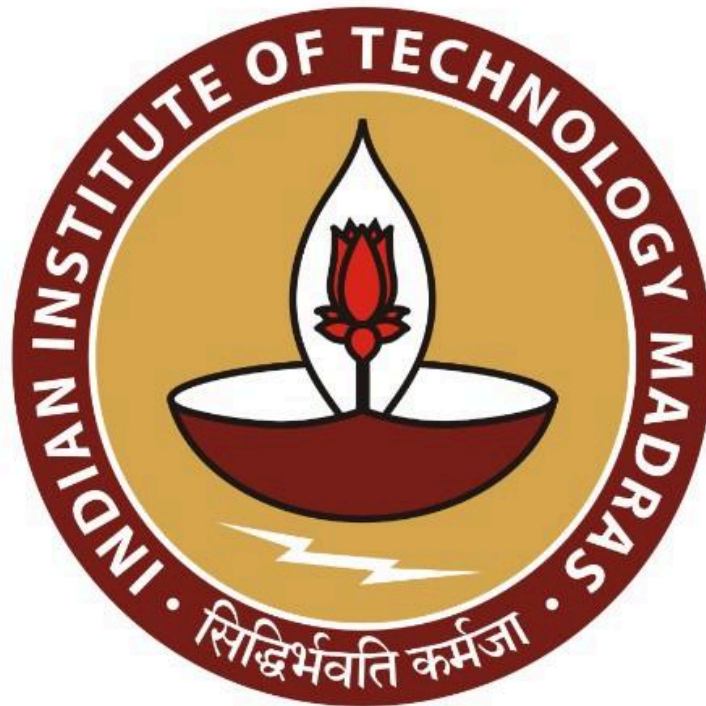# Optimizing Production and Quality in Packaging Manufacturing

A Constant Approach to Fulfilling Client Expectations

Submitted by

Name: Dwarapureddy Manasa

Roll No: 23ds3000013

IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600036

Contents

Declaration Statement

I am working on a project titled "**Optimizing Production and Quality in Packaging Manufacturing**". I extend my appreciation to NRICH PRINT PACK 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 from primary sources and carefully analyzed to assure its reliability.
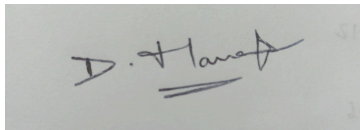
Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through analytical procedures.

I am dedicated to adhering to the principles 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 understand that all recommendations made in this project report are within the context of the academic project taken up towards course fulfillment in the BS Degree program offered by IIT Madras. The institution does not endorse any of the claims or comments.

Signature of Candidate:

Name: Dwarapureddy Manasa

Date: 02/09/2024

1. Executive Summary

This project is focused on a small manufacturing business named NRICH PRINT PACK PRIVATE LIMITED, a B2B company located in the Apparel Export Park, Autonagar, Visakhapatnam that makes Corrugated Boxes and PET Printed Pouches for B2B customers in the seafood storage sector.

The company's biggest problem is meeting client needs while maintaining high-quality standards. These consist of the gum application, printing quality, color consistency, and corrugated box material qualities such as bursting factor and compression strength. Avoiding these standards could lead to product rejections, which would be expensive and require valuable resources for businesses.

The main objective of this project is to focus on major issues across the production process to ensure that all products meet the exact specifications requested by our clients.

To overcome these challenges, this project will analyze production data to identify the main inefficient and changeable areas. A complete approach for increasing production accuracy and consistency will be developed by combining statistical analysis, process optimization, and quality control procedures. Through the implementation of error reduction and customer compliance measures, the project aims to improve the production process's overall efficiency and improve the company's profitability by decreasing waste and reducing the chance of order cancellation.

2. Organization Background

The company I am working with is Nrich Print Private Limited (NPPPL), an established manufacturing company. It was established on May 29, 2013. It is one of the private limited non-governmental organizations in India. It's been 11 years and 3 months since it started. The longest-serving directors currently on the board are Nannapaneni Radhika and Siva Rama Krishna Nannapaneni who were appointed on 29 May 2013.

It is Located in Autonagar, Andhra Pradesh, India's Apparel Export Park, it specializes in manufacturing and printing corrugated boxes and printed PET pouches.

This company is creating a place for itself in the packaging market by providing its customers with high-end, personalized solutions, mostly in the cargo and seafood storage sectors.

As a B2B company, it gathers raw materials from reliable suppliers and applies the latest technology and machinery to produce goods that follow strict industry requirements.

These packing options are required for keeping seafood fresh and high-quality during storage and shipping. Nrich Print Pack is committed to making sure that all of its goods follow strict requirements that it sets for quality, focussing on material integrity, durability, and printing quality.

3. Problem Statements

1. To improve PET pouch print quality, color matching precision, and consistency for compliance with customer specifications while delivering lower rejection rates.
    - The objective is to make sure that the printed material conforms exactly to client parameters like minimizing rejections caused by pattern sizing or color change issues.

2. To refine the gum coating process of PET pouch manufacture to achieve even thickness and faster drying, neutralizing the risk of product failures.
    - The objective is to introduce uniform gum thickness and optimum drying capability important for pouch strength and reliability.

3. To improve quality control mechanisms during the corrugated box manufacturing process.
    - To improve quality control in corrugated box manufacturing by ensuring that all major physical properties including bursting factor, compression strength, GSM, and moisture content adhere to or exceed industry standards.

4. Background of the Problem

At the moment, the biggest hurdle in front of the company is that it has to ensure consistent quality across its production for PET pouches and corrugated boxes. This is due to the very exacting nature of customer requirements, especially in terms of print quality and materials. On the inside, through hurdles come from the variability involved in manufacture—gum one a few pouches through to cardboard quality across corrugated boxes. They can cause errors in some aspects, for example, wrong color matching and incorrect box compression strength among others which may get products rejected leading to financial loss.

Outwardly, the business is under intense customer pressure for accuracy and perfection. This pressure intensifies in the context of a very competitive market where slight discrepancies can cause orders to be canceled. Further, the supply chain ingredients present threats in terms of inconsistencies within raw material quality that can trickle down to product consistency. The interaction of these factors, both internal and external to the company leads in one direction; which is that constant review needs to be carried out in its operations to always adhere strictly to what the customers demand Say. The absence of these can, in turn, tarnish the reputation and cause financial losses to the business; hence it is critical to get down to debugging as its root.

5. Problem-Solving Approach

To resolve challenges experienced by the manufacturing company with the quality and consistency of its PET pouches and corrugated boxes, a structured problem-solving process will be utilized. It will involve several data-driven, process-oriented, and continuous improvement-tye approaches.

Step -1: Data Collection:
Collecting data on production processes for PET pouches and corrugated boxes. This includes:

a. Data about Printing Accuracy, Color Matching & preparation process for Gumming at Internal physical properties of boxes (Bursting Factor, Compression Strength/GSM/Moisture).
b. Information about defects, rejections, and deviations from compliance with quality standards.
c. Data about Raw material quality metrics such as uniformity and adherence to specifications.
d. History of customer complaints, returns, and quality feedback.

I used Google Forms and Excel for data collection for individual production metrics i.e., color matching, gum application, and other QC documents.

Step -2: Analytical Tools and Methods:
When data is collected, a variety of analytical tools and methods are used to identify patterns, correlations, and root causes of the problems:

a. Descriptive Analysis: I performed a descriptive analysis of the output based on Excel and Python in summarizing key metrics like Mean thickness, Color accuracy, and Gum application rates. This will establish a minimal understanding of real-time performance.
b. Root Cause Analysis: I conducted a root cause analysis (RCA) to find out the top drivers of deviations in product quality using fishbone diagrams, Pareto charts with Tableau and Power BI, etc.
c. 2- Predictive Modeling: I employed Python Data Science & Machine Learning libraries to generate predictive models that can predict future quality issues based on historical patterns.
d. Statistical Process Control (SPC): This included control charts for significant variables such as print color fidelity and gum thickness so that real-time monitoring of these relevant parameters became possible. This allowed for deviations to be detected early and corrective actions can take place before these become widespread problems.

Step -3: Implementation of Solutions:

According to the insights gathered through data analysis, the following solutions will be executed:

a. Process Optimization: Printing, gum application, and material handling process optimization to improve consistency and minimize defects.

b. Collaborating with Suppliers: Partnering with suppliers to enhance the quality of inputs. This includes measures such as putting in place tighter quality control protocols or also implementing a Vendor Management System (VMS) to help monitor supplier performance.

c. Implementing a PDCA (Plan-Do-Check-Act) cycle to ensure the sustainability of improvements and continuous evolution of the processes based on identified data and constructive feedback.

6. Expected Timeline

- Visiting the factory owner to learn how everything works.
- Discussing current problems related to PET pouches and corrugated box making.
- Gathering data for raw materials, printing, gum applications, and box inspection.
- Pouch & Box Manufacturing Process Control Points.
- Processing and cleaning the collected raw data.
- Studying the data on color matching, gum used, drying duration as well performance indicators about box strength.
- Finding out why there is a difference in what was printed when compared against quality determination difficulties.
- Formulating Plans for how to solve the issues uncovered like quality checks, and better raw materials selection.
- Suggesting improvements to the processes to better meet client specifications.
- Collating findings, analysis, and recommendations into a single report.
- Asking for the factory owner and stakeholders to prepare this report and recommendations.
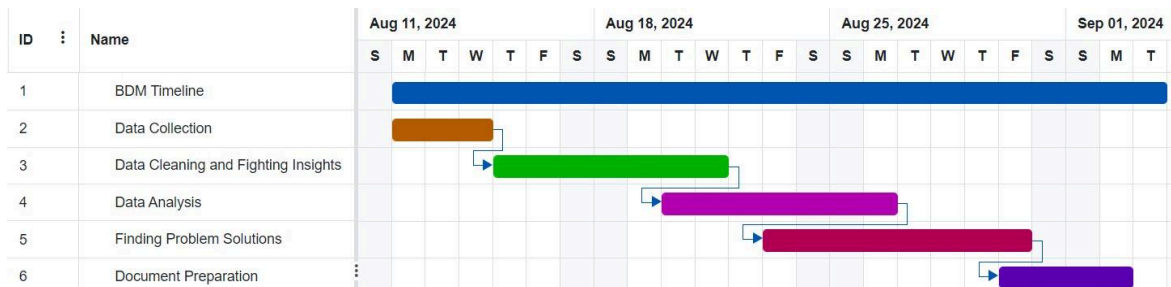
7. Expected Outcome

Overall, this project is expected to improve manufacturing efforts and end-product quality at the PET pouch and corrugated box manufacturing factory. The factory will improve on several critical parameters, including color control, printing accuracy, gum application, quality parameters, and several others. Due to this, there will be a decrease in the number of orders canceled due to failure to meet client's specifications, consequently, the factory will reduce operational costs and at the same time, increase client retention and satisfaction. Cost-saving shall be through reducing the amount of resources wastage and ensuring no rejected final products while other benefits shall emanate from a good cost/benefit ratio. Through these efforts, the PET pouch and corrugated box manufacturing factory achieves maximum operational efficiency in ensuring that products consistently meet client expectations and hence long-term relationships and profitability.