

PROBLEM DEFINITION AND OBJECTIVES

Cummins has always been striving for **continuous improvement** to ensure orders can be shipped on time while ensuring quality and workers' safety and welfare. However, **substantial wastes remain pervasive** in the processes. This project concerns the operation at three main areas:

- | | | |
|--|---|---|
| <p>i) Packaging Area (PA)</p> <ol style="list-style-type: none"> Packs parts in Cummins corrugated boxes Puts away for Outbound team to pick once there is an order | <p>ii) Inbound Area (IA)</p> <ol style="list-style-type: none"> Receives goods Sorts the goods according to size Stores sorted goods in the warehouse | <p>iii) Outbound Area (OA)</p> <ol style="list-style-type: none"> Receives orders Picks the orders Checks and packs the picks |
|--|---|---|

Objectives

- To **understand and evaluate** the current process performance at the main three areas
- To **implement sustainable initiatives** to assist Cummins in **streamlining the processes and increasing efficiency** at the three main areas

METHODOLOGY

Lean Six Sigma

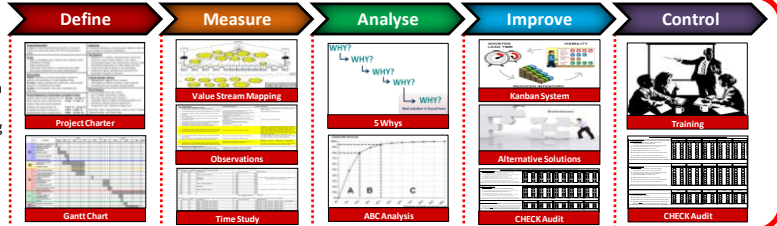
- Define** project opportunity
- Measure** current performance
- Analyze** opportunity and determine solutions
- Improve** process by implementing solutions
- Control** and monitor process performance

Inventory Management

- Create a purchasing plan to ensure items are available when they are needed (neither too much nor too little is purchased)
- Keep track of existing inventory and its use

Human Factors Engineering

- Consideration of human capabilities and limitations to warehouse environment design
- Application improves ease of movement and shorten walking distance, thus reducing fatigue

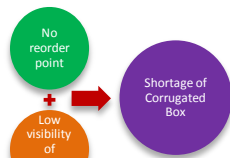


ANALYSIS AND RECOMMENDATIONS

Shortage of Corrugated Box

This problem disrupts the packaging process in PA. Also, the next best alternative corrugated box would be used, creating unwanted variation.

Possible causes

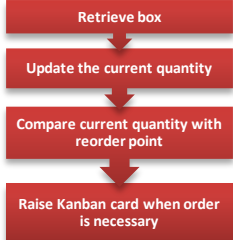


Improvement ideas

- Provide reorder point
- Use visual signal to indicate time to order to associates
- Provide clear signal to the person in-charge of placing order using Kanban card
- Build a Heijunka box where Kanban cards can be slotted

Approach 1 Manual Updating System

Information such as reorder point and current quantity is displayed on whiteboard at storage location. This enables associates to do immediate checking of inventory level upon retrieval of corrugated box.

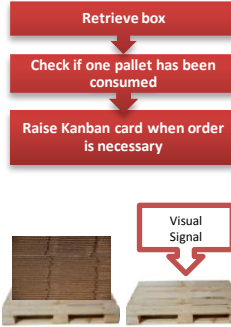


Necessary information on Kanban card:

- Type of corrugated box
- Order quantity

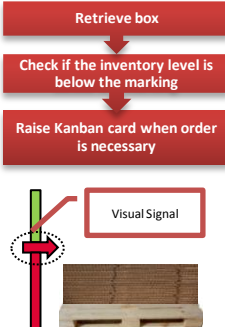
Approach 2 Two-Bin System

Two pallets are kept for each box type. Pallet quantity is the reorder point. Hence, order is placed when a pallet is fully consumed. In addition, one pallet has to be entirely used before retrieving from the other pallet.



Approach 3 Inventory Level System

Vertical marking is installed at storage location to provide visual signal for critical level. It is the level corresponding to the height of corrugated boxes at reorder point at which order should be made.



Evaluation

- + denotes advantage
- denotes disadvantage
- Manual Updating System**
 - + Accurate reorder point
 - + Feasible for corrugated types that keep any number of pallets
 - Prone to errors in updating the current quantity
- Two-bin System**
 - + Easy to monitor
 - + Clear reordering point
 - + Simple procedure
 - + Less inventory in warehouse
 - Infeasible for types that keep more than 2 pallets
- Inventory Level System**
 - + Easy to monitor
 - + Clear reordering point
 - + Simple procedure
 - + Less inventory in warehouse
 - Inventory level varies for different corrugated box
 - Lower rack location needed due to inventory level marking
 - Infeasible for types that keep more than 1 pallet

INBOUND

No.	Problems	Recommendations	Results
1	Location of dumpster not centralized	<ul style="list-style-type: none"> Centralize dumpster Allocate runners → Disposes trash 	<ul style="list-style-type: none"> Reduction of walking time by 22.7%, from 17.6s to 13.6s Higher manpower utilization
2	Layout of workstation randomized	<ul style="list-style-type: none"> Standardise layout of workstation 	<ul style="list-style-type: none"> Neater workplace Easy maneuvering
3	Urgent items needed by OA placed beyond IA workstations	<ul style="list-style-type: none"> Build a rack → Ensures safety → Reduces walking 	<ul style="list-style-type: none"> Safer order picking procedures Reduction of unnecessary walking
4	Dangerous work areas outside IA	<ul style="list-style-type: none"> Draw floor markings to mark boundary 	<ul style="list-style-type: none"> Increase alertness of drivers Clear demarcation of working area

OUTBOUND

No.	Problems	Recommendations	Results
1	Lack of official storage area → No dedicated space to store orders ready to be shipped	<ul style="list-style-type: none"> Build a rack → Reduces double handling → Saves floor space → Ensures safety 	<ul style="list-style-type: none"> Tremendous reduction of the need to stack pallets Neater work area Reduction of double handling
2	Ineffective location of sealed air pockets container	<ul style="list-style-type: none"> Relocate container to a more centralised location May add a temporary container 	<ul style="list-style-type: none"> Reduction of cycle time of walking from pallet to sealed air container by 51%, from 9.2s to 4.5s
3	Disorganized arrangement of pallets around workspace	<ul style="list-style-type: none"> Introduce floor marking to ideal location of pallets, considering human factors principles 	<ul style="list-style-type: none"> Easy maneuvering around pallets No interference with workspace

FUTURE WORKS

- Monitor the demand for various corrugated boxes on a daily basis
- Build closer ties with suppliers so that lead time can be minimised and orders at or approximately equal to Economic Order Quantity (EOQ) can be made instead of ordering at minimum order quantity
- Continue having both internal and external audits to critically examine the processes
- Establish an estimation for holding cost, setup cost, and shortage cost
- Encourage associates to identify potential improvement opportunities and provide regular feedback to supervisors

Partners at Cummins

- Amit Gokhale (Operations Leader)
- Amy Lum (Customer Care Director)
- Charolette Dawn Mallari (Packaging Supervisor) and the Packaging team
- Jamadi bin Samat (Inbound Supervisor) and the Inbound team
- Wong Fook Yuen (Outbound Supervisor) and the Outbound team

NUSISE Supervisors

- A/Prof Poh Kim Leng
- Dr Kim Sujin

Team Members

- Angel Astaman
- Chay Yu Wei
- Theresia Gladys Novena
- Wang Huan