International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 11 Issue 9, September-2022, Impact Factor: 7.957

A Quantitative Analysis of Quality Improvement Methods in the Manufacturing Sector: A Review

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ABSTRACT

"Quality" implies matching customer needs. Quality control will become more crucial as human civilisation evolves. No financial advantage without quality assurance, they say. Manufacturers and service providers must improve product quality due to increased global competition. Globalisation and corporate dynamism contribute to today's competitive market. It is more crucial than ever to provide clients with various alternatives at affordable and quickly. It collects and analyses data to improve operations. It is often utilised as a part of a Six Sigma project, although it may also be used alone or in combination with lean. Companies without solid standards will fail. Quality affects sales, pricing, productivity, risk management, and regulatory compliance. Defining quality is challenging despite its significance. We evaluate "excellent" from quality control, quality assurance, product, marketing, manufacturing, and economic perspectives.

Keywords: Financial, Affordable, Prices, Quickly, Assurance.

INTRODUCTION

By using a wide array of quality control measures, businesses strive to achieve their goal of avoiding the expenses that are associated with poor quality. "Quality control" refers to "the procedures taken by a corporation to guarantee that its goods and services meet or exceed the expectations of the customer" [3], and "quality control" refers to "quality control" in its broadest definition.

In certain businesses, quality control may refer to nothing more than the identification of errors, but quality assurance will contain both of these goals in some way, shape, or form. Businesses need either a quality assurance team or a person working for them to keep their standards high. There are several circumstances in which a manager can benefit from the advice of quality assurance professionals. [4].

Companies that are dedicated to improving their offerings are the ones that use quality control measures for their products. Computers have the potential to have a significant impact in many areas, including the quality control of products. [1].

Altering the methods in which a company operates is another strategy that a company may consider in their quest to enhance product quality. Process control is something that comes into play in this particular sector. The firm that manufactures the shafts will, on occasion, put its employees through a test to see how well they understand the correct processes for machine configuration. A comprehensive approach to controlling the process requires various strategies, one of which is establishing a culture that rewards and acknowledges achievement. [2-3].

It is possible to regulate processes using a variety of accessible strategies effectively. Accurate Gauge and Manufacturing uses process control to improve the quality of the precision components it manufactures for construction equipment, trucks, and automobiles by identifying and addressing the underlying causes of faults during the production process. These faults can be caused by various factors, including operator error, improper material handling, or improper assembly of the component. These high-precision components find usage in a broad range of different systems and processes.

The group responsible for quality assurance meets once a week to discuss possible issues and ways to solve such issues. When an issue developed with a product line that the company had already decided to retire, the engineering manager tried to remedy it by having production employees follow a set of checks and balances. However, the endeavour was unsuccessful. This work not only revealed the client's unwavering attention to quality but also established a baseline for the production of additional components that are equally faultless. [5].

The purpose of these experiments was to find the most effective approach for quality control and productivity increase, which is the central topic of this thesis. The experiments were carried out on a manufacturing firm. It is not an economical alternative to get a whole set of high-quality instruments and a model approach and spend the money on doing so. The control chart is the benchmark for quality assurance testing in all areas of the economy, including finance, healthcare, and manufacturing. A cause-and-effect diagram or a histogram may be used to analyse the causes and consequences of the manufacturing process. Utilising acceptance sampling as a tool to quantify the amount of error in a control chart is possible. Histograms are by far the most common sort of graph that is used in the process of displaying the shape and pattern of frequency distributions. The data sets' shapes define the statistical characteristics of the sets. This chart is much different from a bar chart, despite numerous parallels between the two.

LITERATURE REVIEW

Lee (2022), Firms can now more easily keep viable alliances and develop connections of tremendous value with other businesses through the use of global technology, notably digital objects. Each day brings with it new digital technology that will eventually have an impact on every facet of running a business. This research looks into how the adoption of a digital supply chain has altered the supply chain and the efficiency of businesses in Malaysia's manufacturing sector. In addition, the research evaluates how supply chain performance acts as a moderator between the digital supply chain and organisational performance in the Malaysian manufacturing sector. With a quantitative approach, we are able to accomplish our goals. Using a stratified sample technique, the researchers emailed the online survey questionnaire to 1160 manufacturing firms featured in the Federation of Malaysian Manufacturers (FMM) directory. Of those, 63 enterprises responded. 7 partially completed responses were removed, leaving 56 valid responses (5.43 percent of the total). Partial Least Square Structural Equation Modeling was used to examine the data (PLS-SEM). Seven hypotheses (including all moderating effect hypotheses) are supported, while three are rejected. If Malaysian manufacturers want to maintain their credibility in the face of fierce competition, they should think about implementing the DSC into their operations. Researchers and industry professionals, particularly those in the manufacturing sector, are advised on the study's implications. Both the study's limitations and its call for more research into the topic have been discussed.

Ding Wu (2021), In order to make better metal goods, manufacturers and processors would benefit from real-time and online quantitative composition analyses. The influence of inaccurate plasma temperature calculations, uncertainties associated with Einstein coefficients, and imprecise efficiency of spectral detection system continue to be obstacles to the accuracy of classical calibration-free laser-induced breakdown spectroscopic (CF-LIBS) quantitative analysis. In this study, we demonstrate how the one-point calibration LIBS (OPC-LIBS) approach may be used to perform a more accurate quantitative examination of titanium alloys, including their trace elements. The primary experimental and spectroscopic parameters in OPC-LIBS were simultaneously corrected using a single matrix-matched reference sample of known composition. Improved figures for plasma temperature and electron density were obtained by using a Saha-Boltzmann plot that included a wide energy range. Based on the findings of the comparison, the OPC-LIBS technique provides a more precise measurement of the composition of the titanium alloy than the standard CF-LIBS method.

Analysis performed by C. Bhedasgaonkar (2020) for the aim of the green sand casting industry of the manufacturing company. In this instance, Six Sigma is used for the component known as the Transmission Case. In order to bring the number of faults in the transmission case down to an acceptable level, the Taguchi defect reduction approach is used with the DMAIC (Define-Measure-Analyze-Improve-Control) methodology. "The essential tools for carrying out this activity are the project charter, the process map, and the cause-and-effect diagram. The mould hardness, green strength, and pouring rate are optimised through a series of trials that are designed using a design of experiments (DOE), and the results of these trials are analysed using an analysis of variance (ANOVA) in order to establish a statistical relationship between defects and their respective control variables. 8 The experimental data were subjected to Taguchi analysis so that statistical analysis and modelling could be performed on them. The findings provided guidance for selecting experimental variables that would increase the performance of the process, and eventually, those variables exhibited the enhanced performance of the manufacturing process. This piece of research attempts to compare and contrast the traditional technique with the one offered, and it goes into some detail on the results.

The work that B. Shinde (2014) did at the foundry to decrease the number of castings rejected due to severe flaws was presented as research. There is a problem with the head of one of the cylinders in the engine. The primary focus of our inquiry is on the blow hole defect, which is responsible for an abnormally high percentage of all product returns. The quality investigation undertaken to discover the real reasons for the blow holes includes a root cause analysis as one of its components. The Pareto chart, the "Cause and Effect (Ishikawa) diagram," and the "why-why analysis" are all examples of tools that may be used in quality control. In light of this, remedial and preventive actions are being considered and implemented. During the assembly and cleaning of the mould box, new checkpoints have been added to the process control check sheet. These checkpoints pertain to applying wet green sand to the central gas vent. Following the execution of these alterations and the completion of an analysis of the effectiveness of these analyses, we have discovered that both blow hole rejection and overall rejection have significantly reduced. The number of applications turned down due to blowholes falls from 7.74% to 1.81%. The outcomes of these changes include an improvement in productivity of 8.60% and a considerable reduction in the loss of total income.

PROCESS DESCRIPTION

Thirteen steps are involved in the production process of fog lamps for the lighting and automobile sectors. In the moulding shop, the lens and housing of the fog light are created using injection moulding machines, and the reflector is also created in the moulding shop using bulk moulding compound machines. For the production of Lens and Housing, we use thermoplastic material processed by an injection moulding machine. For the production of reflectors, we use thermostat material in our bulk moulding compound machines. When the reflector and the lens have been successfully moulded, the reflector will be sent to the Surface Treatment (ST) shop. Lens was put into the Hard Coat department at the ST store, while reflector was moved into the Base Coat department.

The first step in the challenging coat process, which occurs after the lens has been cleaned using an anti-static air gun and has arrived at the processing facility from the moulding shop, is known as the arduous coat process. An air cannon may remove the static charge from the lens surface. After that, the lens is mounted into the fixture, and lacquer is sprayed onto the lens with the assistance of a robot. Lacquer is made composed of both solid and liquid particles. After the lacquer lens has been processed using infrared rays, the pores on the surface of the lens are generated as a result of the evaporation of liquid particles from the surface of the lens by the infrared rays. The lacquer's solid particles penetrated the pores of the surface. The lens is next subjected to ultraviolet rays, which cure the lacquer and give the lens its shine after the infrared rays have gone through it.

The technique known as a base coat is carried out on reflectors since thermostat material is used in their construction. The base coat is a method. In the first step of this procedure, the reflector is cleaned or washed with demineralised water, which is produced by mixing water and control. This demineralised water eliminates moisture and oiling from the bulk moulding compound (BMC). After that, clean it with fresh water and air to eliminate any remaining moisture and ions that may be present. The moisture is then removed from the reflector by placing it in a bake oven with a temperature between 180 and 220 degrees Celsius. After unloading the oven, use base coat thinner with the assistance of lint-free cloth to determine whether or not there are any moulding faults remaining and to eliminate dust. Moulding flaws such as silver, scratches, flashes, and so on are then cleaned using an anti-static air pistol to get rid of static charge. After that, the reflector was mounted on the fixture and transferred to the pre-treatment area (one Ultraviolet lamp is used to remove moisture from the reflector). Following the Pre-treatment zone, the reflector was transported to the Cooling zone. In this zone, fresh air was delivered to the reflector to bring it down to room temperature, between 25 and 28 degrees Celsius. The reflector then reached room temperature and proceeded to the robot zone after passing through the cooling zone (In the robot zone, Base coat lacquer is sprayed on the reflector, 3281 grade of lacquer is used). Following that, the reflector is relocated to the Heating zone (In the heating zone, the temperature is around 85-95 C, and this zone increases the viscosity. If viscosity increases, then the density will also increase, for clotting the lacquer on part). The reflector was then transported to the UV zone, where it baked the lacquer and eliminated any remaining liquid particles. The reflector was relocated again to the cooling zone, where its components eventually reached room temperature.

CONCLUSION

It is essential to use the appropriate industrial engineering tools to keep up with the demand. It is possible to reduce cycle time and work-in-progress by putting it into action. Eliminating waste may also lead to increased productivity in individuals and communities. Increasing quality at the point of origin will not affect anything else but will reduce the waste and rework that must be done. Producing goods with fewer defects at each stage will assist in meeting the demand. After obtaining the necessary information, the station causing the blockage was located. To determine what was causing the production rate to decrease and what might be done to address the issue, a diagram showing causes and their subsequent effects was used.

A manufacturing corporation was the subject of a series of experiments designed to determine the most effective method for maintaining quality control while simultaneously boosting output. Using all the quality tools and developing a sample strategy comes at a significant financial expense. A control chart is the most effective method for determining quality in any industry. To determine what happened and why it occurred, one might use a cause-and-effect diagram or a histogram. Control charts use acceptance sampling to determine the total number of errors they contain. Statistical process control is one of the most efficient methods for reaching the sig sigma level. The updated list of shaft manufacturing tools that can be seen below is suitable for use in any sector that emphasises quality and efficiency. The operations of a shaft maker may be improved in terms of quality and efficiency in several different ways. Because of time and resource constraints, the methods used in this thesis could not be further upon. In the course of this inquiry, only quality instruments were used to determine the method that proved to be the most effective in carrying out quality testing and boosting overall productivity. These give a better reaction. However, the reader will profit more by using other approaches to industrial engineering processes than by listening to this argument. It would be fascinating to see how the data are utilised in studies that are conducted in the future. This may be the best route to take if you want to maximise productivity and quality. The production of outer shafts will go on as planned to enhance quality and productivity. Investigating the possibility that the findings might be applied to other equipment and machinery inside the plant is an excellent strategy for the future of the plant. The findings of this study may be more readily understood and applied to a broader variety of topics if more research and clarification are conducted.

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