Applying Lean Manufacturing to Assembly Operations in the Food Industry

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Abstract
The focus of this project is to apply Lean Manufacturing concepts to re-packaging assembly lines for customized pallets. The design team worked within the business area, “Special Pack,” which produces a variety of customer orders and re-packages perishable food items according to customer demands and specifications. As with other large organizations, working with two major global companies required coordination across multiple business groups including management, front-line supervisors and the temporary employee agency. The design team has introduced Lean Methodologies to address project management as well as process improvement. The aim of the project is to create best practices for the Special Pack group, unveil barriers for management and minimize non-value added activities through Visual Management, 6S, Standard Operating Procedures, and other Lean techniques. Each phase of the Lean project requires research, testing, and employee engagement. The Lean analysis results include time-savings, cost savings, and potential to incur more special packaging business at the current facility, with the capability to expand across multiple sites, corporations, and industries.

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The Need for Project

Within the “Special Pack” area there exist high levels of irregular, manual processes, with highly variable seasonality of demand, making it difficult for management to plan, execute, and monitor repackaging operations effectively.

The purpose of this project is to optimize a set of highly variable, unstandardized processes within a food repackaging system for perishable food products. This repackaging system is referred to as “Special Pack” which includes the profitable business of customizing pallets for clientele. The products range across many different brands, but are all marketed and owned by General Mills. All of the distribution and handling of General Mills products is managed by Ryder, a Third Party Logistics partner. Together, General Mills and Ryder would like to create best practices across operations, particularly within the Special Pack area.

Special Pack consists of converting pallets from single-product pallets to consolidated pallets with an assortment of product types in quantities as requested by the customer. These processes require manual labor to unpack product and then repackage it in another form of certain products in varying sizes and quantities. This labor is obtained through a Temp Agency where employees are hired on a day-to-day or week-to-week basis. The accurate assignment of employees can be difficult to manage given the varying demand, unstandardized processes, and ambiguous tracking. The Special Pack area is comprised of highly variable, manual processes with minimal standardization and unknown system capacity, resulting in multiple process inefficiencies. The team’s corporate sponsor is looking for more control and transparency within the inconsistent nature of Special Pack.
The Design Project Objectives and Requirements

All employees should foster a standard, manageable, flexible and transparent repackaging system.

**Design Objectives**

Concerns with the system and pertinent business goals have been discussed with all constituents through multiple working sessions. After aligning the different goals including fostering a system that is more transparent, standardized, predictable and manageable, all stakeholders agreed upon the three major deliverables of the project to be,

1) Conduct line balancing among the main processes
2) Create Standard Operating Procedures (SOPs)
3) Deliver a Daily Management System to track key metrics

Line balancing is essential for the new system design because all tasks must be evenly distributed among employees in order to create a steady-state flow. This is a prerequisite for the second objective of creating Standard Operating Procedures because the processes must be effective before they are standardized. The company sponsor has expressed the specific need for documented Special Pack SOPs in order to support the potential application of improvements to other facilities. The third objective is a combination of a visual management system with an electronic management system for project tracking and trend analysis. The visual aspect of the management system will engage and assist employees working on the assembly line, while the electronic version will assist with long-term process control. The vision in the overall project is to apply Lean Methodologies including low-cost/high-impact solutions to eliminate waste and document standard operating procedures in order to minimize non-value activities and create best practices building customized Special Pack pallets.

**Design Requirements**

The final design must be comprised of low-cost solutions, which address the standardization, management, and transparency of the Special Pack system. The critical success factors of this project include all constituents understanding the capacity of the system, receiving buy-in from managers and employees, balancing both mutual and unshared goals of General Mills and Ryder, and fitting all designs in the physical space allotted for Special Pack.
Design Concepts Considered

The project team explored low cost, high impact solutions to eliminate waste and drive positive change. The project team conducted several observations on the refrigerated warehouse floor in order to collect data and identify opportunities for improvement within the Special Pack area. After collecting over 30 hours worth of data spread over several months on the two main processes within Special Pack, the team had a representative understanding of the current state process. The two main processes are Hand Pack, a micro level repackaging process, and Modular (MOD) Pack, a larger operation, which creates pallets with varying product types. In order to organize observations and insights, the team created current state process maps for the Hand Pack and MOD Pack processes. The opportunities that were identified through observations served as key drivers in the development of the project’s deliverables. The main solution paths were listed and then assessed as to which were reasonably feasible regarding cost, time, pertinence to goals, and difficulty level. The project team used the Lean tool, PICK chart, in order to determine which solutions to implement. The PICK chart shows the analysis of each of the following ideas: 1. Standard Operating Procedures, 2. Daily Management System, 3. Line Balancing, 4. 6S, 5. Resource Allocation, 6. Pull System, and 7. Automation. Not seen in the chart includes warehouse automation and advanced IT solutions. These solutions were researched, but did not fit the scope of the project or its’ main objectives and will not be carried through during this time.

Recommended Design Concept

The project team engaged the employees when testing and implementing the Daily Management System and the Process and Layout modifications. Process improvements were tested and then implemented throughout a series of three Work Place Organization events at the facility: Process Changes, 6S, and MOD Pack. Each of the events focused on receiving input from employees and engaging them in the overall implementations. These events were critical points in the final decision-making of the recommended designs.

Design Description

The recommended design is centered around the Daily Management System in the Special Pack area. The system features a board that is displayed prominently on the work floor available for all employees to see. The purpose of the visual aspects of the board is to display and track hourly work status in an organized and efficient
manner for knowledge of all employees on the floor. In addition to the
daily management board, we also created a daily management analyzer
tool in Microsoft Excel, which will be used to keep an electronic record
of daily goals versus actual performance. We incorporated other Lean
concepts and models such as 6S – along with a 6S checklist, which will
allow for a standard evaluation schedule for the area to ensure that all
necessary materials are available and in their designated locations. This
checklist will sustain a clean and organized environment for future
projects. Recommended layouts are also included in the project for both
Hand Pack and MOD processes.

**Experimental Investigations**

The design team tested the process changes on an additional
assembly line, which mirrored the typical set-up. Employees were
asked to relocate to the additional (third) assembly line to
experimentally simulate some of improvement ideas including re-
ordering tasks and utilizing employees cross-functionally.

**Key Advantages of Recommended Concept**

All of the Lean concepts and Standard Operating Procedures
are both physically and electronically handed over to the sponsor. The
advantages of these flexible tools and solutions include the ability to be
repeated regardless of the product that is being repackaged. We created
a “Handoff” binder and presented it to General Mills and Ryder for
future reference and use. They have presented completed subprojects to
upper management and plan to enroll more of these solutions
throughout additional facilities.

**Financial Issues**

The project costs were $800.00, while project savings are anticipated to be over
$15,000.00

The cost benefit analysis measures the financial stability and
earnings of the implemented Lean tools and overall project solutions.
All costs will be rolled up into an annual dollar amount as well as a cost
per case and cost per pallet rate. General Mills may be billed differently
depending on the customer, so the cost/benefit analysis was created to
be flexible enough to convert dollar amounts into the appropriate form.
The team spent a total of approximately $800.00 on this project between fuel for traveling to the facility and the purchasing of 6S materials such as pallet jack tape, flip charts for facilitating employee meetings, and special warehousing floor tape. The annual savings of this project will accrue to over $15,000 and has the potential to be multiplied across all processes in the facility using the models created.

**Recommended Improvements**

Lean Manufacturing solutions help companies to continuously improve, as well as speak a common language. It is important that employees are actively engaging in cell meetings, brainstorming sessions, and quality circles. The team recommends the continued use and updates of the Daily Management System. It is critical to maintain a continuous improvement mindset where all employees are looking for ways to do their job better. This project has helped General Mills and Ryder communicate business needs through more transparent management systems. Recommendations include increased use of visual management and employee engagement through more regular, but perhaps smaller scale, Continuous Improvement events. Standard Operating Procedures have been developed so these events can be reproduced recurrently.