We Got EZ-Kits to be EZ-er

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Abstract

WeGotSoccer (WGS), located in Foxborough, MA, is an online and in-store retailer of soccer-related items including equipment, footwear, clothing and uniforms. In the summer of 2012, WGS began selling what is known as the EZ-Kit. The EZ-Kit is a soccer club-specific apparel and accessory package that is customizable by each player on a given team. WGS has experienced exponential growth in EZ-Kit orders, and the growth each season has required the process to be drastically improved and the facility layout to be redesigned. Northeastern’s WGS Capstone team’s focus was to optimize the EZ-Kit facility layout, and to reduce waste in current processes using industrial engineering tools.

The Capstone team conducted time studies, calculations and link analyses in order to develop a more efficient layout for the operations. The team also analyzed the inventory allocation to determine wasted bin usage and create improved alternative storing strategies.

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The Need for Project

An examination of current operations and identification of wastes in order to offer fundamental process improvements as EZ-Kit order volumes dramatically increase year after year. Given the current and projected rate of growth of EZ-Kit orders, which are personalized soccer merchandise for club players, WeGotSoccer realizes the need to reduce waste in manufacturing operations. WGS is challenged with the following wastes: transportation, defects, excess motion, inventory, waiting, and over-processing. The current system of randomly storing inventory does not allow for the reservation of prime warehouse real estate for high traffic merchandise. Slower moving products can find their way into easier to reach bins and occupy that bin for an extended period of time, forcing fast-moving products to be stored in bins that are less accessible.

WGS recognizes the need to improve their process and layout design, because with the current layout they are not able to store, pick, and custom embellish material at the same time due to the safety hazard of operating a forklift in the same area. The current method of picking one order at a time is inefficient and will not be a viable option as business increases in the upcoming fall season and years to come. An improved inventory storage and order-picking strategy will reduce transportation waste, and allow more orders to be fulfilled at a faster rate.

The Design Project Objectives and Requirements

One objective of this project is to offer a layout design that will allow for the EZ-Kit operations to occur in parallel. The second objective is to develop an inventory allocation strategy that reduces the time required to pick orders.

Design Objectives

The first design objective of this project is to develop alternative facility layouts for EZ-Kit operations so that each entity of the operation is placed in an optimal location. This will be done with consideration given to the relationships between each entity within the EZ-Kit manufacturing process. The second design objective is to evaluate current randomized inventory allocation methodology and develop a new inventory allocation strategy that will optimize EZ-Kit inventory, storing and picking.

The goals for a new layout are to maximize the use of storage space and to enable parallel processing in separate cells. The main goal for the reallocation of inventory is to minimize the amount of time taken to pick an EZ-Kit order, which is the result of reducing the distance traveled, defining the best storing and picking methodologies, and designing easy-to-understand picking documents.
Design Requirements

Several requirements must be met in order for the Capstone project to be considered successful. The final layout must fit within the WGS warehouse space, must not detract from day-to-day business operations, and should allow for separate warehouse operations to happen in parallel, resulting in a reduction of idle time. The evaluation of the inventory allocation aims to reduce the distance traveled to pick orders through the strategic allocation of highly demanded inventory and obsolete inventory.

Design Concepts Considered

The Capstone team narrowed down their decision to one possible warehouse layout design and one inventory allocation strategy.

Warehouse Layout

The Capstone team mapped the warehouse in its current form and considered various alternative layouts, discussing each with management at WGS. The layout that was determined optimal was one that minimized migration of current equipment, but organized EZ-Kit operations into independently operating cells. With EZ-Kit operations organized in this fashion, there is a reduction in downtime as separate processes no longer overlap in the same location. The Capstone team also analyzed the advantage of adding a fourth side of an aisle, concluding that this would not be necessary with proper inventory allocation.

Inventory Allocation

The Capstone team modeled a number of inventory allocation strategies in order to determine the design that would reduce aggregated distance traveled by the pickers. The two major alternatives to the current completely randomized storage procedure in use are to randomize storage within categories or to assign fixed bin locations to each stock-keeping unit (SKU). The categories that the Capstone team assessed for randomized storage included organizing inventory by popularity, by type, and by date received. These were modeled using 30 pick tickets in order to determine the minimum distance traveled. Assigning dedicated bin locations was another option considered. This would have the advantage enabling workers to learn the locations for specific items, but requires a larger amount of warehouse space and constant updates as certain SKUs become obsolete.
Recommended Design Concept

With the capability of experimentation with their inventory allocation strategy, the Capstone team determined the most efficient strategy for inventory storage and retrieval.

Design Descriptions

The Capstone team has developed two deliverable design concepts that meet the design objectives. First, the team finalized a new layout for EZ-Kit operations. Second, the team recommended an inventory storage allocation strategy based on an analysis of spreadsheets about the current inventory locations and open EZ-Kit purchase orders from March of the 2014 season.

Analytical Investigations

The initial investigation of the EZ-Kit process made it apparent to the team that the process was flawed and contained many forms of waste. Utilizing a spaghetti diagram, the team outlined and tracked the various routes that were taken to fulfill an EZ-Kit order. After conducting this analysis, the problems at hand were confirmed and made visually apparent. Following this link analysis, time studies were conducted to find at a higher level what steps in the process were taking the most time. Utilizing this data, the team then created an Activity Relationship Diagram that graded the importance of the relationship between each entity in the EZ-Kit process, which formed the framework for our alternative layout designs. The team then used Excel and WorkPlace Planner to assess the distance traveled in various inventory storage setups.

Experimental Investigations

Once the team designed multiple bin configuration strategies, they studied the time taken to pick the material for 30 of the same orders used for the link analysis. Through comparative computations, this investigation revealed the most efficient locations for SKUs.

Key Advantages of Recommended Concepts

The proposed new layout for EZ-Kit operations would allow storing, picking, and replenishment tasks to be completed independently and simultaneously without a safety hazard. The new layout also optimizes the flow of material so that picking orders leads into the embellishing operation, quality assurance, and shipping.

The chosen bin configuration strategy reduces the time that is required for an EZ-Kit order to be picked, which in the past was the bottleneck for shipping orders during the busy season. With a reduced
time to pick orders, lead-time will be reduced and more orders can be fulfilled at a faster rate.

**Financial Issues**

With the inventory allocation strategy proposed, the financial obstacles to implementation are the costs of manpower required to move merchandise. Overall the financial impact of designing alternative layouts and the evaluation and development of an inventory allocation strategy will be limited by the cost of implementing each aspect. This cost will be associated primarily with the needed manpower to physically move entities of the new layout and also move inventory into new bins and locations. The other concern is to keep business running as usual to fill customer orders during the change in setup, which may require hiring additional resources.

**Recommended Improvements**

Supplementary process improvements are outlined that will maximize impact and reduce the most waste. While the Capstone team focused on creating a viable inventory storage system, there are many supplementary improvements that were identified late in the process. Each of these would improve the efficiency of picking processes and reduce wasted storage space. One of the Capstone team’s recommendations is to improve the readability of the pick tickets that are used to collect merchandise in a single order. In the current process, the picker must reference the sheet several times, and this over-processing waste accounts for a large part of the time taken to pick each order and can contribute to potential errors.

Discrete and batch picking were modeled to better understand the time savings associated with picking multiple orders in one trip and subsequently sorting the batch into individual orders. It was found that efficiency increases with batch picking up to a certain point where pickers will begin to make mistakes.

The other important aspect of the group’s solution strategy is that it may be an initial improvement, but the strategy must be sustainable in order for the efficiencies to maintain in the long term. If inventory is stored randomly, the benefit of this analysis may be lost, since empty bins would be filled with merchandise that does not necessarily need to be in high priority areas.

Another important aspect of the Capstone team’s solution strategy is that this configuration method must be reconsidered periodically. As customer demands shift and certain inventory becomes outdated, the allocation of SKUs in bins will have to change.