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Lead time reduction in manufacturing process of CNC machines by lean Principles

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Abstract - *Current economic crisis raises the constant demand to raise the more profitable solution that drive the organizations to gain competitive advantage. For the same reason the companies searching for management methodologies that allow them to improve the process of manufacturing the product and provide more reliable product and improve service characteristics. This have been attempted using through Lean manufacturing and Six sigma integrated approaches in there managerial and production processes in which, Lean focus mainly on the waste elimination, using simple and visual techniques whenever possible and Six Sigma on the control and processes variability reduction, using statistical tools.*

The main objective of the project was to improve the productivity of the production line, by identifying the value-added activities and eliminating the non-value-added activities through time study. To improve the value adding activity to the production process the layout redesign was proposed considering eliminating non-value adding activities.

Value stream mapping is used to map the current state and map the future state after implementing the improvement.

***Key Words*: Productivity improvement1, Time study2, Line balancing3, Value stream mapping4.**

1. INTRODUCTION

Lean and Six Sigma are two widely acknowledged business process improvement strategies available to organization today for achieving dramatic result in cost, quality and time by focusing on process performance. Lately, Lean Six Sigma practitioners are integrating the strategies into a more powerful and effective hybrid, addressing many of their weakness and retaining most of the strength of each strategy. Lean Six Sigma combines the variability reduction tools and techniques from Six Sigma with the waste and non-value-added elimination tools and techniques from Lean Manufacturing to generate saving to the bottom line of an organization.

1.1 Lean Production Facility layout.

The production facility layout is as important as the technology it houses and has a significant impact on business performance. The layout must be modified and improved continuously. Only then can the waste associated with a poor layout be eliminated or reduced. Still, change to the existing layout is rarely taken into consideration when planning for production improvements. Instead the focus is on process, materials and the layout is most often out of scope.

1.2 Grouping of process.

Process of manufacturing and the grouping of the similar kind of the activates based on the principle of rationalization.

2. Methodology

DMAIC is the methodology used for carrying on the project.

3. Review of literature

Overview of the literature reiview shows the Manufacturing Organizations faces an a Problem in reduction of cost and efficiency Challenges in their manufacturing Operations. To Stand up in today's Globalization world, Manufacturers need to find ways to reduce Production time and cost to improve operating performance and Product quality. The tool commonly used for improvements are value stream mapping, process mapping etc.

4. Process visual Board

Process visual board show as the process overview and current working procedure.

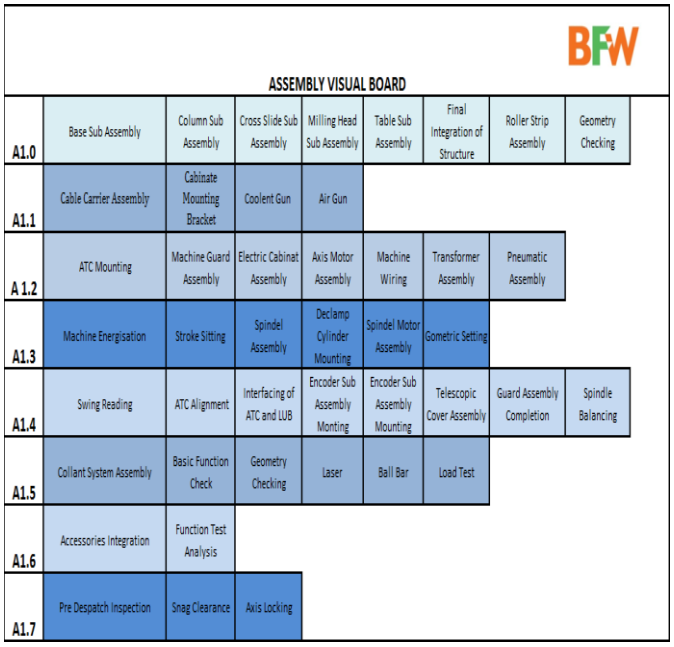

Fig 1.1 Process overview usin visual board

4.1 Current Value stream Mapping

Data is collected by systematic method using Flow process chart for accouting the value and non value adding activities of the process. Value stream mapping basically show the non value adding activites in the process.

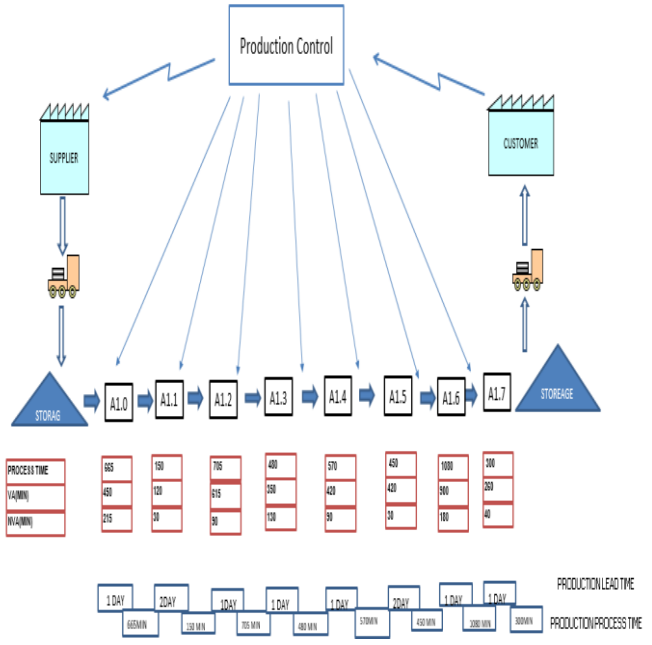

Fig 1.2 Value Stream Mapping of current process

4.2 Current Layout Design

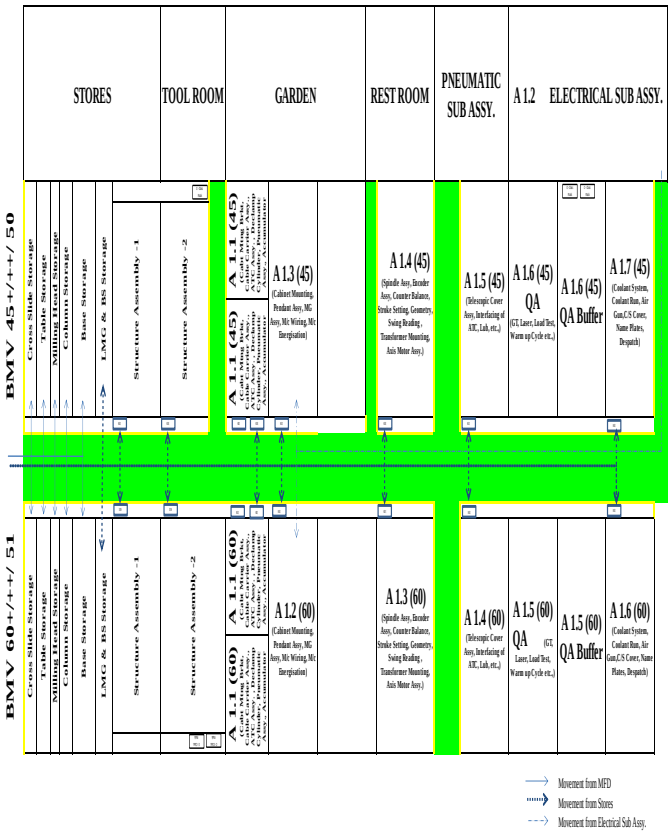

Fig 1.3 Current layout Design

4.3 Process capability test for current state

The process is studied for a period of 3 months and total 63 machines are produced. The lead time for each machine is collected and process capability test is performed.

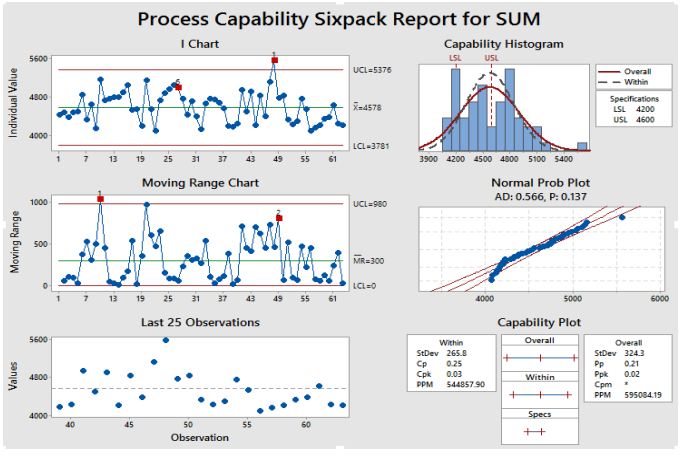

Fig 1.4 Process capability plot of current process

Which shows the current process is performing at 1 sigma level and the proces output is 60% defective considering defective percentage of milion.

4.4 Procedure of improvement

- Cause and effect diagram is used to list down the potential causes of incease in lead time and cause and effect matrixs to list the potential need to improved.
- Having consideing the problems the grouping of process and layout redisign is considerd for improvement of the process.

5. Visual display of regrouped and improved process using value stream mapping.

The process is grouped to 7 process to 4. The lead time of the new improved process design. Value stream mapping of the improved process is collected.

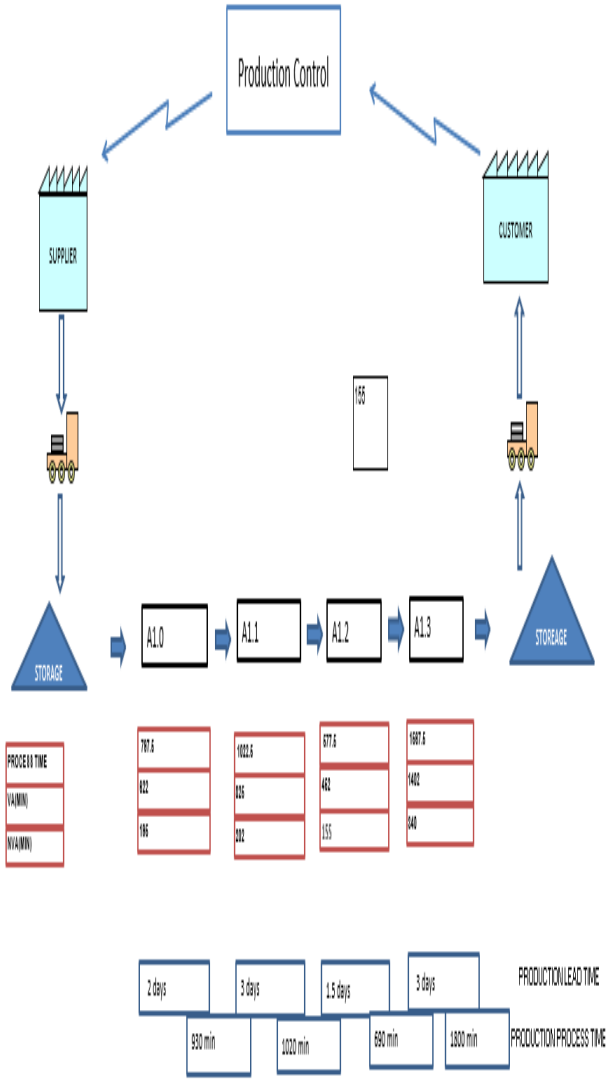

Fig 1.5 Value stream mapping of improved process

5.1 Proposed New Layout

New layout is proposed by based on grouping of the process and lean plant layout design procedure.

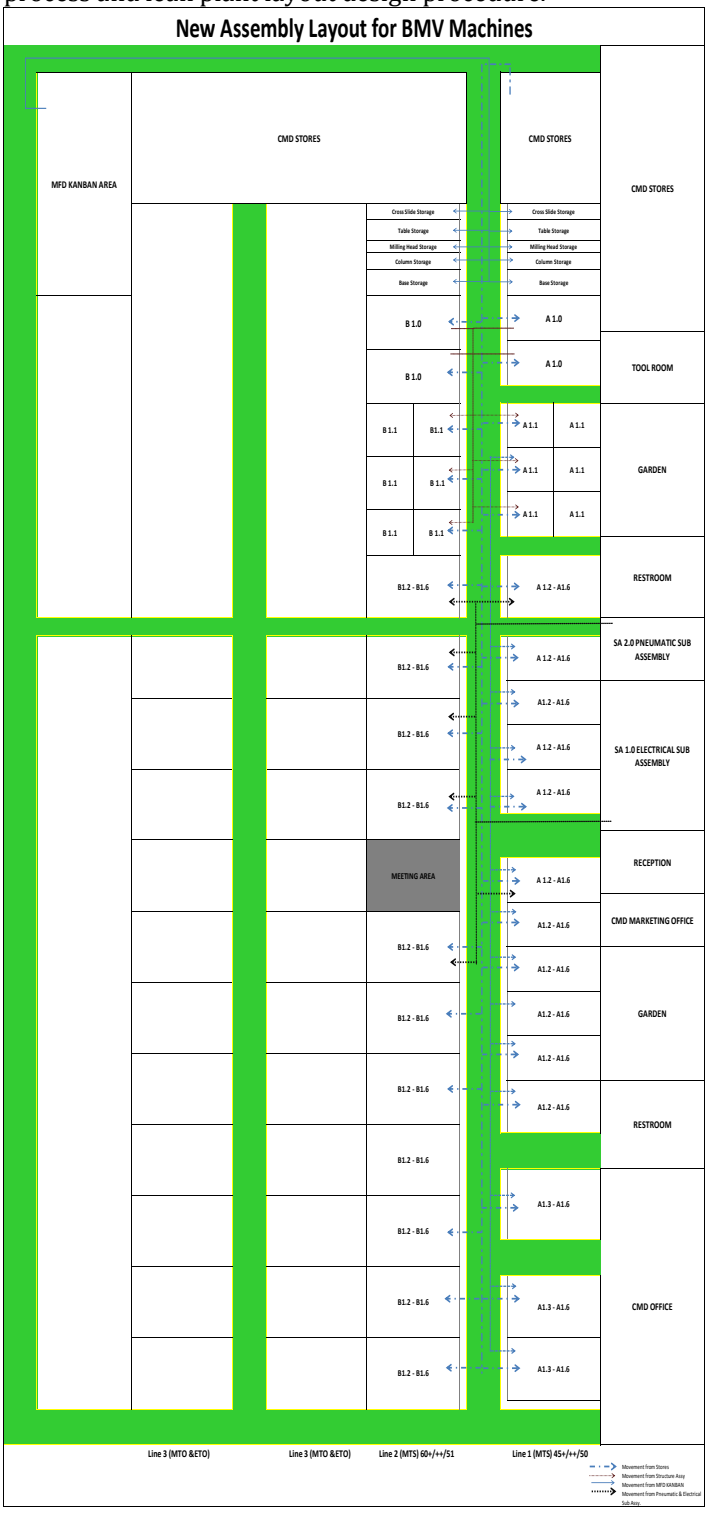

Fig 1.6 Improved layout design

6.1 Results

a) Combination chart displaying the variation in the present and proposed state lead time collected.

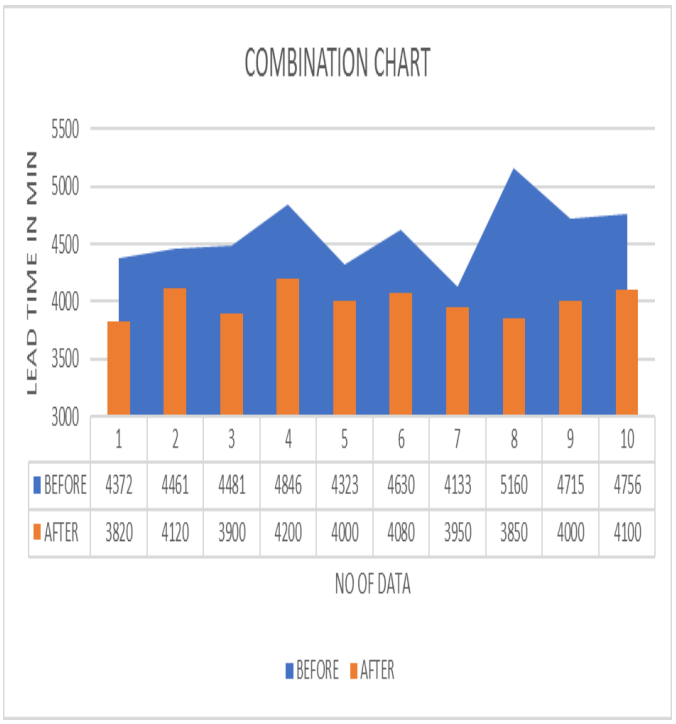

Fig 1.7 Combination chart of comaprision of two state

b) Box plot

Box plot displaying the reduction of lead time of the assembly process. The lead time as been reduced from 4587 to 4002, which show the reduction of 587 min.

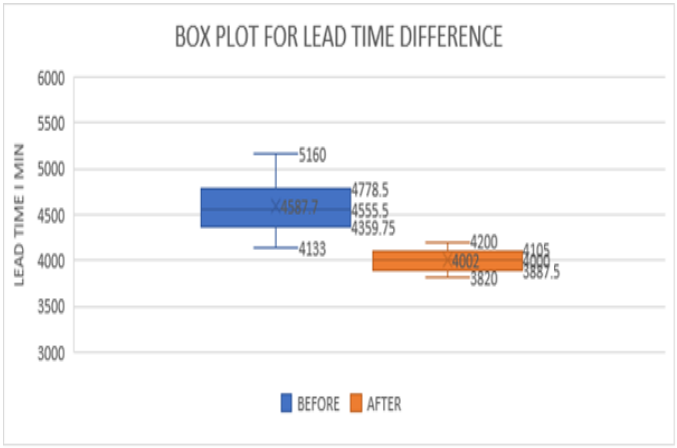

Fig 1.8 Comparision of two state using box plot

c) Process capability test for future(Improved) state

Process capablity test for improved phase after implementing the new layout design and grouping of processs. Lead time is studied for a 10 machines and checked for process capablity.

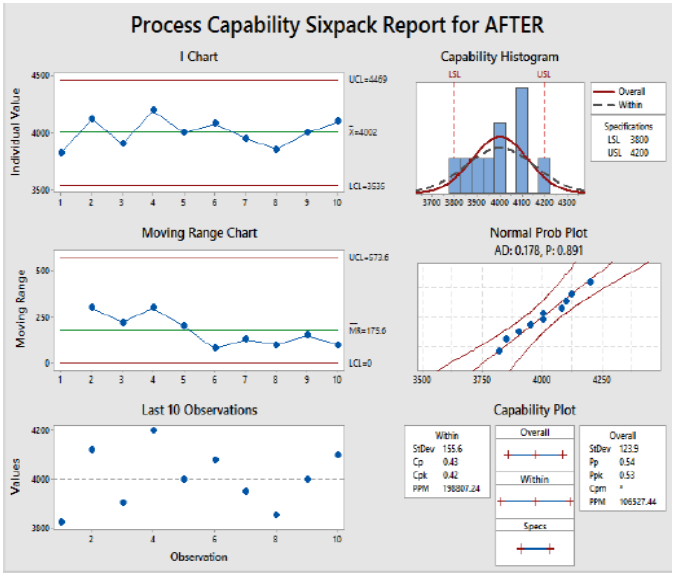

Fig 1.9 Process capability plot of current process

Process capability plot shows the significant reduction in the standard deviation of the process from mean and increase in sigma level, and increase in productivity for 60% defective to 19% defective per million.

3. CONCLUSIONS

CTQ of the project as defined was to reduce the lead time of the production process, which has been succeeded in the project. The mean lead time of the manufacturing process has been reduced from 4587 to 4000 which is shows the reduction of 587 min.

- The number of days required for manufacturing of one machine has been reduced from 8 to 9 days to 7 to 6 days.
- The quality control plan is deployed for continuous improvement of the process and layout.
- Increase in process capability of the process from 60% defects to 19 % defects by increasing the sigma level.

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