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**Inventory Management and Demand Forecasting
of the Bright Box Company, a Manufacturing
Firm, in 2024**

FINAL SUBMISSION FOR THE BDM CAPSTONE PROJECT

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EXECUTIVE SUMMARY AND TITLE

Title: “Inventory Management and Demand Forecasting of the Bright Box Company, a Manufacturing Firm, in 2024.”

Introduction:

The Bright Box Company, a manufacturing firm, established in 1993 by Mr. Humayun Anwar, initially specialized in corrugated boxes and cartons. Expanding its offerings to corrugated sheets. Catering primarily to B2B, currently facing challenges due to the global economic downturn & trade uncertainties necessitating effective inventory, manpower, and cost management strategies.

Objective:

To analyze the company's sales data and provide actionable insights for improving inventory management, cost reduction, and optimizing operations during low-sales periods.

Data Collection:

Two datasets were collected:

1. Daily sales data, including customer details and daily sales.
2. Monthly expenditure data, including expenses and earnings.

Methodology:

The project utilized various analytical approaches:

- Descriptive, Predictive, Statistical, and Time Series Analysis for demand forecasting.
- Product Category Analysis, Customer Analysis, Revenue Analysis, and Monthly Expenditure Analysis to understand operational efficiency and profitability.

Tools:

MS Excel-

- Pivot tables
- Bar charts, Line charts, Scatter plots, etc.

Conclusion:

The analysis provides valuable insights for the company. By implementing the recommendations, the company can mitigate financial risks associated with inventory management and fixed expenses, ensuring sustainability and profitability.

DETAILED EXPLANATION OF ANALYSIS PROCESS

Encompassing all the key aspects of business, a comprehensive analysis of the company's sales data was conducted. The analysis was structured around several core components, each aimed at providing insights into different facets of the company's operations and performance.

Data Cleaning and Pre-processing: The initial step involved cleaning and pre-processing the collected data. This was crucial as the data contained outliers, misspelled words, and incorrect entries. Under the guidance of the managerial team, these issues were rectified. Entries exhibiting abnormal behaviour were adjusted to approximate values based on the pattern observed in neighbouring entries. The cleaned data was then organized and stored in an Excel sheet, laying the groundwork for further analysis.

Product Category Analysis: The performance of different product categories was evaluated to identify top-selling products and those that were underperforming. This analysis provided insights into product demand which would be helpful in optimization of the company's product offerings and inventory management strategies.

Customer Analysis: Customers were a focal point of the analysis, with a specific focus on segmentation based on purchasing behaviour. By grouping customers into segments, key customer groups were identified and their preferences and buying patterns were observed. Loyal customers were identified through repeat purchases pattern, providing valuable information for targeted marketing efforts and customer retention strategies.

Exploratory Data Analysis (EDA): EDA was employed to gain a deeper understanding of the data. This involved visualizing data distributions, identifying outliers, and exploring relationships between variables. EDA provided valuable insights into the structure of the data, guiding subsequent analysis and helping to uncover hidden patterns or trends.

Revenue Analysis: The company's financial performance was analysed by observing revenue trends over time. This helped in identifying seasonal patterns and trends in revenue, that would be beneficial in making informed decisions regarding pricing, promotions, and inventory management.

Monthly Expenditure Analysis: A detailed analysis of monthly expenditures was conducted to identify opportunities for cost savings. By analyzing expenditure patterns, areas where costs could be reduced or optimized could be assessed, leading to improved profitability.

Profitability Analysis: Profitability was a key focus of the analysis, with a detailed examination of trends, seasonality, and patterns in profitability. This analysis could help the company understand the factors influencing its profitability and identify areas for improvement.

Operational Efficiency: The relationship between the number of employees and the quantity sold was analyzed to determine operational efficiency. By understanding this relationship, an effort is made to optimize the staffing levels and improve overall efficiency.

Forecasting: Based on historical data, forecasting was conducted to predict future sales and revenue. This analysis could help the company in anticipating future demand and plan accordingly, ensuring optimal inventory levels and resource allocation.

Fixed Cost Expenses Analysis: Fixed cost expenses were analysed to identify opportunities for cost reduction. By understanding the impact of fixed costs on profitability, an effort is made to understand any cost-saving measures.

In a nutshell, the comprehensive analysis conducted in this project provided valuable insights into the company's operations, financial performance, and areas for improvement.

RESULTS AND FINDINGS

- A column chart as a graphical representation of the products versus quantity was generated from the daily sales record data. From the graph depicted in Figure-1 below, it could be seen that the top-seller product is **250-Double** followed by **ALL SEMI** and the under-performing products are **HEAVY** and **SEMI**.



Figure-1

- A pie chart was created to represent the distribution of demand across various thickness categories. It could be seen that '5 ply' thickness accounts for the highest demand, comprising approximately 49.5% of the total sales volume. Please refer Figure-2 for the same.

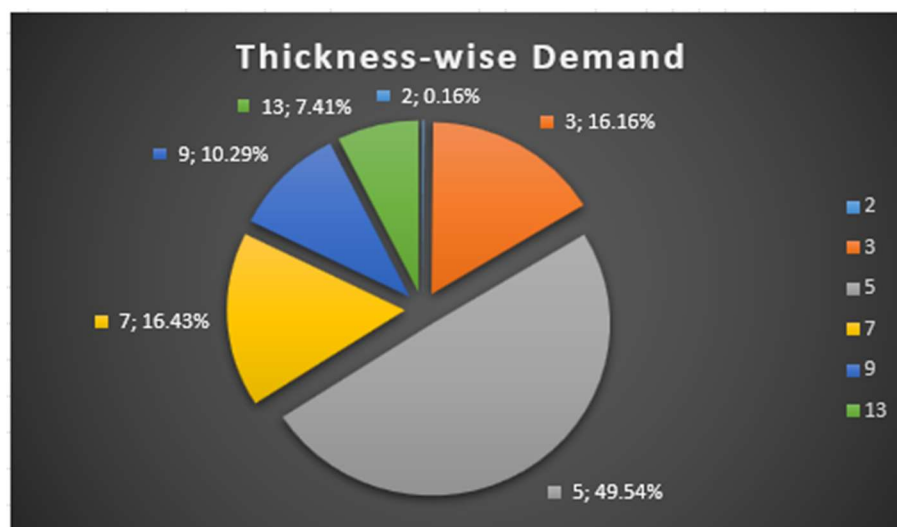


Figure-2

- Another chart was generated from the available three month sales data to illustrate the Customer-wise Demand relationship, please refer Figure-3. Analysis of the chart revealed that **N S EXPORTS** holds the largest share as the customer with 46464 units bought in a span of three months followed by **MARQUE IMPEX** with 23754 units bought in three months.

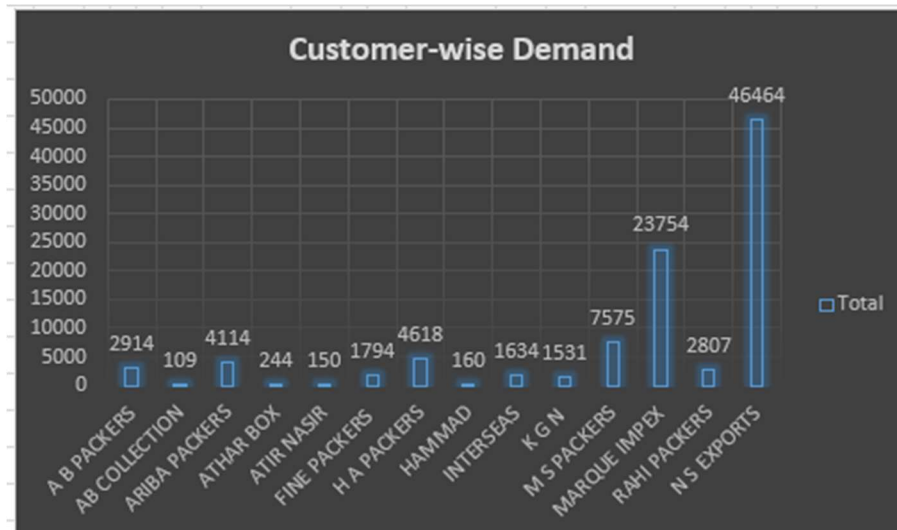


Figure-3

- A graphical representation of the monthly revenue trend was generated from the available data. Analysis of the graph depicted in Figure-4, reveals notable peaks in revenue during the months of June and July, indicating an anticipated uptick in sales following May. Based on this trend, the company can anticipate substantial spikes expected in June and July.



Figure-4

- **PROFITABILITY ANALYSIS:** The total expenditure incurred by the company is subtracted from the monthly revenue generated to obtain the monthly profit. Below attached graph shows the pattern of the profit earned in a month.



Figure-5

- A graphical representation of the quarterly revenue trend was also generated from the available data. Analysis of the graph depicted in Figure-6, reveals notable peaks in revenue during SECOND and THIRD quarters. A significant drop in revenue was seen in the fourth quarter for the year 2023.

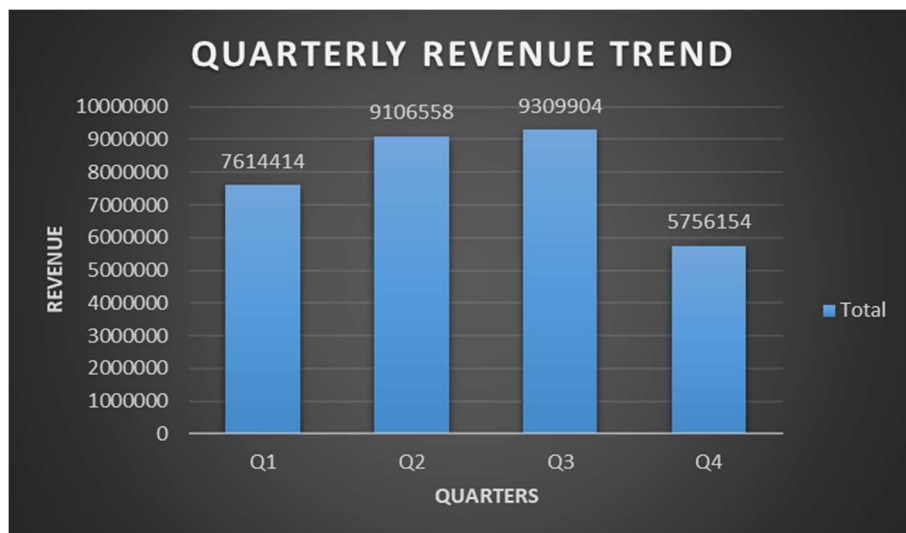


Figure-6

- The monthly expenditures of the organization are shown by the pie chart attached below which reveals that the company spends 64% on employee wages, 23% on the glue, 3% on electricity and 10% on gas.

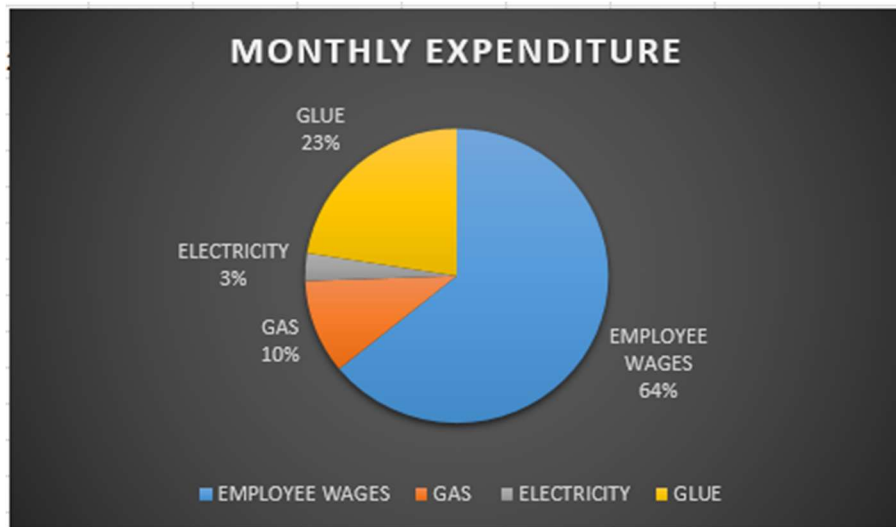


Figure-7

- A bar chart depicting the correlation between products and quantities is created for each customer, providing insights into their respective product preferences and demand levels.

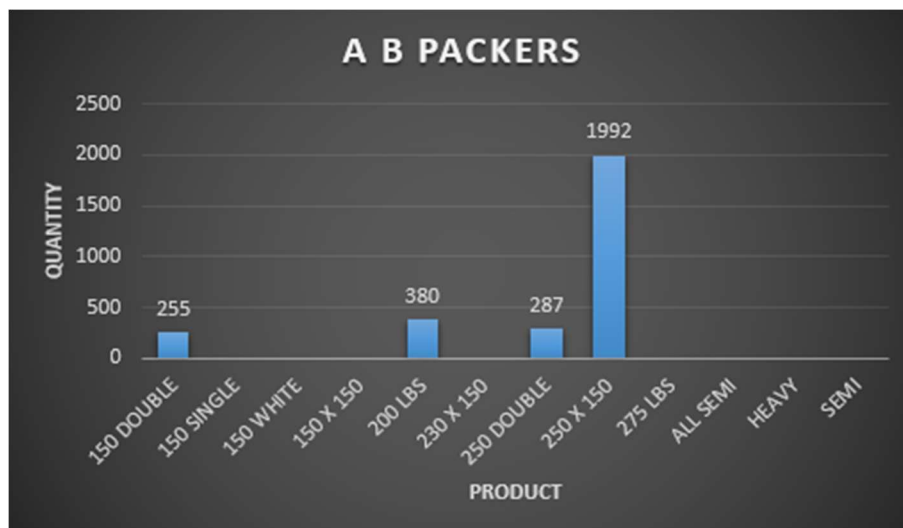


Figure-8

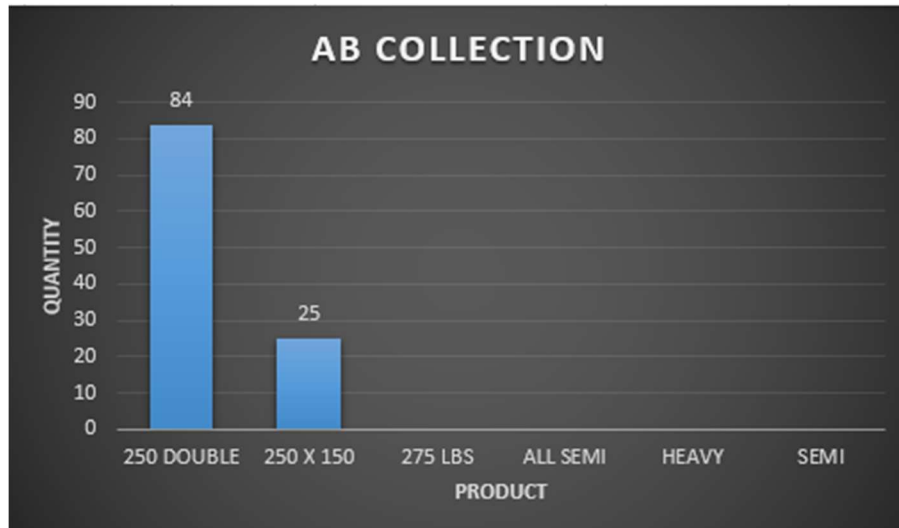


Figure-9

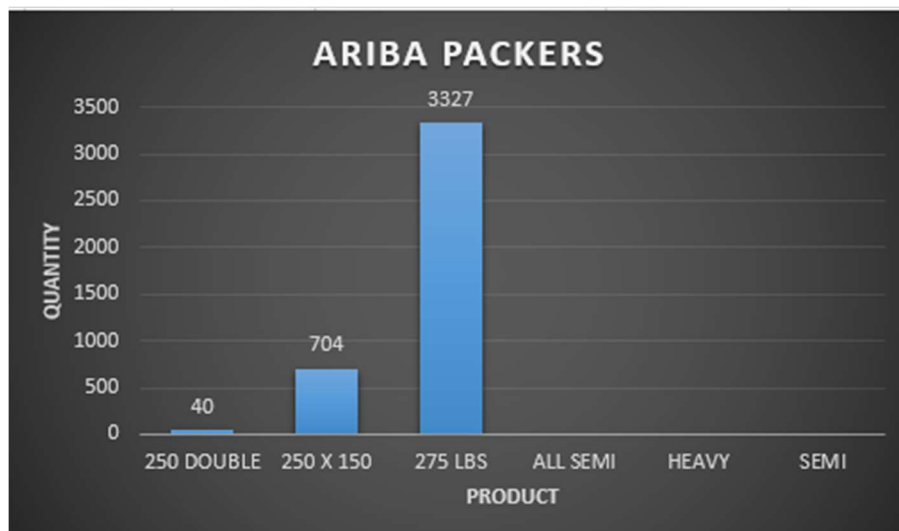


Figure-10

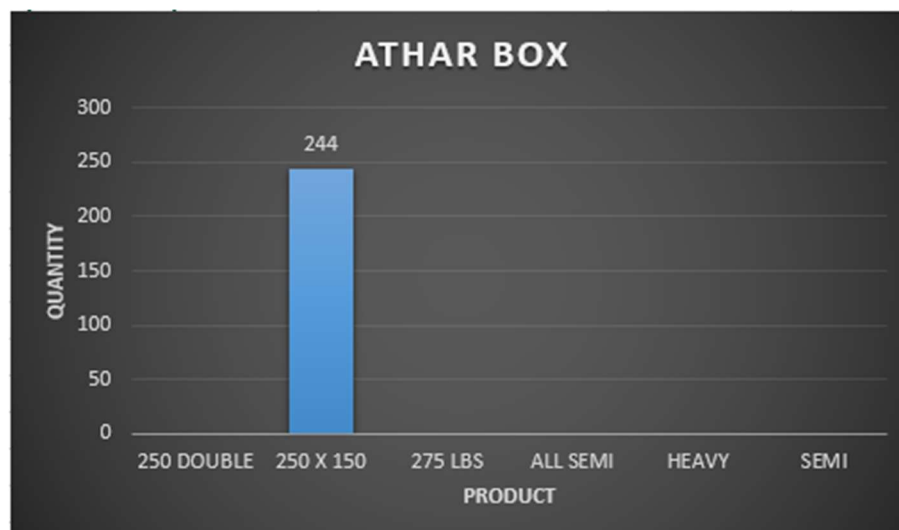


Figure-11

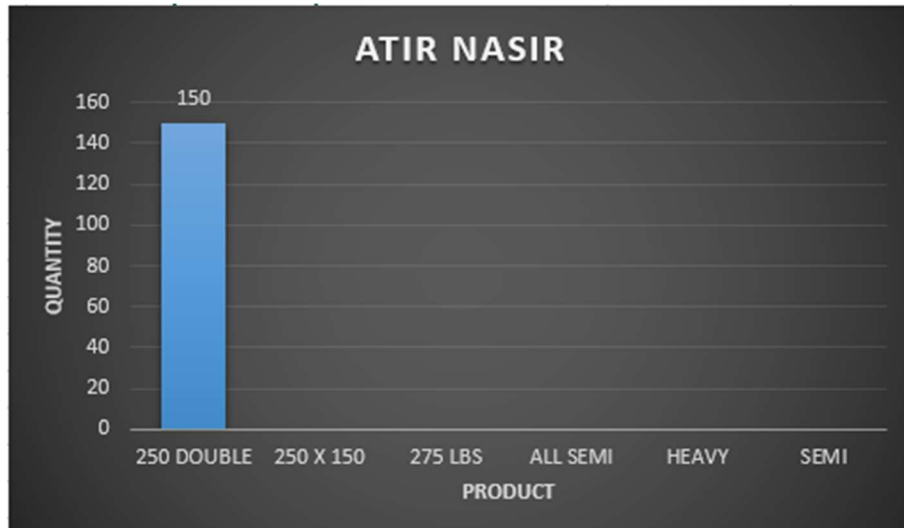


Figure-12

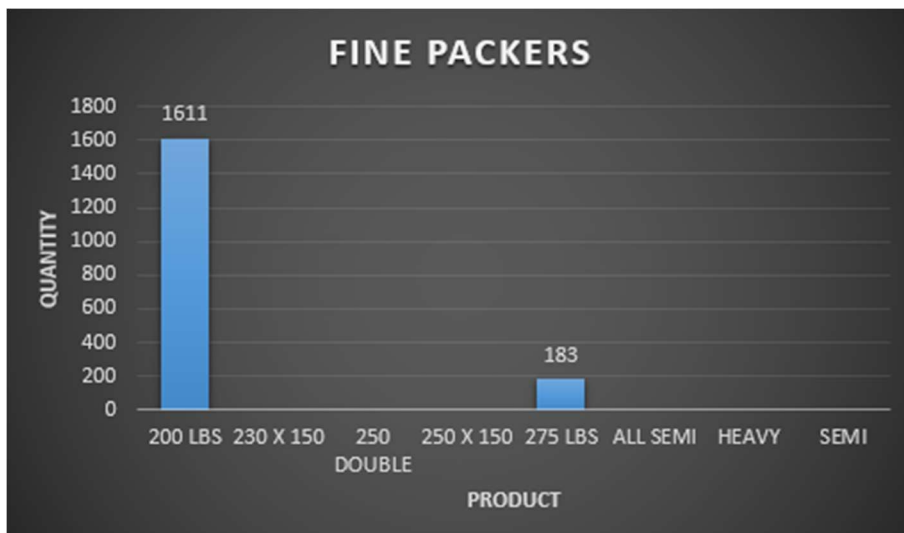


Figure-13

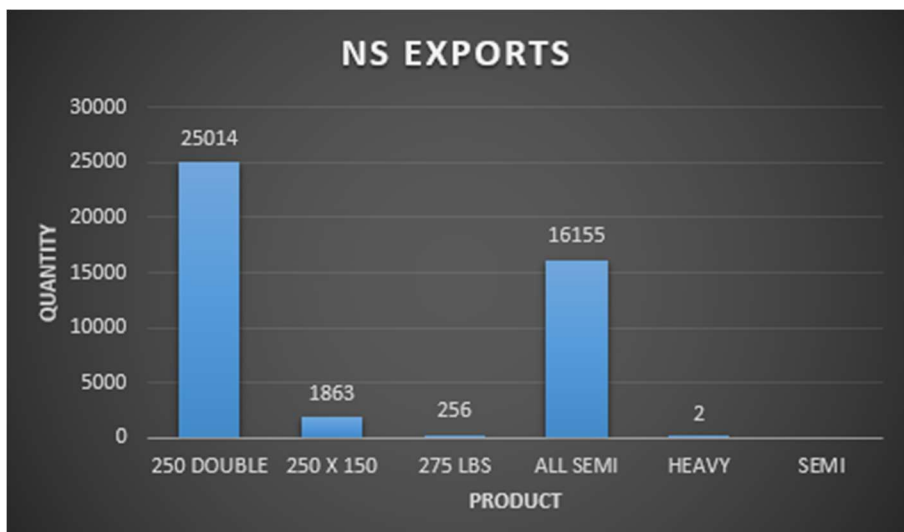


Figure-14

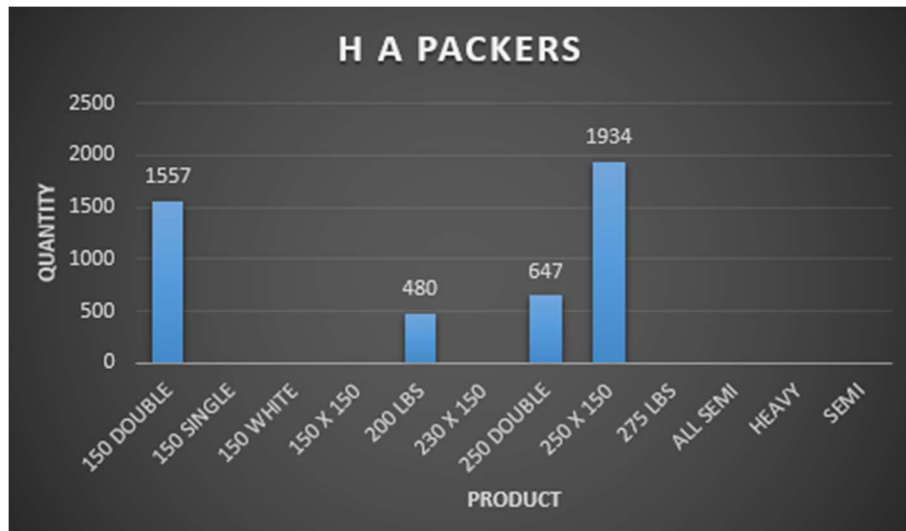


Figure-15

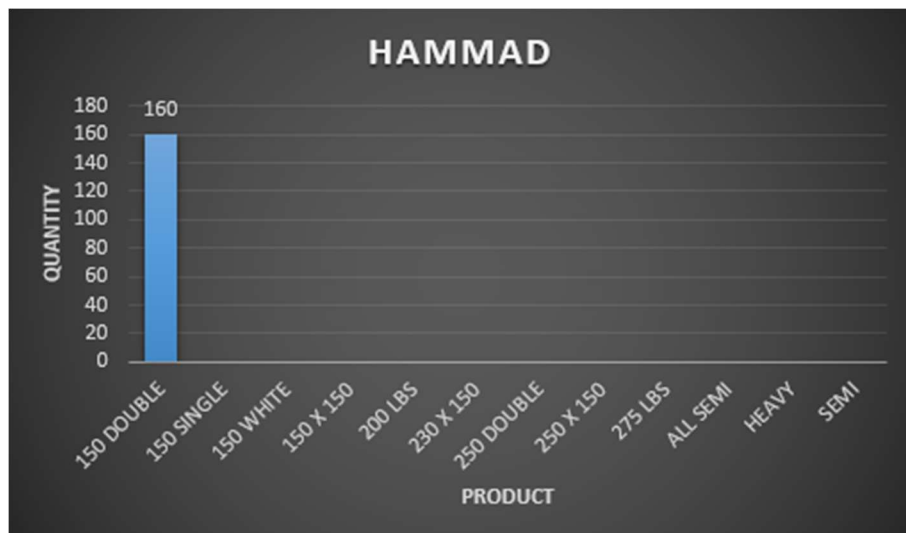


Figure-16

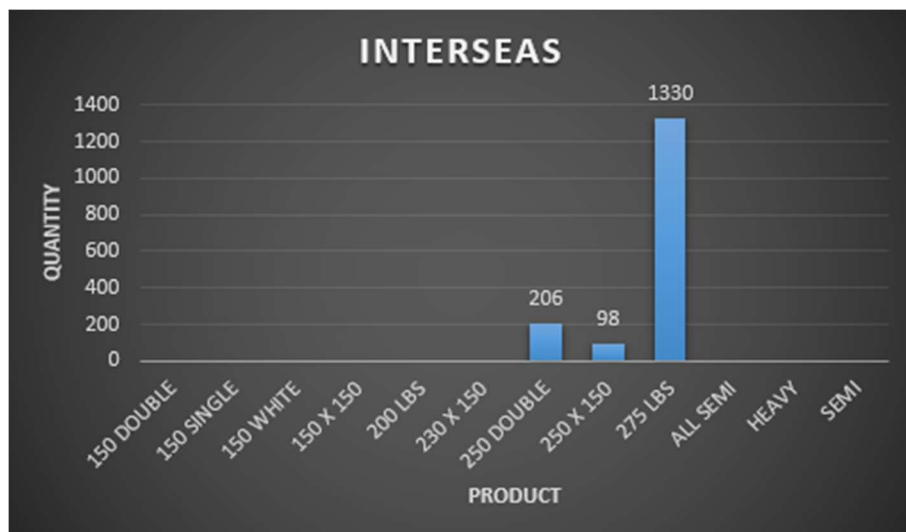


Figure-17

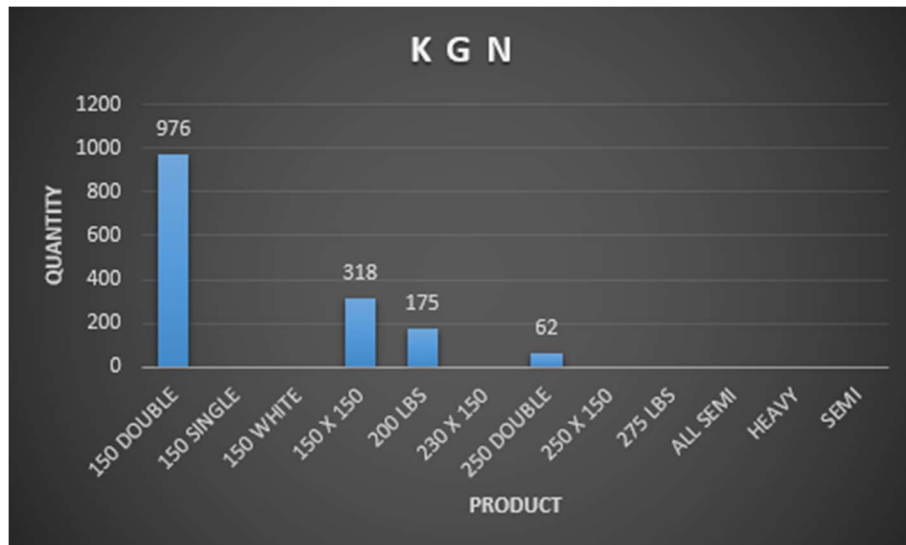


Figure-18

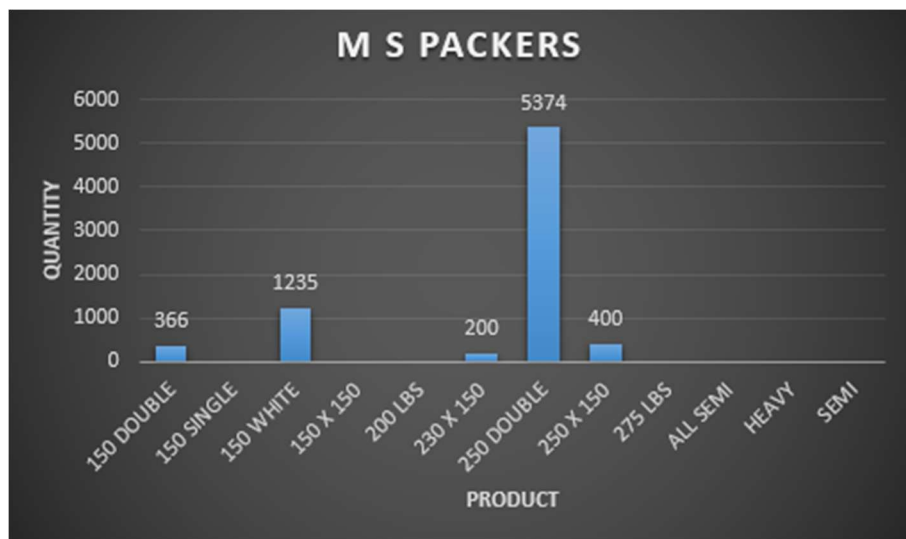


Figure-19

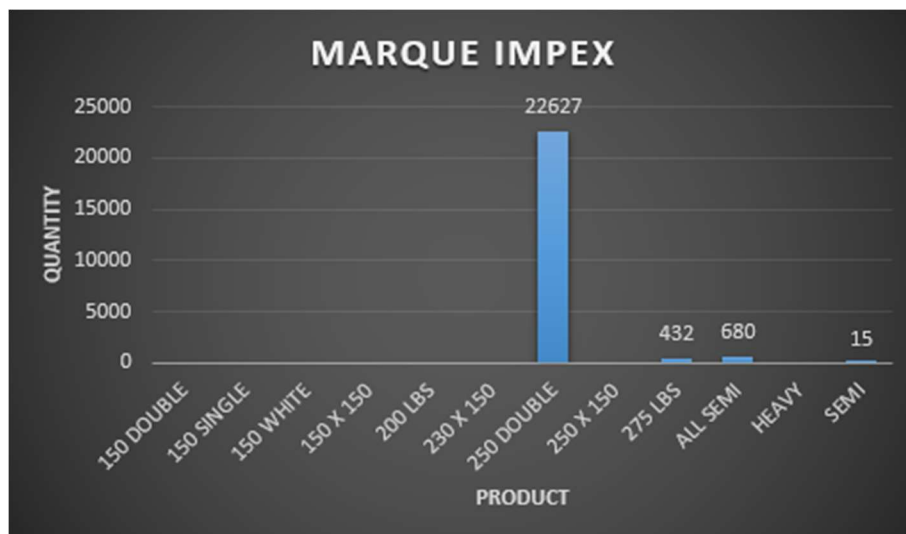


Figure-20

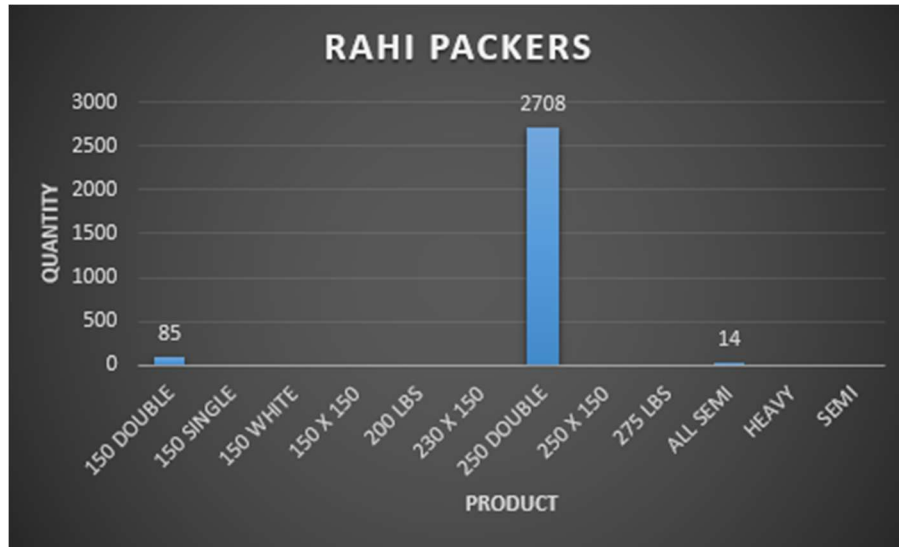


Figure-21

Based on the analysis from figures 8-21, the table below summarizes the most in-demand product for each customer.

S. No	CUSTOMER	TOP-SELLING PRODUCT
1	AB PACKERS	250 X 150
2	AB COLLECTION	250 DOUBLE
3	ARIBA PACKERS	275 LBS
4	ATHAR BOX	250 X 150
5	ATIR NASIR	250 DOUBLE
6	FINE PACKERS	200 LBS
7	NS EXPORTS	250 DOUBLE
8	HA PACKERS	250 X 150
9	HAMMAD	150 DOUBLE
10	INTERSEAS	275 LBS
11	KGN	150 DOUBLE
12	MS PACKERS	250 DOUBLE
13	MARQUE IMPEX	250 DOUBLE
14	RAHI PACKERS	250 DOUBLE

Table-1

- A scatter plot was created to analyze the relationship between the number of employees working in a month and the total quantity sold in a month (Refer figure-22). The graph indicates that with 25 employees, the quantity sold is approximately 20,000 units; with 30 employees, the quantity sold ranges between 30,000 and 40,000 units; and with 35 employees, the quantity sold ranges between 50,000 and 60,000 units.



Figure-22

- A line chart was created to visualize the trend in gas expenses over time. Figure 23 illustrates that gas expenses increased in June, decreased in October, and then rose again after October.

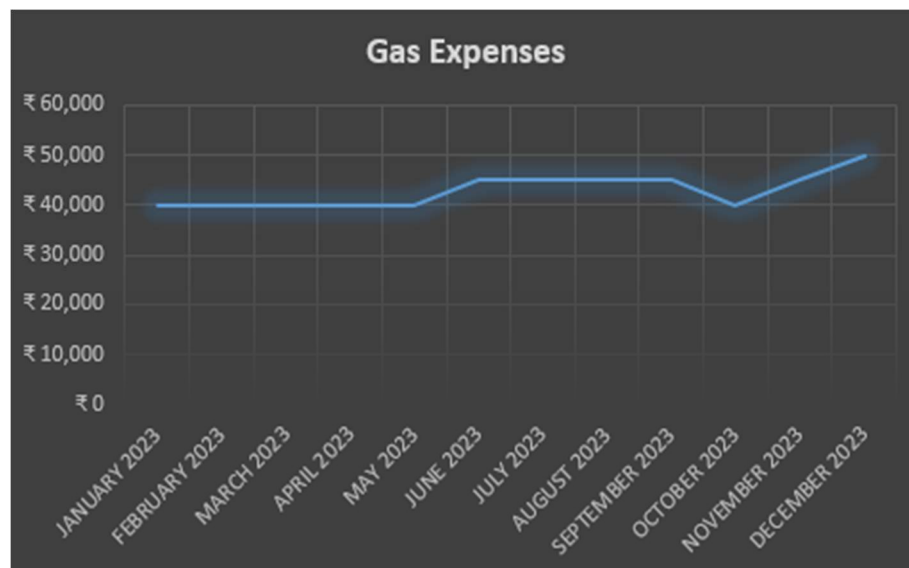


Figure-23

- Another line chart was created to visualize the trend in electricity expenses over time. Figure 24 illustrates that electricity expenses generally follows an upward trend with slight spikes in June and then August.

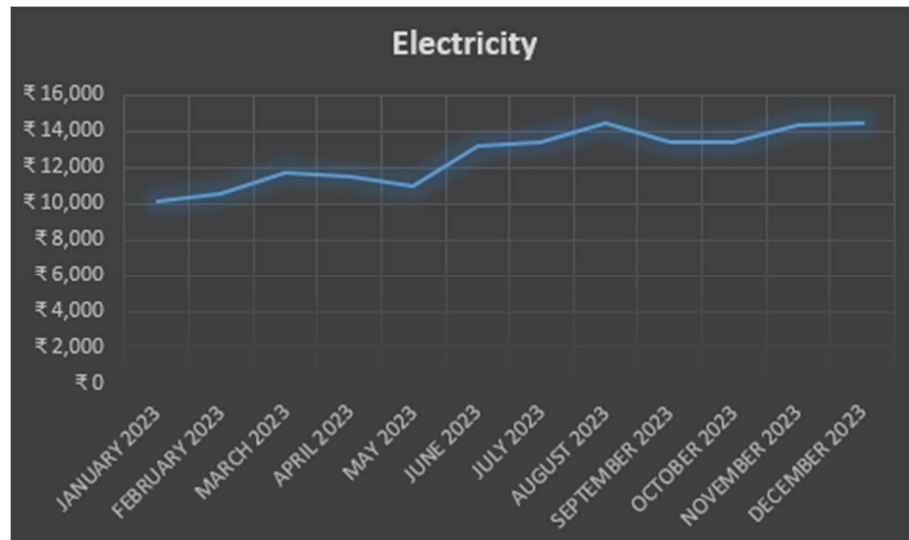


Figure-24

- A line chart was generated to illustrate the trend in glue expenses over time. Figure 25 shows that glue expenses remained constant from January to August and then spiked in September 2023, after which the cost again stayed constant.

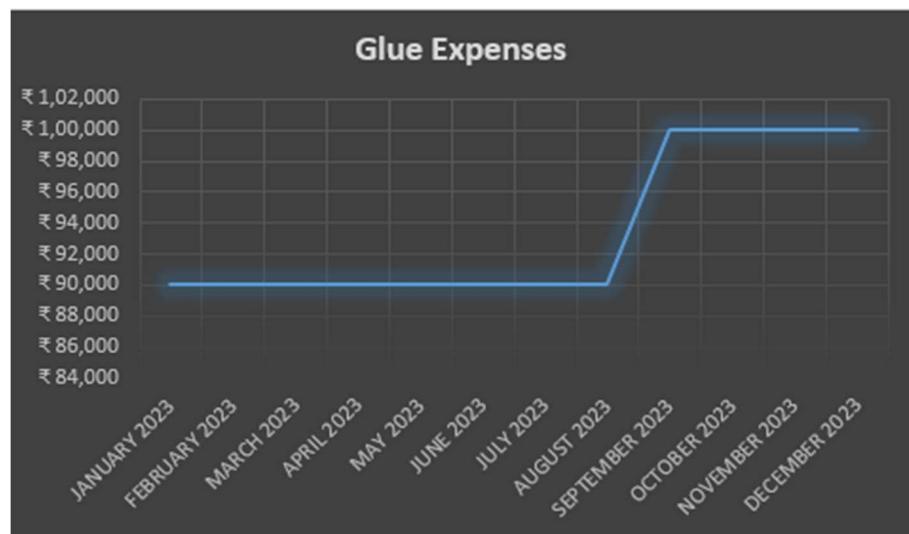


Figure-25

- **FORECASTING:** Figures 4 illustrates a notable increase in monthly revenue during the months of June and July. In June 2023, the total quantity sold was 52,889 units, compared to 34,263 units in May 2023. By applying the formula for percentage increase:

$$\text{Percentage increase} = \frac{\text{New quantity} - \text{original quantity}}{\text{original quantity}} * 100$$

The calculated percentage increase in sales is approximately 54%. This indicates that the company can anticipate a 54% rise in sales for the following month and should prepare accordingly.

Conversely, after July, a decline in sales can be expected. By analyzing the data from 2023 and using the formula for percentage decrease:

$$\text{Percentage decrease} = \frac{\text{Original quantity} - \text{new quantity}}{\text{original quantity}} * 100$$

A 20% decrease in sales is projected for August 2024. Subsequent calculations for September, October, November, and December reveal a 26% decrease in sales in September, followed by a 37% decrease in October, and a subsequent 21% decrease in November. An unusual 174% increase in sales is observed in December.

INTERPRETATION OF RESULTS & RECOMMENDATIONS

☞ Analysis of Product Category:

- The column chart depicting products versus quantity sold indicates that '250-Double' is the top-selling product, followed by 'ALL SEMI'. This suggests that these products are in high demand and should be prioritized in production and inventory management. The products “250 X 150”, 150 Double, 275 LBS and 200 LBS are average performers.
- The pie chart showing the distribution of demand across thickness categories reveals that '5 ply' thickness accounts for nearly half of the total sales volume. This indicates a strong preference for this thickness category among customers.
- Monthly-revenue trend and Monthly profit trend revealed that the revenue/profit peaked in the months of June and July. Therefore, a special focus should be made on inventory management before June. Adequate stock should be kept for the top-selling products and enough amount of stock should be kept of other products which are performing average, i.e., “250 X 150”, 150 Double, 275 LBS and 200 LBS. Also, a certain level of stock should be kept of all the other products who have under-performed as spikes in sales could trigger the requirement of those low-selling products also.
- Monthly-revenue trend and Monthly profit trend also revealed that the sales declined after July and reached the lowest value in the month of November. Therefore, avoid overstocking after July and other than the top-selling product avoid keeping stock of any other product to reduce the related costs. As there is an increase in sales in December, stock up the top-selling and average-selling products in late November to meet the requirements.

Recommendation for Inventory Management-

- Maintain adequate stock of top-selling products, especially the 250-Double with 5 ply thickness, even during low-sales periods to avoid production delays and meet demand efficiently.
- During high-sales months, keep enough stock of “250 X 150”, 150 Double, 275 LBS and 200 LBS and certain level of stocks of the remaining products also.
- Other than the high-sales months, avoid stocking of the products other than 250-Double with 5 ply thickness especially after July till November. In the month of November, sufficient products should be stocked to meet the demand in December.

- To address the issue of inventory management during low demand, the company should also focus on conducting regular market surveys and analyzing industry trends to forecast future demand accurately.

☼ Customer Analysis:

- The analysis of customer-wise demand relationship shows that 'N S EXPORTS' is the largest customer, followed by 'MARQUE IMPEX'. These customers should be given special attention and their demand patterns closely monitored to ensure timely fulfillment of orders.
- Table-1 can be used to determine the demand of the product by the customer. From table-1, it is seen that the top-selling product for 'N S EXPORTS' and 'MARQUE IMPEX' is 250-double.

Recommendation for Market Demand-

Focus marketing efforts and tailor product offerings to meet the specific needs of key customers, such as N S EXPORTS and MARQUE IMPEX, to capitalize on their high demand.

☼ Forecasting:

- Sales projection for 2024 revealed that the company can anticipate an approximately 54% increase in sales in June-July 2024
- For August 2024, a 20% decrease in sales is projected followed by 26% decrease in September 2024, 37% decrease in October 2024 and a subsequent 21% decrease in November 2024.
- The company can expect a hike of about 174% in sales in December 2024.

Recommendation for Future Scope-

- Prepare for the projected 54% hike in sales for the month of June-July 2024, a low-sales period till November 2024 and then for the high-demand period in December 2024.

- To identify future scope and demand in the market for corrugated box manufacturing, the company should invest in market research and stay updated with industry developments and emerging trends.

🌀 Working Capital Management & Recommendations-

Implement strategies to reduce expenditure on non-essential items and improve efficiency in resource utilization to optimize working capital during low sales periods.

1. **Manpower Management:** Figure-22 illustrates that for the sales of about 20,000 units, 25 employees are needed, for the sales of 30,000-40,000 units, 30 employees are needed and for the sales of 50,000-60,000 units, 35 employees are needed. Adjust the number of employees based on sales forecasts to ensure optimal utilization of manpower and avoid overstaffing during low sales periods.
2. **Production Planning:** Use insights from revenue trends to plan production schedules and inventory levels to capitalize on peak sales periods and minimize the impact of low sales periods on profitability.
3. **Expenditure planning:** According to the trend in gas expenses (Figure-23), the company should prepare for the increase in gas prices in June 2024 and then in October 2024. Similarly, according to the trend in electricity expenses (Figure-24), the company should expect a nominal increment in the cost throughout the year with slight hikes in June and then in August. The trend in glue expenses (Figure-25) states that the cost may hike in the month of September otherwise will stay constant.

In summary, analyzing the company's sales data provided valuable information to make better decisions. This includes improving how to manage inventory, predicting how much product will be needed, using the money efficiently, and managing the staff well when sales are slow. By following the suggestions mentioned earlier, the company can steer the business through tough times and make the most of opportunities in the corrugated box manufacturing industry.