



LEAN MANUFACTURING THROUGH VENDOR DEVELOPMENT : A CASE STUDY OF THERMAX LTD

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Abstract

Lean manufacturing practices are concerned with elimination of all types of waste in manufacturing practices & processes followed. One of the approaches towards this is to build the strong vendor chain. Thermax Ltd., a thermal and an environmental engineering major uses a Green Channel Methodology for rating its vendors. The paper highlights a case study of this methodology implemented at Thermax and results achieved by implementation of this methodology.

Key Words: Lean Manufacturing, Green Channel, Vendor Management.

1. Introduction

Lean is about standardizing work processes to make problems noticeable and developing employee's critical thinking ability so that they can solve those problems and improve work processes. Lean may be defined as *the relentless pursuit of the strategic elimination of waste*. Or Lean can be defined as a systematic method for elimination of waste. Through the continuous refinement of practices and procedures, lean management seeks to produce more goods more quickly while using fewer resources - less factory space, fewer worker movements and fewer assembly steps. Although often associated with leaders in manufacturing eg. Toyota, Ford etc. it is more significant in services settings such as Southwest Airlines, Wal-Mart etc. as the waste is hidden. The three types of wastes primarily noticed and they provide a framework for their identification in production and service processes are, Muri: Overburden on the worker resulting from poor management practices Mura: Unevenness in scheduling (variation) and Muda: Non-value-added work or any non-value-adding activity in the process. When the waste is reduced, overall quality is improved with reduction in production time and production costs. One of the approaches to lean manufacturing in the context of outsourced material is to improve the flow or smoothness of work flow of vendor supplied material.

Green Channel is the direct channel where vendors can deliver the parts directly at the assembly line or point of ultimate use, hence the inspection is carried out at the vendor's site, physical check at the entry point of OEM and line side inspection is totally eliminated. The vendor is termed as 'self certified vendor' and hence inspection and re-work of vendor supplied parts is waived off. By Green Channel, quality and delivery performance improves dramatically; it ensures optimum utilization of resources; vendors take responsibility for smooth execution of delivery process and hence Green Channel implementation ensures win- win situation for OEM as well as Vendor. Hence implementation of Green Channel would minimize or remove the waste in terms of operators waiting for getting the material on line, unnecessary inventory pile up alongside the line, excess transportation and excess inspection at different levels in entire supply chain.

This project discuss about implementation of Green Channel as a vendor performance optimization method by Thermax Ltd. for the vendor M/S. Decon equipment private limited, Pune. After implementation, entire wastes were eliminated resulting in optimizing cost of inspection and reducing inspection time throughout the process is reduced to the minimum. Operational advantage for vendor was flow of the material is streamlined which enabled vendor to deliver the material alongside the assembly line. Strategic advantage for vendor was vendor became self certified vendor of Thermax and this status helped them to expand their business.

2. Review of Literature

The engineering industry continuously faces the challenge of improving performance of production processes and efficiencies. With this objective at the background coupled with management of cost, it becomes more important to develop a strong chain of the suppliers and make them strategic partners of the company. Willis and Huston (1990) in their research work on 'Vendor Work and Evaluation in Just-in-Time Environment' estimated that almost 50% of manufacturing costs are attributed to purchased items, and raw materials account for 80% of a finished product's lead time and 30% of its quality problems. According to Babineaux (2002) suppliers are key value chain participants who affect the firm's total performance. Global leaders in engineering industry have proved that collaborating with suppliers can help in gaining competitive advantage. Good supplier measurement systems allow companies to improve quality and dramatically reduce both order cycle times and inventory levels. Thus there needs an effective system in which supplier performance is objectively measured and one such system is supplier score card.



According to Lefkowitz and Dave (2001) supplier scorecard serves two key roles. First it identifies the supplier performance metrics that are most critical to the organisation. Second, it enables the evaluation of the suppliers against these key metrics. From the perspective of supplier, an effective supplier scorecard has the potential to help the supplier in three different ways. First, supplier scorecards enable a supplier to link its own performance measures with the strategic objectives of its customers. Second, the supplier scorecard enables suppliers to identify opportunities to improve their performance so that they are better able to meet customer requirements. Finally, scorecard documents the criteria used to define what levels of performance are considered acceptable and superior by the customer organisation. When focussed in these ways, the supplier scorecard becomes a planning guide for suppliers. In addition to establishing measures that provide a balanced view of performance, performance measures must be also objective, credible and timely. Brookes & Coleman (2003) in their study titled 'Evaluating Key Performance Indicators Used to Drive Contractor Behaviour at AEDC' stated that the best performance measures are based on the data that cannot be manipulated and these measures must be credible. In other words, organisational members must understand the link between performance measure and the desired performance objective. Effective performance measures must also be timely and be shared on a regular basis so they can be used to proactively drive the changes in performance. Youngblood & Collins (2003) in their study of trade-off issues between performance metrics further stated that, if performance measures are used to identify how current performance will impact the future, measures become leading indicators rather than retrospective indicators. By developing a set of leading performance measures, managers have the information necessary to identify opportunities for performance improvement. They developed a supplier scorecard design and implementation process using these performance measures guidelines. Tony Doolen et al. (2006) in their research work entitled 'Using Scorecards for Supplier Performance Improvement: Case Application in a Lean Manufacturing Organisation' developed a five step process in design and implementation of supplier scorecard. The first step identifies strategic and operational objectives of the organisation are related to supplier performance, in step two the balanced and objective performance measures appropriate for suppliers are developed. The step three covers engaging the suppliers to ensure that performance measures are credible and actionable, while step four establishes a graphical design that provides a clear evaluation of supplier performance. In the fifth and last step suppliers are educated on the performance measures and its implications.

Every manufacturer develops its own evaluation model for assessment of supplier performance. Thermax Ltd. Is an Indian energy and environment engineering major engaged in manufacturing of boilers, vapour absorption machines, chillers for large scale air-conditioning units etc. It also offers water & waste solutions and installs captive power projects. As a step towards lean manufacturing practices, the company has developed a 'Green Channel Methodology'. Green channel is a direct channel by which vendor can supply items directly to customer shop or stores for ultimate use where inspection is waived off. It is a process of working with existing vendors on a one to one basis to improve their performance to 'Self Certified' levels for mutual benefit of both the organisations. Therefore it creates a strategic partnership. The 'Green Channel Methodology' offers following advantages.

- Improvement in quality & delivery performance.
- Improve business alignment between vendor and buying organisation.
- Meet requirements of safety standards
- Cost reduction through optimum utilisation of resources at both organisational and vendor level.

The study presents a case under the 'Green Channel Methodology' to highlight the lean manufacturing practices followed at Thermax Ltd.

3. Research Objectives

1. To analyse the vendor rating process at Thermax Ltd.
2. To study in detail the Green Channel Methodology.

4. Case of Thermax Limited

Area Focused- Supplier of Fabricated materials

Criteria to choose Green Channel Vendor,

1. Vendor should be associated with Thermax for at least five years.
2. Vendor should have minimum turnover as prescribed by Thermax's guidelines.
3. Criticality, complexity and uniqueness of the part supplied by the vendor.
4. Percentage share of business of vendor with Thermax should be significant as compared with other OEM's.

Purpose for Developing Green Channel Vendor

Build supplier capabilities to achieve Seamless Material Flow with 100 % OTP (On Time Performance) or OTD (On Time Delivery) & Zero Defect by implementing Thermax operating system at supplier's place.



Performance Measures

Following parameters will measure the performance of Green Channel Vendor.

1. 100% RFT (Right First Time) at Thermax
2. Quality System Compliance
3. Throughput Time (days) & Lead Time (days)
4. Production capacity (kg/ month)

Target Setting

Set the target for both output as well as process KPI's (Key Performance Indicator).

Output KPI's

1. Lead Time (days)
2. Throughput Time (days)
3. Throughput (tons)
4. Space Utilization (kg/sq ft/month)
5. Manpower Productivity (tons/ month)

Process KPI's

1. Quality System Compliance
2. Material Availability
3. Space
4. 100% RFT
5. Manpower

Diagnosis

I. Study current facility arrangement

- Cleanliness
- Material Storage System
- Current Layout
- Inventory System.

II. Draw

- Process Map to Understand the Current Issues,
- Draw issue tree and waterfall.

III. Broad solution strategy

Pre-Work / Solution Design

- Clean shop floor, implement 1S and 2 S, and implement layout and material storage system.
- Implement visual dash boards and order tracker.
- Implement loading and window planning.
- Identify and implement jigs and fixtures for maintaining critical parameters.
- Set up MIS

Implementation

- Conduct Weekly Gemba meeting / review at suppliers sites.
- Monthly MIS

Monitoring and Sustainability

- Trend review of all KPI'S in review meeting.
- Document the process. Draw rollout plan for other vendors.

SOP for Selection of Green Channel Vendor

Step 1: Consideration for Green Channel Inspection

Supplier parts will be considered for Green Channel - No inspection if quality of parts under any one of the following group conditions are met.

A. Conditions for GROUP - Bought Out Items

1. Supplier with ISO 9001 Quality Systems compliance (Certificate not mandatory)

2. Minimum 95% vendor rating for last 3 months
Vendor rating done on the following parameters
 - a. Points for Delivery: 45 Points
 - b. Points for Quality : 20 Points
 - c. Points for Site Performance : 35 Points
3. Dimensional and / or material test reports for the part supplied as per agreed quality plan / control plan.
4. There should not be any rejection for the minimum of last 3 months/ 25 lots
5. Recommendation by material & QC HOD.

B. Conditions for GROUP - Fabricated items

1. Supplier with ISO 9001 Quality Systems compliance (Certificate not mandatory)
2. Minimum 95% vendor rating for last 3 months
Vendor Rating done on the following parameters
 - a. Points for Delivery: 45 Points
 - b. Points for Quality : 20 Points
 - c. Points for Site Performance : 35 Points
3. Dimensional and / or material test reports for the part supplied as per agreed quality plan / control plan.
4. There should not be rejection for the minimum of last 3 months/ 25 lots
5. Recommendation by material & QC HOD.
6. Vendor audit score should be greater than 3 (out of 5).

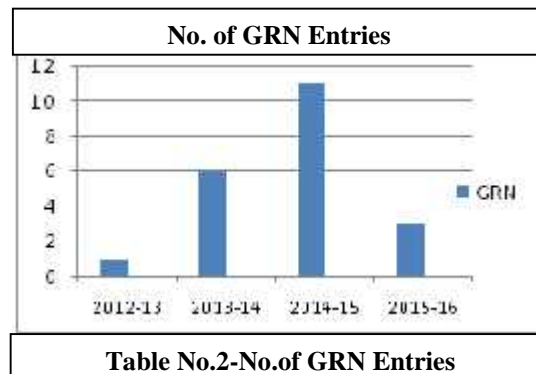
Once the parts satisfy the above group conditions, they will be recommended for Green Channel.

The list of such parts/suppliers and method of approval will be maintained by shop QC / Receipt QC.

Vendor Rating and GRN Details of M/s Decon Equipments with Thermax

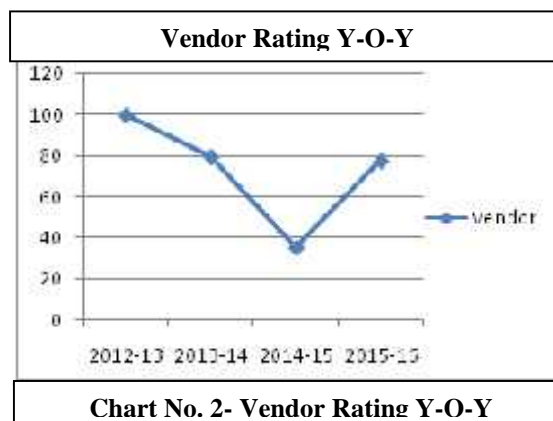
Goods Receipt Note: GRN	
GRN Entries	
Year	GRN
2012-13	1
2013-14	6
2014-15	11
2015-16	3

Table No.1- GRN Entries (Yearly)



Vendor Rating	
Year	Vendor rating
2012-13	100
2013-14	79.55
2014-15	35
2015-16	90

Table No.2- Vendor Rating





Step 2: Requirements for Sustenance for Both the Groups in Green Channel

On receipt of material, the part has to be cleared at receiving inspection based on the verification of the dimensional inspection reports and Material Test reports received from the supplier as per agreed quality plan / control plan.

The parts will be removed from green channel in case of any line rejections/ customer complaint and the same will be communicated by shop QC to supplier / Buyer / Vendor QA and follow step 3.

Step 3: Procedure for Taking Corrective Actions in Case of Line Rejections

The part will be brought under normal inspection procedure as per Thermax sampling plan. Corrective action will be raised for the part and the same has to be brought to the notice of supplier.

To bring this part again under green channel follow step 1 and step 2 of above procedure.

Green Channel Implementation at Vendor's Place

Vendor Profile

Vendor Name: Decon Equipments & Systems Pvt. Ltd., Bhosari MIDC, Pune
(Vendor Code: 119182)

The criteria for selecting the vendors as the GC Vendor is as below-

This is the sample format of vendor rating.

Required 90 - 95% vendor rating for last 3 months

Vendor Rating as per below

- Points for Delivery: 45 Points
- Points for Quality : 20 Points
- Points for Site Performance : 35 Points

Below recommendation/ Approval from internal stake holders (OEG/Purchase/QAC): The selected vendors for the Green Channel.

Vendor Audit before Implementing 10 Step Methodologies

Zero Level Mapping

Purpose: To understand the current status of M/s Decon Equipments for all processes. After this audit Thermax identifies area of improvement. So that Thermax can make the correct action plan by using this audit report.

Safety Audit Before 10 Step Methodology

Purpose: The Purpose of this Safety Audit at Vendor's place is to know the current and actual situation of the safety measures available at shop floor. By conducting this audit Thermax can judge whether vendor follows the safety rules or not? If not, then prepare action plan and give target date to the vendor to complete or follow all the rules. This improves awareness about safety at shop floor. This audit taken by the Thermax's Safety officer.

MOU Signoff between M/s Decon Equipments and Thermax

Purpose: Memorandum of Understanding (MOU) is the Agreement between Thermax and vendor M/s Decon Equipments. In this MOU defines the responsibilities of vendor, responsibilities of Thermax and Duration of the MOU.

Start Implementation Process of 10 Steps Methodology at Vendors Place

Step 1: Process Mapping

- Mapping flow of Material & Information through the entire process.
- Analysis on activities on Critical path & Parallel path
- Capturing total throughput and bottlenecks: To check all these processes are actual working or not at vendors place, so that they need to maintain this document as well.

Step 2: Wastage Identification & Elimination

- Identification of 'Waste' in process (Refer 7 wastages)
- Root cause identification
- Action plan to eliminate the 'waste' & their implementation

7 Types of wastages as defined in Lean: Over Production, Inventory, Waiting, Motion, Transportation, Rework, and Over Processing. There were identified wastages at vendors place; then gave the suggestions to them to remove all those wastages



which were lying on the shop floor as soon as possible. A deadline was given and they were following the deadline and remove the wastages on the shop floor.

Step 3: Capacity Estimation

- Estimation of existing resources like manpower, machines, space and raw material suppliers.
- Estimation of current business with different customers.
- Customer wise share of business.

Importance of Capacity Estimation: Why capacity estimation is required in the Green Channel Methodology?

The reason being, if Thermax gets an emergency project order and if it is required to be placed with the vendor, it is necessary to estimate all the above information.

Estimation of Existing Resources: Estimation of Manpower:

List of Workers & Staff

There are 17 no. of workers as below-

- Fitters - 7
- Lathe Machine Operator – 3
- Drill M/c Operator - 1
- Welder – 3
- Argon Welder - 1
- Helper - 1
- Gas cutting operator – 1

Space Details

- Total Factory Area: 687.31 Sq mtr.
- Actual Plant Area (Shop Floor): 527.57 Sq mtr.
- Lathe Machine shop: 35.52Sq mtr.
- MD Office: 7.77 Sq mtr
- Reception Area: 11 Sq mtr
- Other: 105.45 Sq mtr
(Garden, Security Gate, Wash room, Parking Area etc)

Step 4: Capacity Allocation

Define capacities for each vendor: In order to estimate capacity data related to inputs such as Men, Machine, Method, Material, Money has been collected and analyzed. Optimization of the resources to increase efficiency with resources allocation exercise.

Step 5: Plantlayout Change, 5S Implementation& Safety

- Taking snap shot of current positions of all physical facilities.
- Map the material movement from raw material to finish product.
- Prepare new layout considering best suitable locations of all physical facilities.
- Fix up place for Gangways, Stores, FG storage, Raw material storage etc
- Make maximum utilization of vertical space by providing suitable racks etc.

Plant Layout

Initially M/S Decon Equipment did not have defined plant layout at shop floor. There was no any specific operation wise area allocation.

Implementation Process

Initially to avail maximum space for production, a 5S activity was started at M/s Decon's shop floor. 5S stands for "Sort", "Straighten", "Shine", "Standardize", and "Sustain".

In this activity vendor was first asked to identify usable & non-usable material lying at the shop floor. Then usable material was stacked properly into vertical racks to save space & non-usable material was scrapped.

After analysing manufacturing process flow chart, M/s Decon was asked to allocate operation wise work station for each operation & to ensure that the particular work is happening at the allocated work station only.

Later nomination of 1 person from each workstation was done, who started ensuring daily cleaning of workstation before leaving shop floor.

Implementation of 5S Systems

Meeting with Shop Floor People to Elaborate Importance of 5S

Here Thermax officers give the 5S training to the shop floor people to ensure safe working conditions & Cleanliness on shop floor.

SEIRI -- 1 'S' (Sorting - Remove unwanted material)

Activities in Seiri

- Throw away things that are not needed
- Organize cleaning the floors and housekeeping
- Remove all the material from the wall sides, columns and corners etc.
- Sort out all material into required & not required.
- Keep the shop entrance, gang ways and passages always clear.
- Proper use of available space

Action Taken

- Removal of all unwanted material lying on the shop floor.
- Appointment of one fix worker to clean the shop floor on daily basis.

SEITON -- 2 'S' (Set in order - Systematic arrangement)

- Make process wise layout.
- Fix locations of the racks for the material regularly required.
- Make item wise separators for the materials in the racks & label them.
- Everything has a clearly defined name & place

Actions Taken

- Here the suggestions them to make a **new rack** to store the all raw material and in-process material.
- Mark the Gangways as per the plant layout
- Make the separate room to store the paint box
- Make trolleys for cylinder movement
- Proper storage of Empty & Filled Cylinder

Final Space Utilisation after Implementation

Total Space Distribution



Chart No.3-Total Space Distribution

Safety

Meeting with Shop Floor People to Elaborate Importance of Safety

Here Thermax safety officer gives the safety training and 5S training to the shop floor people to ensure safe working conditions & cleanliness on the shop floor.

Provide PPE (Personal Protective Equipments) to Workers

To avoid any kind of injury on shop floor, every worker is provided Personal Protective Equipments (PPE). Before starting the GC implementation at M/s Decon, workers used to work without wearing safety shoes, safety goggles, etc.



Benefits

1. Due to vertical stacking, space required to store raw material reduces vastly.
2. Due to Systematic arrangement & segregation of raw material, time required for identification & issue of particular raw material for production reduced.
3. Paint is inflammable fluid. Spark generated in vicinity of paint storage area can lead to fire accident. Due to separate storage of paints, possibility of fire accidents reduced drastically.

After Implementation Process M/s Decon's Efficiency was Increased

Efficiency in terms of Inputs and Outputs-

Inputs declined and Outputs were increased

Inputs such as –

- Reduce the Material Handling time.
- Reduce the Crane moving time
- Reduce the rework process and reduce the usage of electricity

Outputs are –

- Increased the space as well as productivity
- Increase the efficiency of workers
- Increase the Quality of the product.

Step 6: Visual Management

- In visual management display of the process flow chart, plant layout & product range
- Visual boards
- Work instructions & standard operating procedures.

Display of Work Instructions and SOPs

Display Board on Shop Floor

Documents on the Display Board

- Quality Policy
- Organization Structure
- Manpower Strength
- List of Instruments
- Calibration Record
- List of Machineries
- Product Range
- Customer wise Share of Business
- Production Plan etc.

Step 7: Inventory Management

- Understand the monthly output requirement
- Calculate optimum / safe inventory of raw material & other sub components
- Provide space for all types of inventory

Step 8: Quality Systems & Improvement

Dedicated QC Person

As per the Thermax standard for Green Channel, Vendor should have one separate Quality Engineer to do the inspection for all products. His involvement only in Quality not in the production and other departments. So, as per the Thermax requirement M/s Decon appointed one separate Quality Engineer to Mr. Wadle (Quality Engineer).

System for Handling Customer Complaints & CAPA

Purpose: Purpose of to prepare the Customer Complaint Register is to receive any complaint from customer about the rejected product. Vendor need to record that complaint in this register. By using this record vendor can take the corrective and preventive action to eliminate the problem. It can be a help to improve the quality of the product and can give the better quality product to the Customer.

Step 9: Organizational Effectiveness

- Define organization chart for Roles, Responsibility, Authority and Accountability to achieve organization goals.



- Ensure communication facilities available at vendor end. Use of email, internet, telephone, fax etc.

Step 10: Motivation & Involvement

- Formation of continuous improvement teams at vendor end.
- Knowledge sharing and visit to best shop
- Reward & Recognition scheme (optional)

Green Channel Improves	Green Channel Reduces
Productivity increases	Transportation cost
Quality increases	Manufacturing cost
Work standardization	Lead Time
Process Reliability	Waste
Profitability	Inventory
Efficiency	Rejection and Rework
Safety	Wastage in materials, time and energy.

Table No.3-Improvement with Green Channel Implementation

5. Conclusion

Green Channel in the context of Thermax Ltd. is a ToS(Thermax Operating System). Implementing the green channel is strategic move of Thermax where the focus is to reduce the number of vendors from 10X to 2X. This will enable Thermax to take a better control of activities of few selected vital vendors. Vendors will also experience increased share of business with Thermax, better coordination and collaboration with Thermax team, reduction in lead time and cycle time. Green Channel implementation not only starts from physical distribution but it covers every activity starting from component designing, hence overall cycle time is reduced to minimum. In case of M/S. Decon, the average cycle time was 27 days which reduced to 8 days after the implementation of green channel. Core principle of Lean Management is that any process that does not add any value should be eliminated. Green channel methodology emphasises reduction in the redundancy of inspection and checking of vendor supplied part at different stages in supply chain. Thus, it addresses the wastage in terms of waiting time and movement of parts.

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