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***Haldiram Snacks Food Private Limited***

**Project Report File**

**Supply Chain Management**

**DEMAND FORECASTING PROJECT**

**By -** Summit Tabhane

**Under the guidance of –** Mr. Ashish Lakhe **Sir**

**DECLARATION**

I declare that this written submission represents my ideas in my own words and where other ideas have been included. I have adequately cited and referenced the original source. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that non violation of any of the rules and guidelines instructed.

**SUMMIT TABHANE**

**ACKNOWLEDGEMENT**

I would like to offer our sincere gratitude to everyone who helped our small project succeed. First and foremost, I would like to express my gratitude to Mr. Ashish Sir, who served as my project's mentor, for his invaluable advice and ongoing encouragement. I also want to express my gratitude to the members of operations &logistics team especially

Mr. Bhushan Channe Sir for providing me with their guidance and resources I needed to complete my project work. The success of this endeavour would not have been possible without their constant support.

**Mr. Ashish Lakhe Sir**

**Senior Manager SCM - Planning**

**AIM**

The objective of this project is to identify and eliminate outliers from historical sales data of over 350 SKUs at Haldiram using statistical techniques in Excel. By detecting anomalies in sales patterns over the past twelve months, the project aims to enhance the accuracy of demand forecasting using the moving average method. This will support more reliable inventory planning and supply chain decision-making by providing a cleaner and more consistent dataset for forecasting future demand.

**TOOL USED -** Microsoft Excel & Power BI

**DATA DESCRIPTION**

Haldiram’s forecast template June’ 25 – Aug’ 25 which includes the sales of all the SKUs for past 12 months in Metric tons, Carton and crores. This data includes the sales of all the SS and categorizes data based on region it’s manager and the respective plant which, manufactured the SKU also the plant and product ID for all the individual products. The sales data is of from April-24 to April-25.

**BUSINESS CONTEXT**

Haldiram, being a leading brand in the Indian snack food industry, manages a vast portfolio of over 350 Stock Keeping Units (SKUs) across multiple product categories. Accurate demand forecasting plays a critical role in ensuring optimal production planning, inventory management, and supply chain efficiency. In a highly seasonal and region-sensitive market like India, sales data is prone to fluctuations caused by factors such as festivals, promotional campaigns, and unexpected demand surges.

However, raw sales data often includes anomalies or outliers—extremely high or low values that deviate significantly from typical patterns. These outliers, if not addressed, can distort forecasts and lead to overproduction or stockouts, resulting in increased costs or lost sales opportunities. Therefore, identifying and correcting such outliers before performing any forecasting is essential for data reliability.

This project is focused on enhancing forecasting accuracy by detecting and handling such outliers from Haldiram’s past 12 months of sales data. By applying statistical techniques and using Excel tools, the data is first cleaned, then forecasted using the moving average method. The goal is to support the business in making informed, data-driven supply and demand decisions.

**DATA CLEANING &PREPARATION**

Data was in cleaned format it didn’t have any type of missing value or any type of error.

For preparation of data taking all the necessary columns which contains all the important data required for analysis. This was done with the help of Pivot table.

Used SKU Variety, industry segment and sales in Carton from May -24 to April- 25.

Pivoted the monthly sales along with SKU variety, industry segment and then sorted the data in descending order.

**OUTLIER DETECTION**

Once the data was cleaned & prepared arranged the data in descending order so that SKU with highest sales tops the table.

* Calculated the average sales of all the individual SKU.
* Checked which SKU performed consistently with the help of sparkline , greater the fluctuations greater the chance to get outlier.
* Calculated the standard deviation for all the SKUs.

**Inter Quartile Range (IQR)**

Used IQR method to identify outliers , this method is mathematically complicated but used widely graphically to identify outliers with the help of box & whisker chart .

To identify outliers here, first calculated the 1st & 3rd quartile with the help of percentile function in Excel .

**\* IQR = 3rd Quartile – 1st Quartile**

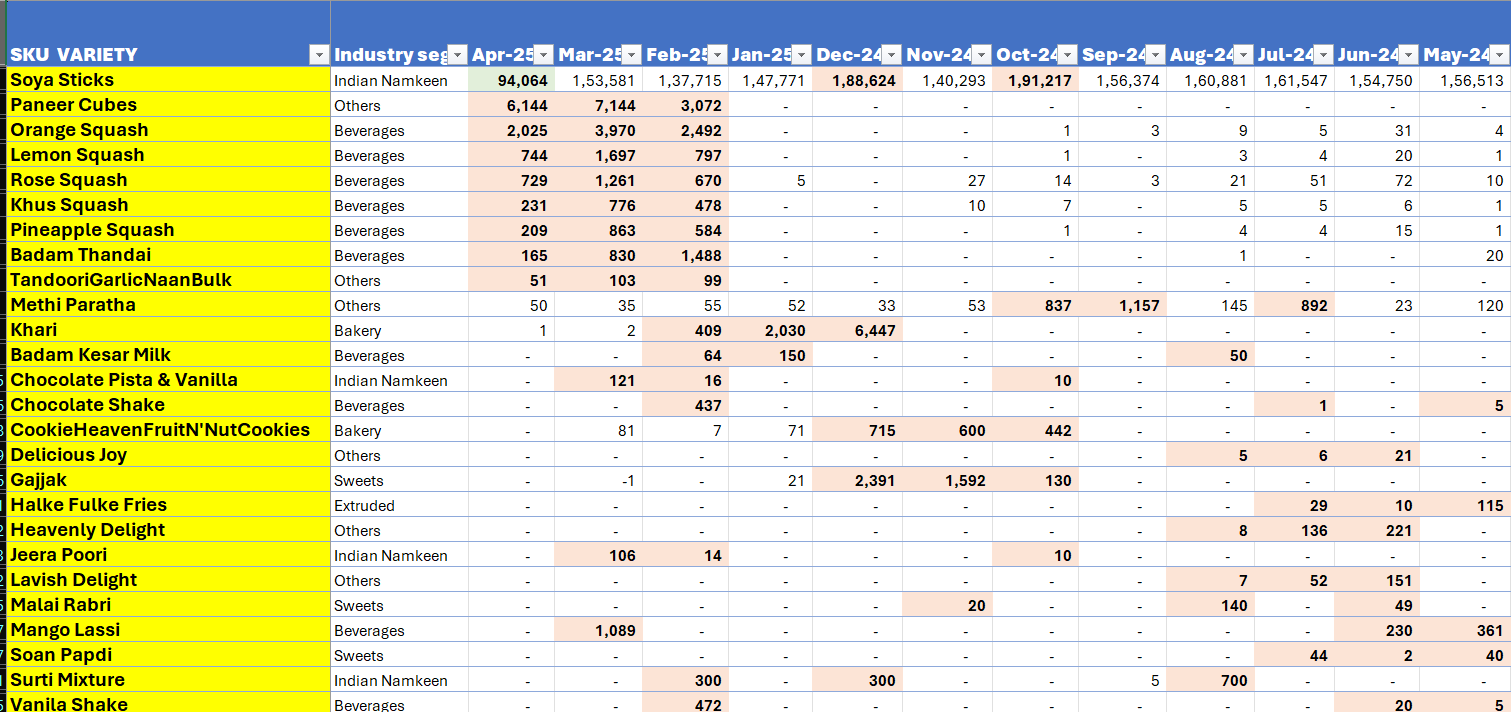
Once IQR was calculated, calculated the upper limit and lower limit for all the SKUs

**\* Upper limit = 3rd Quartile +( IQR×1.5)**

**\*Lower limit =1st Quartile – (IQR×1.5)**

* A graph with blue and white lines

  AI-generated content may be incorrect.Once the upper limit and lower limit was calculated, used the formula-
* **=IF(AND(MIN(F3:Q3) >= [@[LOW LIMT]], MAX(F3:Q3) <= [@[UP LIMT]]), "Within range", "Outlier")**
* this allowed to find out SKU having an outlier in it.
* Then with the help of filter option, filtering the row having “Outlier” in it.
* Once outliers were detected, copied all the outlier’s data to different worksheet to perform further operations on the table.
* Applied conditional formatting to visually identify the specific month in which an outlier occurs for the given SKU.
* This allowed to highlight all the cells having outliers for that SKU.
* Categorized outlier based on crossing upper limit or exceeding the lower limit and then formatted them accordingly.



**List of SKUs with most number of outliers**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SKU VARIETY** | **Apr-25** | **Mar-25** | **Feb-25** | **Jan-25** | **Dec-24** | **Nov-24** | **Oct-24** | **Sep-24** | **Aug-24** | **Jul-24** | **Jun-24** | **May-24** |
| **Sev Murmura** | 2,06,745 | **2,36,909** | 2,17,062 | 2,12,706 | **2,72,216** | 2,16,256 | 2,29,990 | 1,98,430 | 2,19,172 | 2,16,516 | 2,11,198 | 2,16,371 |
| **Moong Dal** | **1,04,217** | 1,65,860 | 1,28,307 | 1,22,421 | 1,75,930 | 1,78,294 | 1,69,669 | 1,55,646 | 1,52,097 | 1,80,680 | 1,72,101 | 1,53,799 |
| **Soya Sticks** | **94,064** | 1,53,581 | 1,37,715 | 1,47,771 | **1,88,624** | 1,40,293 | **1,91,217** | 1,56,374 | 1,60,881 | 1,61,547 | 1,54,750 | 1,56,513 |
| **Aloo Bhujia** | **84,427** | 1,34,679 | 1,08,306 | 1,20,708 | 1,31,317 | 1,18,854 | **1,64,697** | 1,16,465 | 1,34,015 | 1,37,901 | 1,17,975 | 1,19,195 |
| **Mixture** | **33,865** | **60,705** | 37,202 | 44,223 | 49,758 | 45,791 | 48,239 | 48,157 | 44,588 | 48,494 | 48,736 | 40,146 |
| **Cereal Pellet** | 33,697 | 44,764 | 58,188 | **73,346** | 43,982 | 39,704 | 44,545 | 33,372 | 42,339 | 33,250 | 38,117 | 32,683 |
| **Ratlami Sev** | **31,554** | 58,737 | 46,184 | 35,098 | 55,761 | 67,311 | 64,538 | 54,280 | 57,925 | 49,607 | 65,731 | 56,552 |
| **Pancharatan Mixture** | 15,068 | 22,108 | 21,247 | 11,614 | 22,981 | 21,240 | **32,608** | 16,305 | 27,937 | 21,946 | 18,812 | 22,565 |
| **Soya Chips** | **13,626** | 26,012 | 32,636 | 39,551 | 25,305 | **44,579** | 31,124 | 28,596 | 28,901 | 35,596 | 28,808 | 26,687 |
| **Elaichi Bread Toast** | 9,580 | 6,871 | 7,706 | **17,353** | **23,792** | 5,732 | 3,568 | 4,478 | 7,903 | 8,168 | 10,313 | 11,032 |

* Outliers in the most selling SKUs ,green indicates SKUs which have exceeded the lower limit (not sold much).
* Whereas brown indicates months when SKUs were sold much than their usual demand and have crossed the upper limit of sales.

**INSIGHTS & RECOMMENDATIONS**

* Multiple SKUs showed significant spikes or drops in sales due to events such as promotions, seasonal demand, or data entry errors.
* SKUs like beverages had over demand this was because of seasonal demand, in months like February, March & April.
* Many SKUs with significant sales throughout the year had dropped the sales in April, this was because of ongoing merging of Nagpur and Noida Haldiram. (Moong Dal, Soya sticks, Aloo Bhujiya, Mixture).
* Namkeen & Sweets had a huge sale from August – October this was because of the festive season.
* Few SKU witnessed heavy sales because of schemes/offer given by the company.
* Many NPD also came as outliers because of product launched in recent dates. – (Khari, Snac Lite Soya Katori, Paneer Cubes)
* SKUs like Yummy Bite, Chakoli, Chips Sour Cream N Onion had low sales in few months because of shortage of raw material.

**Segment wise fluctuation in sales**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Segment** | **Sum of May-24** | **Sum of Jun-24** | **Sum of Jul-24** | **Sum of Aug-24** | **Sum of Sep-24** | **Sum of Oct-24** | **Sum of Nov-24** | **Sum of Dec-24** | **Sum of Jan-25** | **Sum of Feb-25** | **Sum of Mar-25** | **Sum of Apr-25** |
| **Bakery** | 11,032 | 10,313 | 8,168 | 8,024 | 4,591 | 5,502 | 8,716 | **33,766** | **20,320** | 8,738 | 7,601 | 9,885 |
| **Beverages** | 3,136 | 2,920 | 412 | 622 | 74 | 341 | 162 | 110 | 2,139 | **22,693** | **20,613** | 10,183 |
| **Bridges** | **5,297** | **5,288** | 2,839 | 3,757 | 3,206 | 3,367 | **6,765** | 2,059 | 2,872 | 2,400 | 3,446 | **108** |
| **Extruded** | 940 | 976 | **283** | 1,069 | 1,807 | 5,973 | **10,821** | **9,196** | 6,544 | 4,035 | 3,852 | 789 |
| **Indian Namkeen** | 8,45,245 | 8,72,471 | 9,04,916 | 8,75,683 | 8,10,245 | **9,77,355** | 8,70,987 | **9,79,035** | 7,72,826 | 7,70,492 | 9,14,862 | **6,07,197** |
| **Others** | 83,774 | 80,268 | 99,729 | 95,753 | 80,547 | 92,100 | 71,345 | 80,620 | **1,40,350** | **1,24,557** | 93,421 | **54,089** |
| **Potato Wafers** | 16,999 | 14,679 | 14,817 | 16,362 | 10,744 | 12,699 | **1,793** | 17,858 | 16,480 | 16,178 | 10,997 | **2,432** |
| **Sweets** | 10,596 | 13,650 | 11,254 | 19,928 | **36,777** | **56,726** | 11,629 | 14,017 | 10,990 | 9,036 | 8,710 | 6,922 |

**A graph of different types of lines

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* The potato wafers segment had a lot of fluctuations in sales because of raw material shortage few times , and overdemand during season.
* Sweet segment has hikes during season, mostly between August and October.
* Beverages have sales only in summers.
* Namkeen have very less fluctuations and maintains almost constant sales but raw material shortage or seasonal overdemand affects the sales.

**A graph of different types of food

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**CONCLUSION**

* Outlier detection is an essential task to follow while moving the average trend for forecasting the demands of product.
* To maintain accuracy outliers are detected and the excess value is distributed evenly.
* This allows us to plan production, which reduces the chance of over production and inventory can be controlled.
* From calculations it was found that the reason for most of the products for high sales was high demand during the season.
* Low sales were witnessed because of the unavailability of raw material and during the merging of the two firms.
* NPD mathematically had high sales because of the recent launch and due to less sale data but they aren’t really considered as outliers.

**MEASURES**

* For products having seasonal demand, planning the production according to seasonal forecast and developing a category for different seasons to maintain accurate production.
* For lower sales due to raw material shortages, we can use different measures for procurement or to keep sales consistent maybe reducing the packet weight or increasing the sales can help.

**FORECASTING USING MAT**

* To forecast the demand of SKU ,I have used moving average trend .
* For this I have helped with sales data for the past 12 months and forecasted the monthly sales by using average sales of the last 3-month data.
* Using ***=sum(range of last-3 month)/3***.
* This approach enabled us to generate monthly forecasts accurately. Subsequently, we extracted the corresponding sales figures for each month to facilitate a clear comparison and analysis.
* For a detailed analysis I have calculated PVA percentage for each SKU for every month.
* For PVA I have used (Plan versus Actual)

***= (Actual Sales-Forecasted sales)/Forecasted sales***

**Forecasted sales data from July-24 to March-25**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SKU VARIETY** | **P-July** | **P-Aug** | **P-Sept** | **P-Oct** | **P-Nov** | **P-Dec** | **P-Jan-25** | **P-Feb-25** | **P-Mar-25** |
| Halke Fulke Plain Wafer | 3,86,936.67 | 4,17,274.67 | 3,98,137.67 | 4,01,226.00 | 3,48,590.67 | 2,41,982.67 | 1,82,719.67 | 2,46,488.33 | 3,29,530.67 |
| Sev Murmura | 2,07,984.33 | 2,14,695.00 | 2,15,628.67 | 2,11,372.67 | 2,15,864.00 | 2,14,892.00 | 2,39,487.33 | 2,33,726.00 | 2,33,994.67 |
| Khatta Meetha | 1,43,059.00 | 1,52,712.00 | 1,69,039.33 | 1,72,216.67 | 1,79,698.33 | 1,76,393.67 | 1,81,965.67 | 1,65,598.33 | 1,57,987.33 |
| Moong Dal | 1,61,405.67 | 1,68,860.00 | 1,68,292.67 | 1,62,807.67 | 1,59,137.33 | 1,67,869.67 | 1,74,631.00 | 1,58,881.67 | 1,42,219.33 |
| Soya Sticks | 1,45,461.00 | 1,57,603.33 | 1,59,059.33 | 1,59,600.67 | 1,69,490.67 | 1,62,628.00 | 1,73,378.00 | 1,58,896.00 | 1,58,036.67 |

**Planned VS Actual sales of SKU with highest sales**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SKU VARIETY** | **Jul-24** | **Aug-24** | **Sep-24** | **Oct-24** | **Nov-24** | **Dec-24** | **Jan-25** | **Feb-25** | **Mar-25** |
| Halke Fulke Plain Wafer | 4.48% | -12.58% | 126.37% | -6.59% | -100.00% | 22.97% | 157.40% | 238.43% | 97.95% |
| Sev Murmura | 4.10% | 2.09% | 27.27% | 62.54% | -98.13% | 130.47% | 71.77% | 341.98% | 82.08% |
| Khatta Meetha | 18.32% | 14.55% | 59.88% | 84.15% | -99.98% | 102.45% | 44.63% | 290.47% | 76.81% |
| Moong Dal | 11.94% | -9.93% | 55.08% | 48.80% | -66.76% | 106.16% | 29.46% | 170.04% | 90.45% |
| Soya Sticks | 11.06% | 2.08% | 48.02% | 86.85% | 11.96% | 115.97% | 51.02% | 83.61% | 66.96% |

* Positive data indicates actual sales of the product being more than that of forecasted.
* Negative indicates lesser sales than that of the forecasted.

**STOCK NORMS CALCULATION**

The **Stock norms** refer to the optimal level of inventory that should be maintained at a location (such as a store, depot, or warehouse) to ensure uninterrupted supply during the replenishment cycle. It is typically calculated based on average daily sales, lead time, and a safety stock buffer to account for demand variability or delays.

* To calculate stock norms for each SS, first I calculated the daily average sale for each SS.
* Then I calculated the safety stock, in this case I kept a margin of 25%
* Safety stock = 0.25 \* Average daily sales
* Then I defined lead time to SS according to their average daily sales if
* ADS>100, LT = 5
* 50<ADS<100, LT=7
* ADS<50, LT=10
* After getting Lead time for each SS.
* Once I got lead time, safety stock and average daily sales, I calculated Stock Norms
* Stock Norms = (Average Daily Sales \* Lead Time) + Safety stock

SS With Highest stock norms SS With Lowest stock norms

|  |  |
| --- | --- |
| **SS NAME** | **SN** |
| SS-241 | 35055.93 |
| SS-15 | 26287.51 |
| SS-197 | 25717.00 |
| SS-152 | 19063.53 |
| SS-139 | 18142.21 |

|  |  |
| --- | --- |
| **SS NAME** | **SN** |
| SS-226 | 0.36 |
| SS-62 | 0.34 |
| SS-67 | 0.31 |
| SS-31 | 0.19 |
| SS-32 | 0.03 |