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Pella Lean Utilization Cell Improvement

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Problem Statement

Observe a wood utilization that is not meeting the efficiency and output goals they are looking for and give feedback on different ways to improve uptime and efficiency. The cell is comprised of a cell that includes two moulders, an electronic press, a gluer, and a robot. This cell is used to combine boards that are made of scrap material from another line with full-length edge boards to create an array of larger boards that are used on various products that Pella.

The utilization cell in question is the newest Utilization Cell (U-Cell) at the Pella, Iowa facility and has been running for just over a year. Operators from the older U-Cells have been getting trained on the machine over the course of the year to train all workers on the newer utilization cells. Despite the utilization cell not meeting the output goals Pella Corp. is looking for, it is still producing 150% more than the older U-Cells.

Disciplines

Bioresource and Agricultural Engineering | Industrial Technology

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IOWA STATE UNIVERSITY

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

Pella Lean Utilization Cell Improvement

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1 PROBLEM STATEMENT

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Business Case Statement

Department of Agricultural and Biosystems Engineering (abe@iastate.edu) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders.

By improving the efficiency of the utilization cell, we will be reducing the amount of downtime cost Pella Corp. incurs as well as increasing the amount of final product the cell creates in a given shift.

A. The cell is not meeting the output and efficiency goals that Pella has set for it, Pella is looking for a 30% increase in U-Cell UPH which is equal to 250 board feet per labor hour with three operators.
B. The U-Cell is still operating on a daily basis but has downtime issues daily.
C. The problems happen on a daily basis in several locations throughout the cell. There is not just one sole problem that we could identify as the main culprit of the issues the U-Cell is having. Instead we believe it is a combination of many smaller issues that need to be addressed.
D. This Cell is already producing more product than the older U-Cells at Pella Corp. despite not meeting the UPH goals they are looking for. If this cell were fully operational, it would not only produce much more product for Pella but also give them a return on investment.
E. Pella incurred a large cost by implementing this cell in their facilities, and by it not meeting the production goals they have set for it they are not getting the return on investment they are looking for. By improving the UPH and efficiency of the cell, Pella will be getting a larger return on investment as well as justify the purchase of this new U-Cell.

2 GOAL STATEMENT

To improve the U-Cell output and efficiency by 30% as well as identify all value added and non-value added and identify forms of waste.

A. The fundamental improvement is to improve the cells overall output and efficiency.
B. The cell is measured by Output Quantity, Hours Worked, and UPH Actual & Budgeted (Board Feet/ Labor Hour) of the cell. This is data recorded by the operators.
C. Studies we completed to reach our goal:
    - We conducted time studies on the cell to understand better how long it takes to produce product within the U-Cell
    - Another study we conducted was verbally surveying the employees that work within the U-Cell. This gave us insight on areas to focus on and where problems occur within the cell.

- **Main Objective**
    - Pella has tasked us with identifying problems with their new Utilization Cell and increase the overall efficiency and UPH
- **Specific objectives**
    - Improve Efficiency while meeting all client criteria and constraints:
        - Identify Value Add versus Non-Value Add Time
        - Categorize the Non-Value Add Time (7 Forms of Waste)
        - 30% Improvement to U-Cell UPH, which would result in 250 board feet per labor hour with three people
        - No added people
        - Maintain AMAA standards (glue weight, cook time)
        - Budget > $1000
- **Rationale**
    - Currently, implementing one of our proposed solutions is not feasible.
    - We must account for the constraints Pella provided at the beginning of the project.
    - Main considerations:
        - Feasibility
        - Cost

- Estimated improvement in U-Cell UPH
- The frequency of issues that the solution would be fixing.

- **Project Scope**

The scope of this project was to improve the U-Cell's overall UPH while maintaining Pella's standards and adhering to their constraints.

- For this project, we were given several constraints from our client as well as a time constraint of the end of the spring semester.
- We focused on one U-Cell at Pella while comparing it to other cells to make sure it met their standards.
- Many of the solutions came as recommendations from operators or maintenance personnel who have spent more time with the machine.

3 PROJECT PLAN/OUTLINE

A. Methods/Approach

- Reference Material(s)
  - We referenced two books from TSM 440 and TSM 444. The books are listed below.
    - *Lean Production Simplified A Plain-Language Guide to the World's Most Powerful Production System*
    - *Manufacturing Facilities Design & Material Handling.*
- **Data collection**:
  - Data for this project included Uptime data and Time Study data. The Uptime data was provided by the client and was used to analyze what percentage of the line's time was used for production. The Time Study was performed by members of the team and was used to identify parts of the process that had major fluctuation in time.
- **Skills**:
  - We used a combination of techniques, procedures, and skills that we learned from Industrial Technology classes. Some of the classes that helped us throughout the project are listed below.
    - TSM 115 – Solving Technology problems
    - TSM 240 – Introductory to Manufacturing
    - TSM 310 – Total Quality Improvement
    - TSM 440 – Cellular Lean Manufacturing Systems
    - TSM 444 – Facility Planning
    - TSM 465 – Automation Systems
- **Solutions**:
  - Once we made our final visit to Pella. We sat down as a team and developed a list of potential solutions for the project. Once the list was completed, we created a chart to discuss work needed to complete the task, rating of usefulness, rating of feasibility, and estimated cost of the solution. For ratings of usefulness and feasibility, we took a vote from each member on a scale 1-5, five being the most important and one be not important. Before voting on the solutions, we discussed as a group our thoughts and opinions of each solution to make sure we all were on the same page of what the solution detailed.

- After the numbers were averaged out, we could see which solutions were important to focus on. The top two solutions in numerical order were Implementing a downtime system and adding lights to the cell. The chart is shown as Figure 2-2 in the *Appendix* Below.

- We found talking to operators, managers, and engineers that downtime was occurring on a daily basis. Although it was not be recorded why or how it was occurring. So, our idea is to implement a simple procedure of documenting a downtime when it occurs via paper or excel. This chart would have the time the cell stops working, a reason for a stoppage, and a time when the product started again. This would help everyone understand the exact areas of where to focus on to fix or improve after a sufficient amount of data was accumulated. There are also downtime reporting systems that can be implemented to the cells logic so that it outputs real-time tracking to an Excel sheet for the engineers to look at. However, this reporting system comes at a much greater cost, needing an estimate from the companies.

- The second solution we decided would be beneficial for the cell would be implementing a three-color light system. This cell is pretty well automated and needs minimal amounts of human help. Although one worker has the task of moving back and forth between the build table and loading material station. The operator has to constantly turn around and check the loading table and occasioning forgets, causing the cell to come to a stop. We thought a light system would help notify the worker when to walk over with three different color codes: green = material is over halfway full, yellow = material is under halfway full, red = material needs to be refilled.

- **Organization:**
  - We communicated with our client weekly at the beginning of the project, but as we neared the end of the project, we communicated bi-weekly. Each week we would decide what needed to be done to meet our goals and divide the work among the group members. Through multiple visits to Pella to observe the line we were working on we gained a better understanding of the issue at hand. Milestones for the project included: visits to Pella, TSM 415 Poster Day, completion of time study, and TSM 416 Capstone Day.

B. Condensed timeline

- October 1st 2018 --> Project Received
- October 10th 2018 --> First Visit to Pella Corporation - Facility overview
- October 22nd 2018 --> Processed defined with Fishbone Diagram & Process Map
- November 13th 2018 --> Second Visit to Pella Corporation – Observed and surveyed workers
- November 30th --> Poster Presentation – Met with Pella Corporation & ABE Faculty
- December 4th --> Value Added vs Non-Value added created
- January 15th --> Brainstormed solutions
- February 18th 2019 --> Third Visit to Pella Corporation – Time studies conducted
- February 19th 2019 --> Potential Solutions Matrix & 5 Whys created
- March 19th 20019 --> Created Final Report and Final Presentation
- April 26th 2019 --> Present final solutions

4 RESULTS

Results/Deliverables

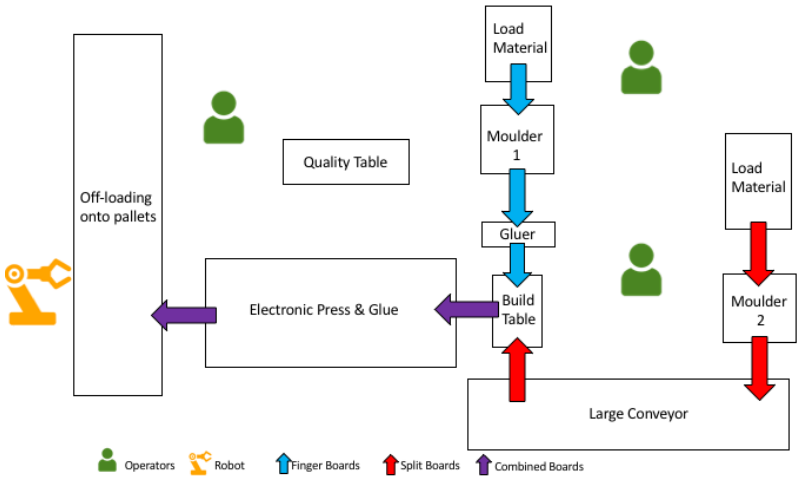
- We are proposing many possible solutions to Pella Corp. That we believe will help increase the U-Cell UPH.
- We developed a spreadsheet to Identify Value Added vs. Non Value added time.
- All suggestions in the proposal keep the project's scope and constraints in mind while deciding on which option would best improve the U-Cells UPH and efficiency.
- We began by intending on implementing a solution after we proposed one; however, due to scheduling and an increase in production at Pella implementation was not feasible. We talked with our contact and established what deliverables they were looking for to meet their needs at this time.
- After Pella has received the proposal, we will remain in contact with them in regards to what solution they decide to go with, as well as be contacted if they need any other information regarding the project or our decisions.

5 BROADER OPPORTUNITY STATEMENT

A. By implementing and improving the U-Cell at Pella Corporation, the operations of the cell will become more efficient and easier to use for operators. This could be helpful when training new employees how the cell works in the future. Although the U-Cell is unique to Pella Corp., the concepts of both solutions, implementing lights and downtime system, proposed could be utilized in similar manufacturing cells at any company. This can be accomplished by using a similar budget of less than $1,000 to purchase lights, sensors, and excel. However, purchasing software to document production downtime and eliminating waste may help a company accomplish long-term futuristic goals.

6 GRAPHICAL ABSTRACT

Figure 1.1



7 REFERENCES

Pella Corporation:

The following people at Pella Corporation helped to provide information about the process of the cell and the background of the company.

- Jason Vander Werff
- Matt Miller
- Dale Hodgell
- Josh Blom
- Dana King
- Joe Vanstrom

Listed below are the Andon Lights considered for a possible solution.

https://www.mcmaster.com/andon-lights

Listed below is the downtime software considered for a possible solution.

https://www.downtimecollectionsolutions.com/

Listed below is our TSM 415 Capstone Day poster.

https://lib.dr.iastate.edu/tsm415/32/

8 APPENDIXES

Figure 2.1 Value Add vs Non-Value Added Table

Process	added or non added	Type of waste
Material brought to line	Non Added	Moving
Extra raw material stores on the side	Non Added	Waiting, Inventory
Material moved from storage to machine	Non Added	Moving, Excess Motion
Finger Board side		
Boards loaded on to loading table	Non Added	Moving, Excess Motion
Finger Boards moulded on both sides	Added	
Glue is applied	Added	
Full board side		
Full boards split in two	Added	
Moved on Conveyor to Work table	Non Added	Moving
Work Table		
Split boards and Finger boards assembled by operator	Added	
Enters the Press to cure glue and fully join the boards	Added	
Moved off process via robot	Non Added	Moving
Stacked onto a pallet	Non Added	Moving, Waiting

Figure 2.2 Decision Matrix

Possible Solutions					
	Idea	Work Needed/ Questions	Rating of Usefulness	Feasibility	Cost
A	Improving edgeband fixture	Pneumatic cylinder	3.25	4	Fabrication Cost
B	Adding lights	# of Lights	4.50	5	$200 per set of lights
C	Enlarging tables or improving loading process	Reconfigure the whole station	4	2.25	<$1000
D	Improve gluing machine/maintenance process	bottleneck and maintenance problems?	3.75	3	>$1000
E	Reconfigure material processing	Ergonomics	3.88	3	Free
F	Implement Downtime reporting system	Tracking of problems, help with Root Cause Analysis for future issues	5	5	Varies

Figure 2.3 Loading table in the U-Cell

Figure 2.4 Large conveyor System

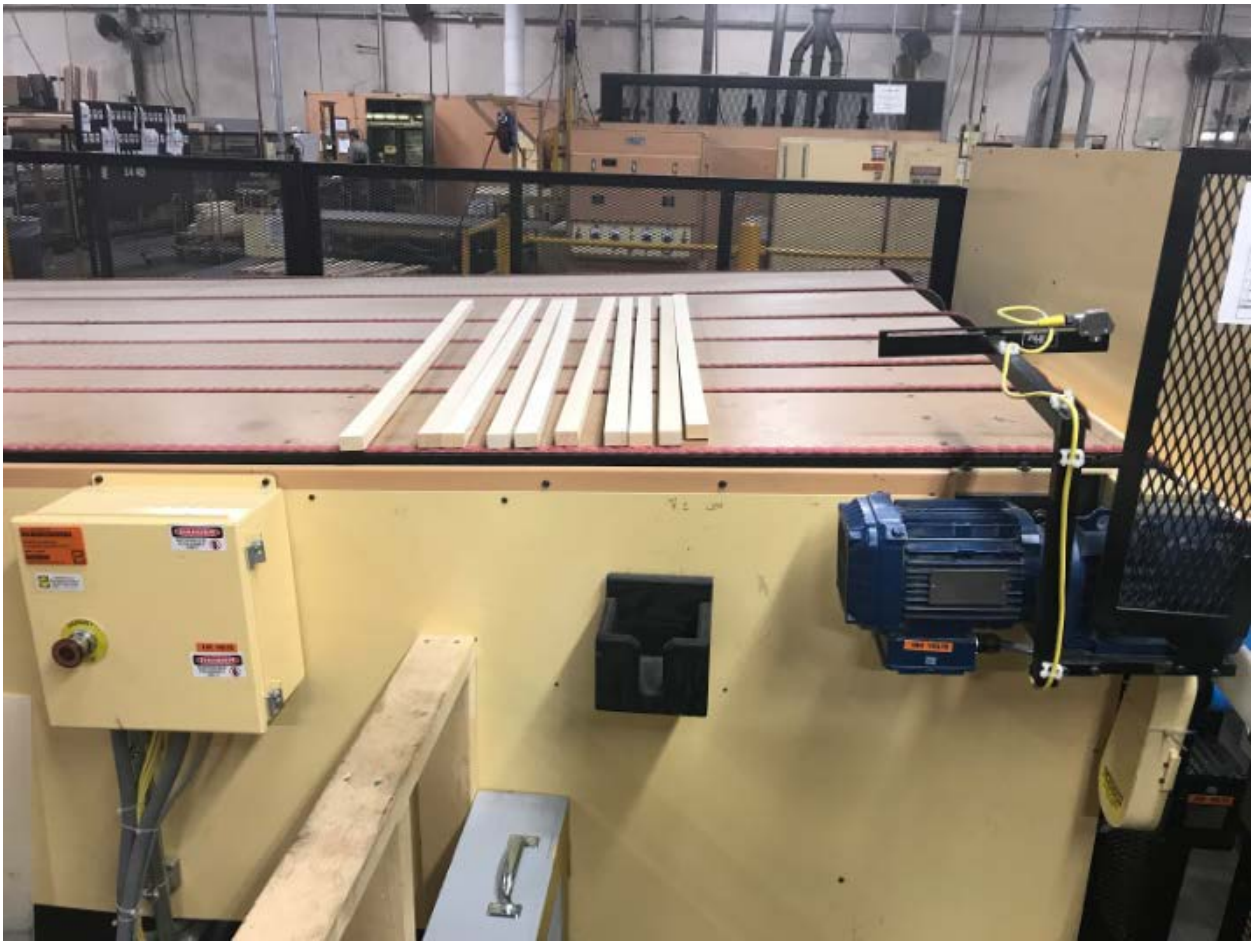


Figure 2.5 The conveyor to gluer

Figure 2.6 Edgeband fixture preload to press

Figure 2.7 Split board glued together