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A Study On 8d Methodology in Manufacturing Industry

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***Abstract:** Paper This study delves into the measurement and optimization of the manufacturing process, through the implementation of the 8D Methodology in problem-solving. The paper discusses the fundamental aspects of the manufacturing industry and the specific products manufactured by the company. Utilizing secondary data from relevant journals, the research aims to identify potential production issues and enhance efficiency by applying the 8D Methodology. The study employs an experimental approach, analyzing 15,018 samples obtained from the final inspection of produced tubes. Attribute analysis using the p-chart reveals process non-conformance and identifies defects affecting production efficiency. Various tools, including the Pareto diagram, Fishbone diagram, flow chart, and Decision matrix, are utilized to propose corrective and preventive actions. A Comparative study on the 8D methodology at various industries is outlined. The findings suggest that optimization of the manufacturing process is achievable through proactive measures. By implementing the recommended actions, the study proposes further refinement of the manufacturing process. The paper concludes by outlining actionable steps to optimize production.*

***Keywords:** Manufacturing Process, 8D Methodology, Production Optimization, Quality Management, Preventive Actions, Corrective Actions.*

I. INTRODUCTION

The pursuit of perfection in manufacturing faces continual challenges, particularly in metal tube fabrication, a crucial sector in automotive, aerospace, and construction industries. This project delves into the systematic analysis of failures within metal tube manufacturing, employing the attribute chart and 8D (Eight Disciplines) methodology, complemented by the Ishikawa diagram. These structured problem-solving techniques enable manufacturers to diagnose root causes, implement corrective actions, and monitor trends, bolstering production processes. Attribute analysis via the P-chart monitors defect proportions, ensuring quality standards. The 8D methodology guides manufacturers through comprehensive problem-solving steps, while the Ishikawa diagram visually aids in identifying causes across multiple dimensions.

Trend analysis post-correctional measures is vital for sustaining improvements and fortifying manufacturing resilience, allowing proactive anticipation of failures and optimization of processes. This paper underscores the significance of structured methodologies in scrutinizing metal tube manufacturing failures and emphasizes the importance of trend analysis in fostering continuous improvement and innovation. By fortifying operational frameworks and navigating challenges with precision, manufacturers can uphold product integrity and sustain growth in competitive markets.

II. REVIEW OF LITERATURE

A study was conducted on the maintenance management using PARETO's method in a 16-slice CT scanner. By analyzing service reports from three scanners over two years, they identified 53 failures, with the majority occurring in the gantry (38%) and console (25%). Subsequent analysis revealed that 80% of gantry failures stemmed from four specific components, and 80% of console failures from two components. The authors recommended prioritizing preventive maintenance and improvement actions for these critical components to enhance scanner availability and reliability [1]. Further study focused on reducing failures in the automotive industry by applying the 8D methodology. Employing both Value Stream Mapping (VSM) and Failure Mode Effect Analysis (FMEA) within the 8D framework, they successfully reduced the total parts per million (ppm) from 1,071 to 0.00, resulting in cost savings. The study underscores the effectiveness of the 8D methodology as an approach to quality management and process improvement [2]. Studies Conducted on product defects in SP Aluminum, a cooking utensil manufacturer. Through the use of quality control methodologies such as flowcharts, check sheets, p-charts, Pareto diagrams, and fishbone diagrams, they identified prevalent issues such as holes, dregs, and pores in their Super Wok Number 12 product. The study emphasized the importance of addressing root causes, including the absence of standard operating procedures, inadequate training, and poor raw material handling [3].Investigation on effectiveness of the 8D problem-solving method in addressing customer dissatisfaction in the crane industry revealed Utilizing various tools within the 8D framework, they pinpointed critical issues impacting customer complaint management and showcased the practical application of 8D in process improvement and cost reduction [4].Exploration on the application of the 8D methodology in resolving production issues related to PVC pipes. They detailed the eight steps involved in the methodology and emphasized the importance of a systematic approach and data-driven analysis in implementing effective solutions [5]. A focused on optimizing process parameters

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in drilling carbon fiber reinforced polymer (CFRP) composites using the Taguchi method combined with the Response Surface Methodology (RSM)provided valuable insights into process optimization and quality enhancement in composite material manufacturing [6]. A structured guide for problem-solving, aiming to address challenges in defining problems and identifying root causes was proposed the Defined 8D model as a structured guide for problem-solving [7], aiming to address challenges in defining problems and identifying root causes [8]. The model emphasizes clear step completion criteria and aims to enhance efficiency in problem resolution [9]. The application of the 8D methodology in industrial processes was explored to emphasize its efficacy in addressing complex challenges and fostering a culture of continuous improvement [10]. To enhance manufacturing processes through the 8D method, detailing its application in the study by utilising problem tools such as p-chart and Pareto diagram [11]. Focusing on rootcause analysis assessing the practical application of problem-solving tools and techniques, was undertaken [12]. Their research offered an effective problem-solving framework applicable across various industries [13]. To reduce the quality costs and enhance customer satisfaction the 8D technique was utilized to address customer complaints in the automotive industry, resulting in reduced quality costs and enhanced customer satisfaction [14].

III. OBJECTIVE

This study aims to evaluate the efficacy of the 8D methodology in reducing production defects, validating root causes, and assessing preventive actions' effectiveness. It also investigates problem-solving steps within the 8D framework, evaluates short-term action success in preventing escalations, and proposes best practices for defect mitigation in manufacturing.

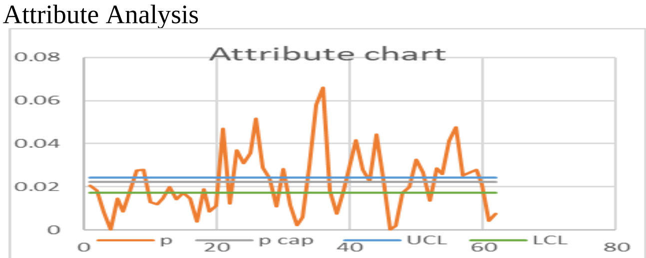
IV. RESEARCH METHODOLOGY

Research methodology refers to the systematic approach and techniques used to conduct research, including data collection, analysis, and interpretation. It encompasses the research design, data sources, sampling methods, data collection tools, and statistical or qualitative analysis. A well-defined research methodology is crucial for ensuring the reliability and validity of research findings.

Research Design: - Experimental Research Design Data **Collection: -** Secondary data
Period of study: - 2 months

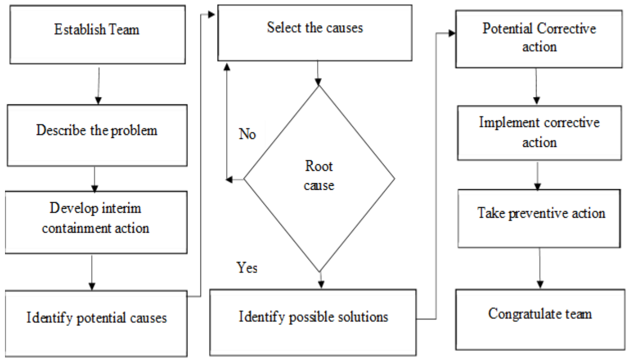
V. DATA ANALYSIS AND INTERPRETATION

Attribute Analysis



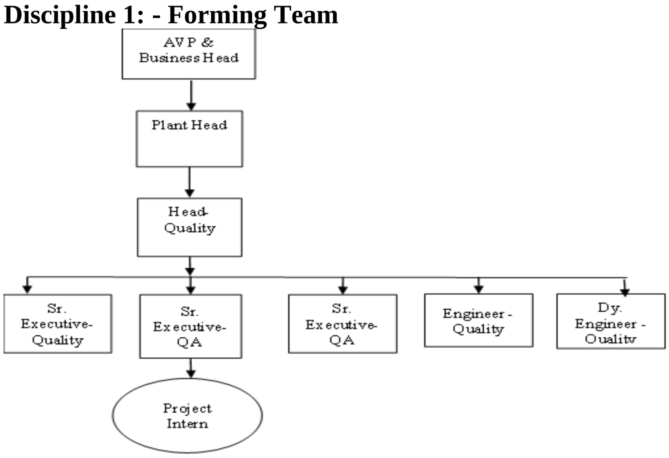
The chart assesses tube rejections compared to their mean, with the p-value exceeding upper and lower control limits (UCL and LCL), indicating outliers with p value 0.221, UCL value 0.024 and LCL 0.017.

Process Map For 8d Methodology



It illustrates identifying the root cause of a problem through a series of steps. The process starts with describing the problem and then establishes a team to address it. If the root cause can't be identified, then corrective actions are taken. If the root cause is found, then potential solutions are identified and corrective actions are implemented. The process concludes with congratulating the team.

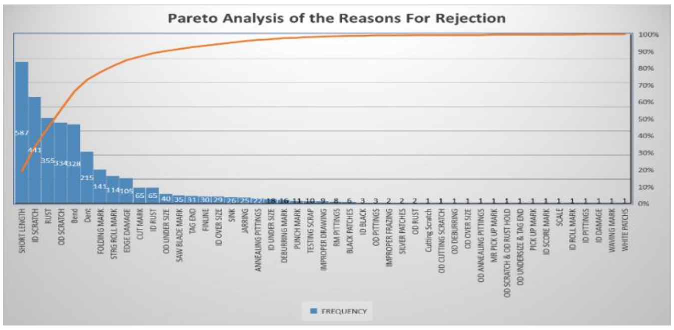
Discipline 1: - Forming Team



The organization's quality control team, led by managers and executives, ensures impeccable product standards.

Discipline 2: - Problem Identification

Pareto Diagram



The chart indicates "Short Length" as the top reason for rejection, followed by "ID Scratch" and "Rust," totaling about 60% of rejections.

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Ishikawa Diagram

The Ishikawa diagram offers structured analysis of root causes for internal diameter scratches in metal tubes during drawing, using the 5M framework.

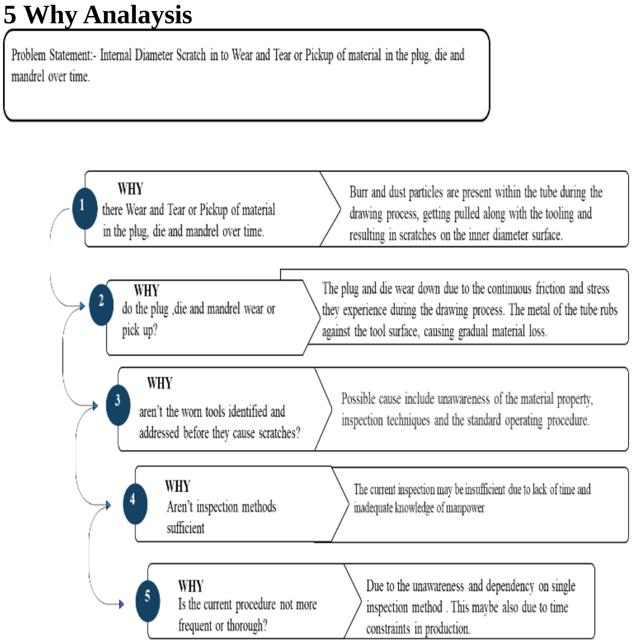
Discipline 3: Containment Action

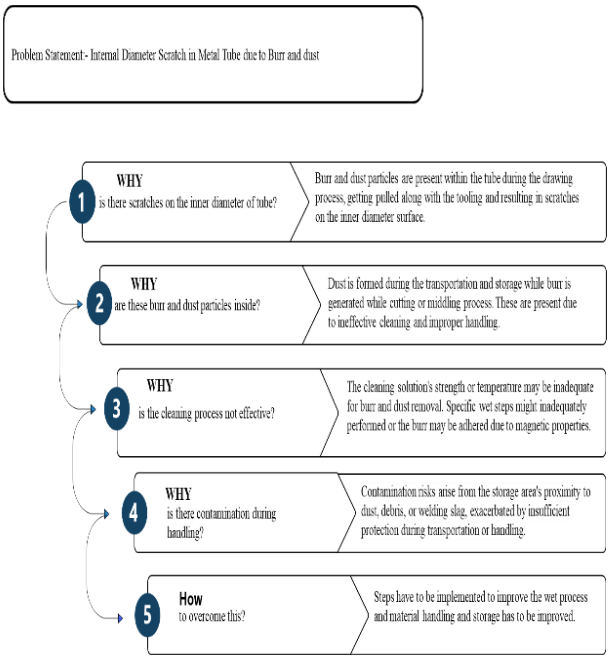
A comprehensive containment action plan is in place to prevent and address risks, defects, and issues affecting product quality, safety, and efficiency. Stringent quality control protocols are enforced from raw material procurement to distribution, aimed at early detection of deviations and defects. During metal tube production, immediate action is taken upon identifying ID scratches, with thorough checks on plug surfaces and tube batches for abnormalities like metal chips or Finn burrs. Proactively addressing drawing process issues maintains stringent quality standards, ensuring manufacturing precision and excellence. Disruptions such as metal chip accumulation or Finn burr presence are promptly identified and resolved to safeguard product quality and prevent production delays.

Discipline 4: - Root Cause analysis

The root cause analysis identified wear and tear/material pickup on plugs, dies, and mandrels as significant factors. Burrs and dust particles were also found to contribute to the issue.

5 Why Analaysis





Discipline 5: Corrective Actions:

Tool, Die, and Mandrel Wear:

- Implement a strict polishing regimen
- Utilize Polytetrafluoroethylene (PTFE) coatings to minimize friction and wear

Burrs and Dust Particles:

- Employ efficient wet treatment processes for dust removal
- Utilize sharp cutting tools to minimize burr formation
- Conduct thorough visual inspections before drawing

Discipline 6: - Implement Corrective action

This focuses on implementing corrective actions to prevent scratches on the internal diameter of metal tubes caused by burrs and wear on dies, mandrels, and plugs. This involves several steps: first, thoroughly inspecting these components for signs of wear and burrs, then maintaining and sharpening them regularly to ensure smooth surfaces and prompt replacement of worn-out parts. Additionally, applying appropriate lubricants helps reduce friction during manufacturing, thereby minimizing scratching. Monitoring and controlling parameters like cutting speed and tool pressure optimize machining conditions, while operator training emphasizes proper handling techniques and the importance of maintenance. Stringent quality control measures are implemented to detect scratches early, and a feedback loop gathers insights for continuous improvement and prevention of recurrence.

Discipline 7: - Preventive Action

- **Man-related:** Training programs to enhance operator skill, address fatigue, and promote quality awareness
- **Material-related:** Regular testing, proper storage, and contamination prevention protocols.
- **Machine-related:** Maintenance schedules, vibration control, and proper lubrication practices.
- **Method-related:** Monitoring machining speeds, selecting appropriate cutting fluids, and ensuring proper fixturing.
- **Measurement-related:** Regular tool inspection, calibration, and training to minimize operator errors.

Discipline 8: - Congratulate team

- The paper emphasizes acknowledging the team's efforts and fostering collaboration. Sharing findings with stakeholders allows for process optimization and identification of further improvement opportunities.

VI. COMPARATIVE ANALYSIS OF 8D METHODOLOGY

Industry	Potential Challenges	Focus of 8D Analysis	Root Cause Analysis	Corrective Actions
Automotive	Paint defects Engine malfunctions Component failure	Identifying the specific part causing the issue Determining the root cause of malfunction Preventing future occurrences	Material inconsistency Machine calibration issues Assembly line errors	Implementing stricter quality control measures Adjusting production processes Retraining or replacing faulty components
Electronics	Circuit board defects Software bugs Hardware malfunctions	Identifying the specific component causing the issue Analyzing software code for errors Preventing future hardware failures	Soldering issues Incorrect component placement Design flaws	Implementing automated inspection systems Improving soldering techniques Redesigning faulty components
Food & Beverage	Product contamination - Inconsistent taste or texture Packaging defects	Identifying the source of contamination Determining the cause of taste/texture variations Preventing packaging leaks or damage	Improper sanitation practices Incorrect ingredient proportions Faulty packaging materials	Implementing stricter sanitation protocols Updating recipes and ingredient sourcing Replacing or redesigning packaging
Pharmaceuticals	Dosage inaccuracies Sterility issues Labelling errors	Identifying the specific batch or process causing the issue Ensuring sterility throughout production Preventing labelling mistakes	Equipment calibration issues Human error during mixing or filling Labelling machine malfunctions	Implementing automated dosage control systems Additional training for staff Updating labelling machinery and procedures

VII. FINDINGS

The P-chart highlights numerous data points surpassing the Upper and Lower Control Limits, indicating process instability. The top three defects identified include short length, rust, and internal diameter scratches. Employing the Ishikawa diagram, internal diameter scratch causes are categorized within the 5M framework, facilitating comprehensive solutions for quality control and production efficiency. Containment actions employ various strategies to mitigate risks, ensuring product integrity and efficiency. Thorough inspections maintain high-quality standards, safeguarding reputation and customer satisfaction. Primary causes, such as machine issues and contaminants, contribute to scratches during the drawing process. Preventive measures involve training on tool handling, maintenance, and quality inspection, alongside addressing operator-related risks. Regular training sessions foster a culture of quality consciousness. Effective preventive actions include maintenance, inspections, vibration dampening, and monitoring lubricant levels. Clear procedures for fixturing, speed settings, fluid selection, and operator training are crucial to mitigate risks associated with machining.

VIII. CONCLUSION

In summary, this project adopts a comprehensive approach to enhance process quality and address internal defects in manufacturing. Utilizing statistical process control tools like the P-Chart enables continuous monitoring of process stability. Through the application of the 8D methodology, defects are analyzed systematically, beginning with Pareto analysis for prioritization. The fishbone diagram further explores root causes, enhancing understanding. Validation processes ensure proposed solutions' effectiveness and sustainability. Integration of the 5 Why analysis aids in identifying root causes for targeted corrective actions. Comparative studies on the 8D methodology across various manufacturing industries inform best practices. Root causes such as tool wear and inadequate training prompt actions like enhanced training and maintenance schedules. This holistic approach yields significant process improvements, reducing defects, and enhancing product quality, laying the groundwork for ongoing enhancement and continuous improvement through diligent monitoring and corrective actions.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

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- **Authors Contributions:** The authorship of this article is contributed equally to all participating individuals.

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