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Supply Chain Optimization for Epoxy Resins & Coating Materials at Roto Polymers and Chemicals, Chennai

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Abstract

The objective of this study is to analyze the material management and supply chain used at Roto Polymers and Chemicals to understand the material storage, control and handling methods used to deliver good material management. It studies aspects of the procurement, storage and delivery of key materials like epoxy resins and coating products, and highlights common problems associated with material flow, stock availability and warehouse management. From the company records and the company operational activities, data are gathered and analyzed using analytical tools like ABC analysis and Pareto analysis which categorizes inventories according to value and importance to prioritize critical inventory items. The study also assesses the efficiency of present process to pinpoint delays, inefficiencies and improvement points. From the analysis, suggestions for improvement have been provided which will help to improve the performance of the supply chain in the organization in terms of better control of inventory, minimization of wastage, better coordination among different departments and cost optimization and ultimately lead to better operational efficiency.

Keywords: ABC – VED Analysis, FMEA, Inventory Control, Material Movement, Supply Chain Management, Warehouse Management

Introduction

In today's industrial environment, effective supply chain management is important for maintaining smooth production and customer satisfaction. Managing inventory, storage, and movement of materials help organisations minimise delays and maximise efficiency in operations.

Roto Polymers and Chemicals, Chennai, produces epoxy resins and coating materials from different raw materials, hardeners, solvents and additives. Storage and control of these materials must be done correctly to prevent shortage, delays and handling problems.

Review f Literature

Awaad et al. (2024): Investigated the link between material supply chains and project productivity, demonstrating that effective procurement and inventory management boost productivity and minimize project expenses. Chauhan et al. (2022): Analyzed material consolidation strategies by optimization models and concluded that consolidation can lower the logistics and inventory costs but it could also prolong the lead time. In Industry 5.0, the optimization of the sustainable supply chain, Hasan et al. (2024), focused on green practices, automation and digitalization, which reduced waste, increased efficiency and competitiveness. The material supply optimization of smart manufacturing was explained by Kovács et al. (2021): Material supply optimization in smart manufacturing involves automation and digitalization, which can facilitate smarter material flow, lower error rate, and enhance operational efficiency in the production process, thereby supporting cost reduction and improving resource utilization. Sharma et al. (2023): Examined inventory management in supply chains and highlighted the benefits of adopting digital resources and classification methods for better inventory control, minimising waste and optimising operations.

The study was designed to investigate the following objectives:

- To learn the company's process in storing and controlling materials.
- To know the common problems in material handling and availability.

Research Methodology

The study is analytical in nature which aims to understand the material storage and control method adopted by Roto Polymers and Chemicals, Chennai and common problems associated with material movement and availability. The study, on which this work is based is based on the secondary data obtained from company records, inventory reports, stock registers and documents related to the study. Various tools were employed to analyze the inventory control practices and operational problems in the supply chain system, including ABC–VED Analysis and Failure Mode and Effects Analysis (FMEA).

Analyse and Interpret Data

Table 1 ABC–VED Analysis

Item Name	ABC Category	Final Category
Epoxy Resin (Bisphenol-A)	A	AV
Epoxy Resin (Novolac)	A	AV
Hardener (Amine)	A	AV
Hardener (Polyamide)	A	AV
Reactive Diluent	A	AE
Fillers (Silica)	A	AD
Fillers (Calcium Carbonate)	A	AD
Solvents (Xylene)	B	BE
Pigments (Coloring)	B	BE
Accelerator (DMP-30)	B	BE
Solvents (Toluene)	B	BE
Packing Material (HDPE Cans)	B	BD
Packing Material (Drums)	B	BD
Additives (Defoamer)	B	BE

Additives (Wetting Agent)	C	CE
Lubricants	C	CD
Cleaning Chemicals	C	CD
Release Agent	C	CD
Miscellaneous Consumables	C	CD

Source: Company Reports

Table 2 ABC Analysis

Category	Range
A	Top 70% value
B	Next 20%
C	Last 10%
Final Category	Priority
AV, AE, BV	Highest
AD, BE, CE	Medium
BD, CD	Low

Source: Company Reports

The items of inventory had been classified using the ABC–VED analysis as per annual usage +value and operational importance. The research resulted in the identification of epoxy resins, hardeners, and important chemical materials under the category AV, which were high value and critical to production. Their special care and timely restocking are essential in order not to delay the production. The B category includes medium value materials, like solvents, pigments and packing materials, which need to be reviewed periodically, and the C category includes low value materials, like lubricants and cleaning chemicals, which can be handled by routine inventory procedures. Overall, the analysis contributes to better inventory management, minimizing stock-outs and optimizing material management efficiency.

Failure Mode and Effects Analysis (FMEA)

In this project FMEA was used to identify the common problems and potential failure points encountered in the material movement and material availability in the supply chain process. It assists in learning about problems like supplier delay, stock shortage, wrong labelling, storage damage and dispatch delay. FMEA considers the severity, occurrence, and detection of each problem and then assigns the Risk Priority Number (RPN). This enables you to pinpoint problems that have to be addressed right away. FMEA helps the company to take preventive measures, minimise the operational risks and enhance material quality.

Table 3 Priority Classification

Recommented Action
Improve Suppliyer Folllow Up
Train Workers
Bettter Forcasting
Use Bar Code
Improve Transport Planing and Real Time Tracking
Improve Co Ordination
Implement Bar Code System with Double Verification

Ensure Proper Handing Procedure and Safety Training
Control Ordering

Table 4 Recommended Action

PROCESS	FAILURE MODE	RPN	PRIORITY
Receiving	Delay in raw material	270	High
Storage	Improper stacking	210	High
Inventory	Stock shortage	200	High
Storage	Wrong labeling	192	Medium
Dispatch	Late delivery	180	Medium
Movement	Delay in internal transport	175	Medium
Dispatch	Wrong material issued	144	Low
Handling	Spillage of chemicals	135	Low
Inventory	Excess stock	120	Low

Source: Company Reports

BAR CHART

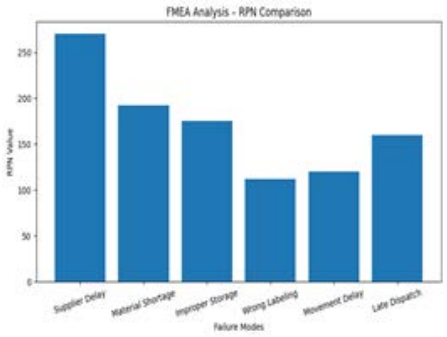

Chart 1

FMEA analysis has been performed to determine potential failures in the supply chain operations and to measure the effect of the failure on the performance of the business. The study revealed supplier delay, material shortage, wrong labelling, inadequate storage, delay in movement and delay in dispatch as major operational risk which has a impact on production efficiency and service quality. Delay in suppliers and shortage of stock were identified as very critical factors, because they directly affect production activities. These risks can be mitigated through improved supplier coordination, optimal inventory planning, clear labelling systems, standard storage procedures, and better transport management, the analysis reveals. In general FMEA assists the company in determining critical areas and implementing preventative measures to enhance the performance of the supply chain.

The following results showed in the study:

The study revealed that epoxy resins and hardeners are very critical materials for uninterrupted production activities. The same inventory control and continuous monitoring need to be maintained with these materials.

Delayed materials from suppliers was identified as a significant problem related to material

availability and production schedules. This can be minimized with good coordination of suppliers.

Interruptions in manufacturing and decrease in overall productivity due to material shortage. Having sufficient stocks can help to reduce production delays.

The risk of material damage and quality reductions may occur if the product is not stored appropriately. Safe and proper handling of materials in a warehouse is a part of standard warehousing practice.

Inventory inaccuracies and confusion in warehouse operations are caused by wrong labeling of materials. Good identification systems can enhance material traceability.

The impact of internal movement delay is on the efficiency of work flow and on the operation time of the supply chain process. More harmonization among departments will help to streamline the flow of materials.

Dispatch delay has a negative impact on customer delivery commitments and on service performance as a whole. To deliver products on time, transport planning must be done properly.

Medium value materials need ongoing stock checking, and the right reorder planning for seamless operation.

Low value consumable items can be controlled using normal stock control processes and bulk buying arrangements.

It is inferred from the study that the proper classification and risk management practices in inventory enhances the efficiency of supply chain, mitigates problems and enables improved material management performance.

Suggestions

To ensure continuity of production activities, the company should have sufficient safety stocks of critical raw materials.

Coordinating with suppliers, to minimize delays in material procurement and delivery.

The suitable stock forecasting and planning techniques should be used to maintain the availability of materials.

It is recommended to adhere to the normal warehouse storage standard to keep the material from damage and deterioration.

Effective labelling and material identification systems should be put in place to enhance inventory accuracy and handling efficiency.

A periodic inventory checkup should be made to check that stock changes are noted and inventory records are kept.

Regular monitoring of internal movement of materials should be carried out to minimise delays in the operations and to optimise the work flow.

Ensure that the dispatch scheduling and transport planning are proper to deliver the finished goods timely.

Low-value consumable goods should be purchased in a systematic way and have regular inventory control processes.

Activities within the chain should be constantly monitored and evaluated to ensure the activities are undertaken in an optimal manner and to mitigate future risks.

Conclusion

This study helped to have an understanding about the impact of supply chain and material management on the overall performance of the company. ABC–VED analysis identified the following important materials that must be properly controlled and monitored continuously to avoid production problems: From FMEA analysis, it is found that the production flow and customer satisfaction can be affected by the problems as supplier delay, shortage of materials, storage problems, and dispatch delay. The study also outlines how effective inventory management,

coordination with suppliers, and warehouse management can enhance operational efficiency and mitigate risks. In summary, good material management in the company plays a vital role in ensuring production activities are conducted smoothly and the overall performance of the company is enhanced.

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