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Enhancement of Production by using Industrial Engineering Techniques in a Manufacturing Industry

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Abstract **— Enhancement of production is a great challenge that is faced by many manufacturing industries. The identification of losses and the reduction of such activities only helps to improve the productivity. In this study the plant capacity of the manufacturing industry is identified as 13824000 components per month but the plant is utilized only for its 67%. Setting time is the major time consuming process that is identified during Pareto analysis. The higher demand of the products in market makes the industry leads to a higher productivity. This paper is indented to reduce the time taken for the setting time and maximum utilization of the machines so that the enhancement of the production. DMAIC techniques have used for the improvement in production. Cause and effect diagram has been plotted for the idleness of the machines. Capability analysis of machines is conducted and the obtained results for capability on various parameters are discussed in detail.**

Keywords — Setting time, DMAIC techniques, Cause and effect diagram, Capability analysis

I. INTRODUCTION

Nowadays many manufacturing industries are looking for the elimination or reduction of various kinds of wastages that is happening inside the industry. That is very much required for the survival of the industries in this highly competitive environment. Several types of wastages are happening in the industry and it cannot be eliminated at once but step by step procedures can. Productivity depends upon several factors. [3] Pankaj Bhagat,F. and Ujjainwala S increased the productivity using the cycle time reduction in a electrode manufacturing industry. Such that cycle time reduction as well as setting time reduction will enhance the productivity. The identification of major losses and the improving those areas will certainly helps the industry to become successful. The concentration of this paper is on reduction of setting time and other losses in the industry thus making the industry to attain the required benchmark. Setting time is a major time taking process in the manufacturing industries.. The higher demand of the products in the market makes the industry works more towards the achievement of the same.

A. DMAIC Technique

DMAIC Techniques are comprised of the methods Define, measure, analysis, improvement, control which used for the resolving of problems. [1] Amal S Das has used the DMAIC technique for the productivity improvement with the help of why-why analysis for root cause losses.

DMAIC refers to a data-driven improvement cycle used for improving, optimizing and stabilizing business processes and designs. The DMAIC improvement cycle is the core tool used to drive Six Sigma projects. However, DMAIC is not exclusive to Six Sigma and can be used as the framework for other improvement applications

B. Cause and Effect Diagram

Cause and effect diagrams are created by Kaoru Ishikawa. It is the diagram which shows the causes of a particular problem. It can be used for the identification of potential causes of a specific area which is responsible for the total effect.

C. Pareto Chart

A Pareto chart that contains both bars and a line graph, where individual values are represented in descending order by bars, and the cumulative total is represented by the line. The vertical axis on left is the frequency of occurrence. The vertical axis on right is the cumulative percentage of the total number of occurrences. The values are in decreasing order and the cumulative function is a concave function. Pareto chart highlights the potential problem from a set of problems. It can be used to identify most common sources of defects, the highest occurring type of defect, or the most frequent reasons for customer complaints etc.

D. Capability Analysis

Capability analysis is a set of calculations used to assess whether a system is statistically able to meet a set of specifications or requirements. [9] B.N. Sarkar discussed on the capability enhancement of metal casting process. To complete the calculations for the capability analysis a set of data is required, usually generated by a control chart. Data can be collected specifically for this purpose. Specifications or requirements are the numerical values within which the system is expected to operate, that is, the minimum and maximum acceptable values. Occasionally there is only one limit, a maximum or minimum. Customers, engineers, or managers usually set specifications. Specifications are numerical requirements, goals, aims, or standards. It is

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important to remember that specifications are not the same as control limits. Control limits come from control charts and are based on the data. Specifications are the numerical requirements of the system.

E. Future technology

In this world technology has a vital role in the manufacturing industry. The industry will not sustain for a longer period without considering the modern technologies. [6] J.Oliveria,A and Ferandes states that Industry 4.0 is the critical pillar for the future of organizations. Lean, innovative technologies, critical knowledge are the other dimensions need to consider for the sustaining of the industry.

F. Safety

Safety has a prime importance for a manufacturing industry. [8] G. Reniers states the importance of safety for a manufacturing industry. Once the accident happens the losses will be a huge and it may lead to collapse of the entire system according to the impact of accidents. Manufacturing industry has to give much priority for the safety as well as for the safety equipments so that the accidents can be avoid or eliminate.

II. PROBLEM DEFINITION

The production capacity of the plant is 13824000 components per month. But the actual production rate is only 9256000 components per month Thus plant has a loss around 4568000 components per month, which in all together causes a huge loss in terms of productivity. 50 days of observation has done in the company and came to know that there exist some losses in terms of setting, maintenance etc. This study indents for the understanding of various factors that reducing productivity and increase the productivity by reducing various losses at the critical processes. Also it aims to find out capability of machines for the machining of those components.

III. DATA ANALYSIS AND DISCUSSIONS

A. Define

In this stage the process flow chart of components is identified and the graphical representation of the this shown below. It helps to understand the overall picture of the processes in the plant. This process flow chart clearly shows the areas need to focus more for the elimination of wastes.

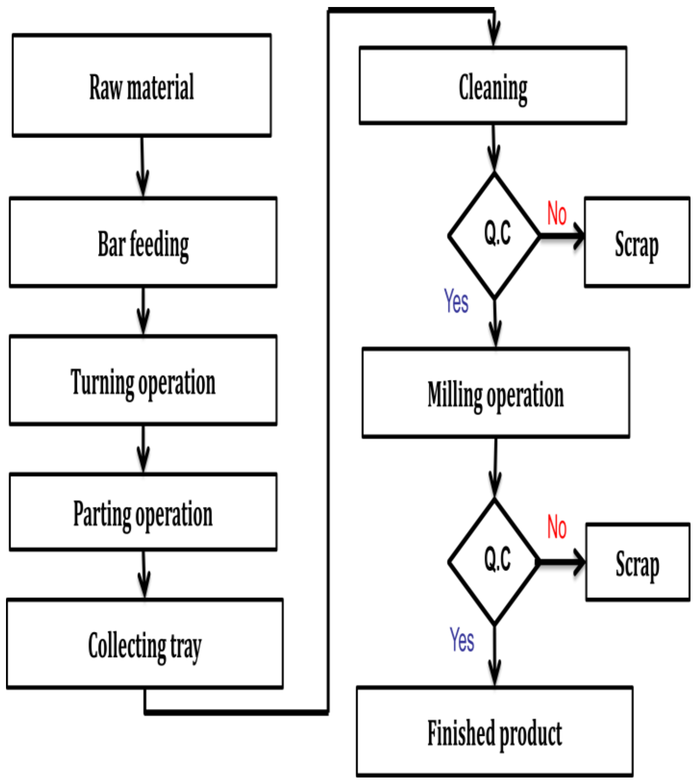

Fig. 1 Process flow chart of components

Figure 1 shows the process flow chart of components which describes the various operations taking place in the manufacturing plant. These process need to focus more for the enhancement of the productivity.

B. Measure

The manufacturing of components in the respective machines for the period of period of 50 days is observed and measured properly using some industrial engineering tools.

1) Cause and Effect Diagram

The cause and effect diagram clearly shows the weak areas that caused for the idleness of machines in six categories of area. The major effects are on the areas of setting of machines and maintenance it.

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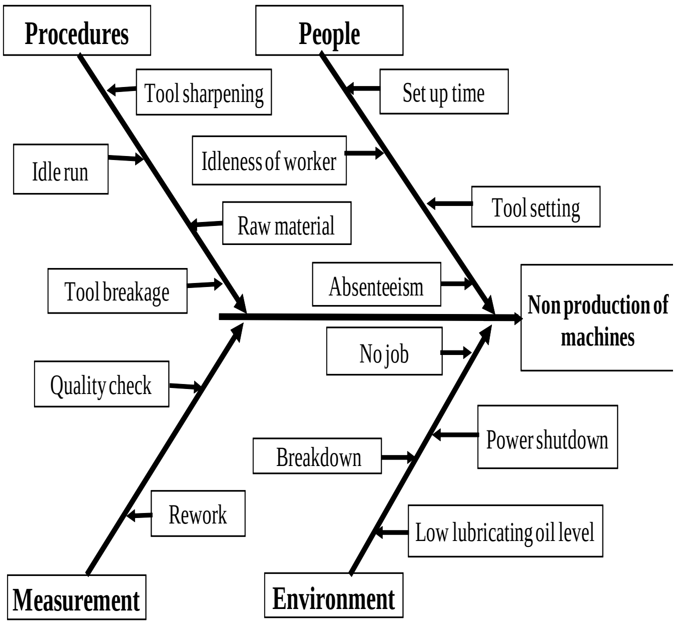

Fig. 2 Cause and effect diagram for the non production

Cause and effect diagram for the non production is shown in the figure 2. It is the graphical representation of the causes for the non production of machines. Set up time and the tool setting is the major causes in the section of people where the breakdown and the power shutdown are the major causes for the same problem in the section of environment. In the measurement side the quality check and the rework are the causes effecting for the machining

2) Production measure

Total number of machines available = 32
Number of components (per machine/shift) = 96
Total number of components for 50 days = 50 * 32 * 96
It gives a total of 153600 components
Total number of components per day = 153600 * 3
It gives a total of 460800 components
Total number of components per month = 460800 * 30
It gives a total of 13824000 components
Plant capacity = 13824000 components / month
Utilization of machines =Produced quantity/Plant capacity
9256000/13824000=.67
Utilization of machines = 67%

TABLE 1: OBSERVED TIME OF PRODUCTION

Observed hours of 32 machines	Machining hours	Non machining hours
12800.00	3611.87	9188.13

Table 2 shown above is the non productive hours for the 32 machines for the period of 50 days which is divided into various segments. The time has calculated for both machining as well as non machining hours.

TABLE 2: NON PRODUCTIVE HOURS

Observed hours of 32 machines	Setting	1450.50
	Maintenance	1300.78
	Break down	560.00
	No job	102.00
	No tool	72.666
	Power cut off	51.96
	Idle run	50.42
	Others	23.55

The non productive hours have been divided into different categories as shown in the table 2. The setting time is having the major share for the non production. 1450 hrs is spent for the setting time. The next priority need to give for the maintenance section which causes for the 1300 hrs of non production.

C. Analysis

1) Pareto Analysis

According to the table 2 the Pareto chart has plotted.

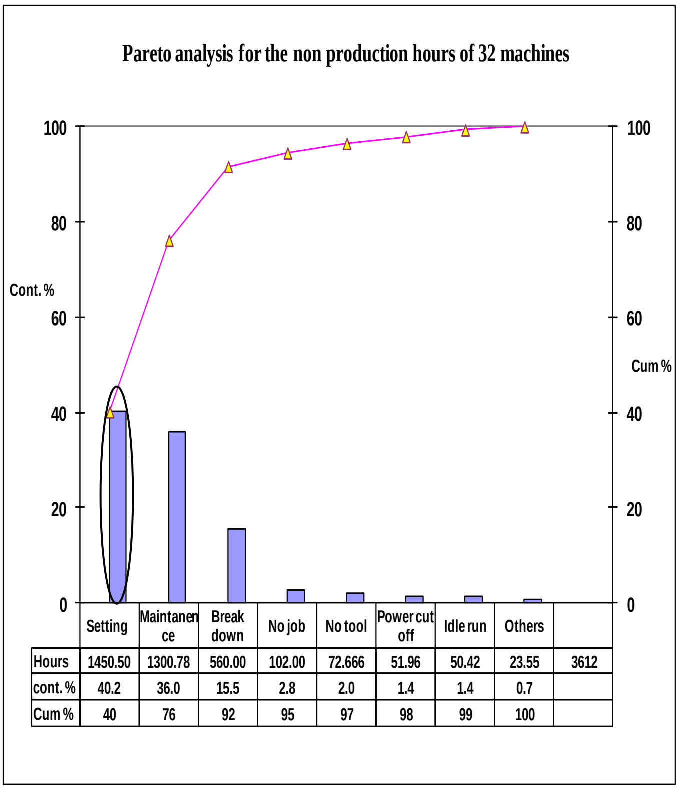

Fig. 3 Pareto chart for the non productive hours of machines

As shown in the figure 3 Pareto analysis shows the setting time and the maintenance are the major causes for the losses in the industry. Elimination of such kind of wastages will help to improve the productivity.

2) Capability analysis

Capability analysis test conducted by taking sample of 75components.It has taken 10 to 15 minutes of varying intervals. The components collected and cleaned properly to measure the dimensions of components. An instrument which having the least count of 0.0001mm used for the measurement. Three dimension parameters have checked for the same. The obtained results shown in the graphs below.

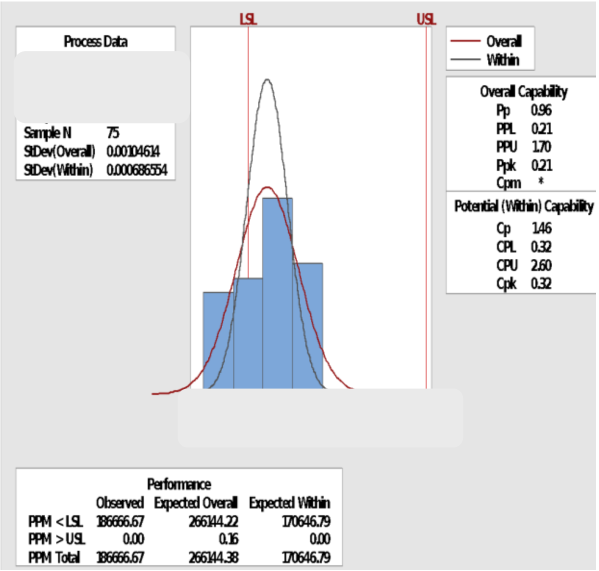

Fig. 4 Capability analysis of the parameter A

Capability analysis of the parameter A is shown in the figure 4. The samples taken shows that the parameter A is shifted towards LSL value of the component. It may leads to a larger number of defects. The capability index value is less than the standard value of 1.33. For this parameter the tolerance is of 20 microns because of this close tolerance it is having a larger number of defects by using the same machine.

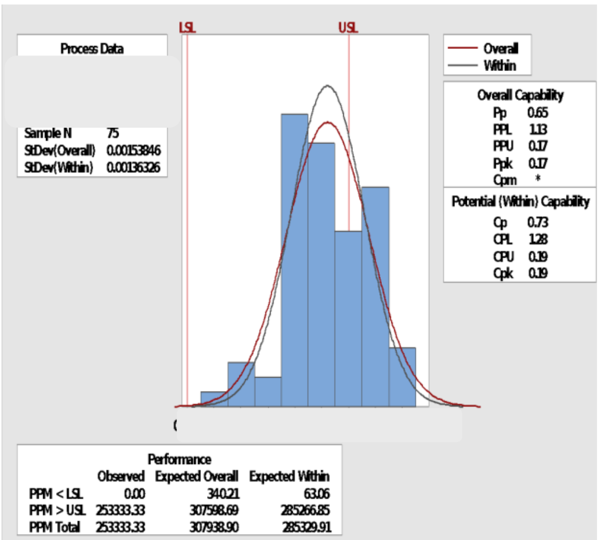

Fig. 5 Capability analysis of the parameter B

Capability analysis of the parameter A is shown in the figure 5. The samples taken shows that the parameter B is shifted towards USL value of the component. It also leads to a larger number of defects. The capability index value is less than the standard value of 1.33. For this parameter the tolerance is of 20 microns because of this close tolerance it is having a larger number of defects.

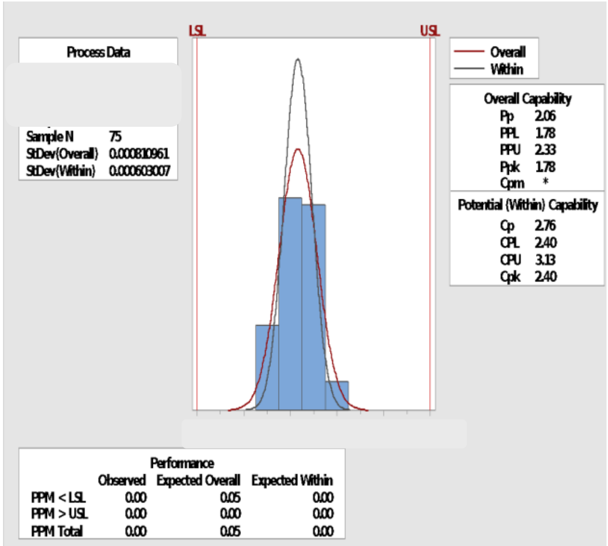

Fig. 6 Capability analysis of the parameter C

Capability analysis of the parameter A is shown in the figure 6. The samples taken shows that the parameter C. It is in between the LSL and USL value of the components. It leads to a very less number of defects. The capability index value is more than the standard value of 1.33. For this parameter the tolerance is of 40 microns because of this higher tolerance it is having very lesser number of defects.

D. Improve & control

This step leads to the implementation of various solutions for the given problem. Some solutions will have a major impact for the reduction of the problems identified.

- Regular meeting has to conduct on the production shop floor which helps to identify the lacking areas.
- Frequency of quality inspection needs to revise for the reduction of the defects in the components.
- Supervisor has to unite employees and should coordinate the work properly.
- Encourage the employees can help to reduce the setting time.
- Implementation of generator for the power shut down.
- Control chart has to maintain to reduce the defects.
- Setting dimension should be in between the upper limit and the lower limit of the tolerance and do not shift towards the LSL and USL dimensions of the components.

IV. RESULTS AND CONCLUSIONS

The Pareto chart shows the problematic areas of those machines. Cause and effect diagram implies the causes associated with the problem. Setting time is the major time consuming process this is due to the lack of experience for the new employees. A training section can cover up this situation to a greater extent. Incentives for the employees based on their performance will encourage them for being more productive. It will also reduce the absenteeism trend among the employees. A regular follow up really needed for the improvement in production. The implementation of 5S technique is recommended for the easy handling of the equipments which also helps to improve the production. .

The capability analysis shows the parameter A & B is having Cpk value less than 1.33 which indicates it is below the 4 sigma level. Cpk value of 2 implies that is of 6 sigma level. The parameter C lies on this value whereas parameter A & B are not following the same because of the low tolerance value.

In this case a frequent quality check is recommended. Here quality checking is required once in an hour whereas in parameter A & B required twice in an hour. It leads to the reduction of lot rejection and hence the improved productivity.

V. SCOPE FOR FUTURE WORK

Automatic setting of components will be helpful for a huge time saving in the section of setting. It can reduce the defects by implementing a frequent checking on the machined components. 3D capturing devices can capture the dimensions quickly. Lean six sigma techniques have a large scope and can be adopted to reduce the defects in components while manufacturing.

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REFERENCES

[1] Amal S Das, P V Gopinathan “Productivity Improvement Using Industrial Engineering Tools”, IJEDR 2016, Volume 4.pp: 911-916

[2] T.B.Pankhania, P.M.George, A.H.Jariya, V.K.Modi, ‘‘Attributes enhancing industrial productivity an empirical analysis’’,IJRET: International Journal of Research in Engineering and Technology: pp: 2321-7308

[3] Pankaj Bhagat,F. Ujjainwala S, “Productivity Improvement By Cycle Time Reduction Using Time And Motion Study A-Case Study Of Electrode Manufacturing Company” Journal of Industrial Mechanics, 2017,pp: 9-18

[4] M. Colledania,b, T. Tolioa,b, A. Yemanea “Production quality improvement during manufacturing systems ramp-up”, CIRP Journal of Manufacturing Science and Technology (2018)

[5] Yatin Damor1, Hemant R Thakkar2 “A Literature review on Quality and Productivity Improvement in foundry industry” Journal of Emerging Technologies and Innovative Research (JETIR) 2014, pp: 827-829

[6] J.Oliveria,A. Ferandes, “Continuous improvement: An application in a mechanical company”,2017, Procedia manufacturing,1082-1089

[7] Neha Gupta, (2013), ‘ An Application of DMAIC Methodology for Increasing the Yarn Quality in Textile Industry’, IOSR Journal of Mechanical and Civil Engineering Volume 6, Issue 1 (Mar. - Apr. 2013), pp: 50-65

[8] G. Reniers, “ On the future of safety in the manufacturing industry”, Manufacturing Engineering Society International Conference 2017, MESIC 2017, Elsevier

[9] B.N. Sarkar “Capability enhancement of a metal casting process in a small steel foundry through Six Sigma: a case study”, Int. J. Six Sigma and Competitive Advantage, Vol. 3, No. 1, 2007, pp: 56-71

[10] B. Naveen, Dr. T. Ramesh Babu, ‘Productivity Improvement in Manufacturing Industry Using Industrial Engineering Tools’, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), pp: 11-18