Integration of Lean compatible Quality management system (LCQMS)

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Abstract: In the ever increasing level of customer expectations in a competitive environment, the sustenance of a company solely dependent on robustness in its process and applications. Many industries at the early stages of its production focus more on the ways and means to increase the volume. A management system will be more effective if implemented ahead of the commercial production. There are many popular tools to support a systematic approach reaping benefits in terms of keeping the costs low, distinguishing from the competitors while satisfying customer needs. Among these, Quality management system (QMS) (ISO 9000) and Lean Manufacturing System (LMS) make remarkable effects in a business. This paper presents the ways and means to integrate Quality management and Lean Manufacturing in an organisation and to implement the same at its infancy (before production). This model has been tried out in one of the units (blanking) of a leading automobile manufacturer situated at South India and the relevant details and benefits are also presented.

Keywords: Lean Manufacturing, Quality Management, Process Failure mode and Effects Analysis (PFMEA), Value Stream Mapping (VSM), Kaizen

1. INTRODUCTION

The concept of quality is common, but can be applied in many ways in an industry. The goal is to achieve customer satisfaction and to
sustain the quality. Standardisation helps an organisation to effectively implement a management system. ISO, the International Organisation for Standardisation, was founded in the year 1947 as a means of developing voluntary technical standards. The original documents were highly specific, targeted to engineers, and documented technical specifications to ensure consistency in materials, products, processes and services. In 1987, ISO expanded its technical scope to create ISO 9000, which includes standards for non-technical functions.

Lean manufacturing started in Japan after World War II. During this time, Japanese companies found themselves having to rebuild with limited resources such as people, material, and finance. As a result, Japanese companies developed lower cost manufacturing practices with the objective to minimise the use of resources on non-value added processes and to minimize necessary investment in capital and inventory while simultaneously providing a high level of customer service. Companies across the world are now finding the benefits of implementing these lean concepts into their operations.

Integration in the modern business sense is defined as the blending of data, applications, and processes into a functioning, ultimately leading to a unified whole. Integration unlocks information and functionality in individual applications and turns them into a shared, company-wide resource. While quality is a direct attribution to customer satisfaction, Lean manufacturing is centered on the efficiency of an organisation. Lean focuses on reduction of wastes and effective utilisation of resources in an organisation. The integration of QMS and LMS envisages a balanced approach thereby avoiding many priorities arising from different forums.

Generally most of the industries tend to develop system after the commencement of its production. In such cases, the implementation of system during the course of business is a very hard task as it requires organisationwide change in culture and practices. This gets further complicated when the products have
greater demands in the market at the early stages of launch, eventually creating back pressure to its manufacturing operations. When there is a conflict, systems implementation takes a back seat in most of the cases. If the systems are not robust, stability in the market would be at risk. Waiting for materials, searching for tools, poor work environment are the symptoms of weak system. Hence an attempt has to be made to integrate QMS and LMS principles and requirements. An integrated system is to be developed right from the stage of infancy of the organisation. Such an integrated system would avoid wasted/duplicated efforts which help in the conglomeration of resources towards a common goal.

2. LITERATURE SURVEY

Bill Gaw (2001) states that now-a-days, companies feel the need to right size, become leaner, more agile, time-based, faster, stronger, smarter, cheaper and better than their competitors. Incremental improvements, even gradual, continuous improvement to the existing order, won’t bring most organisations to pre-eminent positions in their areas of endeavour. David Hoyle (2000) mentions about ISO that for some it conjures up mountains of paper, work, bureaucratic procedures, form filling and non-value added activities. To others it is just a common sense merely codifying principles that have been applied by successful businesses for generations. Dennis (2005) in the International Journal of Productivity and Performance Management states that the viewing of Lean Implementation across the entire enterprise minimises the possibility of overlooking opportunities for further performance improvement. A silo view of Lean implementation may allow gaps in performance to persist with no one assuming responsibility for the entire enterprise. Employing Lean principles can improve performance through quality, on time delivery and customer satisfaction. ISO (2000) emphasises that customer satisfaction is essential for any business. Working to recognise Quality Management System can help to meet customer expectations. QMS provide a frame work for its processes and activities. They can help a business
to improve its efficiency by providing a best practice model for it to follow. Javier Freire et al (2002) mentioned that an improvement methodology is proposed for the design process in construction projects. Based on concepts and principles of lean production, the methodology considers the design process as a set of three different models - conversion, flow, and value. According to the authors, four stages are necessary to produce improvements and changes (1) diagnosis/evaluation (2) changes implementation (3) control and (4) standardisation. The methodology suggests the application of seven tools in accordance to specific needs (detected and desired) on five potential areas of improvement namely client, administration, project, resources and information. Results of an application included an increase of 31% in the share of value adding activities, 44% reduction of unit errors in the products, up to 58% decrease of waiting times in the process, and an expansion of the utilisation in the cycle times. Kristin Marshall (2002) had undertaken a study on Quality and Lean in which he briefly discussed the backgrounds and contents of the ISO standards and lean initiatives. In his findings there are certain characteristics of both tools that would leave on believing that conflict would arise that could lead to discrepancies in quality audits or slowness in implementation of lean-driven change. One potential conflict of considerable interest is how the quick changes resulting from kaizen events in lean would exist with the traditional documentation and heavy requirements associated with ISO certification. From the case studies, it is notable that none expressed any conflict between their ISO certification and lean initiatives. In fact, all of the companies discussed how the two tools complemented each other. The companies did, however, express common hurdles that had to be overcome through proper channel. Angappa et al (2003) asserts that productivity and quality are an integral component of organisations’ operational strategies. Productivity continues to play an important role both at the macro and micro levels. At micro-level, firms continue to use productivity as a performance measure to benchmark against the best-in-class companies with the objective of identifying best practices. Quality
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management has become an important part of culture, particularly, in new enterprises which are characterised by supply chain, e-commerce and virtual enterprise environments. Shao et al (2006) claims that to prosper in today’s fiercely competitive global marketplace, enterprises, especially small and medium-sized ones, we must strive to provide products with shorter time to market, lower cost, higher quality, and better customer satisfaction. Quality management plays a vital role in achieving these goals. Stanley et al (2003) state that Companies can eliminate wide variation in quality program results by fusing strategic, tactical, and operational elements of previously proposed quality disciplines, say the authors of Fusion management. The synergies evolve to drive success. The book dissects the major quality management strategies used by companies today. Fusion management attempts to specify a continuous, ever evolving management system that uses the best of past strategies in a new way, a way that won’t fail and won’t fall into disuse over time. Theory suggest that certification with a management standard may reduce information asymmetries in supply chains and thereby generate a competitive advantage for certified firms. Terlaak (2006) in his article indicated that a 11 year panel of US manufacturing facilities was assigned to test whether certification with the ISO 9000 Quality Management standard generates a competitive advantage. Results suggest that certified facilities grow faster after certification, and those operational improvements do not account for this growth. Results also indicate that the growth effect is greater when buyers have greater difficulty acquiring information about suppliers. Womack et al describe that Lean Manufacturing is a generic process management philosophy derived mostly from the Ford Production System (FPS) and Toyota Production System (TPS) and also from other sources. It is renowned for its focus on reduction of the wastes in order to improve overall customer value. Lean is often linked with six sigma because of its emphasis on the reduction of process variation.

3. TRADITIONAL APPROACH

Previously the implementation of Quality management system happened after the launch of a new product and commencement of
production. While investigating the causes for problems reported at the factory where the present study was made, the findings revealed that lack of robustness in the process control measures. The findings are: (i) preventive measures were not robust in the previous plant as Failure mode and effects analysis (FMEA) was not made for all the processes. (ii) Parts identification status was not clear in some cases. (iii) Methodology of tagging the rejects was not defined clearly. (iv) Some issues observed were related to procedures implementation. (v) cross functional team structures was not established on time. Whenever a system was proposed, it did not reach the users on time. Delayed communication caused confusions and issues. (vi) Poor housekeeping was observed in many functions. With regard to products too many inspections, repair and rework were experienced. (vii) There were instances of line stoppages due to unavailability or critical spares. (viii) Quality initiatives and Lean related initiatives were driven simultaneously. (ix) Too many priorities from various forums did not allow the users to respond to problems in a timely and effective manner. (x) Way for continuous improvement was also affected because of competing requirements.

4. PROACTIVE APPROACH

4.1 Integrated Systems Approach

To eliminate the issues which were mentioned above, it is learnt that the integrated systems approach is a must for any organisation right from the initial days of its production. Based on lessons learnt from the past production, a set of propositions are made ready to observe in the upcoming new projects.

4.2 CFT Formation

Cross functional team (CFT) structure shall be developed well before the commencement of production. This team should include representation from all functions within and outside the department. The representatives will own the responsibility to communicate the proceedings of CFT to their respective teams.
4.3 Systems Development

Procedures and supporting systems shall be developed ahead of production. QMS requirements per ISO 9001:2000 may be included in the basic frame work of systems in the new project.

4.4 Integrated Approach

The procedures shall be developed keeping lean concepts also in the basic platforms of the system. The agenda of the cross functional team shall include the issues of Quality and Lean Manufacturing. The issues shall be taken up based on the prioritisation by the team.

4.5 Integrated System Model

Based on the discussed propositions, an Integrated Model was developed for QMS and LMS. The model identifies the possible linkages between the two concepts as depicted in Fig. 1.

![Fig. 1: Integrated QMS/LMS Model](image)

The process approach in ISO 9001:2000 requires to view the organisational operations as a set of processes needed to run the business. Every process begins with inputs followed by blending of inputs to outputs. Lean concept requires to breakdown the process
into various stages to provide for identifying opportunities for elimination or reduction of wastes in a process along with effective utilisation of resources.

The comparison between QMS (ISO) and LEAN is shown in Table 1.

<table>
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<tr>
<th>ISO</th>
<th>LEAN</th>
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<td><strong>Customer focus</strong>: Top management shall ensure that customer needs and expectations are determined, converted into requirements and fulfilled with the aim of achieving customer satisfaction.</td>
<td>First principle of lean is to start with the customer.</td>
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<td><strong>Human Resources</strong>: Personnel who are assigned Responsibilities defined in the QMS shall be Competent on the basis of education, training, skills and experience. Training needs shall be identified, training provided and evaluated for effectiveness.</td>
<td>Lean has a major stress on cross training and an operator’s ability to do several jobs, not only one.</td>
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<td><strong>Facilities</strong>: The organisations shall identify, provide and maintain the facilities it needs to achieve the conformity of product including workspace and associated facilities, equipment, hardware and software and supporting services.</td>
<td>5S</td>
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<td><strong>Improvement</strong>: The organisation shall plan and manage. The processes necessary for the continual improvement of the QMS, take corrective action to eliminate the cause of nonconformities in order to prevent the recurrence, and identify preventive action to eliminate the causes of potential nonconformities to prevent the occurrences.</td>
<td>Many companies are using lean to fulfil this requirement.</td>
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<td></td>
<td>• Mistake proofing</td>
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<td></td>
<td>• Method sheets</td>
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<td>• Kaizen</td>
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The integrated model was tried at the blanking unit which is a new division at an automobile industry which is situated in South India. A cross functional team was formed. Team structure was established and the team had been meeting periodically to discuss on the implementation. For QMS the requirements of ISO 9001:2000 were considered and general lean principles on waste reduction were considered for implementation. The procedures and other
supporting systems were developed before this division commenced its production. Procedures mandated by ISO 9001:2000 for the organisational process have been prepared.

6. RESULTS AND DISCUSSION

The basic structure of QMS has been established and procedures mandated by ISO 9001:2000 and the quality system documents required by the business have been developed. The integrated QMS LMS manual has been released. This manual has ISO 9001:2000 requirements listed on one side and the corresponding LMS principles have been posted against appropriate clauses. This will serve as a guide for any new plant that intends to implement QMS and LMS simultaneously. Such a combined approach avoids the duplication of efforts. Process flow (pre-requisite of PFMEA) is linked with Value Stream Mapping (VSM) to assess if a failure mode can be addressed through waste elimination approach. A process step of process flow might indicate the existence of a failure mode. If the process step has an alternative, then it can be modified suitably which would eliminate a non-value adding element as well as address a failure mode. This requirement is to be captured as a part of PFMEA procedure. In the model tried out, the incoming material effect is identified to be a failure mode at that stage. Management has identified that the routing of material from the supplier to Blanking site directly can reduce the transit damages (avoidance of multiple handling) thereby reducing RPN. Kaizen is one of the powerful tools in Lean Manufacturing system. PFMEA requires action on high RPN indicators. Kaizen is to be looped in the PFMEA so that resources deployed for correcting the RPN can be made more effective and simpler. ISO 9001:2000 requires a documented procedure for control of non-conforming products. Implementation of 5S at rejection handling area can combine the benefits of quality system and housekeeping. At the blanking site, handling of rejects procedure has been modified to incorporate the principles of 5S. There is a designated place for storing non-conforming products and 5S has been practiced at the same location. The benefits of the
adopted approach were found to be (i) clear direction of operations and instruction (ii) clear accountability (iii) High morale (observed through Lean Behaviour survey (LBS)) (iv) sustainable development (v) uniform and efficient approach. Lean behaviour study was conducted as a survey at the industry. The survey includes feedback from various angles of lean manufacturing system in terms of respect for people, process and results driven approach and continuous learning and development. The survey has received favourable responses on various parameters and is shown in Fig. 2.

![Figure 2](image_url)

7. CONCLUSION

It has been learnt that proactive approach in system implementation (ahead of production) can help the organisation in the direction to eliminate or reduce wastes (non-value added issues) very effectively. The implementation of quality management system right from the early stages of production helps the organisation to have clearly defined roles and responsibilities, process and interfaces thereby avoiding unnecessary confusions. Integration of Lean manufacturing and QMS has enabled a Lean compatible quality management system (LCQMS) which is built simultaneously thereby avoiding duplication in efforts. The high level benefits include job satisfaction, control of rejections, elimination of wastes and customer satisfaction. Results of the Lean behaviour survey shows the high morale of employees at all levels which is due to timely establishment of...
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system. Having a system in terms of defined process, procedures, roles and responsibilities etc makes the employees feel motivated on their jobs. Integration of QMS and LMS envisages concerted efforts and eventually accelerates the yield of benefits at an early stage.

REFERENCES