2024


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

## MID-TERM REPORT FOR THE BDM CAPSTONE PROJECT

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# EXECUTIVE SUMMARY AND TITLE

**Title of the project:** "Inventory Management and Demand Forecasting of the Bright Box Company, a Manufacturing Firm, in 2024."

The project is based on a manufacturing firm located in the Moradabad city of Uttar Pradesh - the Bright Box Company. The company was established in 1993 by Mr. Humayun Anwar. Initially, the company began with the manufacturing and supplying of corrugated boxes and cartons and later, it added a corrugation unit and started the manufacturing of the sheets as well. This is a B2B oriented firm and deals in the manufacturing of corrugated boxes, cartons and sheets of various sizes and quality.

The business is currently experiencing a downturn due to various reasons including global market downfall, international relations & trade, inflation etc which necessitates the maintenance of sufficient inventory, manpower & other costs. The company also requires an insight on the future business prospects in this low-sales period.

The data corresponding to their daily sales is gathered which includes the details of the company's customers and the sales done on the daily basis to find out the patterns, trends and other features which could help the organization in optimal performance. Another date set containing the details of the expenditures incurred by the company in a month and the total earnings, is collected to find out the profit/loss of the company and other such features.

Analytical approaches like Descriptive, Predictive, Statistical and Time Series Analysis would be used to provide the organization with effective demand forecasting techniques and aid in mitigating financial hurdles associated with inventory management and fixed expenses. This, in turn, will diminish the risk of losses during periods of decreased sales activity.

# PROOF OF ORIGINALITY

To support the Research & Analysis, the following documents are attached in a Google Drive folder-

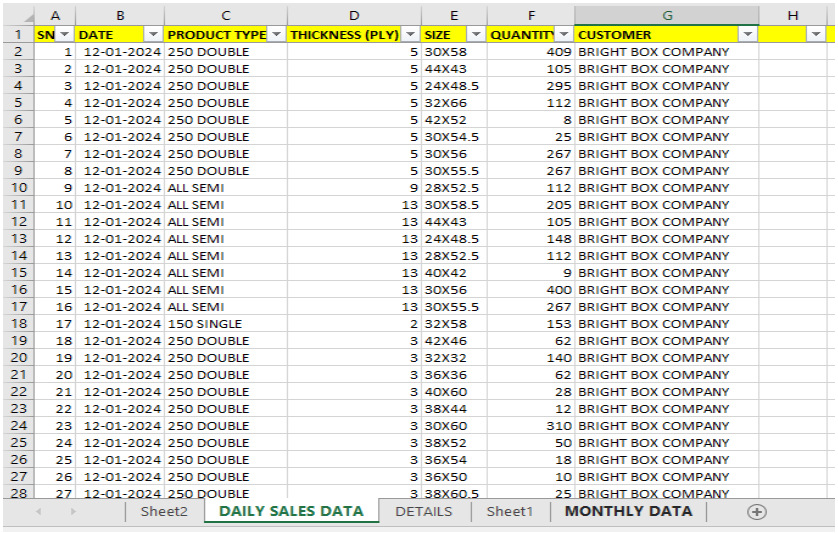
- Interview with the Owner of Bright Box Company
- Data Collection proofs and a photograph with the founder.
- Letter of Authorization

To find the attachments, Please Click Here.

# METADATA DESCRIPTION

The data collection has two types of records: daily sales records and monthly earnings and expenses. The daily sales record spans three months, including data from November 2023, December 2023, and January 2024.

**Snapshot:**



| SN | DATE | PRODUCT TYPE | THICKNESS (PLY) | SIZE | QUANTITY | CUSTOMER |
|---|---|---|---|---|---|---|
| 1 | 12-01-2024 | 250 DOUBLE | 5 | 30X58 | 409 | BRIGHT BOX COMPANY |
| 2 | 12-01-2024 | 250 DOUBLE | 5 | 44X43 | 105 | BRIGHT BOX COMPANY |
| 3 | 12-01-2024 | 250 DOUBLE | 5 | 24X48.5 | 295 | BRIGHT BOX COMPANY |
| 4 | 12-01-2024 | 250 DOUBLE | 5 | 32X66 | 112 | BRIGHT BOX COMPANY |
| 5 | 12-01-2024 | 250 DOUBLE | 5 | 42X52 | 8 | BRIGHT BOX COMPANY |
| 6 | 12-01-2024 | 250 DOUBLE | 5 | 30X54.5 | 25 | BRIGHT BOX COMPANY |
| 7 | 12-01-2024 | 250 DOUBLE | 5 | 30X56 | 267 | BRIGHT BOX COMPANY |
| 8 | 12-01-2024 | 250 DOUBLE | 5 | 30X55.5 | 267 | BRIGHT BOX COMPANY |
| 9 | 12-01-2024 | ALL SEMI | 9 | 28X52.5 | 112 | BRIGHT BOX COMPANY |
| 10 | 12-01-2024 | ALL SEMI | 13 | 30X58.5 | 205 | BRIGHT BOX COMPANY |
| 11 | 12-01-2024 | ALL SEMI | 13 | 44X43 | 105 | BRIGHT BOX COMPANY |
| 12 | 12-01-2024 | ALL SEMI | 13 | 24X48.5 | 148 | BRIGHT BOX COMPANY |
| 13 | 12-01-2024 | ALL SEMI | 13 | 28X52.5 | 112 | BRIGHT BOX COMPANY |
| 14 | 12-01-2024 | ALL SEMI | 13 | 40X42 | 9 | BRIGHT BOX COMPANY |
| 15 | 12-01-2024 | ALL SEMI | 13 | 30X56 | 400 | BRIGHT BOX COMPANY |
| 16 | 12-01-2024 | ALL SEMI | 13 | 30X55.5 | 267 | BRIGHT BOX COMPANY |
| 17 | 12-01-2024 | 150 SINGLE | 2 | 32X58 | 153 | BRIGHT BOX COMPANY |
| 18 | 12-01-2024 | 250 DOUBLE | 3 | 42X46 | 62 | BRIGHT BOX COMPANY |
| 19 | 12-01-2024 | 250 DOUBLE | 3 | 32X32 | 140 | BRIGHT BOX COMPANY |
| 20 | 12-01-2024 | 250 DOUBLE | 3 | 36X36 | 62 | BRIGHT BOX COMPANY |
| 21 | 12-01-2024 | 250 DOUBLE | 3 | 40X60 | 28 | BRIGHT BOX COMPANY |
| 22 | 12-01-2024 | 250 DOUBLE | 3 | 38X44 | 12 | BRIGHT BOX COMPANY |
| 23 | 12-01-2024 | 250 DOUBLE | 3 | 30X60 | 310 | BRIGHT BOX COMPANY |
| 24 | 12-01-2024 | 250 DOUBLE | 3 | 38X52 | 50 | BRIGHT BOX COMPANY |
| 25 | 12-01-2024 | 250 DOUBLE | 3 | 36X54 | 18 | BRIGHT BOX COMPANY |
| 26 | 12-01-2024 | 250 DOUBLE | 3 | 36X50 | 10 | BRIGHT BOX COMPANY |
| 27 | 12-01-2024 | 250 DOUBLE | 3 | 38X60.5 | 25 | BRIGHT BOX COMPANY |

Sheet2 | DAILY SALES DATA | DETAILS | Sheet1 | MONTHLY DATA

*Figure-1*

The data is organized in tabular format with eight columns:

1. **SNo.**: Serial number.
2. **Date**: Date of the sale.
3. **Month**: Month of the sale.
4. **Product**: Type of product (e.g., "250 DOUBLE," "ALL SEMI," "150 SINGLE").

5. **Thickness**: Thickness of the sheet (measured in 'ply').
6. **Size**: Size of the sheet (length multiplied by breadth).
7. **Quantity**: Number of products sold.
8. **Customer**: Name of the customer.

Additionally, one year of monthly expenses and earnings data is collected from January 2023 to January 2024, as shown in Figure-2 below-

| A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| SNO | MONTH | YEAR | TOTAL QUANTITY | REVENUE | NO. OF EMPLOYEES | EMPLOYEES WAGES | ELECTRICITY | GLUE | GAS |
| 1 | JANUARY | 2023 | 33406 | ₹ 25,00,000 | 30 | ₹ 2,50,000 | ₹ 10,171 | ₹ 90,000 | ₹ 40,000 |
| 2 | FEBRUARY | 2023 | 35646 | ₹ 26,73,450 | 30 | ₹ 2,50,000 | ₹ 10,575 | ₹ 90,000 | ₹ 40,000 |
| 3 | MARCH | 2023 | 32986 | ₹ 24,40,964 | 30 | ₹ 2,50,000 | ₹ 11,757 | ₹ 90,000 | ₹ 40,000 |
| 4 | APRIL | 2023 | 37656 | ₹ 27,86,544 | 30 | ₹ 2,50,000 | ₹ 11,500 | ₹ 90,000 | ₹ 40,000 |
| 5 | MAY | 2023 | 34263 | ₹ 24,32,673 | 30 | ₹ 2,50,000 | ₹ 10,989 | ₹ 90,000 | ₹ 40,000 |
| 6 | JUNE | 2023 | 52889 | ₹ 38,87,341 | 35 | ₹ 3,00,000 | ₹ 13,151 | ₹ 90,000 | ₹ 45,000 |
| 7 | JULY | 2023 | 53656 | ₹ 38,90,060 | 35 | ₹ 3,00,000 | ₹ 13,400 | ₹ 90,000 | ₹ 45,000 |
| 8 | AUGUST | 2023 | 42889 | ₹ 30,45,119 | 35 | ₹ 3,00,000 | ₹ 14,509 | ₹ 90,000 | ₹ 45,000 |
| 9 | SEPTEMBE | 2023 | 31663 | ₹ 23,74,725 | 35 | ₹ 3,00,000 | ₹ 13,402 | ₹ 1,00,000 | ₹ 45,000 |
| 10 | OCTOBER | 2023 | 19878 | ₹ 14,90,850 | 30 | ₹ 2,75,000 | ₹ 13,454 | ₹ 1,00,000 | ₹ 40,000 |
| 11 | NOVEMBE | 2023 | 15708 | ₹ 11,62,392 | 25 | ₹ 2,50,000 | ₹ 14,323 | ₹ 1,00,000 | ₹ 45,000 |
| 12 | DECEMBEI | 2023 | 43096 | ₹ 31,02,912 | 25 | ₹ 2,50,000 | ₹ 14,500 | ₹ 1,00,000 | ₹ 50,000 |
| 13 | JANUARY | 2024 | 18064 | ₹ 13,27,704 | 25 | ₹ 2,50,000 | ₹ 12,575 | ₹ 1,00,000 | ₹ 45,000 |

*Figure-2*

The data is presented in tabular format with ten columns:

1. **SNo.**: Serial number.
2. **Month**: Month of the data entry.
3. **Year**: Corresponding year for the month.
4. **Total Quantity**: Total number of products sold in the respective month.
5. **Revenue**: Total amount generated in the respective month.
6. **No. of Employees**: Total number of employees in the company.
7. **Employee Wages**: Total monthly expenditure on employee wages.
8. **Electricity**: Total monthly expenditure on electricity.
9. **Glue**: Total monthly expenditure on glue.
10. **Gas**: Total monthly expenditure on gas.

These data sets will be used to provide crucial insights into the company's sales performance, product trends, and financial health over the specified periods.

**Brief explanation about the various product types:**

The company specializes in manufacturing sheets and boxes using paper as the primary raw material. Sheets are crafted by layering various sheets of paper as per specific requirements. The term "ply" denotes the thickness of the sheet, indicating the number of layers of paper it comprises.

For instance:

- **250 Double (3 ply):** This signifies a sheet composed of three layers. The outer two layers consist of 250 grams of paper each, while the middle layer comprises 100 grams of paper.
- **150 Double (7 ply):** Indicates a sheet with seven layers. The outer two layers are made of 150 grams of paper each, while the inner five layers are composed of 100 grams of paper.
- **ALL SEMI:** Denotes that all layers of the sheet are constructed using 100 grams of paper.
- **150 Single:** Refers to a single-layered sheet comprising 150 grams of paper, with the remaining layers made of 100 grams of paper.
- **250 X 150:** Indicates a sheet with two outer layers, one consisting of 250 grams of paper and the other of 150 grams, while the inner layers are made of 100 grams of paper.
- **275 lbs:** Specifies a heavy-duty sheet capable of supporting weights up to 275 pounds without breaking.

These product categories offer a diverse range of options to cater to the specific needs of clients, ensuring customization and versatility in the company's offerings.

# DESCRIPTIVE STATISTICS

Over a three-month period, the company's daily sales record revealed a mean quantity of 72.269 units, with a median of 53 and a mode of 56. The standard deviation and sample variance were approximately 82.725 and 6843.404, respectively.

Thickness analysis showed that 5-ply sheets were in high demand, with a minimum thickness of 3 and a maximum of 13.

Turning to the monthly data from January 2023 to January 2024, the mean total quantity sold annually was 34,753.84 units, with a median of 34,263. Monthly sales varied from a minimum of 15,708 units to a maximum of 53,656 units. The average revenue generated over the year was ₹2,547,287.231, with a median of ₹2,500,000. Monthly revenue ranged from ₹1,162,392 to an impressive ₹33,114,734.

During this period, the average number of employees stood at 30, with a minimum of 25 and a maximum of 35. The company allocated an average of ₹267,307.69 annually to employee wages, with monthly wages ranging from ₹250,000 to ₹300,000. Other expenditures included an average of ₹12,638.92 per month on electricity and monthly expenses of ₹93,846.15 on glue and ₹43,076.92 on gas. Total annual expenses for glue and gas were ₹1,220,000 and ₹560,000, respectively, with monthly expenditure fluctuating between ₹90,000 and ₹100,000 for glue and ₹40,000 and ₹50,000 for gas.

# DETAILED EXPLANATION OF ANALYSIS PROCESS

The initial phase of the analysis journey involved deciphering the intricate manual entries recorded in the company's registers. Under the guidance of the managerial team, each entry was meticulously examined and understood. This process was crucial in unravelling the complexities of the data, comprehending various terms, and establishing connections between entries.

Subsequently, the data was transformed into structured Excel sheets presented in a tabular format. Each entry was carefully entered to ensure coherence and facilitate seamless integration with other data points. This meticulous organization paved the way for the creation of the daily sales record, providing a comprehensive snapshot of the company's transactions.

Next, with bills and rough records provided by the company, the task of extracting pertinent information began. Through careful alignment and extraction procedures, the data was synthesized into a cohesive format, capturing essential values with precision.

The determination of the number of employees required a deeper exploration, necessitating discussions and calculations centered around salary expenditures and average employee compensations.

However, our journey was not without its challenges. Data cleaning emerged as a pivotal phase, demanding meticulous attention to detail. Numerous entries contained cancelled values and obscure terms, which required careful scrutiny and correction. Under the vigilant oversight of company representatives, missing values were expunged, and misspelled terms were rectified, ensuring the integrity of our dataset.

Next, the analysis of the polished and refined data began. Employing Excel's powerful tools, the descriptive statistics was extracted for the quantitative variables in the data, shedding light on the company's performance landscape. Pivot tables emerged as indispensable tool, in unravelling the intricate relationships between variables.

Various Excel charts were also generated to view relationships among variables. Charts depicting quantity versus customers, quantity versus product type, and quantity versus thickness were created to explore these correlations. A pie chart was constructed to illustrate the total share of different thicknesses in demand. This data visualization approach facilitated a comprehensive understanding of the dataset.

# RESULTS AND FINDINGS

- A graphical representation of the products versus quantity was generated as column chart from the daily sales record data. From the graph depicted in Figure-3 below, it could be seen that the most in-demand product is **250-Double** followed by **ALL SEMI.**

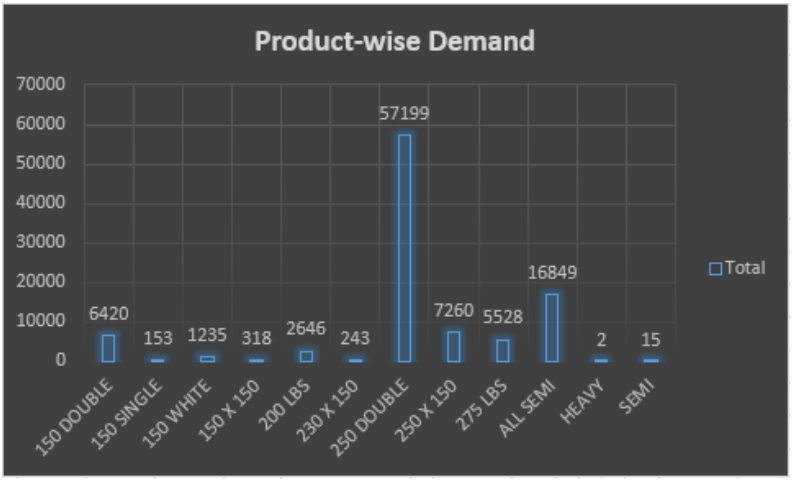



*Figure-3*

- 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-4 for the same.

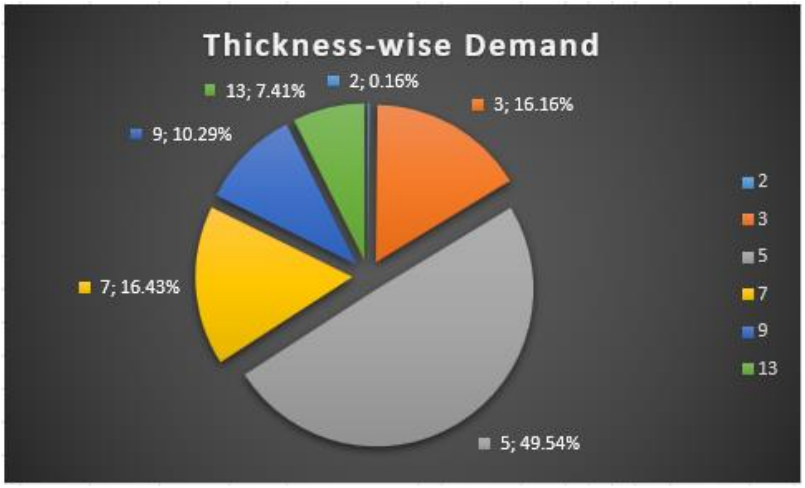



*Figure-4*

It can be inferred from the above two graphs that **250 double** with **5 ply** thickness is the highest selling product and the stock for the same should be kept in advance even in low-sales period to avoid any delay in production.

- Another chart was generated from the available three month sales data to illustrate the Customer-wise Demand relationship, please refer Figure-5. 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.

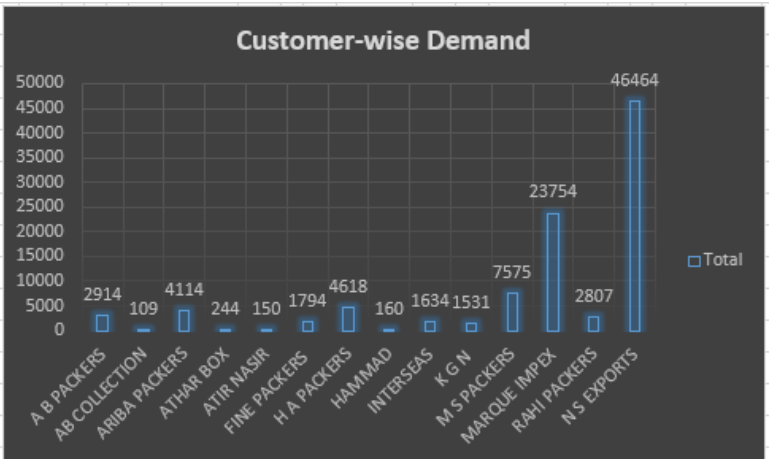



*Figure-5*

- A graphical representation of the monthly revenue trend was generated from the available data. Analysis of the graph depicted in Figure-6, 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-6*