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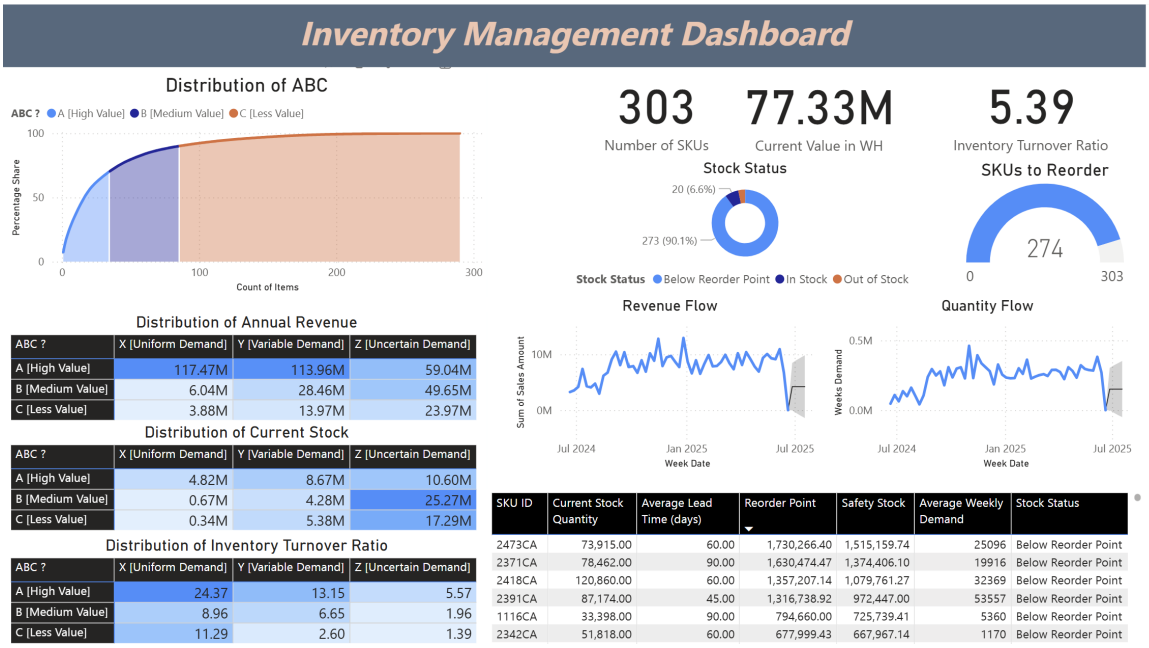
Project: Inventory Management Dashboard (clickable link)



For any warehouse inventory related data, 2 main tables are important:

1. What is the stock quantity

2. What are the orders/Asked Orders

- The way we classify ABC analysis is based on the revenue it generates. So, we have to check for each SKU, how much the revenue is annually.
- Against each SKU, we will try to get the annual sales qty from the "Past Orders" data

Step 1. We created following new columns on stock data

a) Annual sales quantity: We calculated the quantity of each SKU ID. Quantity was present in "Past Orders" Column
b) Annual Revenue: Annual sales quantity * unit price
c) Revenue Share %: % share of each SKUs with respect to total revenue
d) (Formula = Individual revenue / total revenue)
e) I replaced empty cells with 0 because these empty cells should be considered in the average function.
f) Cumulative Share = Cumulative sum of Revenue Share % Value
g) Reminder: ABC analysis follows the Pareto Principle so 70-80% of revenue is generated by 20% of the stock/inventory.
h) ABC ? : Categorized the stocks as 'A','B','C' using "Cumulative Share" column,
    a) Stocks from 0-70 will come under 'A' category.
    b) Stocks from 70-90 will come under 'B' category.
    c) Stocks from 90+ will come under 'C' category.

Step 2. Adding new graph to check if ABC categorization follows Pareto Principle:

a) Added a link and stack column chart.
b) x axis: ABC ?
c) y axis: Annual Revenue
d) Line value: % of SKU ID (To check the Pareto Principle)

Step 3: XYZ Classification

Definition of XYZ Classification –

XYZ Classification is a method of inventory management that categorizes items based on their demand variability and level of importance. This method is also known as the ABC-XYZ analysis, as it is often used in conjunction with the ABC Classification method, which categorizes items based on their value.

In XYZ Classification, items are categorized into three groups:

- X items: These are items that have the lowest demand variability and are the easiest to forecast. They are typically managed using a reorder point (ROP) approach, where inventory is replenished when it falls below a certain level.

- Y items: These are items that have moderate demand variability and are relatively easier to forecast. They are typically managed using a make-to-stock (MTS) approach, where production is based on a forecast of demand.
- Z items: These are items that have the highest demand variability and are the most difficult to forecast accurately. They are typically managed using a make-to-order (MTO) approach, where production is triggered by customer orders, rather than by a forecast.

The XYZ Classification method is often used in combination with the ABC Classification method, which categorizes items based on their value. This allows companies to prioritize their inventory management efforts based on both the demand variability and the value of the items.

Made-to-Stock (MTS): MTS is a strategy in which goods are produced based on anticipated customer demand, before actual customer orders are received. This means that goods are manufactured and stocked in inventory, in anticipation of future sales. In other words, MTS companies create products based on a forecast of what customers will want to buy.

Made-to-Order (MTO): MTO is a strategy in which goods are produced only after a customer place an order. This means that goods are manufactured in response to a specific customer request. MTO companies create products based on the specific requirements of each customer.

Step 4: To do XYZ analysis, we need to analyze the weekly demand for each item

a) Modelling -> New Table -> Name should be "Week Table"
b) Write a formula to create a date series from "14th June 2025 - 365" to "14th June 2025" with an increment of 7 to make it weekly.
c) Modelling -> New Table -> Name should be "SKU Table" (This table would contain all the SKU ID)
d) Write a formula to fetch all SKUs in SKU Table
    - Now every week, we will have to monitor all SKUs Demand

Step 5: CROSS JOIN both Week Table and SKU Table

a) Modelling -> New Table -> "Weekly Demand Sheet"
b) CROSSJOIN both tables using GENERATE.
c) In this case, the GENERATE function would create a new table that combines every row of the 'Week Table' with every row of the 'SKU Table'.

Step 6: Create a new column "Weeks Demand" in "Weekly Demand Sheet" Table with the formula below:

```
Weeks Demand = CALCULATE(
  SUM('Past Orders'[Order Quantity]),
  FILTER('Past Orders',
    'Past Orders'[SKU ID]='Weekly Demand Sheet'[SKU ID] &&
    'Past Orders'[Order Date] >= 'Weekly Demand Sheet'[Week Date]-6 &&
    'Past Orders'[Order Date] <= 'Weekly Demand Sheet'[Week Date]
    )
      )+0
```

- Note –
  - 'Past Orders'[Order Date] >= 'Weekly Demand Sheet'[Week Date]-6: The reason we use -6 is because we are using >= , if we used just > then we could have used -7
  - We used +0 at the end because we don't need blanks.

Step 7: Add a new column "Average Weekly Demand" in "Stocks" Table

Note: SKU IDs in STOCK table are unique (no duplicates)

We take the average demand of each stock in "Weekly Demand Sheet.Weeks Demand" column and populate the value in this new column.

Step 8: We need to calculate the standard deviation for demand of each SKU

a) Make a new column "Stdev of Weekly Demand."
b) Use the formula below.

```
Stdev of Weekly Demand = CALCULATE(
STDEV.P('Weekly Demand Sheet'[Weeks Demand]),
FILTER('Weekly Demand Sheet',
        'Weekly Demand Sheet'[SKU ID]=Stock[SKU ID]
```

)

)

Step 9: Add coeff of variation Column in "Stocks" table

The formula is = Stdev of Weekly Demand / Average Weekly Demand

- Note –
  - So, whenever the coeff. of Variation is very less, that means Stdev is very less compared to its average weekly demand, which means it is a very uniform demand scale.
  - When the coeff. of Variation is very high, that means the demand is very high, so it means it is not uniform or uncertain demand.
  - So, we need to allocate smaller coeff. of variation, under 'X' category, High coeff. of variation would be categorized as 'Z' category, and whatever comes in between is 'Y' category.
  - So, we need to decide a threshold for classification, usually first 20% items are considered under 'X', next 30% under 'Y' and remaining under 'Z'.

Step 10: Make a new column and rank those using "Coeff. of Variation" column in ascending order

a) Use "RANK.EQ" as the RANK.EQ function assigned a unique rank.

Step 11: We can see many NULL/NaN values in "Stdev of Weekly Demand" column, so I modified the formula of the column.

a) I assigned "1000" value to the coeff. of Variation, when the respective "Stdev of Weekly Demand" is equal to 0.
b) By doing this because when ranking "coeff. of Variation" using RANK.EQ, the NaN values were getting ranked as 1 and I didn't want that, so I replaced the NaN values with 1000 in "Coeff. of Variation" column

Step 12: Make a new column 'XYZ' column for XYZ classification:

a) Assign 20% of the RANK.EQ column items under X, 30% under Y and remain under Z.

Step 13: Make a new column "Value in WH" means Value in Warehouse

a) Formula: Quantity * unit price

Step 14: Make a new column "ABC Rank" as this will be helpful to create an ABC Pareto Chart

a) We rank based on "Cumulative Share" column.

Step 15: Add a new measure: Inventory Turnover ratio (This ratio tells us how efficient our inventory management is)

a) Formula = Costs of Goods Sold (COGS) Annually / Avg Inventory value in WH(Warehouse)

- Note: The reason we make it a "New Measure" and not "new column" is because:
  - A measure is evaluated in the context of the cell evaluated in a report or in a DAX query, whereas a calculated column is computed at the row level within the table it belongs to
  - Use this link to understand:
    I. https://community.powerbi.com/t5/Desktop/What-is-the-difference-between-a-measure-and-calculated-column/td-p/2900507
  - A new column can be used to perform calculations at a row level, whereas a new measure is used to perform calculations at an aggregated level, such as summing up a column or calculating an average.
  - A new column adds new data to your data model, which can increase the size of your data model. A new measure does not add new data to your data model and therefore does not affect the size of your data model.

Step 16: Now it's time to do some visualization, starting with Pareto Chart

a) a. Create a Stacked Area chart with X-axis = ABC Rank, Y-axis = Cumulative Share, Legend = ABC ?
b) Results: Here we see that this classification follows pareto principle where cumulative share of 'A' is almost 70%

Step 17: Now we will create an ABC-XYZ Matrix -> name it as "Distribution of Annual Revenue"

a) Create a Matrix with X-axis as ABC ? , Y-axis as XYZ ? , Values = Sum of Annual Revenue
b) Now change the Revenue values to "Millions" Unit
    a. Select the matrix -> Visual -> Specific column -> Values -> Display Units -> Select Millions -> Lessen the decimals.
c) Disable Row Totals and Column Totals
d) Add conditional formatting (See the visual)
    a. Results: What this matrix tells us for- against each type of category (ABC or XYZ), what is the distribution of our annual revenue

Step 18: Current Stock Value Distribution

a) Create a Matrix with X-axis as ABC ? , Y-axis as XYZ ? , Values = SUM of Value of WH
b) Now change the Revenue values to "Millions" Unit
    a. Select the matrix -> Visual -> Specific column -> Values -> Display Units -> Select Millions -> Lessen the decimals.
c) Disable Row Totals and Column Totals
d) Add conditional formatting (See the visual)

Observation:

- When we see the "Distribution of Annual Revenue" matrix, we see the highest value of the cell (A-X, ex. High Value - Less Demand Variability)
- But when we see the "Current Stock Value Distribution" matrix, we observe high value cells to be in (B-Z, C-Z, ex. medium to low value - High Demand Variability / Uncertainty)
- This usually happens because as we are uncertain of B-Z or C-Z item demands, we tend to stock up high to improve the service value.

Step 19: Select Card and add "Inventory Turnover Ratio"

Step 20: Select Card and add Count of "SKU IDs"

Step 21: Select Card and add SUM of "Value in WH"

Step 22: Distribution of Inventory Turnover Ration against ABC-XYZ:

a) Create a Matrix with X-axis as ABC ? , Y-axis as XYZ ? , Values = SUM of Value of WH
b) Disable Row Totals and Column Totals
c) Add conditional formatting (See the visual)
d) Note: The more the inventory turnover ratio, the better our efficiency.
e) Observation: We can see Uniform Demand Items(X) got high inventory turnover ratio which means these inventories are doing extremely well because the less we store, the better the service level
f) Now, we are going to calculate Safety Stocks and Re-Order Points
g) Safety Stock formula = (Peak Demand) * (Max Lead Time) - (Avg. demand) * (Avg. Lead Time)
    a. Note: Here we will be calculating it in weeks

Step 23: Add a column "Peak Weekly Demand" (We need this column for Safety stock calculation)

a) Identify peak demand of each SKU by taking max weekly demand of each SKU from "Weekly Demand Sheet" table.

Step 24: Calculate Safety Stock

a) Formula: Safety Stock = (Stock[Peak Weekly Demand] * Stock[Maximum Lead Time (days)]/7) - (Stock[Average Weekly Demand] * Stock[Average Lead Time (days)]/7)
b) Here we are dividing "Maximum Lead Time (days)" and "Average Lead Time (days)" by 7
    a. 7 because as these values are in days unit and we are calculating Safety Stock in week level

Step 25: Calculate Re-Order Point

a) ROP = Safety Stock (SS) + (Avg. Demand) * (Avg. Lead Time)
b) Step 26: Now after calculating ROP, we want to see if there is any Ordering required as of now.
c) Whenever the current stock is equal or lesser than ROP, then we need to re-order.
d) So, add a column "Is Ordering Required ?"

e) Step 27: To categorize the items based on stock quantity, whether they are in stock or out of stock.
f) Add a column "Stock status."
g) If Current Stock Quantity = 0 then "Out of stock" else "in stock"
h) If it is in "In stock" then we need to check if it is below ROP (Re-Order point) or below SS (Safety Stock).

Step 28: We want to see how many re-orders are required (Count of "Yes" in column "Is Ordering Required")

a) click or check the box (Is Ordering required) -> click on "Yes" in Basic Filtering column -> click on "CARD" visual to change it into a card visual.
    a. Note: This card is shifted to Page-1 visual

Step 29: To show the same above visual in Gauge instead of stock

a) Add a new measure "SKUs to reorder" and count SKUs with "Yes" in column "Is ordering required"
b) The "yes" count has come up to 284 but by default the max gauge value has come to double (568), but we want max gauge value to be the total count of SKUs, so we add SKU ID in "Maximum value" field.

Step 28: Distribution based on stock status

a) Add Donut chart.
b) Legend = Stock Status, Values = Count of SKU ID

Step 29: Push 3 columns "ROP", "SS" and "Stock Status" in the previously created table at left-bottom of the visual

Step 30: What is the flow of revenue and quantity out of warehouse for each SKUs and overall, as well

a) To populate the stock.unitprice * weekly demand sheet.quantity, use "LOOKUPVALUE"

b) FORMULA: = LOOKUPVALUE (Stock[Unit Price],Stock[SKU ID],'Weekly Demand Sheet'[SKU ID]) * 'Weekly Demand Sheet'[Weeks Demand']
c) Here we look up the unit price of each SKUs from the Stock table and then multiple it with Weeks Demand(qty)

Step 31: Add a relationship between Stock sheet and Weekly Demand Sheet

Note: The reason we are doing this is because:

a) All the visualizations made till now are from stock sheet, so whenever we click on a particular element in visual, the other visuals change as well.
b) But as we are about to create a visual from Weekly Demand sheet, click on a different element of a visual might not change the visual from Weekly demand sheet or vice versa.
c) Hence, we need to create a relationship.
    a. Modelling -> Manage relationships -> then add weekly demand sheet and select SKUID -> then add stock sheet and select SKUID.

STEP 32:

a) Add clustered column chart.
b) X-axis = Week Date, Y-axis = SUM of Weeks Demand (to get quantity wise flow), or add Y-axis = SUM of Sales Amount (To get revenue wise flow)
c) Make it a line chart, as it gives an added advantage of adding a forecast.
d) Microsoft says the forecast is an exponential smoothing forecast, we don't know the smoothing constant, but they have something as confidence interval.
e) To do forecast, click on the search icon -> turn on Forecast -> add 5 points (we need to forecast 5 points only)
f) You can add 2 in "Ignore the last" to see if the actual and forecasted lines are matching or not or how good the forecasting is. So, if you select 2 then it will start predicting from 2 points before the actual data ends.