Improvisation Of Material Handling Activities For Continuous Conveyor Mixed Model Assembly Line

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Abstract— The project work exclusively focuses on improving the material handling activities for the continuous conveyor mixed model assembly line (MMAL).The material handling includes activities ranging from issuing of purchase orders to issue of material at point of use. The forklift movement which is a parameter of high priority is taken into consideration with respect to the mixed model assembly line. The main objective is to reduce the forklift movement and also the transit delay that occurs between point of storage to point of use. The zig zag movement of fork lift within warehouse is a major cause for delay in feeding the items to MMAL. Some purchasing policies with respect to bottleneck items are taken into consideration in order to improve their movement. The usage pattern of materials is not taken into consideration in present storage layout, which results in shifting the items from large distances. The warehouse is used not only for storing items for MMAL but also for storing items needed for individual assembly lines.

This occupies more space in the warehouse. Many of the items which are non-moving, not at all moving (due to change of design) are also stored in warehouse.

The methodology implemented to reduce the fork lift movement is done by replacing the fork lifts by tow-trucks. The Kraljic purchasing portfolio model and also the Porters Five forces model have enabled to reduce the risk of delays associated with bottleneck items(high supplier's risk, low profit impact). So for the firm, one of the goals ie, converting the bottleneck items into leverage items is slowly progressing. The imports storage area which is near to individual assembly line but away from MMAL is redesigned(using Solidworks) for storage of items which exclusively focuses on individual assembly lines and not on MMAL.

After the implementation of proposals the fork lift movement is likely to be reduced and results in savings of distances travelled from **14764 m to 7639 m**, and diesel consumption by **49%**. Also the working hours of forklift operators in second shift is avoided. The main warehouse is redesigned to focus only for MMAL so that the problem of shortage of items in kits is eliminated. This approach has removed many non-moving items from warehouse and made the kit making process easier by saving time. The Kraljic model has classified the items in four different categories, so that the bottleneck items are highly prioritized and their risk of non-availability in assembly line reduces. The conversion of open area (imports) to mini warehouse has improved the utilization of huge storage area to hundred percent. The surrounding areas around MMAL are fully utilized to **100%** which was **55%** earlier. So that the items are stored properly and fed on time according to their usage.

***Key words*:** Conveyor, Literature Gap,Inventory layout,DOLS items.

I. INTRODUCTION

Material handling embraces all of the basic operations involved in the movement of bulk, packaged and individual products in a semisolid or solid waste by means of machinery and within limits of a place of business. Material handling means delivering the right amount of material in right time at right place in right condition in right quantity and for the right cost. The material handling industry manufactures and distributes the equipment and services required to implement material handling systems **.**

II. LITERATURE REVIEW

The papers referred are fully focused on material handling activities that take place in automotive, manufacturing sectors. Also some papers throw light on layout designing for reduction of material handling cost. Some papers explain the complex factors that influence the supply chain and inbound material handling process.

- A case study is also taken into consideration which is in and out only with "MIXED MODEL ASSEMBLY LINE at VOLVO Construction Equipment". This case study explains how the material handling takes place when there is change of model in assembly line. At the same time the literature review focuses on Kraljic portfolio purchasing model and porters five forces theory in order to improvise supplier-buyer relationship, to overcome the risk of late delivery associated with bottleneck items. This thesis also stresses importance on sequencing technique for assembly of machines so that the material handling cost is optimized.
- The paper is been referred in order to improvise the material handling equipment in order to reduce the forklift equipment. A Toyota material handling equipment is taken as a benchmark to bring some changes in the material transfer path as well the quantity of items shifted over one travel from point of storage to point of use.
- Brigitte Faber et al., (2011), discusses that most of the purchasers in the Netherlands, Germany, and Sweden rely upon the portfolio method of Kraljic for decision making. In the USA Monczka has become extremely popular amongst purchasers with this Michigan State University (MSU) model. This Paper shows the comparison between the two models as well their results and suggests both the models should be used side by side as they enforce each other.

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III. LITERATURE GAP

After comparing the current scenario with the above mentioned papers &thesis there are lot of opportunities for the scope of improvement. Some of the areas like planning, scheduling has to be improvised. The material handling equipment also should be considered to improve the entire material handling system. The method of rolling out machines from assembly line is completely based on sequencing which always focuses on having less material handling cost but in current scenario the machines are rolled out without giving importance for sequencing and material handling cost. The supply chain is robust and the supplier relationship is managed well to meet immediate demand. A lot of improvements is to be done in order to improve supplier relationship so that the buyer power is maximized and supplier has the highest stake in our business.

IV. PROBLEM STATEMENT

Day by day as the manufacturing sector is becoming competitive in nature . The customer is demanding for the quick delivery of product. Based on customer priority the manufacturer has stepped ahead to improvise the method of manufacturing. The individual assembly line is taken over by mixed model assembly line, which rolls out product according to the customer orders and their needs. One such mixed model assembly line that exists in hydraulic excavator manufacturing firm is taken into consideration. The material handling activity is keenly studied and understood. There is a delay in items reaching the MMAL because of several reasons like items stored at improper locations, the physical location is different from system location, and material handling equipment that is extensively used.

V. SCOPE AND OBJECTIVES

In this project the inbound transportation cost consists of only fork lift movement and the overhead cranes are not considered. The voluminous items are taken into consideration and not all other items. The fork lift analysis is calculated only for eighteen items which occupy more space during transit. The imports area is newly designed only by taking 1200 sq foot into construction out of 2500 sq foot. Keeping the MMAL concept in mind the material handling activity is to be improvised.

The factors like time, cost and safety is taken into account for improving the existing material handling system. The storage areas around assembly line are closely monitored for the quick feed of items to MMAL. The objectives defined for the project is as follows:

To achieve on-time delivery of items, particularly bottleneck items.

- To reduce the shortage of items in kits those are fed to assembly lines.
- Reduce the fork lift movement from different storage areas, so that the shifting of same items in locations is avoided.
- To reduce the fork lift movements which inturn helps in reducing inbound transportation cost.

VI. METHODOLOGY

- Application of model to increase the buyer power and to reduce the supply risk of those items.
- With the help of "kraljic portfolio purchase model & porter's five forces model" the concept of increasing buyer power and his control over the supplier is explained so that items reaches the point of use with less or no suppliers risk.
- Redesigning of inventory layout - (1) Calculate the entire storage area, (2) list the items stored in those areas and (3)reduce the storage of those items in multiple locations and also to reduce the material handling cost in those path.
- Considering the tube making process: To alter the system of outside processing for few items (OSP's).
- Considering transportation cost within the premises of the firm. Reduce the inbound transportation cost. Examining the current method of moving the materials, ie the fork lift.
- Determine the cost involved in shifting the items from point of storage to point of use. To replace the fork lift by tow-truck which is of the same capacity but shifting many or multiple items in one travel rather than multiple travels.
- The required cost analysis and design of pallets and components are done with the help of solid works.

VII. OBJECTIVES OF MATERIAL HANDLING

The primary objective of a material handling system is to reduce the unit cost of production. The other subordinate objectives are:

(1) Reduce manufacturing cycle time
(2) Reduce delays, and damage
(3) Promote safety and improve working conditions
(4) Maintain or improve product quality
(5) Promote productivity
(6) Promote increased use of facilities
  - Promote the use of building cube
  - Purchase versatile equipment
  - Develop a preventive maintenance program
  - Maximize the equipment utilization etc.
(7) Reduce tare weight
(8) Control inventor.

VIII. CONCLUSIONS

The implementation of Kraljic portfolio model and Porter's five forces theory has made the identification of bottleneck items (high supplier's risk) easy so that buyer will be aware of increasing his power and to reduce the supplier's bargaining power. The main intention is to make the suppliers have high stake in business with L&T Komatsu.

The introduction of new material handling equipment has enabled in reduction of material handling cost with respect to time, cost and safety. The usage of tow-truck in place of fork lift has resulted in reduction of diesel consumption by 49%.

The new inventory layout designs has enlightened about all the storage areas that feed items to MMAL. The newly suggested layout has helped in complete utilization of storage areas around MMAL. This has also reduced the distance travelled from POS to POU.

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The snags are been classified into different groups. By effective communication between process engineers and employees any change in design is well communicated. Also the process check sheets are revised to include coolants and adhesives in that station which were missing earlier in the check list. This avoids the particular items skipped from assembly.

By incorporating Kraljic portfolio purchasing model all the items are classified according to the risk associated with them. Since the main focus is bottleneck items the model has helped in reducing items from the risk associated with bottleneck items.

By exploring different material handling equipment's like AGV's, conveyors and so on. The utilization of tow truck was the right choice too use in place of fork lift .As a result the diesel consumption and time involved in shifting items from POS to POU is reduced.

A. FURTHER SCOPE OF PROJECT

- To reduce the storage area for assembly works, as of now the storage area is 10485 m^2. As per the top management decision the storage area is to be reduced by 35% since each square foot is expensive and should not be misused.
- Improvise some DOLS items so that they can be fed on FIFO basis.
- Redesign the storage of **all** the items as per the usage sequence, so that the fork lift movement can be further reduced.
- Any change in BOM should be notified to the buyer so that the next consignments do not reach L & T Komatsu
- Relook on regular basis for non-moving items stored in warehouse.
- Involve the supplier in ECO implementation.
- Implementation of RFID in warehouse, to improvise the material handling activities, quick highlight of shortage of items to the stores, buyer and the management so that they can plan accordingly**.**
- Safety stock should be made dynamic (floating) in nature, so that keeping the days of consumption (DOC) as constant safety can be changed based on demand. This finally reduces the inventory which in turn adds some value to investment.
- As of now only few voluminous items are considered to move in tow tractor, down the line this material handling equipment should be used on full-fledged basis.

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