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The Improvement of Manufacturing Process by Using Quality Tools

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Abstract**—** *In the era of competitive markets and globalization, quality-related concepts and philosophies have emerged as strategic issues at all institutional levels and across all industries and services. No one can deny the importance of quality in the modern global competitive market, where only those who survive can offer quality products. In 1986, Edward Deming described the "Deming Chain Reaction" in his book Out of Crisis. According to him "When quality improves, cost reduction (less rebuilding, fewer mistakes, less delay and better use of the machine, time and materials), cost reduction productivity improves, productivity is happier, they capture the market with better quality and lower prices and therefore they do business They will grow their business The parties cannot deny the importance of quality in such a competitive market where they can offer the same live, good quality product.Seven quality tools were developed independently of each other, but it was first developed by a doctor from the University of Tokyo during the Quality Revolution in Japan. Korunu Ishikawa is popular. Dr. Koru Ishikawa did not invent all of these devices, some of them already in use since 1900, but he took these seven devices and built this set of seven instruments, calling them "the original seven devices of quality." This is why these devices are also called quality Ishikawa equipment. These tools are also known as basic quality tools because they are popular with the public and require less formal training statistics and are used to solve quality-related problems. Come on. Quality tools can be applied in many ways in the process industry, but the PDCA cycle and the DMIC method are well-known and widely used techniques that can be applied in the industrial process through quality.*

Keywords**—** **PDCA*****, DMIC, Quality Tool, Productivity.***

I. INTRODUCTION

Quality management can be used as a competitive advantage for an organization. According to ISO 9001:2008, organizations should ensure that customer requirements are determined, to ensure their satisfaction. Thus, organizations need to improve their processes and for that use a set of practices, which include various techniques and tools, including most importantly quality tools. Ishikawa discusses the importance of implementing quality tools, stating that 95% of quality problems can be solved by simple tools such as the basic quality tools. The importance of quality tools is recognized by stating that many businesses do not succeed in implementing Total Quality Management (TQM), since they do not apply appropriate methods of quality management, especially quality tools. According to, quality tools can be used at all stages of the product development and production, with the goal of cost reduction and customer satisfaction. However, it is recommended first to diagnose the different processes to identify those most in need of improvement. This will provide managers with the justification for the selection of one particular process for improvement over others. Once the process has been selected, a definition of the problem must be made and the right tools must be chosen to make the resolution more effective and efficient.

Quality tools can be applied in many ways in the process industry, but the PDCA cycle and the DMIC method are well-known and widely used techniques that can be applied in the industrial process through quality. PDCA is Deming's continuous development cycle. PDCA is a four-step iterative cycle used to improve the process, do, study, and act. The planning phase involves setting quality goals and observing the process, collecting data in the second phase, identifying the problem, the third phase analyzing the problem and finally eliminating the problems and taking steps to achieve the quality goals. The DMAIC methodology is similar to the PDCA cycle but with steps

DMAICs are a little more detailed than PDCA cycles. DMAIC is defining, measuring, analyzing, improving and controlling. The DMAIC method is used to improve the process. DMAIC is a systematic basis for improving the process by defining the problem

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and measuring its effectiveness, examining why the problem occurs, and then correcting the process by eliminating the problem and controlling the process without further problems.

Lopez, et al. [1] Demonstrate a study on the use and improvement of quality tools in Portuguese companies. The main results of this study show that Portuguese companies recognize the value and effectiveness of quality equipment, but their use is limited to this recognition. Companies with low levels of maturity in quality processes use certain tools and grow as they reach higher levels of maturity. Jha et al [2]. A case study was conducted to reduce scrap on automotive assembly lines using quality control equipment. Rhys. R et al [3] conducted research in the fan manufacturing industry to address quality issues and improve quality by implementing the basic seven tools of quality. These are important tools used worldwide in manufacturing industries for continuous improvement. Flow charts, check sheets, histograms, cause and effect diagrams, Pareto charts, scatter diagrams, and control charts to define the problem, measure its effectiveness, determine its impact and determine the product. Removals were implemented at various stages of the manufacturing process. In objects that are not deficient. G. Paliska et al [4], this paper deals with a section of extensive research on universalization regularization in the application of seven basic quality tools (7 QC tools). Research has been conducted in various fields, including power plants, process industries, government and health and tourism services. The purpose of the research is to show on practical examples that there is a real possibility for the application of 7QC devices. Nankana, A. N [5], A detailed and systematic study of older 7 QC devices is presented in this paper. The main objective of this paper is to easily introduce and understand the application of the basic 7 QC to improve the quality of any manufacturing process. QC tools include collecting data, analyzing data, identifying root causes and measuring outcomes. These tools are related to numerical data processing. All of these tools together provide great process tracking and analytics, which can greatly contribute to quality improvement. These tools make it easy to see, implement and track quality improvements. Furthermore, it helps to deal with the basic concepts of classic and modern field QC tools and shows how basic quality tools can be used to solve problems and improve quality. William Edwards Dimming, 1982 [6], Deming's deep insights stand the test of time. Every leader who cares about quality improvement in the deepest meanings of the word - which improves people's lives - should be well-read in Deming's philosophy and methods. Deming needs to understand how society and the economy operate, not in the name of efficiency, but because of humanity. Ishikawa. K, 1985 [7], Total Quality Management (TQM) is recognized as an effective management philosophy for continuous improvement, customer satisfaction and organizational expertise. Since this concept was initially developed in the field of manufacturing, there is much doubt as to whether this philosophy applies in education. In this regard, the main objective of this study is to examine the compatibility of TQM with education. At the same time, this study seeks to identify important challenges in the implementation of TQM in education. It is hoped that this study will draw a meaningful conclusion about the trade-off of TQM in education and at the same time provide insights into the challenges that create barriers to TQM implementation in education. Wu et al. (2009) [8] consider explicitly constrained tolerance allocation problems to reduce the ratio between construction cost and risk (GRAZ is a conceptual two-graphical context based on contextual use of geometric requirements with results and measures) and a structural approach. In this conceptual representation model, the structural system is decomposed into three sub-systems: 1) the transformation of physical systems into raw materials. 2) Managing the decision system and / or controlling the physical system. 3) Supporting Information Systems. Chen et al. (2013) Walter and Wartock (2013) [9] have developed an optimization method for the tolerance-cost-optimization of a system in motion, which considers two key features in the use of the system in motion. According to Liu et al. Al. (2013) used an analytical method in a model that included two types of constraints, namely the assembly tolerance barrier and the lack of process accuracy to achieve optimal tolerance based on manufacturing costs and quality losses. Rao and. Al. (2011) [10] proposed a singular approach for determining the minimum total cost tolerance using three evolutionary methods, namely genetic algorithms, differential evolution and particle swarm optimization. Muthu et al. (2009) [11] can apply two meta-heuristics techniques, namely genetic algorithms and particle clusters, to consider both manufacturing cost and quality loss functions to allocate tolerance to components to reduce total cost, so that their results can be reduced to the overall optimization clutch assembly problem by these methods Classical Opt Aijesan surpass the results obtained by the procedure. [12] built an appropriate tolerance based on assembly disability and quality loss with an application in the aviation industry. Geeta and. Al. (2015) [09] implemented a genetic algorithm to determine the best production order of scheduling and component tolerance based on three factors: manufacturing cost, quality loss, and machine idle time. However, none of these authors considered the impact of improvement on productivity. Furthermore, all these studies mediate the exact relationship between standard deviation and tolerance, which in fact represents a fixed value for process efficiency index

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PROBLEM DEFINITION

There are many quality issues identified during work in the industry. The way to quality is to improve by constantly changing, adding, removing and refining processes. Achieving quality is not a journey and a destination.
Furthermore, the needs and community needs of learners are constantly changing and therefore the products and services provided must be constantly changed to meet these needs. There is always room for improvement in educational institutions. Additionally, choosing who to work with is part of the planning process. There may be improvements in teacher and learner interactions across sectors for improvement in educational institutions; Improve communication between practitioners and the organization; Improving learning by helping learners monitor their work; Performance evaluation and the like.

Problem and their effects:

Defective product is one of the mutual problems shared by all the corporations.

- A defective product in a product that does not meet the criteria set for the cause of the production process and for other reasons usually includes physical changes.
- Disability products may be caused by machinery, humans or environmental factors.
- Product defects can also be a loss of the company such as cost and production time.
- Also, if most defective products are manufactured, it increases the cost of repairs and other costs. Not only this, defective products can also lower the selling price.

To deal with product shortcomings, each company should have a quality control unit that checks for any defects in the product before marketing.

II. DATA COLLECTION

The purpose of data collection is to provide a basis for turning data into information, in other words, to make decisions and be useful. However, before collecting data, a data collection plan must be developed. At the manufacturing plant, data is collected to identify the obstacle station and analyze and eliminate them. The data collected is under direct observation on the shop floor.

III. METHODOLOGY

Basic statistical tools are of great importance because there are seven indispensable tools for quality for any organization to thrive at the peak of excellence. The concept behind the seven basic tools comes from Koru Ishikawa, which states that 95% of quality problems can be solved with these basic tools. The ability to identify the problem, use appropriate means, and communicate the solution quickly to others, depending on the nature of the problem, is the key to successful problem solving. Seven basic quality improvement tools are used to assist in data collection and integration, problem definition and / or resolution, pattern or trend analysis and analysis:
(i) Check sheet
(ii) Histogram,
(iii) Pareto chart
(iv) Cause and effect/Fishbone diagram
(v) Scatter diagram
(vi) Control charts
(vii) Flow chart/Run chart/Stratification diagram

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IV. CASE STUDY

5.1. Introduction of the case study.

The problem investigated in this case study is about the rejection of lath beds, because defects that cause inflammation after the heat treatment process have been used to provide the necessary hardness. Criteria for Acceptance As specified by the design department, a rigid bed is expected to have a certain stiffness and a bed without hardness is rejected. A flame hardening process that satisfies the hardness of the HRC from about 42 (Lower Specification Limit, LSL) to 48 (Upper Specification Limit, USL). 48 HRC rejected in bed maintenance with a hardness greater than 48. HRC is measured with the Rockwell C Scale. Rockwell Scale A hardness scale based on the indentation hardness of a material, and the result is a dimensionless number called HRA, HRB, HRC, where the final letter is the corresponding Rockwell scale.

Data Collection: To determine the quality of the lath bed, hardness data were collected on 32 beds and the reading of the hardness inspection is given in Table 1. The run chart of the hardness values is shown in the figure. 2.

Hardness values (in HRC) of 32 Beds

No.	Hardness	No.	Hardness	No.	Hardness	No.	Hardness
1	44	9	45	17	45	25	45
2	50	10	51	18	45	26	47
3	49	11	48	19	47	27	48
4	44	12	45	20	51	28	48
5	47	13	45	21	44	29	43
6	44	14	42	22	50	30	45
7	49	15	45	23	48	31	45
8	45	16	43	24	47	32	43

Figure 2: Run chart of hardness values

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Cause and Effect Diagram.

A brainstorming session and also conducted some trial runs of the flame hardening process and came out with the reasons behind dis satisfactory results in the hardness values. Based on the data they collected, a cause and effect diagram was constructed as shown in Figure 3. The seven main causes were further explored for the sub-causes and the Table 2 summarizes the causes for each main reason behind the hardness defects.

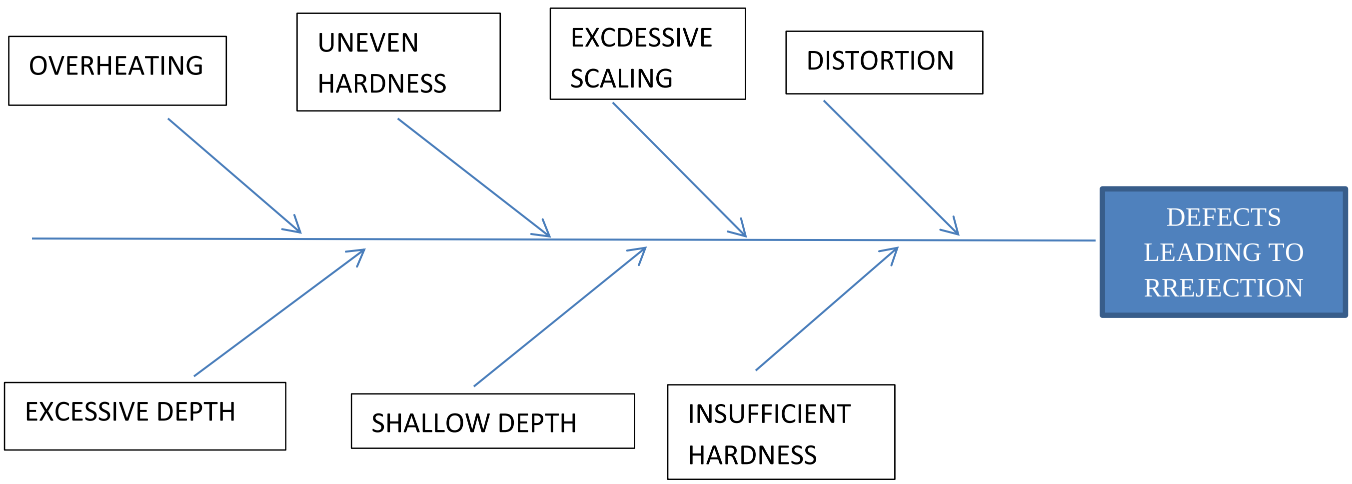

Figure 3: Cause and effect diagram for the rejection of lathe Beds

V. CONCLUSION

These devices are helpful in every phase of defect removal. From the case study it has been concluded that the basic seven instruments of quality are very useful and effective in identifying and removing defects from the manufacturing process. This case study quality guru Dr. Reinforces Ishikawa's famous statement that "95% of quality-related industrial problems can be solved by applying the seven-basic means of quality".

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