

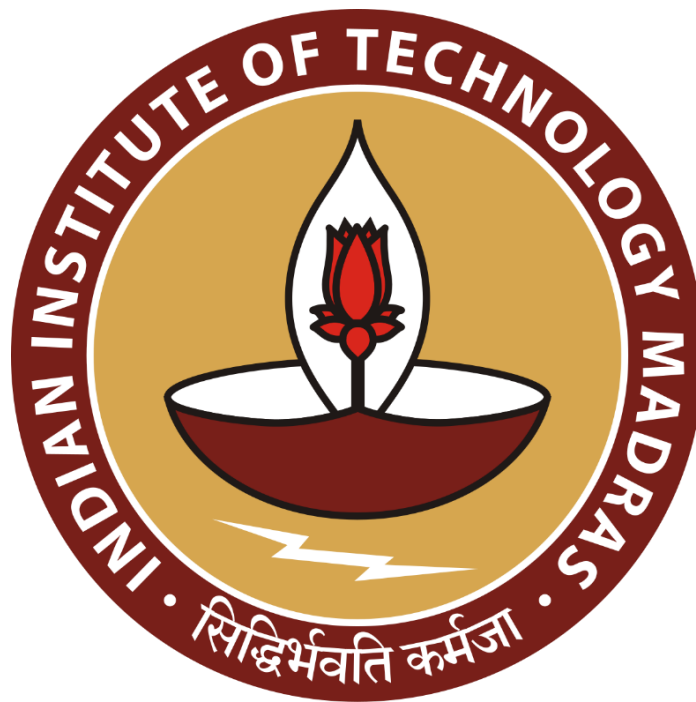
Data-Driven Packaging Optimization: Maximizing Demand, Trends, and Cost Efficiency in Packaging Industry

Mid-term submission report for the BDM Capstone Project

Submitted by

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Declaration Statement

I am working on a Project Title Data-Driven Packaging Optimization: Maximizing Demand, Trends, and Cost Efficiency in Packaging Industry. **I extend my appreciation to TechPack Solutions, 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 ensure its reliability.

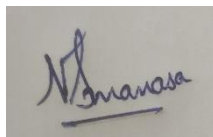
Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

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:

A square box containing a handwritten signature in blue ink. The signature appears to be 'SAI MANASA' with a horizontal line underneath.

Name: SAI MANASA NADIMPALLI

Date: 09-11-2023

Executive Summary

The "Data-Driven Packaging Optimization" project, conducted in collaboration with TechPack Solutions, an esteemed packaging company in Hyderabad, India, has reached a pivotal stage at the midterm. This initiative addresses critical challenges faced by TechPack Solutions, primarily the accurate prediction of future demand and the optimization of packaging costs.

This project has been fortified by an extensive and well-documented dataset sourced directly from TechPack Solutions, covering five years of historical data. This rich dataset includes numerical and categorical elements, providing the foundation for robust data-driven analysis.

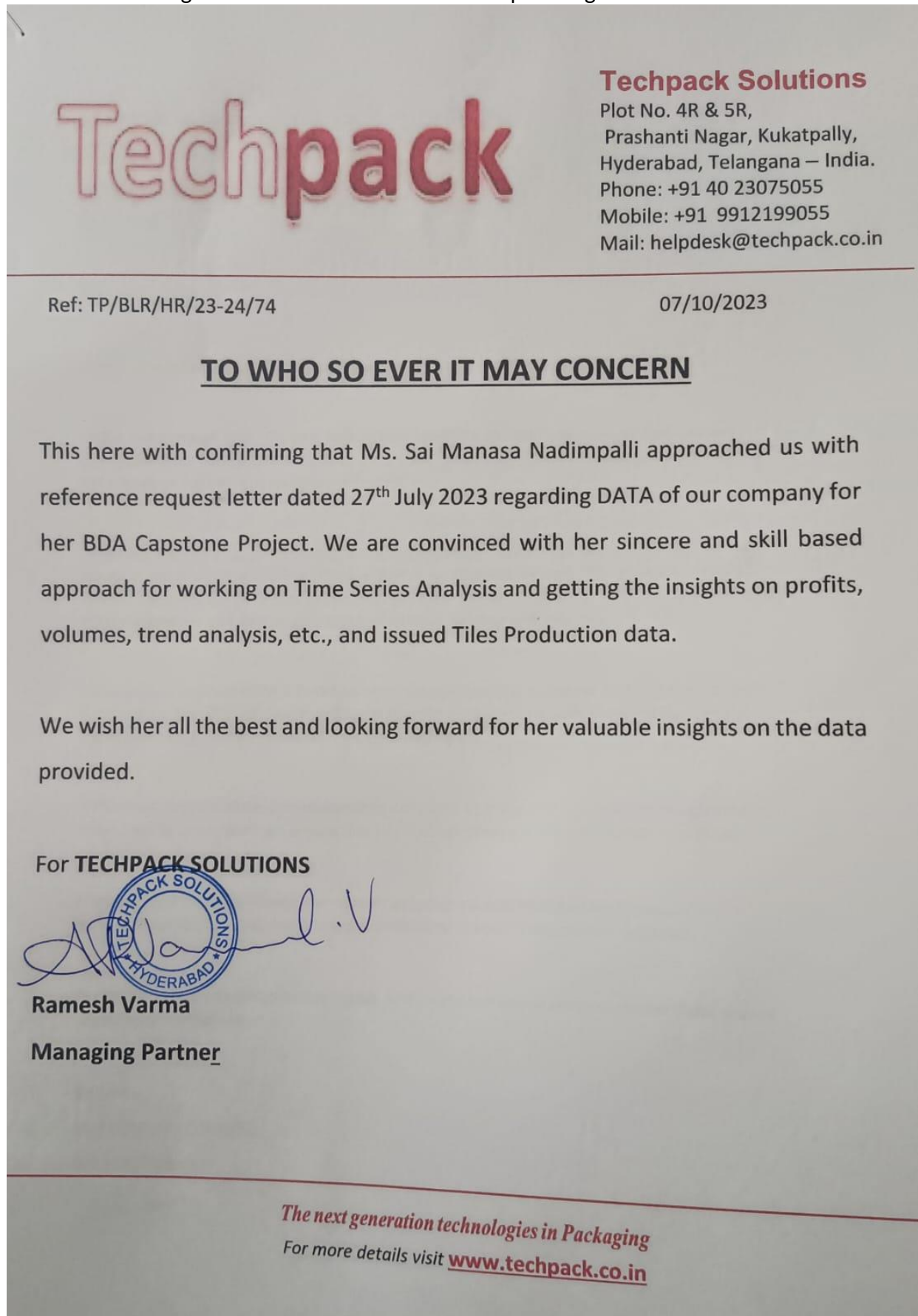
The analytical journey began with a comprehensive descriptive analysis, which revealed significant insights into demand patterns, production quantities, and regional variations. Notably, KCL SKD outshone KCL VN in terms of both production and variety, necessitating a strategic allocation of packaging and transportation resources.

Through time series analysis, we have identified seasonal trends and peak demand periods. The findings guide us in ensuring that packaging materials are readily available during high-demand phases, enhancing responsiveness.

As the project advances, our ultimate aim is to develop an interactive Looker Studio dashboard for efficient data visualization and decision-making. By midterm, this dashboard is already showing promise in enhancing data communication.

Proof of Originality of the Data

Letter from the organization in letterhead with stamp and sign



2. Images related to the organization along with your images with the founder



3. Recorded video of the founder of the organization.

Click on the link for playing the video

<https://drive.google.com/file/d/15qZDynXQ250AeYPCKH9PTxB1eUatkjrF/view?usp=sharing>

Metadata

Data Source:

The dataset has been taken directly from Techpack organization, a tile packaging company. It consists of historical data, including the tile's production, quantity, and locational information.

Link to the data source:

<https://docs.google.com/spreadsheets/d/14WmCK5XQ7kFrgoT5KHPH15zntTlrdWcG7nkGWY0NZqQ/edit?usp=sharing>

Data Format:

The data is structured as a tabular dataset which consists of different columns like location, year, month, tile size, and production quantity of the tiles.

Data Types:

The dataset includes both numerical and categorical data types. Numerical data includes the production quantity of the tiles. Categorical data encompasses location, year, month, and tile size.

Data Collection Period:

The dataset covers a timeframe of 5 years, allowing us to analyze trends, seasonal patterns, and demand variations over this period.

With data collected directly from Techpack, a packaging company, the dataset contains a rich blend of numerical and categorical data, covering a substantial 5-year timeframe. This metadata serves as a foundational element for the project, ensuring that our data-driven analysis is rooted in a well-documented and extensive dataset.

Descriptive Statistics

Total Tile Production:

The total tiles produced in the span of 5 years is calculated using Excel.

Total= 60478826

For Region KCL VN:

Tile Production for the year 2016-2017 = 4112654

Tile Production for the year 2017-2018 = 4062814

Tile Production for the year 2018-2019 = 4651230

Tile Production for the year 2019-2020 = 4386083

Tile Production for the year 2020-2021 = 3515124

The mean of tile production in KCL VN is 4145581

For Region KCL SKD:

Tile Production for the year 2016-2017 = 4646755

Tile Production for the year 2017-2018 = 5136341

Tile Production for the year 2018-2019 = 5996756

Tile Production for the year 2019-2020 = 5690828

Tile Production for the year 2020-2021 = 3317931

The mean of the tile production in KCL SKD is 4957722.5

Therefore, the mean production of tiles in KCL SKD is greater than the mean tile production in KCL VN.

Image 1:

| | LOCATION | Production Quantity |
|----|----------|---------------------|
| 1. | KCL SKD | 24,788,611 |
| 2. | KCL VN | 20,727,905 |

By referring to image 1,

Overall the production of tiles in KCL SKD is greater than the production in KCL VN so more packaging and transportation resources should be present in KCL SKD than in KCL VN.

Image 2:

| | LOCATION | TILES SIZE ▾ |
|----|----------|--------------|
| 1. | KCL SKD | 23 |
| 2. | KCL VN | 3 |

By referring to image 2,
The location KCL SKD has 23 varieties of tiles produced whereas KCL VN just had 3 different types of tiles produced.

The tiles production over the past 5 years is as follows

Image 3:

| | YEAR | Production Quantity ▾ |
|----|------|-----------------------|
| 1. | 2018 | 10,647,986 |
| 2. | 2019 | 10,076,911 |
| 3. | 2017 | 9,199,155 |
| 4. | 2016 | 8,759,409 |
| 5. | 2020 | 6,833,055 |

By referring to image 3,
The data tells us that the maximum demand for tiles was in the year 2018 and the minimum demand for tiles was in 2020

Image 4:

| | TILES SIZE | Production Quantity ▾ |
|----|------------|-----------------------|
| 1. | 600x600 | 20,787,552 |
| 2. | 600x1200 | 6,117,533 |
| 3. | 300x600x8 | 3,565,591 |
| 4. | 300x600 | 3,054,139 |
| 5. | 600x600x9 | 2,446,344 |
| 6. | 200x1200 | 2,124,845 |
| 7. | 150x600 | 1,547,693 |
| 8. | 600x300x8 | 1,421,796 |

By referring to image 4,
The data tells us that the tile size along with the production quantity.

Summary Statistics for Production Quantity:

Mean: 47561.66771

Median:2883.5

Standard Deviation

Minimum: 0

Maximum: 794922

Quartiles:

25th percentile=0

50th percentile=2883.5

75th percentile=46732

Detailed Explanation of Analysis Process/Method

In this project, we will employ a range of analytical methods to address the objectives effectively. The chosen methods include descriptive analysis, time series analysis, and cost-benefit analysis, each of which plays a crucial role in tackling the challenges faced by Techpack Solutions.

Descriptive Analysis:

Method: Descriptive analysis involves summarizing and visualizing data to understand patterns and trends. We will use this method to identify products with the highest demand over the past 2-3 years. By summarizing sales data and creating visualizations, we can pinpoint top-selling products and prioritize packaging efforts accordingly.

Objective: This method helps us find which product has the maximum demand, enabling efficient resource allocation.

Time Series Analysis:

Method: Time series analysis is essential for understanding how demand varies with time. By analyzing historical demand data, we aim to identify seasonal patterns, and trends, and accurately forecast future demand.

Objective: The identification of seasonal variations and trends in demand is critical for aligning packaging production with fluctuating demand, ensuring the timely availability of packaging materials.

Cost-Benefit Analysis:

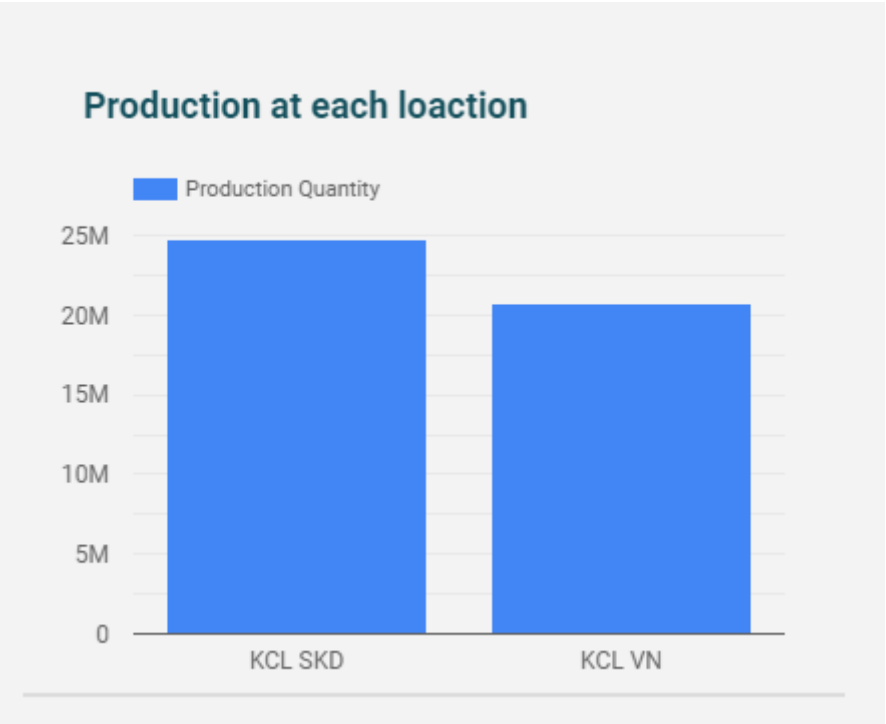
Method: Cost-benefit analysis is a fundamental tool for assessing the cost-effectiveness of different packaging options. We will use this method to optimize packaging costs without compromising product quality.

Objective: Achieving better cost optimization is vital for improving profitability.

In conclusion, these analysis methods will enable us to uncover valuable insights that address the project's objectives. Descriptive analysis and time series analysis will enhance demand forecasting. A cost-benefit analysis will help optimize costs and will shed light on the factors influencing demand. Together, these methods will contribute to data-driven packaging optimization for Techpack Solutions.

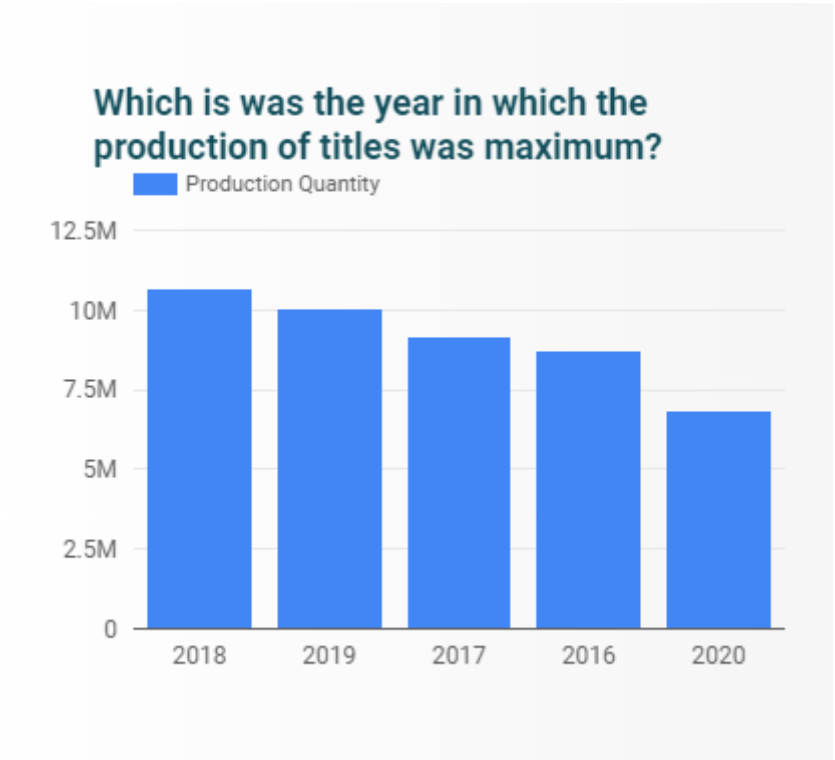
Results and Findings

Bar Chart 1



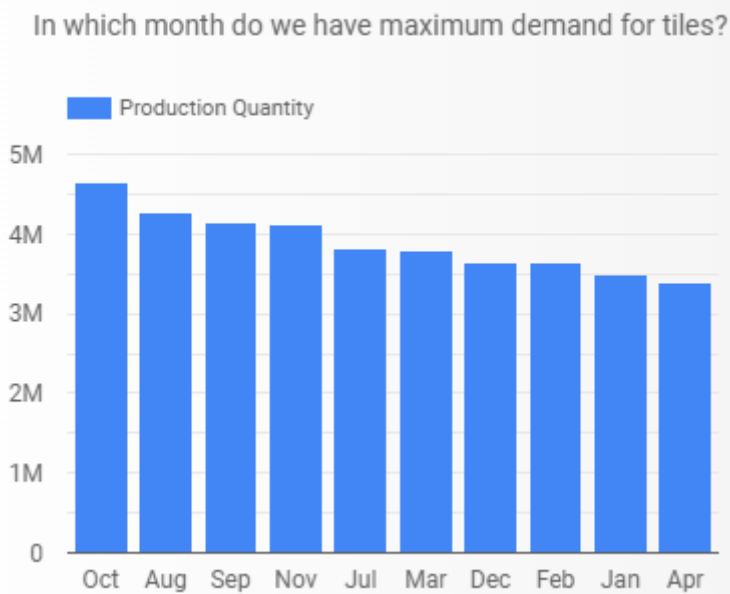
By referring Bar Chart 1,
The bar graph shows us that the tile production in the past 5 years is more in KCL SKD than in KCL VN

Bar Chart 2



By referring Bar Chart 2,
The bar graph shows us the years will maximum and minimum tile production.

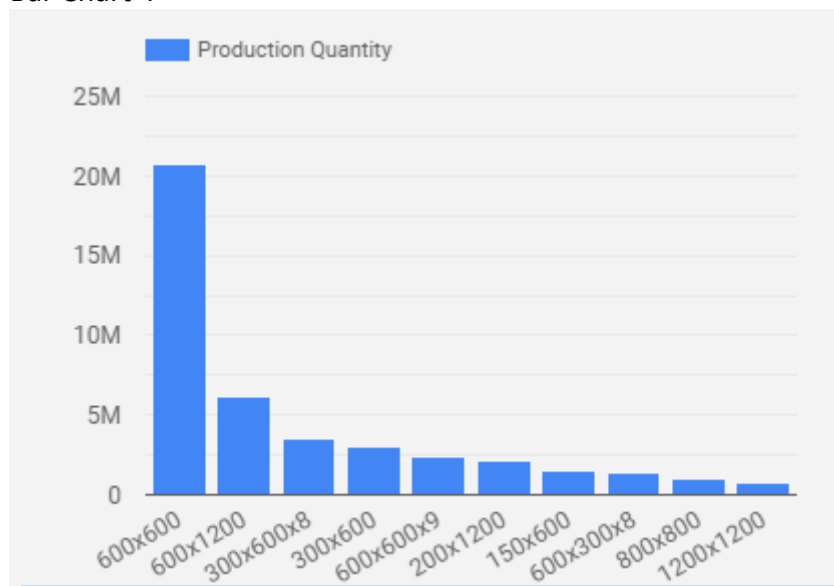
Bar Chart 3



By referring Bar Chart 3,

The above graph shows in the overall 5 years which month there is maximum demand for the tiles. The month oct is when the demand for the tile is maximum.

Bar Chart 4



By referring Bar Chart4,

The above pie plot shows us that the title of size 600x600 has the maximum demand.

Summary of recommendations so far:

Based on the findings, several actions can be taken to improve the packaging and distribution efficiency for Techpack Solutions:

Resource Allocation: Allocate more packaging and transportation resources to KCL SKD due to its higher tile production and variety. This ensures that the demands of this region are adequately met.

Inventory Management: Implement efficient inventory management strategies to match the demand trends. For example, during the peak demand periods, ensure a sufficient stock of packaging materials is available.

Tailored Packaging Solutions: Develop packaging solutions that cater to the specific tile sizes that are in high demand, such as 600x600. This tailored approach can help optimize packaging and reduce waste.

Continuous Monitoring: Real-time monitoring through tools like Looker Studio to keep track of sales trends, demand variations, and packaging performance. This ensures that the packaging process remains agile and responsive to changing circumstances.

By following these recommendations, Techpack Solutions can improve its packaging and distribution processes and enhance its overall efficiency in meeting customer demands and market trends.

Link for the looker studio dashboard created till now:

<https://lookerstudio.google.com/reporting/56709c37-c0a9-474e-b763-45b73f681cb1/page/1M>