased through chopping down and eliminating some of the downtime and working on machine improvement.

This Kaizen project resulted in adding up CS capacity specifically, at Overmold and MTFS. (Fig 13)
This project had contributed to our Financial advantage since it brought Cost Savings and Capacity Gains. Total projected savings are approximately Php 600,000.

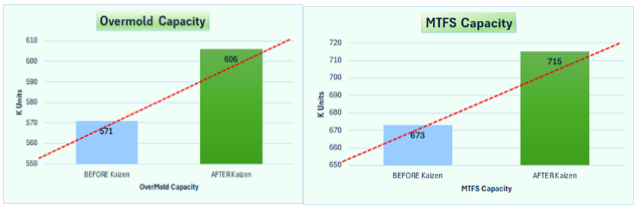


Fig. 13. – Improved Capacity after Kaizen

6.0 RECOMMENDATIONS

It is highly recommended to apply Lean tools and methodologies used in this project such as Pareto Chart, Process Mapping, Pain points, Spaghetti Diagram, Gemba walk, Visual management and Yokoten. The same tool can help with any Capacity improvement in the company.

Fan-out all activities to applicable machines (Fig 14)

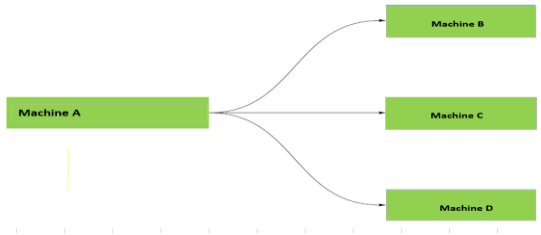


Fig. 14. – Fanning out activities in all applicable machines

7.0 ACKNOWLEDGMENT

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8.0 REFERENCES– NOT APPLICABLE

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10.0 APPENDIX