Improving Production and Quality Control in Injection Moulding through Operational Optimization

A Proposal report for the BDM capstone Project

Submitted by

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Declaration Statement

I am working on a Project Title "**Improving Production and Quality Control in Injection Moulding through Operational Optimization**". I extend my appreciation to **"Ganes Metplast Private Limited"**, for providing the necessary resources that enabled me to conduct my project.

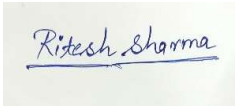
I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

I am dedicated to adhering to the information of academic honesty and integrity, and I am receptive to any additional examination or validation of the data contained in this project report.

I understand that the execution of this project is intended for individual completion and is not to be undertaken collectively. I thus affirm that I am not engaged in any form of collaboration with other individuals, and that all the work undertaken has been solely conducted by me. In the event that plagiarism is detected in the report at any stage of the project's completion, I am fully aware and prepared to accept disciplinary measures imposed by the relevant authority.

I agree that all the recommendations are business-specific and limited to this project exclusively, and cannot be utilized for any other purpose with an IIT Madras tag. I understand that IIT Madras does not endorse this.

Signature of Candidate: 

Name: Ritesh Sharma

Date:13th May 2025

1 Executive Summary and Title

The title of my project is **"Improving Production and Quality Control in Injection Moulding through Operational Optimization".** My project is consult with **Ganes Metplast Pvt. Ltd. ,** located in Chennai, established in 2011 and currently running under the leadership of **Mr. Sadagopan Raju**, Managing Director. This industry is a precision-focused plastic component manufacturer serving primarily the automotive and electrical industries. With a workforce of around **90 employees** and production spread across **three shifts**, the company manufactures more than 10,000 parts per day using advanced injection moulding technology.

The organization is currently facing significant operational challenges, including high rework and rejection rates, inefficient inventory management, and a mismatch between actual and target production. These issues are resulting in production delays, increased costs, and underutilization of resources, ultimately impacting profitability and client satisfaction.

To address these challenges, the project will adopt a data-driven problem-solving approach. Data will be collected from production records, quality control logs, and inventory movement over the past 4 months. Tools such as Microsoft Excel, Power BI, and Python (for exploratory analysis) will be employed. Techniques like Pareto analysis, root cause analysis (RCA), control charts, and inventory turnover analysis will be applied to identify inefficiencies. The expected outcome includes reduced defect rates, improved alignment of production targets, and optimized inventory management, contributing to cost savings and operational efficiency.

2 Organization Background

The organization under study is Ganesh Metplast Private Limited, a privately held manufacturing company established in 2011 and currently running under the leadership of **Mr. Sadagopan Raju**, Managing Director. It is located at No: 351/1, Thiruvalluvar Salai,

Moorthy Industrial Estate, North Malayambakkam, Chennai – 600123. The company specializes in high-precision plastic component manufacturing using advanced injection molding technology, primarily serving the automotive and electrical sectors. Ganesh Metplast operates with a dedicated workforce of around 90 employees and runs three production shifts, manufacturing more than 10,000 parts per day using 9 machines like 150T, 200T , 300T etc operate to produce different parts depending on client requirements.

The organization holds multiple quality certifications including **IATF, Hyundai, SQ Mark, UL, and TUV**, demonstrating compliance with international manufacturing and quality standards. It maintains active production collaborations with **15 to 25 industrial partners**, ensuring timely delivery and responsive production scaling. With its modern machinery, skilled technical personnel, and robust process controls, Ganesh Metplast has positioned itself as a trusted supplier in the competitive plastic manufacturing landscape. The company currently records an **estimated annual turnover of ₹12 crores**, reflecting its strong market presence and consistent demand for its precision-molded components.

3 Problem Statement

1. **High Rework & Rejection Rate:** Frequent moulding defects, such as short-fills and overheating, result in high rework and rejection rates, affecting product quality and increasing production costs.
2. **Inefficient Inventory & Material Planning:** Material mismatches and poor inventory planning lead to overstocking, shortages, and delays, which disrupt production and affect workflow efficiency.
3. **Production Target Gaps:** Inconsistencies between actual and target production arise due to untracked downtimes and shift imbalances, leading to underutilization of resources and lower productivity.

4 Background of the Problem

Ganes Metplast Pvt. Ltd. is currently facing several operational inefficiencies that are impacting its productivity and customer satisfaction. The most significant issues involve high rejection and

rework rates, poor inventory control, and production output gaps.

One of the **major causes** of inefficiency is the **high rate of product defects**, which include short-fills, burn marks, flow lines, and thermal damage. These defects are primarily linked to **internal problems**, such as unstable machine parameters, inconsistent mould maintenance schedules, lack of operator training, and the absence of standardized work instructions. These factors lead to frequent interruptions in production, excessive scrap generation, and extra time consuming.

Another **internal issue** is the lack of an automated or digital **inventory management system**. Without real-time tracking, the company experiences mismatches in material availability, leading to **overstocking of low-demand raw materials** and **stockouts of essential inputs**.

In terms of **external problems**, the company is also affected by **variability in supplier lead times** and **inconsistent raw material quality**. These issues can delay production start times and introduce unexpected quality deviations, making the manufacturing process less predictable and harder to control.

These combined internal and external challenges are the **root causes** behind frequent production disruptions, increased costs, and declining operational efficiency. Addressing these issues through a data-driven approach and process improvements is essential for restoring productivity, reducing waste, and maintaining high standards of quality.

5 Problem Solving Approach

To address the operational challenges at Ganes Metplast Pvt. Ltd., a structured problem-solving approach has been developed. This methodology aims to reduce defects, optimize inventory management, and align production output with targets. It incorporates an eight-step process with additional techniques to address the company's specific needs.

1.Problem Identification:

The company faces major operational issues including high rejection and rework rates, poor inventory accuracy, and production shortfalls. These problems arise from machine inconsistencies, inadequate mold maintenance, manual inventory tracking, inefficient shift planning, and unmonitored downtimes. Additionally, inconsistent supplier deliveries and

variable raw material quality contribute to production delays and disruptions.

2. Data Collection:

Relevant data will be gathered from production logs, quality inspection reports, downtime records, inventory movements, and shift schedules. This includes defect types, machine performance, rejection causes, and stock levels. Tools like Excel and Python will be used to digitize and process the data.

3. Data Analysis:

Data analysis will utilize tools like Pareto Analysis to pinpoint major defects, Control Charts to track defect variations, and Scatter Plots to explore relationships between defects and shifts. Histograms and Run Charts will help track performance trends.

4. Root Cause Identification:

The root causes of problems will be explored using Fishbone Diagrams to categorize potential causes and the 5 Whys technique to identify deeper issues. Real-time observations will validate findings, especially regarding rework rates and inventory mismatches.

5. Solution Development:

Corrective actions will be developed based on the identified causes. These may include machine calibration, improved mold maintenance, operator training, and the implementation of digital inventory systems. For planning issues, real-time shift tracking and standard work procedures will be introduced.

6. Implementation Planning:

Solutions will be prioritized using a matrix based on impact and effort. Quick wins, such as digital inventory systems, will be implemented first, followed by medium- and long-term solutions like machine upgrades and ERP system integration.

7. Monitoring and Control:

Key performance indicators (KPIs) such as defect rates, inventory turnover, and production output will be tracked using dashboards in Power BI. Regular audits will ensure that improvements are sustained.

8. Documentation and Reporting:

All findings, analyses, and results will be documented in a final report, which will include visual tools like charts to demonstrate the improvements. A final presentation will summarize the results and suggest future enhancements.

6 Expected Timeline

i). **WORK FLOW STRUCTURE**

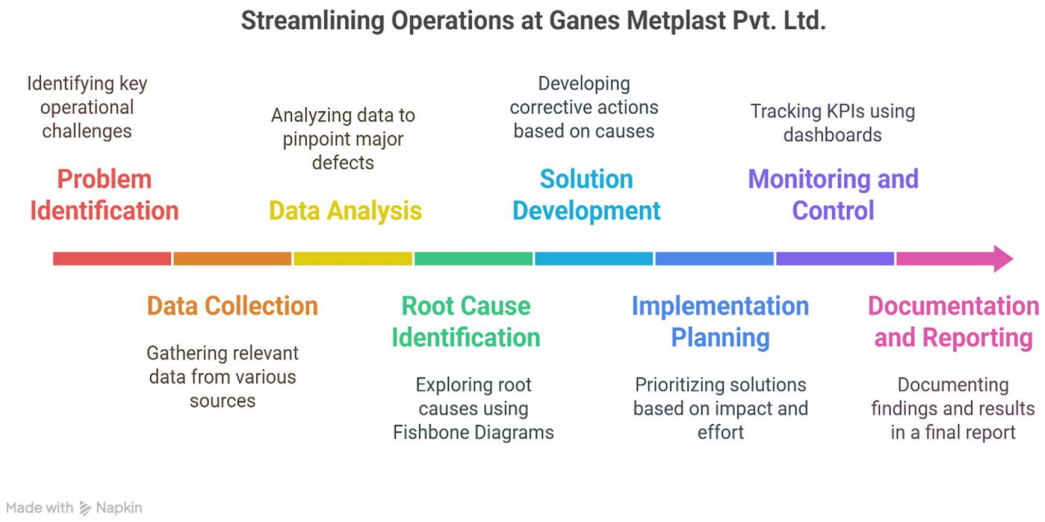


Fig1.1(Work flow chart)

ii). **GANT CHART** (Expected Timeline to complete the project)

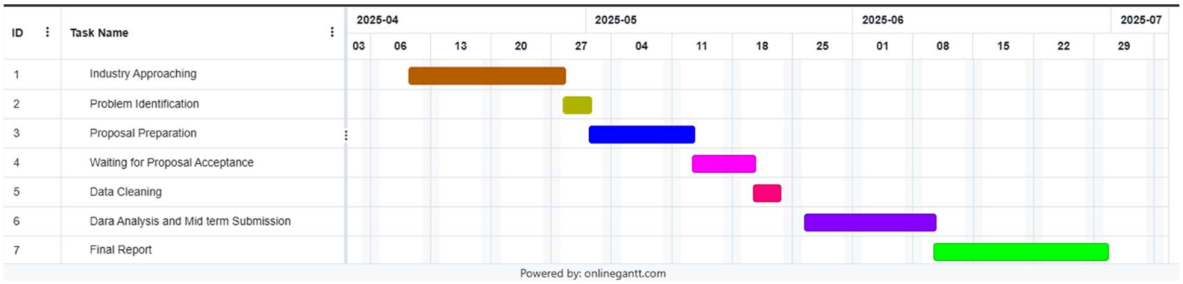


Fig1.2(Gantt chart)

7 Expected Outcome

By focusing on key challenges such as production flaws, inventory mismatches, and overall

inefficiencies, GANES METPLAST can unlock several critical improvements:

1. **Higher Product Standards**: Refining workflows will minimize errors and reduce the need for rework.
2. **Optimized Inventory Management**: Leveraging digital tracking will help maintain balanced stock levels and streamline material handling.
3. **Consistent Production Output**: Enhanced scheduling and better machine usage will bring actual performance closer to production goals.
4. **Boosted Operational Performance**: Lower downtime and effective use of resources will increase productivity and reduce operational costs.

Collectively, these upgrades will strengthen the company's market position, improve customer experience, and drive sustainable, long-term growth.