Application of quality improvement tools to reduce rework in fabrication industry

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Abstract *The fabrication industries deals with tones of material daily and while fabricating, industry faces many problems. Rework is one of the major problem fabrication industry faces, it is depend upon different causes and affects the quality and productivity and leads to loss in the organization. The causes of rework are direct or indirect. This paper aims to investigate the factors contributing to rework and analyzing it through quality improvement tools. Root cause analysis is applied to find out the factors that contributing to rework, this is an efficient problem solving tool to identify the possible factors affecting the quality. Besides brainstorming and 5 why' s is another techniques are applied for productivity improvement. The findings show that process monitoring through check sheets, training, charting and improvement in the inspection process to be needed.*

Keywords — *quality improvement, Root cause analysis, Material handling and rework minimization.*

I. INTRODUCTION

In this fast growing and competitive market the industries and company' s looking forward to improve the quality, service at the reasonable cost and maintaining the position in the market. The fabrication industries have gone through significant changes in the last decade. New firms in markets have increased competition dramatically. Most of them focus on product quality, production time and cost of product. Because of these, a company should maintain a quality system to improve and increase both quality and productivity continuously. There are numerous articles that have indicated that excessive amounts of over-time work can contribute to losses in productivity and reduced quality in projects (Halligan et al., 1994; Thomas and Raynar, 1997; Arditi, 1998). Similarly Li et al. (2000) have also argued that excessively prolonged overtime work can generate quality problems as a result of declines in productivity. When a delay occurs, Li et al. (2000) argue that there are three possible situations that a project manager may be confronted with additional costs, a decline in quality and rework. The fabrication industry considered in this paper is a heavy fabrication industry manufactures towers, columns, piping and structures etc. These research work deals with the rework problems that the industry facing and its causes. In this research root cause analysis (quality improvement tool) is used to find out all the possible causes that are affecting the productivity and quality of the product.

The industry is facing the following problems: project delays, overtime work, additional resources, and major reworks. This problem significantly increases the project cost and leads to loss to the industry, sometimes rejection of the project. To survive in the competitive market the industry should focus on product quality and productivity. In the organization, generally maintaining the quality is difficult and the negligence of quality leads to project rework and rejection. In this research paper findings shows the rework is major caused by improper follow up process, documentation and inspections process these problems is resolved at some extent through application of quality tools and techniques This document is a template. An electronic copy can be downloaded from the conference website. For questions on paper guidelines, please contact the conference publications committee as indicated on the conference website. Information about final paper submission is available from the conference website.

II. BACKGROUND

In the heavy fabrication industry the raw material is gone through various processes: cutting, edge preparation, grinding, and welding etc. to convert into final product. The management is facing the problem of excessive rework, product not confirming the quality specification that leads to loss, sometimes rejection and bad image in competitive market. The industry manufactures heavy structures, towers and piping. The fabrication were facing several problems are follows.

a. Due to deviation in the product specification, rejection and major rework were very high.
b. Over consumption of resources due to excessive rework.
c. Services at the erection sight to overcome problems: the services are manpower and resources for overcoming the problems
d. Complaints from erection sights as the product were not confirming to required specifications.

Considering these problems as sever and should eliminate prior so we categorized each problems and start to identify the root causes of these problems by applying quality tools and techniques.

Consequently, we decided to evaluate data and process with application root cause analysis (Quality improvement tool) the causes is identified by brainstorming and charting a precaution is taken as to maintain the quality of the process and reduce the rework.

III. DATA COLLECTION AND ANALYSIS

The data collection for the study is carried out as per the problem identified. In this study the problem of waviness or angular distortion of plate is identified as the major problem leads to rejection, as the plate is too thin and considerable care should required for welding and it is considered as critical part of the product, the angular distortion of plate is shown in figure 1

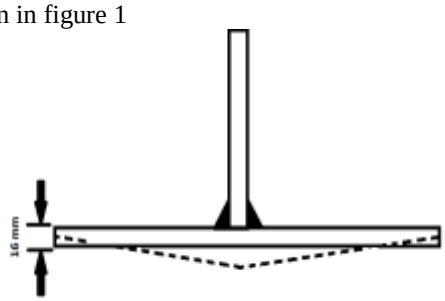

Fig 1: Angular distortion or waviness of the pie-plate

The data is collected over a six month on deviation of plate in the structure fabrication shown in figure 2. The observation of deviation in specification is analysed and the root cause analysis is carried to find the causes of for each problem.

Figure 2: Data analysis line graph on waviness

The collected data is based on six months on tie-plate waviness which considered as critical one it directly makes contact to the boiler surface so it is not allow to deviate from its specified limits. It is observed from data that waviness or angular distortion in the plate is too at different instant to identify its cause a root cause analysis tool is applied. The flow chart shown in Figure 3 Is the existing process in the fabrication industry.

IV. ROOT CAUSE ANALYSIS FOR IMPROPER STRAIGHTNESS

THE ROOT CAUSE OR MOST FUNDAMENTAL REASON THAT LED TO THE FAILURE HAS TO BE IDENTIFIED. SOMETIMES THE ROOT CAUSE MAY BE RELATED TO PROBLEMS WITH THE PRESCRIBED PROCESS. BY ANALYSING THE CAUSES-AND-EFFECT DIAGRAM (CED) SHOWN IN FIGURE 2, GIVES THE FOLLOWING ROOT CAUSES OF THE ABOVE SAID PROBLEMS:

a) Waviness is occurred due to improper method of processing, faulty equipments and measuring instruments were not there with workers.
b) Improper setup during fabrication leads to deviation in the specification.
c) Improper training and guidelines.
d) Improper follow-up by the supervisor

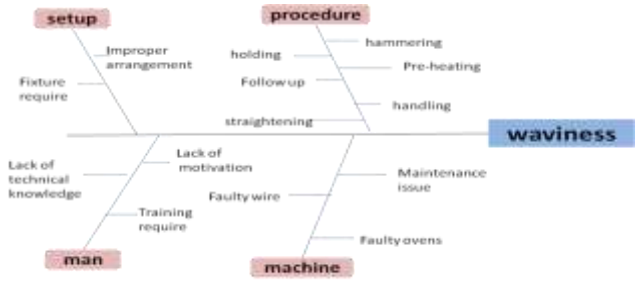

Fig. Ishikawa diagram for waviness

The root cause analysis is the efficient tool applied to find out the possible cause for the tie plate waviness, it is identified that improper set-up, bad material handling and improper method contribute to major rework and leads to loss of productivity and quality. This quality improvement tool helps to identify the possible causes and if we apply 5 why' s tool it will help to identify exact root of the following problem. The 5 why' s shown in figure 4 gives a root cause for waviness in tie plate.

Figure 3: 5 why' s analysis for waviness in tie plate

The figure 4 gives the root causes for the waviness it is identified that the management is responsible for the causes as they were not providing the training, specification chart on the shop floor, improper communication between hierarchic levels and tools

and equipments at the work shop. All this requirements and needs of the shop floor in the fabrication industries to be fulfil by the management. For these issues we suggested check sheet, training and shop practice to minimise the rework and improve productive time and quality.

V. RESULT AND DISCUSSION

The rework is the common problem in the fabrication; it should me minimum, if not then its affects quality and productivity. In this paper we have worked on the most recurring defect i.e. waviness and Poority of welding as it was the critical one it should not allow to deviate from its specification i.e. ±2 and it is observed that it is deviating max: 13 mm, min: 4 mm. it is identified that it was unnecessarily recurring due to improper first stag inspection and follow-up. The root causes and preventive action taken to minimize the problem as shown in table 1. The figure 7 shows the observation on waviness after preventive action shows that the deviation is minimize through proper follow-up and first stage inspection.

The inspection process is also studied, it is observed that there was the need of first stage inspection in the process the following flow chart in figure 5 shows the existing process and figure 6 shows the suggested. In this first stage inspection the location and required set-up, fixture is decided for the product, then followed by existing process it helps to eliminate the prior defects which contributing to major one.

VI. CONCLUSIONS

Based on the study it can concluded that the observed problem was the critical and can be minimize by proper follow-up and first stage inspection at the location. This study carries out on the identified problem i.e. waviness and poor welding and preventive action is taken to reduce them by suggestion and small improvements this helps to minimize the rework of the company. There is the wide scope for lean manufacturing and 5s tool to apply to minimize waste and improve productivity small fabrication industry.

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