INDUSTRIAL, MANUFACTURING, & SYSTEMS ENGINEERING

CAPSTONE PROJECT/INTERNSHIP
SUMMARY

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Type of Capstone (research, teaching, practical application): Practical Application

Capstone Project Title: *Manufacturing Capacity and Optimization of Space: Site Master Plan Line 25* at Johnson & Johnson (Torres Plant in Ciudad Juarez)

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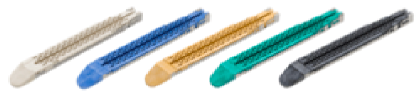
INTRODUCTION

Johnson & Johnson is an American multinational company with a focus in medical devices, pharmaceutical and personal goods with 130 years of experience. For our senior project, we were assigned to work hand in hand with Johnson and Johnson Torres facility, with the objective of optimizing production line 25, by minimizing costs, maximizing production and making a standard work for first and second shift. This production line is considered the most essential and extensive, making this line the most influential in the entire manufacturing plant. Line 25 is known to have time-consuming, and expenditure problems that have to be analyzed by technicians specialized in

Industrial and Systems Engineering.

Line 25 is devoted to the production of thirty-five code types of cartridges, divided among six different families (GST, ECR, Ruby, Wyllie, Platform, and LC) used for medical instruments specialized in delicate surgeries.



Cartridges produced in Johnson & Johnson Torres Facility.

An adequate decision for optimization of the line was reached by using the correct tools and experience obtained by the team, along with the Johnson & Johnson engineering department. To start the investigation, the group surveyed engineers and operators in charge of the focused line, and visited the production plant multiple times. The team created some matrices and charts that were used as tools and excellent references, such as:

- Value Stream Map
- Product Family Matrix
- Layout Design
- Spaghetti Diagram (Material Flow)
- Spaghetti Diagram (Operator Movements)
- Line Balance
- Capacity Usage Analysis
- Standardize work for first and second shift

These surveys, matrices, and charts can help understand how line 25 works, what is produced there, and which problems have to be solved. As we proceeded to do the project, we encountered some constraints that can be seen as barriers to this project in general. Some of those constraints were: cost/money, and the fact that we are working with a medical material manufacturing company, which means any change is hard to make, due to needing approval and having to comply with regulations.

For this project, there were two main objectives that will be presented as recommendations in the final presentation. The first part will identify some of the 8 wastes of Lean; with this, the team would be able to find opportunities based on headcount, unnecessary movements of associates, unneeded transportation of material, and waiting time. The second part of the project would be based on the standardization of work for the first and second shift, creating a regulated plan for both shifts.

It is important to realize how this extensive production line works. The first step of the production starts at the SML machines, where the cartridge is processed by adding staples to the piece, this is done by automated machines cutting and positioning the wire into the cartridge slits. SML stands for Staple Making Loader. After the SML machines, a percentage from all family codes go through a performed process for an inspection and measuring of 5 staples. If one cartridge is approved from one tray, the whole tray passes to the next process. Once they pass performed, all SML cartridges produced and approved go to the lubrication machines, which can hold a large number of cartridges from different codes and families all at once. The cartridge that went to performed gets recycled and reprocessed. After the cartridges are lubricated, they go through a Vision process. The production process pauses between the Lubrication and Vision process, due to the excessive amount of cartridges that enter the two lubricators. When the lubricators end their cycle, Quality Assurance inspects a portion of the product in a separate area to be certified. The certified cartridges are then returned to the production line, which is then processed through the Vision system just like the other cartridges after lubrication are. The Vision process consists of either automated machines or human operated machines for a final inspection. After final inspection, they are packaged and prepared for shipment. Furthermore, it is important to add that after every process in line, if there is a nonconformance, the cartridges can be relocated in the recycling process, where they are prepared to move to the beginning of the cycle, starting again at the SML machines and going through the same process.

A Line Balance was created for our SML machines station, in this station we have 51 machines, which all times were taken for all machines five times, and an average was given. This time included machine time, loading and unloading time, and walk time. In this study you have to carefully assign an operator to its perspective machines that will result in the shortest cycle time with the smallest operator idle time.

We then did a Capacity Usage Analysis for our Preform, Lubrication, and Vision Stations. The main goal of the Capacity Usage Analysis is to get a percentage of how much each station is actually being utilized. Any station with less than 100% utilization can theoretically be improved without any additional cost. Meaning that anything that is not at 100% utilization has a chance for improvement. For these stations all times were also taken 5 times for operators and machines, and an average was recorded.

PROJECT OUTCOMES

The opportunity found in the SML machines was that not all machines have the same cycle and idle time, therefore, they may be grouped differently to maximize cartridges per hour and minimize operator idle time. Below we can observe a current and future state of our SML machines. The SML Line Balancing reduced operator idle times, total cycle time, seconds per piece, idle time per piece and increased productivity by 13%, by producing more cartridges with less associates.

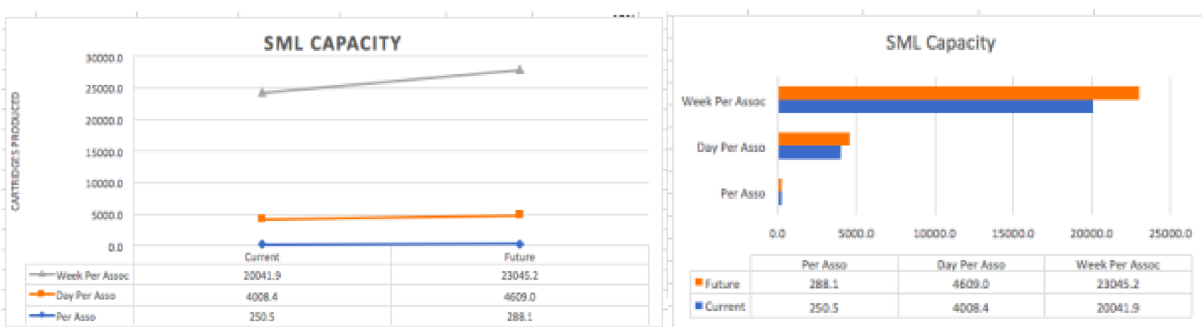
The opportunity found in the Preform Stations was that not all stations have the same Percentage Capacity Utilization as observed before. The best way to make these stations more efficient, was to group codes differently to be able to have around the same capacity usage in all stations. It was also observed that we can reduce one station, since it has such a small percentage of capacity usage, and combine it with another station that can take this capacity without exceeding 80 percent. Stations were grouped differently to increase productivity.

For Lubrication Stations we decided that the best option to increase the capacity for this station was to design a conveyor. This conveyor can remove unnecessary walks, this is, the time that it takes for an operator to get a tray holder from one end of the lubricator to the other end. This conveyor could instead transport the tray back to where it belongs, so the operator can start putting more trays into the lubrication process. Using the conveyor mentioned before, would result in an improvement of the Operator’s Cycle Time. For this analysis, we created a current state and a future state of all the cycle times of this process, with the unnecessary walks and without them.

The total weekly cartridges processed for the current state is: 856,974 compared to the total weekly cartridges processed for the future state that came out to: 1,361,472. There was an increment of 37% in the capacity for this Lubrication Stations. Therefore, we can say that adding a conveyor next to the lubricator will be the best option for an improvement to this process.

Thanks to the Usage Capacity Analysis, we got some opportunities in every Vision Station in the line. Instead of increasing the production, we increased the productivity by reducing the number of associates working the rest of the Vision stations. The production rate per associate was also incremented by doing this study. The capacity in this area maintains the same for most of the stations, it only was increased for Vision B by 12557 pieces/week. The headcount can be reduced for most of the entire Vision area. Some of them maintain the same associates, because they are satisfied by how they are currently running. Vision B has to be implemented with one more worker to fulfill production based on the production takt time. Johnson & Johnson can reduce the total amount of 6 workers on these stations, maintaining the same amount of production by increasing productivity for each worker.

Please see below for current and future states of each station.



SML Stations

Equipmen	Families Codes	Current % Capacity Usage
30263	ECR	84%
ES743	GST/Wylie	83%
30262A	Platform	11%
ES170	GST45	17%
30262B	LC/Ruby/GST60W	73%

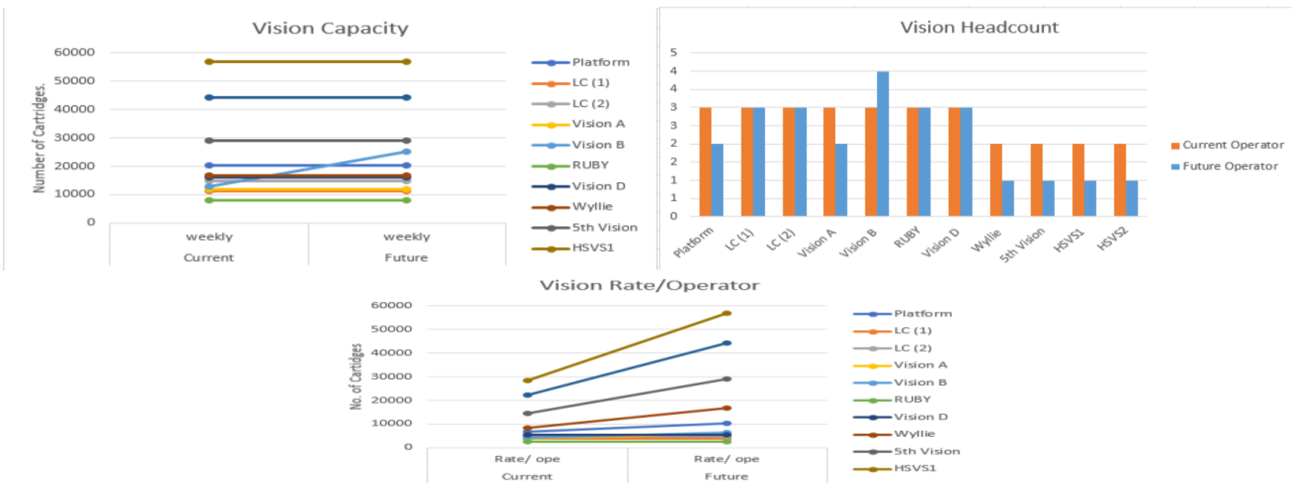
Equipmen	Families	Future % Capacity Usage
30263	ECR60/Wylie	60%
ES743	GST60	74%
30262B	LC/Ruby/GST60W	57%
30262A	Platform/GST45/GST60W/ECR45	76%

Preform Stations

Current		Tray Holder	Tray	Cartridge			Operator 34200	30600	5				
	Equiment	Cycle time (sec)	Cycle time (sec)	Cycle time (sec)	tray/hr	cartridges/hr	9.5 1st shift	8.5 2 nd shift	Daily	week	weekly demand cart.	Tk time	% Capacity usage
WYLIE, TRs, ECR	Lub 30252	40	20	0.6	179	5720	54340	48620	102959	514,796	69,310	4.67	13%
GST. RUBY, LC	Lub 30249	61	30	0.9	119	3802	36119	32317	68436	342,178	116,967	2.8	34%
										856,974			

Future							34200	30600	5				
	Equiment	Cycle time (sec)	Cycle time (sec)	Cycle Time (sec)	tray/hr	cartridges/hr	9.5 1st shift	8.5 2 nd shift	Daily	week	weekly demand cart.	Tk time	% Capacity usage
WYLIE, TRs, ECR	Lub 30252	26	13	0.4	280	8962	85137	76175	161313	806,564	69,310	5	9%
GST. RUBY, LC	Lub 30249	37	19	0.6	193	6166	58574	52408	110982	554,908	116,967	3	21%
										1,361,472			

Lubrication Stations



Vision Stations

In conclusion:

- The SML Line Balancing can help reduce operator idle times, total cycle time, seconds per piece, idle time per piece, and increase productivity per associate by **13%** by producing more cartridges with less associates.
- We can increase usage capacity in perform stations by eliminating one station.
- In Lubrication area capacity can be increased by **37%** by reducing the walking times.
- For Vision B there can be an increment of **12557 pc/week** in capacity by including one associate.
  A total of **6** associates were reduced thanks to the standardization on these stations.
- In SML, Preformed, and Vision stations there is a potential reduction of **9** associates in total by using this plan.

INDUSTRIAL ENGINEERING PROGRAM ASSESSMENT

Thanks to this project, team 2 has earned a lot of knowledge in the industry area. This knowledge can be applied to the personal, professional, and interactive aspects of our life. Team 2 wants to thanks Johnson & Johnson and UTEP College of Engineering for preparing us for the future. Special gratitude to Marcos Huereque, who is part of the Process Excellence Department at Johnson & Johnson, for making this project possible, sharing his knowledge with the team, and making us feel part of the company. This experience prepared us for what to expect in the future for our careers. It taught us how to manage a fast passed environment with changes happening very rapidly. It also provided us with new knowledge, tools and skills that will without a doubt be useful for our future and current jobs. We are pleased to have had the opportunity to apply our knowledge and engineering skills obtained at UTEP in real life with such an amazing company.