

**EXECUTION OF LEAN TOOLS IN SMALL AND
MEDIUM SCALE INDUSTRIES FOR EFFICIENCY
ENHANCEMENT THROUGH DIFFERENT LEAN
TECHNIQUES**

A THESIS

Submitted by

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DECLARATION BY THE CANDIDATE

I declare that the thesis entitled **“EXECUTION OF LEAN TOOLS IN SMALL AND MEDIUM SCALE INDUSTRIES FOR EFFICIENCY ENHANCEMENT THROUGH DIFFERENT LEAN TECHNIQUES”** submitted by me for the degree of Doctor of Philosophy is a bonafide record of work carried out by me during the period from **February 2015 to January 2019** under the guidance of **Dr. S. Nallusamy** and has not formed the basis for the award of any degree, diploma, associate-ship, fellowship, titles in this or any other University or other similar institution of higher learning and without any plagiarism.

I have also published my papers in International Journals (Scopus rated) as per list of publications in the Annexure.



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Certified that the thesis entitled “**EXECUTION OF LEAN TOOLS IN SMALL AND MEDIUM SCALE INDUSTRIES FOR EFFICIENCY ENHANCEMENT THROUGH DIFFERENT LEAN TECHNIQUES**” is the bonafide work of **Mr. SARAVANAN V (Reg. No. ME15D002)** who had carried out the research under my supervision and without any plagiarism to the best of my knowledge. Certified further, that to the best of my knowledge, the work reported` herein does not form part of any other thesis or dissertation on the basis of which a degree or diploma was conferred on an earlier occasion on this or any other scholar.



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ABSTRACT

In the present scenario, it is necessary to follow lean manufacturing techniques more effectively and efficiently in order to meet the challenges of the global competitive market. Hence it is inevitable to introduce lean techniques which increase the productivity and reduce the lead time that ultimately results in customer satisfaction. Lean manufacturing has widely been executed in large scale industries over the past three decades. Productivity is an important parameter for all small and medium scale manufacturing industries. Lean manufacturing emerged as production strategy capable of increasing productivity by identifying and eliminating non value added activities. Hence, the aim of this research is to study the existing system and to implement the appropriate lean tools in small and medium scale industries, Tamilnadu, India.

To study and implement the lean tools to reduce lead time without much affecting the current working systems in a small scale automotive component manufacturing industry. In the first case study, an attempt was made in increasing the capacity of a machining cell with appropriate lean techniques. The enhancement of capacity was to be completed with zero capital investment. A lean approach by using value stream mapping and line balancing was adopted to improve the performance of the manufacturing cell. By collecting the past production data and deciphering the information, gaps were identified for enhancement. Single Minute Exchange of Dies (SMED) was used to regulate the production and Kaizen was also introduced in all work stations. Leveled operator loading for output consistency was suggested. Finally capacity intensification was achieved without any major capital investment. Implementation of lean tools reduced the setup time and idle time. The overall lead time got reduced from 6.9 days to 3.6 days and total cycle time got reduced from 170 to 140 minutes and the customer demand was also met on time by the execution of lean tools.

The aim of the second case study is to investigate the existing system in a small scale automotive component manufacturing industry and use lean tools to reduce lead time without greatly affecting the current working systems in the industry. Standard Operating

Procedure (SOP) is used to standardize the production and Kanban is also introduced by indicating the part number and part description to all work stations. Ranked position weight method in line balancing is used to reduce the transportation time of products from one station to another. After implementing SOP the overall lead time reduced from 5780 seconds to 3946 seconds. The aim of the third case study is to present a lean approach in the manufacturing system of injection moulding facility by reducing the change over time. In this research a lean tool of SMED has proved to be an effective tool for eliminating waste of time. In SMED the time taken for mould or die exchange should be less than 10 minutes. This improves the productivity by reducing the down time of a machine. The objective has been to reduce the change over time from the current setup time of 39.94 minutes to less than 10 minutes.

The fourth case study deals with productivity improvement in a pre-assembly line of gearbox manufacturing company with a case study using lean concepts like process flow chart, process Gantt chart and time study. This research illustrates using a case study on how a value stream mapping has to be carried out in a planet carrier preassembly line. Value stream mapping and work standardization are the key tools used in lean manufacturing and lean transformation. It makes the process smoother, helps in reduction of lead time and ultimately increasing the productivity. From the observed results it was found that, the productivity has been increased from 7 pieces to 10 pieces in the first step assembly when the proposed VSM was implemented.

The objective of the final case study is to achieve the maximum productivity in an assembly line of a valve manufacturing industry through the implementation of different lean tools to minimize the production time. For obtaining the production line performance we shall introduce a solution after finding the problems which affects the lead time. In this case study an attempt was made to introduce a new fixture with appropriate lean methods by focusing on VSM, kaizen etc to eliminate different kinds of lead times consuming phases in the overall process. Designing a fixture for the process is also done in Kaizen, in order to exclude the sub operations. After execution of various lean tools the total cycle time was reduced about 10.49 minutes and the productivity was improved about 20% by eliminating all those non value added activities in the operations to meet the customer demand.

Through the extensive research of implementing various lean tools in five small and medium enterprises, the following could be suggested for obtaining the maximum benefits.

- Implementation of lean manufacturing could be started from the top level management to convince about the benefits that could be achieved
- Thorough proper diagnostic study to identify the bottlenecks and potential opportunities for improvement to be carried out
- Lean team is to be formed for implementation to identify the projects to be undertaken based on priority
- The sequencing of the operations to be carefully designed in order to produce the low hanging fruits initially which will convince all other employees about lean benefits
- Regular training on various lean tools to be provided on regular intervals
- Projects monitoring to be done regularly so that midway corrections can be suggested
- Wherever ample savings are done it should be recognized and suitably rewarded
- Results of each project to be displayed and disseminated for adopting the best practices in other sections and departments
- Wherever sufficient data is generated, it is to be analyzed and put to use through some Lean Tools so that improvement is realized
- Implementing Lean in a cluster mode leads to better dissemination of best practices among the members through cross learning
- Results of all projects to be recorded and archived for future reference

Keywords: Cycle Time, Lead Time, Line Balancing, SMED, TAKT Time, VSM, Kanban, SOP, SMED, Work Standardization.