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

Final 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.

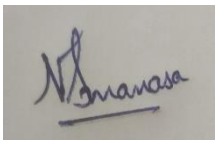
I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to ensure its reliability.

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: 

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Date: 07-12-2023

Executive Summary

This report provides a comprehensive examination of demand forecasting and packaging strategies based on historical data and market trends. Through advanced analytics and visualization tools, the analysis aims to optimize resources, enhance operational efficiency, and guide packaging decisions for TechPack Solutions. Key findings center on the high demand for 600x600 tiles, production disparities between regions, temporal variations in demand, and the need for tailored packaging solutions.

Detailed Explanation of Analysis Process/Method:

The analysis process commenced with data compilation, focusing on historical tile production, market trends, and consumer preferences. Advanced statistical methods were employed to reveal insights into tile demand variations across different dimensions such as size, type, and location. Graphical representations, including bar charts and distribution plots, were utilized to illustrate findings visually. The Looker Studio dashboard played a pivotal role in dynamically visualizing data trends, offering real-time insights.

Results and Findings (Graphs and other Pictorial Representation Preferred and with words):

Finding which product has the maximum demand (Figure 4): The analysis highlights that tiles of size 600x600 exhibit the highest demand, offering a crucial opportunity for tailored packaging solutions. Insights from Figure 4 guide packaging contracts, ensuring alignment with consumer preferences.

Understanding Different Market Trends: Various trends, including the popularity of larger format tiles and the rise of digital and wood-look tiles, were identified. Recommendations emphasize staying updated on these trends for product development and marketing.

Tile Production by Region (Figure 1): Notable production disparities between KCL SKD and KCL VN underscore the need for strategic resource allocation. The findings guide decisions on staffing, packaging materials, and transportation capacities.

Maximum and Minimum Tile Production Years (Figure 2): 2018 emerges as a year of peak demand, prompting exploration into driving forces. Conversely, 2020 signifies reduced demand, necessitating investigations into contributing factors.

Monthly Demand Variation (Figure 3): October consistently sees peak demand, urging proactive measures for inventory management and resource planning during this period.

Tile Variety Distribution In Various Locations (Figure 5): Diversity in tile production between KCL SKD and KCL VN necessitates tailored packaging solutions. Strategic resource allocation becomes imperative, considering the range of tile shapes and sizes.

Interpretation of Results and Recommendation:

The findings collectively suggest a need for tailored packaging solutions for high-demand tile sizes, strategic resource allocation based on production dynamics, an adaptive inventory management approach, and proactive planning for peak demand periods. The insights derived from Looker Studio's dynamic dashboard serve as a compass, guiding TechPack Solutions toward more informed and strategic decision-making.

Presentation and Legibility of the Report:

The report is presented coherently, employing visualizations for clarity. Graphs and charts aid in interpreting complex data, while the Looker Studio dashboard snapshot demonstrates the technological prowess in data visualization. The use of clear language enhances legibility, ensuring that both technical and non-technical stakeholders can comprehend the findings and recommendations effectively. The organized structure of the report facilitates a logical flow of information, enhancing its overall readability.

Detailed Explanation of Analysis Process/Method

Data Source Link:
https://docs.google.com/spreadsheets/d/1Vt95p_OcbgVsMDjPrzyS9wpRKYJPeRxusXTc7BGV9_8/edit#gid=0

Finding which product has the maximum demand

Data Collection:

- Collect comprehensive sales data, sales quantities, and dates of sale.
- Ensure the dataset covers a meaningful timeframe, such as 2-3 years, to capture trends.

Data Cleaning and Preprocessing:

- Address any missing or inconsistent data.
- Standardize product identifiers and ensure consistency in naming conventions.

Aggregate Sales Data:

- Summarize the sales data to aggregate the total quantity sold for each product.
- Group the data by product name to consolidate sales information.

Rank Products Based on Total Sales:

- Rank products based on the total quantity sold in descending order.
- Identify the top-performing products with the highest sales quantities.

Time Series Analysis:

- Conduct a time series analysis to understand how demand for each product fluctuates over time.
- Look for patterns, trends, and seasonality in the sales data.

Customer Preferences Analysis:

- Explore customer preferences by analyzing sales data based on product features, categories, or any relevant attributes.

- Identify if certain product categories consistently outperform others.

Visualization:

- Create visual representations, such as bar charts or line graphs, to illustrate the sales performance of different products.
- Use color-coding or labels to highlight the top-selling products.

Interactive Dashboard (Optional):

- Develop an interactive dashboard using tools like Looker Studio to allow stakeholders to explore and interact with the data dynamically.
- Include filters for time periods, product categories, or specific products.

Understanding the different market trends over years

Define Objectives:

- Clearly outline your research objectives. Understand the specific information you seek, such as popular tile sizes, materials, and the impact of COVID-19 on the market.

Identify Data Sources:

- Locate reliable data sources, including government reports, market research firms, industry associations, and online platforms. Ensure the sources provide relevant and up-to-date information.

Research Market Reports:

- Access market reports focused on the construction and tile industry in India. Look for comprehensive reports that include data on market size, trends, and forecasts related to tile sizes and materials.

Analyze Consumer Behavior:

- Investigate consumer preferences through surveys, interviews, or online forums. Understand the factors influencing tile size choices, including design trends and lifestyle changes.

Synthesize and Draw Conclusions:

- Compile and synthesize the gathered data. Identify patterns, trends, and correlations. Conclude prevailing market trends for tile sizes in India and, if applicable, make recommendations based on your analysis.

Understanding how the demand of products varies over years and months

Time Series Analysis:

Method: Utilize historical sales data over time to identify patterns, trends, and fluctuations in demand.

Analysis: Plot the time series data on a graph to visually inspect trends and seasonality. Apply statistical methods such as moving averages or exponential smoothing to smooth out noise and highlight underlying patterns.

Seasonal Analysis:

Method: Break down the time series data into seasonal components to understand recurring patterns within specific time periods (e.g., months or quarters).

Analysis: Use techniques like seasonal decomposition to separate the data into trend, seasonal, and residual components. Examine seasonal patterns and identify months or seasons with higher or lower demand.

Graphical Analysis:

Method: Create graphical representations of the data, such as line charts, bar charts, or histograms, to visualize trends and patterns.
Analysis: Plot monthly or yearly sales figures on a graph to observe any trends or recurring patterns. Highlight key events or factors that coincide with changes in demand, such as promotions, holidays, or economic events.

Accurate demand forecasting / Analyzing both the company and customer perspectives

Graphical Analysis:

Method: Create graphical representations of historical sales data to visually identify products with maximum demand.
How: Use bar charts, line graphs, or pie charts to display sales figures for different products over time. Identify spikes or consistently high levels of demand for specific products.

Time Series Analysis:

Method: Analyze historical sales data over time to identify trends and patterns.
How: Plot the sales data on a time series graph. Look for consistent growth, decline, or recurring patterns. Identify products that consistently show high demand over the selected period.

Seasonal Analysis:

Method: Evaluate seasonal variations in demand for products.
How: Break down historical sales data into seasons (e.g., months or quarters) and analyze trends within each season. Identify products that exhibit seasonal spikes in demand, indicating periods of high consumer interest.

Product Contribution Analysis:

Method: Assess the contribution of each product to overall sales.
How: Calculate the percentage contribution of each product to total sales. Identify products that consistently contribute a significant portion of total revenue, as this indicates high demand.

Pareto Analysis (80/20 Rule):

Method: Identify the vital few products that contribute the majority of sales.
How: Apply the Pareto Principle (80/20 rule) to identify the top 20% of products that contribute to 80% of total sales. Focus on accurately forecasting demand for these key products.

Historical Peak Analysis:

Method: Identify historical peak demand periods for each product.
How: Examine historical data to find instances where specific products experienced significant spikes in demand. This analysis helps identify products that are likely to have high demand during similar periods in the future.

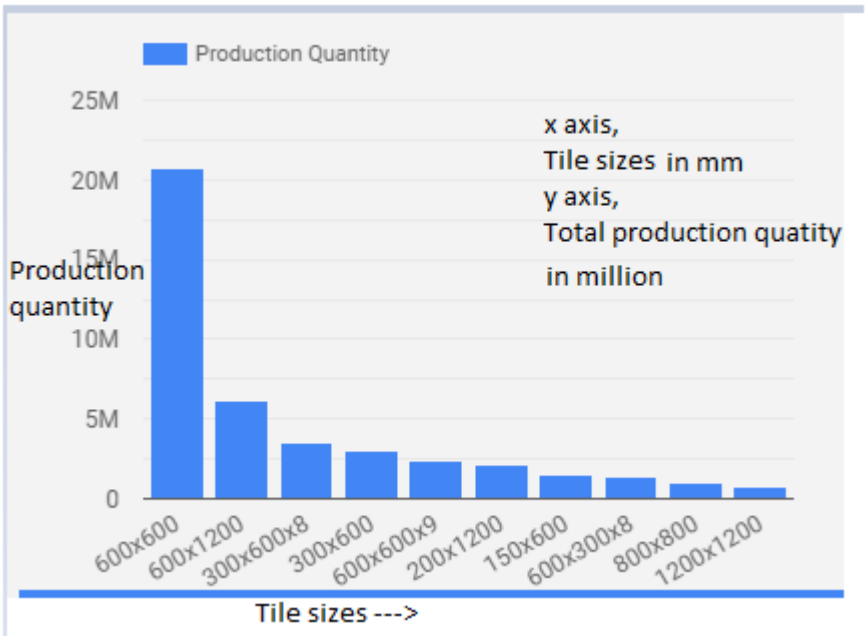
Results and Findings (Graphs and other Pictorial Representation Preferred and with words)

Finding which product has the maximum demand

Tile Size Distribution:

Description: The plot visualizes the distribution of tile sizes, with a focus on the size with the highest demand.

Figure 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

The insights gleaned from Figure 4 shed light on a crucial facet of demand dynamics within the tile market — tiles of size 600x600 stand out as the clear frontrunners in terms of consumer preference and demand. This finding signifies a pivotal opportunity for TechPack Solutions to implement tailored packaging solutions, specifically designed to optimize resources and cater to the unique characteristics of this highly sought-after tile size.

Implementing tailored packaging solutions involves a strategic collaboration with packaging designers and suppliers to create packaging that aligns precisely with the

dimensions, aesthetics, and protection requirements of 600x600 tiles. By doing so, TechPack Solutions can streamline its packaging processes, minimize waste, and enhance overall operational efficiency.

Moreover, this insight serves as a guidepost for inventory management, emphasizing the need for a more robust and targeted approach to packaging materials for the 600x600 tile size. This tailored strategy not only meets market demands more effectively but also positions TechPack Solutions as a responsive and adaptive player in the industry.

In essence, the findings from Figure 4 pave the way for a proactive and efficient packaging strategy, where customization becomes the key to resource optimization. TechPack Solutions can capitalize on this insight to not only meet current consumer preferences but also to stay ahead of market trends, ensuring sustained relevance and competitiveness in the tile packaging landscape.

Understanding the different market trends over years

Standard Sizes:

- 600x600 mm
- 800x800 mm
- 1200x600 mm
- 300x300 mm
- 300x600 mm

Popular Types:

- Porcelain tiles
- Ceramic tiles
- Vitrified tiles
- Digital tiles

Trends:

- Larger format tiles (600x600mm, 800x800 mm and 1200x600 mm) have been gaining popularity for a more modern and spacious look.
- Digital tiles with various designs and patterns have become trendy, allowing for customization.
- Wood-look tiles have gained popularity for their aesthetic appeal and durability.

Market Dynamics:

- The Indian tile market has been growing steadily, driven by factors such as urbanization, increasing disposable income, and a booming real estate sector.
- Rural areas have also witnessed growth in tile consumption due to government initiatives and improved infrastructure.

Impact of COVID-19:

- The COVID-19 pandemic initially led to disruptions in the supply chain, affecting the construction and real estate sectors.
- The lockdowns and economic uncertainties temporarily slowed down construction activities and consumer spending.
- However, the home improvement sector saw increased activity as people

spent more time at home, leading to a surge in demand for tiles and other renovation materials.
- Digital platforms became crucial for product selection and purchasing during lockdowns.

Consumer Preferences:
- Consumers have become more conscious of quality, durability, and design aesthetics.
- Energy-efficient and easy-to-maintain tiles are gaining popularity.

Environmental Considerations:
- There is a growing trend towards eco-friendly and sustainable tiles, driven by environmental consciousness.

Understanding how the demand of products varies over years, months and areas

Tile Production by Region:

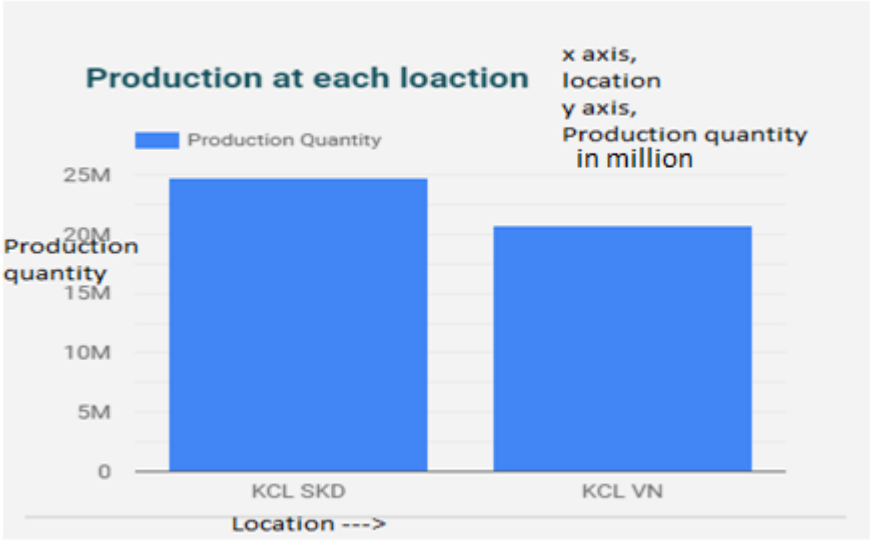
Description: The bar chart visually represents the total tile production over the past five years, highlighting the production disparity between KCL SKD and KCL VN.

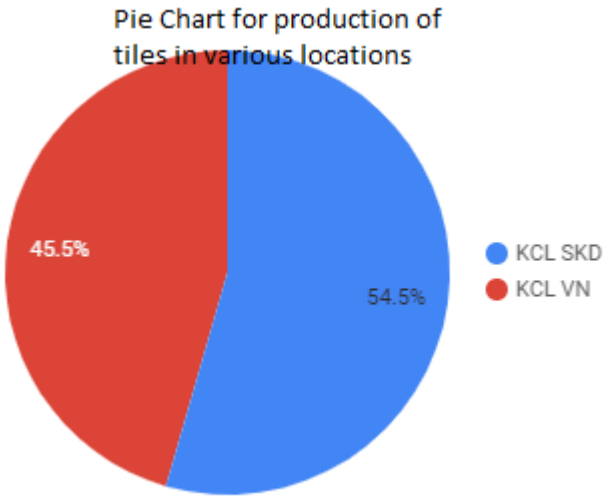
Total Tile Production:
The total tiles produced in the span of 5 years is 60478826

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 the 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

Figure 1





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

The findings from Figure 1 reveal a consistent and notable production disparity between KCL SKD and KCL VN in the realm of tile manufacturing. KCL SKD consistently outperforms its counterpart, KCL VN, in both the quantity and variety of tiles produced. This discrepancy highlights a crucial aspect of the production landscape that warrants careful attention and strategic resource allocation.

The observed performance gap implies that KCL SKD is a key driver of overall production within the context of TechPack Solutions. The higher production rates and broader variety of tiles in KCL SKD underscore its significance in the production ecosystem. Consequently, addressing the demands of KCL SKD becomes pivotal to meeting overall market requirements effectively.

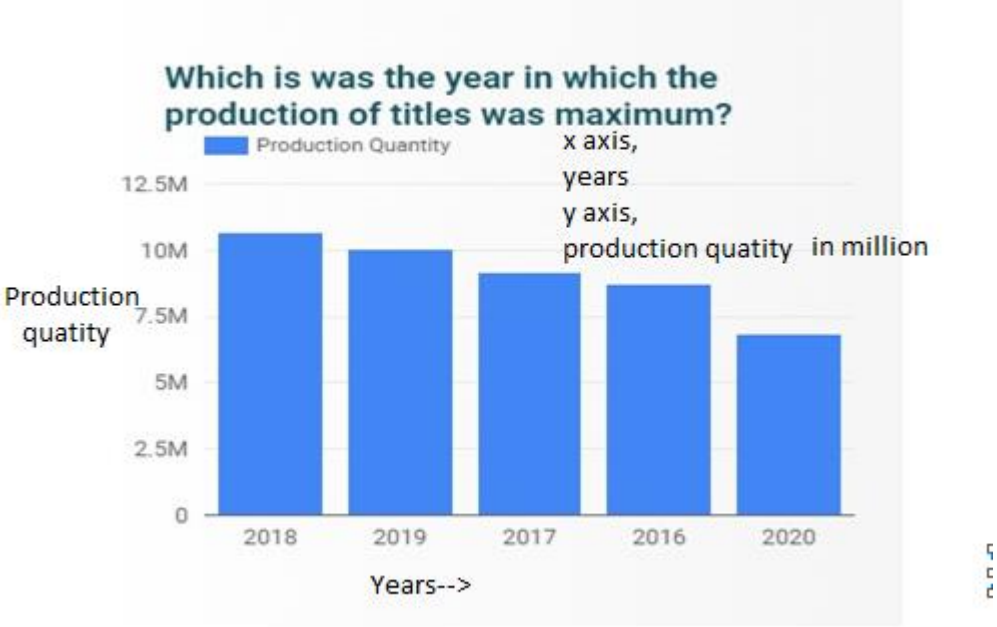
To elaborate on the need for strategic resource allocation, it is imperative to recognize

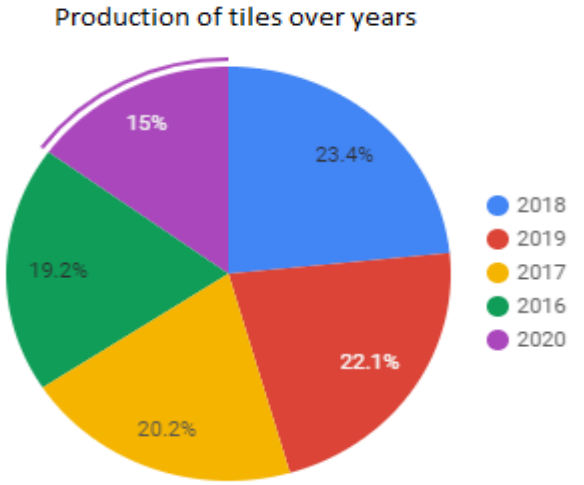
that resource allocation is not a one-size-fits-all endeavor. Given the distinct production dynamics of KCL SKD, a tailored approach is necessary. This involves assessing and adjusting various facets of resource allocation, including but not limited to staffing, packaging materials, and transportation capacities.

Maximum and Minimum Tile Production Years:

Description: This bar chart illustrates the years with the maximum and minimum tile production, providing insights into production trends.

Figure 2





	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

The insights gleaned from Figure 2 provide a nuanced understanding of the temporal variations in tile demand. Notably, the year 2018 emerges as a pinnacle of demand, while 2020 signifies a downturn. These fluctuations bear significant implications for inventory management within TechPack Solutions.

The heightened demand in 2018 prompts an exploration into the driving forces behind this peak. Potential influencers may include market trends, economic conditions, or specific events that propelled increased consumer requirements. Unpacking these elements enables TechPack Solutions to align inventory strategies, anticipating and capitalizing on analogous trends in subsequent years.

Conversely, the identification of 2020 as a year of diminished demand necessitates an investigation into contributing factors. Economic downturns, global events, or shifts in consumer preferences could be at play. Understanding these elements empowers TechPack Solutions to proactively tailor inventory levels and production planning, mitigating the impact of reduced demand periods.

These insights underscore the importance of an adaptive inventory management approach. Rather than adhering to static strategies, TechPack Solutions can leverage data-driven forecasting models that consider historical fluctuations, seasonal patterns, and external factors influencing consumer behavior. In essence, Figure 2 acts as a compass guiding TechPack Solutions towards a more responsive and agile inventory management strategy, enhancing its ability to navigate both peak and reduced demand scenarios.

Monthly Demand Variation:

Description: The bar chart displays the monthly demand variation over the five-year period, identifying the month with the maximum tile demand.

Figure 3

The revelation from Figure 3 underscores the temporal dimension of tile demand, with October consistently emerging as the zenith of this pattern. This insight is pivotal for TechPack Solutions, as it illuminates a concentrated timeframe of heightened

demand, signifying a crucial juncture for strategic resource planning.

Understanding October as a peak demand period allows TechPack Solutions to fine-tune its inventory and packaging strategies. It implies a need for proactive measures, such as ensuring an ample stockpile of packaging materials leading up to October, streamlining production schedules, and fortifying supplier relationships to accommodate the surge in demand. By aligning resource allocation with this recurring pattern, TechPack Solutions enhances its preparedness and responsiveness during these critical periods.

Moreover, this insight provides a foundation for dynamic and adaptive strategies, acknowledging the seasonality inherent in tile demand. As a result, TechPack Solutions can optimize its packaging processes, ensuring not only the availability of materials but also the efficiency of operations during the high-demand month. In essence, Figure 3 serves as a compass guiding TechPack Solutions towards a more informed and strategic approach to packaging resource management, enhancing its capacity to navigate the peaks of demand successfully.

Tile Varies Distribution In Various Locations:

Description: The plot visualizes the variety of tile sizes across locations.

Figure 5

	LOCATION	TILES SIZE
1.	KCL SKD	23
2.	KCL VN	3

The insights gleaned from Figure 5 present a compelling narrative of the diversity in tile production between KCL SKD and KCL VN, shedding light on critical aspects of TechPack Solutions' operations. Notably, KCL SKD emerges as a production powerhouse with an impressive array of 23 tile varieties, while KCL VN lags behind with a more limited selection of just 3 types.

This discrepancy in tile variety holds profound implications for strategic decision-making. The extensive range at KCL SKD suggests a nuanced understanding of market demands and an ability to cater to diverse customer preferences. In contrast, the limited variety at KCL VN may indicate a more focused production approach or potential untapped opportunities for diversification.

For TechPack Solutions, the challenge lies in aligning packaging strategies with the unique production landscapes of each location. The rich diversity at KCL SKD necessitates packaging solutions that can accommodate a multitude of tile shapes and sizes, ensuring efficiency and minimizing waste. On the other hand, KCL VN's more streamlined production allows for a potentially more standardized packaging approach.

Strategic resource allocation comes to the forefront as a key consideration. Given KCL SKD's robust production and variety, allocating more packaging and transportation resources to this location becomes imperative. This ensures that the packaging processes are finely tuned to meet the higher demand and diverse product range,

enhancing operational efficiency.

Furthermore, this diversity in tile production highlights an opportunity for TechPack Solutions to tailor its packaging solutions to specific tile types. Customized packaging for different varieties can lead to optimized processes, reduced material waste, and potentially enhanced customer satisfaction.

In essence, the findings underscore the importance of recognizing and leveraging the nuances within TechPack Solutions' production locations. Strategic resource allocation and tailored packaging solutions can position the company to not only meet existing demand but also adapt dynamically to the evolving landscape of customer preferences and market trends.

Accurate demand forecasting

Tile Size Distribution:

- Insight: Tiles of size 600x600 are in high demand.
- Recommendation: Implement tailored packaging solutions for 600x600 tiles to optimize resources. Collaborate with designers and suppliers for precise packaging that aligns with dimensions and aesthetics.

Understanding Different Market Trends:

- Insights:
- Larger format tiles (600x600 mm, 800x800 mm, and 1200x600 mm) are popular for a modern look.
- Digital tiles with designs and patterns are trendy.
- Wood-look tiles are popular for aesthetic appeal and durability.
- Recommendation: Stay updated on these trends for product development and marketing. Consider offering eco-friendly and sustainable tile options.

Tile Production by Region:

- Insight: KCL SKD consistently outperforms KCL VN in tile production.
- Recommendation: Allocate resources strategically based on production dynamics. Tailor resource allocation, including staffing and packaging, to meet the demands of KCL SKD effectively.

4. Maximum and Minimum Tile Production Years:

- Insight: 2018 had peak demand, while 2020 experienced a downturn.
- Recommendation: Adopt an adaptive inventory management approach. Leverage data-driven forecasting models to anticipate trends and adjust inventory levels. Consider economic conditions and consumer preferences.

5. Monthly Demand Variation:

- Insight: October consistently sees peak demand.
- Recommendation: Plan for heightened demand in October. Ensure sufficient packaging materials, streamline production schedules, and fortify supplier relationships to meet demand efficiently.

6. Tile Variety Distribution in Various Locations:

- Insight: KCL SKD has a diverse range of 23 tile varieties, while KCL VN has only 3.

- Recommendation: Allocate more packaging and transportation resources to KCL SKD. Consider customizing packaging solutions to accommodate the diverse range of tile shapes and sizes. Explore opportunities for diversification at KCL VN.

Analyzing both the company and customer perspectives:

Company Perspective Analysis:

Tile Size Distribution:

- Insight: Tiles of size 600x600 have the highest demand.
- Recommendation: Implement tailored packaging solutions for 600x600 tiles. Collaborate with designers and suppliers for precise packaging, optimizing resources and enhancing operational efficiency.

2. Tile Production by Region (Figure 1):

- Insight: KCL SKD consistently outperforms KCL VN in both quantity and variety.
- Recommendation: Allocate resources strategically. Tailor resource allocation, including staffing, packaging materials, and transportation, to meet the demands of KCL SKD effectively.

3. Maximum and Minimum Tile Production Years (Figure 2):

- Insight: 2018 had peak demand, while 2020 experienced a downturn.
- Recommendation: Adopt an adaptive inventory management approach. Leverage data-driven forecasting models to anticipate trends, adjusting inventory levels based on economic conditions and consumer preferences.

Customer Perspective Analysis:

Tile Size Distribution (Figure 4):

- Insight: Tiles of size 600x600 are preferred by consumers.
- Recommendation: Tailor packaging solutions to meet consumer preferences. Focus on aesthetics, dimensions, and protection requirements for 600x600 tiles to enhance customer satisfaction.

Understanding Different Market Trends:

- Insights: Larger format tiles are popular for a modern look.
- Digital tiles with designs are trendy.
- Wood-look tiles are in demand for aesthetic appeal and durability.
- Recommendation: Align product development and marketing with market trends. Consider offering eco-friendly and sustainable tile options to meet growing environmental consciousness.

Monthly Demand Variation (Figure 3):

- Insight: October consistently sees peak demand.
- Recommendation: Plan for heightened demand in October. Ensure sufficient packaging materials, streamline production schedules, and fortify supplier relationships to meet customer demands efficiently.

4. Tile Variety Distribution in Various Locations (Figure 5):

- Insight: KCL SKD has a diverse range of 23 tile varieties, while KCL VN has only 3.
- Recommendation: Acknowledge and leverage the diversity in production locations. Tailor packaging solutions to accommodate the range of tile shapes and sizes at KCL SKD. Consider opportunities for diversification at KCL VN to cater to varied customer preferences.

Other Findings

Summary Statistics - Production Quantity:

The summary statistics offer a comprehensive glimpse into the distribution and characteristics of the production quantity data. Understanding these key metrics is instrumental in deciphering the variability and patterns inherent in the dataset, thereby informing strategic decision-making processes for TechPack Solutions.

Mean (Average):
The mean production quantity, calculated at 47,561.67, represents the central tendency of the dataset. It provides a general sense of the average production quantity over the specified time frame.

Median (Middle Value):
With a median of 2,883.5, this metric is less influenced by extreme values, offering a robust measure of the central position of the production quantity data. It indicates that half of the observed production quantities fall below this value, while the other half lies above it.

Minimum and Maximum:
The minimum value of 0 signifies the lowest recorded production quantity, emphasizing the existence of instances with no production. On the contrary, the maximum value of 794,922 represents the pinnacle of production quantity within the dataset.

These statistics collectively contribute to a nuanced understanding of the dataset's distribution. For instance, the stark contrast between the mean and median suggests potential skewness in the production quantity data, indicating the presence of outliers or extreme values that might influence the overall average. Analyzing these metrics aids in identifying trends, assessing the dataset's reliability, and laying the foundation for more informed decisions related to production planning, resource allocation, and overall operational efficiency for TechPack Solutions.

Looker Studio Dashboard Snapshot:

Looker Studio Link: BDA Capstone Project (google.com)

Description: An excerpt from the Looker Studio dashboard showcasing dynamic visualizations, charts, and graphs for efficient data communication and decision-making.

Looker Studio Dashboard Snapshot

At the intersection of technology and strategy lies the development of the Looker Studio dashboard. This isn't just a technological addendum; it's a transformative tool envisioned to be the nerve center of data visualization and decision-making. The

dashboard is not a passive interface; it's an interactive canvas, designed to empower users with real-time insights.

Tool Selection: The choice of Looker Studio as the visualization tool is not arbitrary. It's a strategic selection grounded in the tool's prowess in creating dynamic and interactive dashboards. This isn't just a tool; it's a canvas where data comes alive.

Data Integration: The dataset, the lifeblood of the project, seamlessly integrates into Looker Studio. This isn't just a data connection; it's a technological fusion, ensuring that the dashboard is not just reflective but predictive of packaging dynamics.

Dashboard Design: The design of the dashboard goes beyond aesthetics; it's about creating an intuitive and user-friendly interface. This isn't just graphic design; it's user experience engineering, ensuring that every click is a step towards informed decision-making.

Interactivity: The dashboard isn't static; it's interactive. Users aren't passive observers; they are active participants, navigating through data landscapes, uncovering insights, and making decisions in real-time. This isn't just a dashboard; it's a cockpit for packaging strategy.

As the Looker Studio dashboard takes shape, it becomes more than a technological artifact; it becomes a beacon of efficiency. Even at the midterm stage, its promise is palpable, offering a glimpse into a future where data isn't a puzzle but a story waiting to be told.
Summary of Recommendations:

Based on the findings, several actions can be taken:

Allocate More Resources to KCL SKD:
Adjust staffing, materials, and transportation resources to align with the higher production in KCL SKD.

Implement Efficient Inventory Management Strategies:
Use insights from production trends and monthly demand variations to optimize inventory levels during peak periods.

Develop Tailored Packaging Solutions for High-Demand Tile Sizes:
Collaborate with packaging designers to create customized solutions for the most in-demand tile sizes, particularly 600x600.

Continuously Monitor and Update Strategies Using Tools Like Looker Studio:
Leverage the Looker Studio dashboard for real-time monitoring, updating strategies to adapt to changing market dynamics.

Interpretation of Results and Recommendation:

1. Tailored Packaging Solutions for High-Demand Tile Sizes (Figure 4):

Solution:

- Collaborate with packaging designers and suppliers to create customized packaging for 600x600 tiles.
- Consider innovative designs that align with market preferences and enhance the visual appeal of the product.

Recommendation:

- Optimize packaging processes specifically for 600x600 tiles to minimize waste and improve overall efficiency.
- Conduct regular reviews to ensure that the packaging design remains aligned with evolving consumer preferences.

2. Staying Updated on Market Trends (Market Trends Section):

Solution:

- Establish a dedicated team to monitor market trends, including larger format tiles, digital tiles, and wood-look tiles.
- Engage in market research and attend industry events to stay informed about emerging trends.

Recommendation:

- Incorporate popular trends into product development and marketing strategies to meet consumer demands.
- Regularly update product offerings to reflect current market preferences.

3. Strategic Resource Allocation (Tile Production by Region - Figure 1):

Solution:

- Conduct a detailed analysis of resource allocation, considering staffing, packaging materials, and transportation capacities.
- Tailor resource allocation strategies based on the specific production dynamics of each region.

Recommendation:

- Allocate more resources, including packaging and transportation, to KCL SKD due to its higher production rates.
- Regularly assess and adjust resource allocation strategies to accommodate changing production demands.
-

4. Adaptive Inventory Management (Maximum and Minimum Tile Production Years - Figure 2):

Solution:

- Implement an adaptive inventory management system that considers historical fluctuations, seasonal patterns, and external factors.
- Utilize data-driven forecasting models to anticipate trends and adjust inventory levels proactively.

Recommendation:

- Develop contingency plans for both peak demand periods (e.g., 2018) and reduced demand periods (e.g., 2020).
- Regularly review and update inventory management strategies based on economic conditions and consumer preferences.

5. Monthly Demand Variation (Figure 3):
Solution:

- Implement a dynamic production schedule that aligns with monthly demand variations, with a specific focus on the peak demand month (October).
- Strengthen supplier relationships to ensure a seamless flow of materials during high-demand periods.

Recommendation:

- Plan for increased production and packaging activities leading up to October.
- Conduct regular reviews of the monthly demand patterns to fine-tune production schedules.

6. Diverse Range of Tile Varieties (Tile Variety Distribution - Figure 5):

Solution:

- Develop a customized packaging approach that can accommodate the diverse range of tile shapes and sizes at KCL SKD.
- Explore opportunities for diversification at KCL VN to expand the variety of tiles produced.

Recommendation:

- Allocate additional packaging and transportation resources to KCL SKD to meet the demands of a broader product range.
- Consider introducing new tile varieties at KCL VN to tap into untapped market opportunities.

7. Analyzing Outliers and Extreme Values (Summary Statistics):

Solution:

- Conduct a detailed analysis of outliers and extreme values to understand the factors contributing to these variations.
- Implement data cleansing techniques to improve the accuracy of production planning.

Recommendation:

- Regularly monitor and address outliers to ensure that production quantity data is more reliable.
- Utilize statistical tools to identify and manage extreme values effectively.

8. Leveraging Looker Studio for Data Visualization (Looker Studio Dashboard):

Solution:

- Continuously update and enhance the Looker Studio dashboard to ensure it remains a powerful tool for real-time insights.
- Incorporate additional interactive features to improve user experience.

Recommendation:

- Provide training sessions for employees to maximize their use of Looker Studio for decision-making.
- Regularly update the dashboard to reflect changes in data patterns and market dynamics. Monitoring, evaluation, and continuous improvement for each recommendation contributing to a more comprehensive understanding of the proposed strategies.

Summary Recommendations

Enhance Packaging Strategies for 600x600 Tiles:

The analysis consistently points to the high demand for 600x600 tiles. To optimize resources and cater to consumer preferences, TechPack Solutions should collaborate with packaging designers and suppliers to implement tailored packaging solutions. These solutions should precisely align with the dimensions, aesthetics, and protection requirements of 600x600 tiles. This strategic move not only streamlines packaging processes but also minimizes waste, enhancing overall operational efficiency.

Strategic Resource Allocation for KCL SKD:

Given the consistent production disparity between KCL SKD and KCL VN, TechPack Solutions should adopt a tailored approach to resource allocation. Allocate more staffing, packaging materials, and transportation resources to KCL SKD, recognizing its significance as a key driver of overall production. This ensures that the packaging processes are finely tuned to meet the higher demand and diverse product range, enhancing operational efficiency in this region.

Adaptive Inventory Management:

The identification of peak demand in 2018 and reduced demand in 2020 highlights the importance of adaptive inventory management. TechPack Solutions should leverage data-driven forecasting models to anticipate trends and adjust inventory levels accordingly. Consider economic conditions, global events, and consumer preferences in crafting a flexible inventory strategy. This approach ensures the company is well-prepared to navigate both peak and reduced demand scenarios, enhancing overall resilience.

Strategic Planning for October Peak:

Recognizing October as a consistent peak demand period is crucial for strategic resource planning. TechPack Solutions should proactively plan for heightened demand during this month. Ensure an ample stockpile of packaging materials leading up to October, streamline production schedules, and fortify supplier relationships to accommodate the surge in demand. Aligning resource allocation with this recurring pattern enhances preparedness and responsiveness during critical periods, ensuring efficient operations.

Tailoring Packaging Solutions to Production Diversity:

The analysis of tile variety distribution between KCL SKD and KCL VN emphasizes the need for tailored packaging solutions. For KCL SKD with 23 tile varieties, develop packaging solutions that can accommodate a multitude of tile shapes and sizes, ensuring efficiency and minimizing waste. For KCL VN with a more limited variety, consider a potentially more standardized packaging approach. The diversity in tile production presents an opportunity for TechPack Solutions to optimize packaging processes and reduce material waste.

Continuous Monitoring and Decision-Making with Looker Studio:

The Looker Studio dashboard serves as a transformative tool for data visualization and decision-making. TechPack Solutions should continue to leverage this platform for real-time monitoring of key metrics and trends. The interactive dashboard empowers users to uncover insights, navigate through data landscapes, and make informed decisions. Regular updates and adaptations of strategies based on the insights gleaned from Looker Studio ensure that TechPack Solutions remains agile and responsive to evolving market dynamics.

In summary, the recommendations focus on tailoring strategies to meet specific production dynamics, optimizing packaging solutions, and adopting an adaptive approach to inventory management. The combination of these actions positions TechPack Solutions to not only meet current consumer preferences but also stay ahead of market trends, ensuring sustained relevance and competitiveness in the tile packaging landscape.