DEMAND PLANNING

Umoja Demand Planning and Supply Network Planning Solution

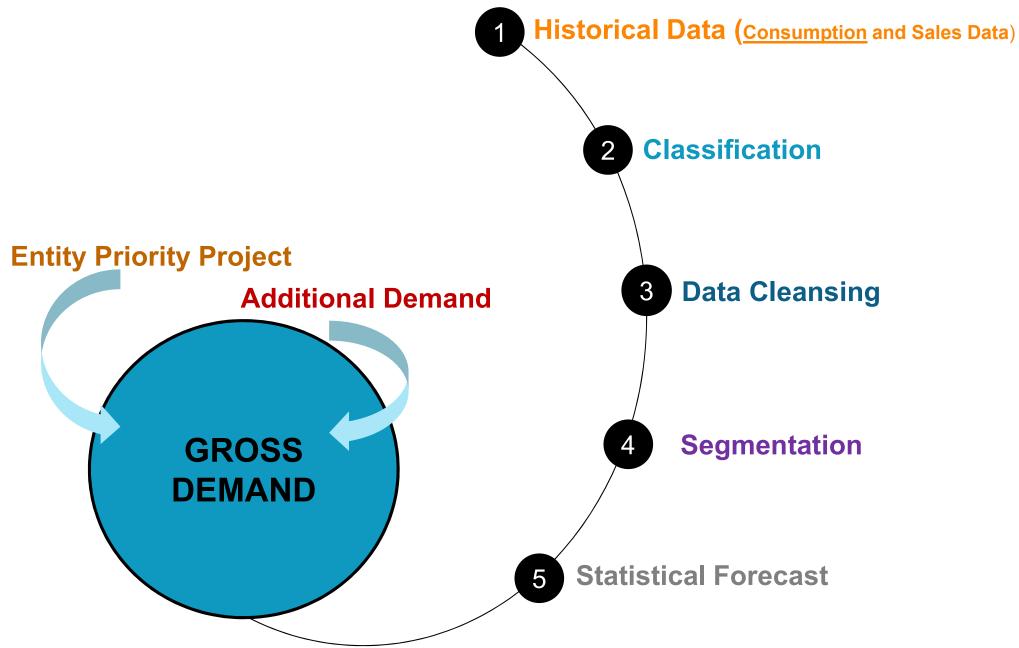
Segmentation and Statistical Forecast

UCS Training Team

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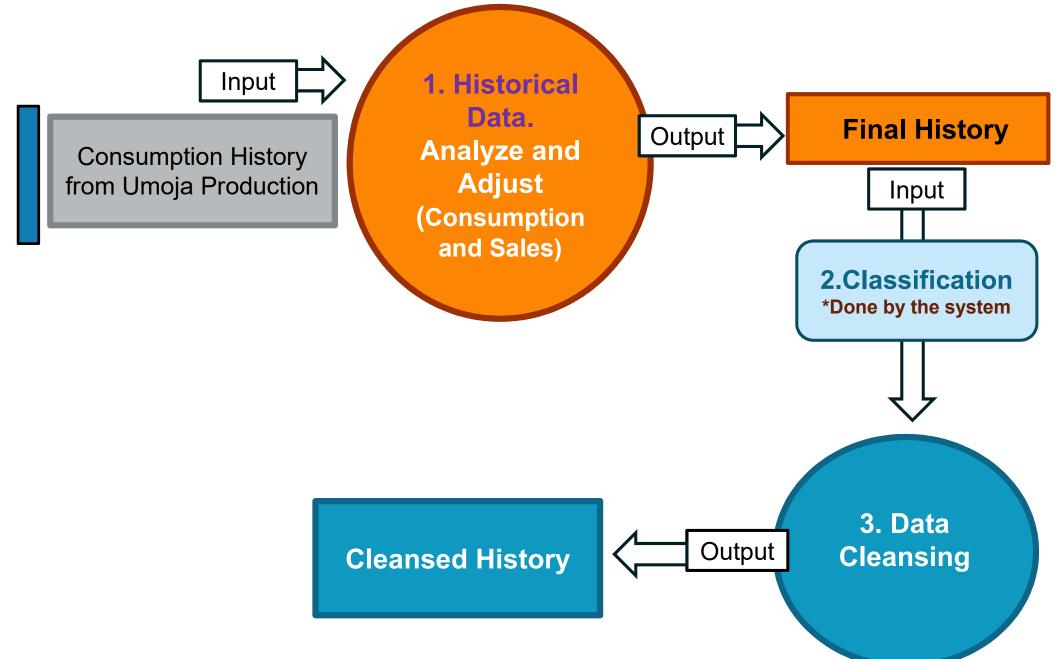


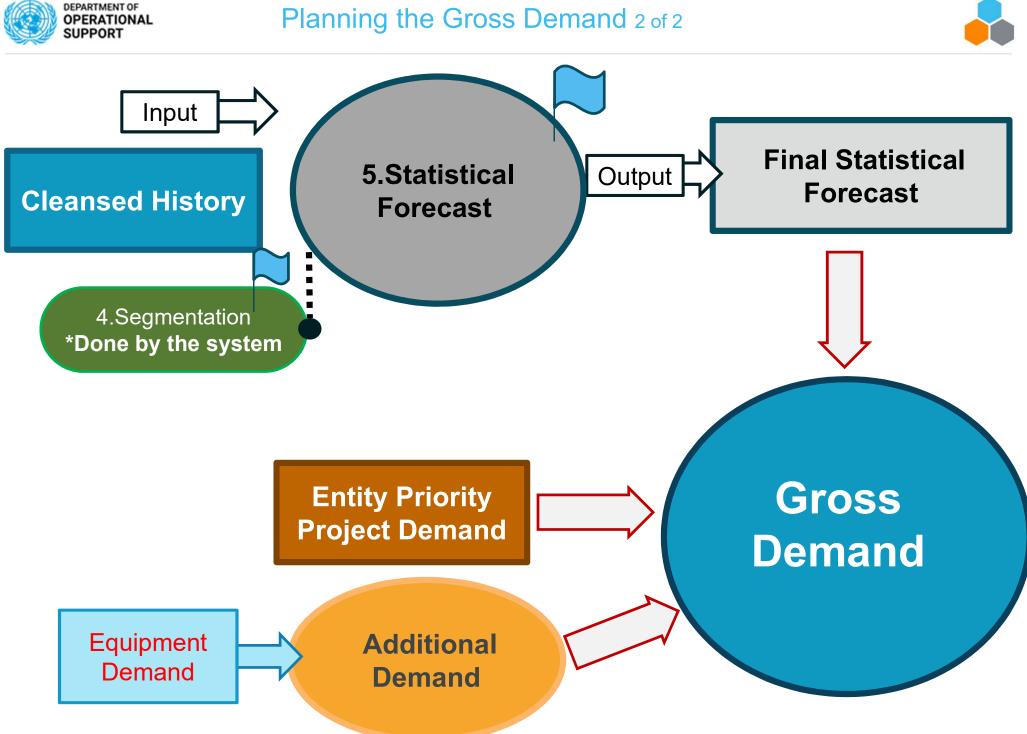




Planning the Gross Demand 1 of 2









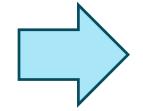


4.Segmentation ***Done by the system**



Therefore:

All goods and services have their own demand particularity or characteristic.



Demand for some products should be forecasted in priority; several factors matter.

The goal of Product Segmentation is:

Prioritize products based on their relative importance within a plant



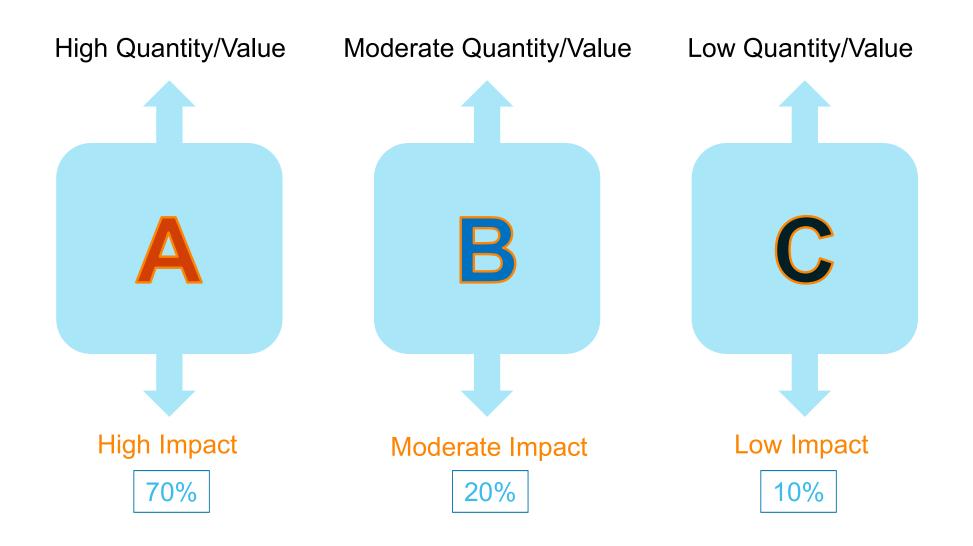


- The concept states that a small percentage of a group accounts for the largest fraction of the impact, value, etc.
- Applying the concept to inventory items we could say that 20% of the inventory items may constitute 80% of the inventory value.
- The ABC principle states that effort and money can be saved through applying looser controls to the low-dollar-volume class items and focus mainly on high-dollar-volume class items.
- > Other factors to consider to segment products:
- 1. Demand characteristics (Consumption Volume, Volatility, etc.)
- 2. Supply characteristics (Cost, Availability, Location, Reliability, etc.)
- 3. Internal Organizational Characteristics (Strategic, Critical)





Determining the Item priority







XYZ analyses group of items according to the volatility of their demand.

It focuses on how difficult is a product/service to forecast, <u>being X the</u> <u>easiest</u> and <u>Z the most difficult.</u>

Formula explained:

oFirst we calculate the Average Demand across a period.

o Then we calculate the Standard Deviation from the Average Demand.

oLastly we calculate the Coefficient of Variation (CV)

Standard Deviation of Average Period Demand

Coefficient of Variation =

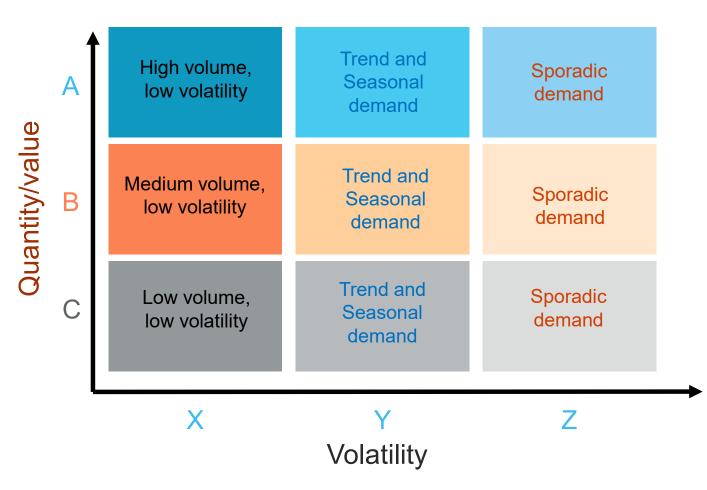
x 100

Average Period Demand





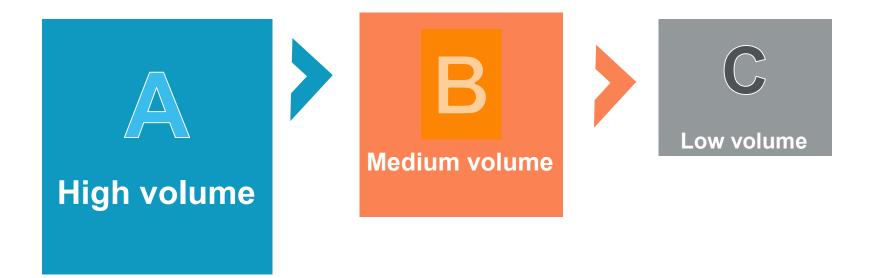
Combine the ABC Segmentation: Items are categorized by importance of their quantities\values (High/Medium/Low), with XYZ Segmentation: items are categorized by the volatility of their historical demand (Constant/Trend or Seasonal/Random or Sporadic)







- Planning should be primarily focused on the demand of class A product. Due to its high consumption volume, these products hold a high quantity/value of the total spending.
 - Demand planning of products of class B and C should be subsequentially addressed



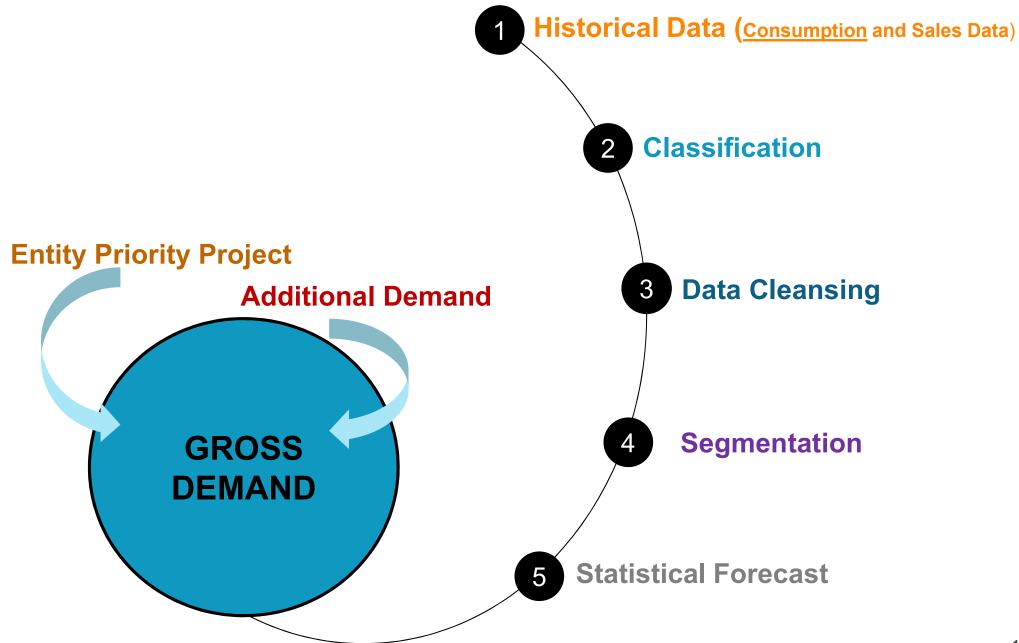


STATISTICAL FORECAST

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It organizes, interprets, and analyzes historical data to predict the future demand for a product or product group.





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Statistical Forecast is the process of making predictions of the future based on past data and most commonly by the analysis of trends.

By collecting, organizing, interpreting, presenting and analyzing Historical Data (time series), the Statistical Forecast allows you to predict the future demand for a product or product group.

Time series analysis:

- Looking at a collection of values observed sequentially over time, it performs time-based predictions.
- It assumes that past data patterns such as level, trend, and seasonality repeat themselves in the future.

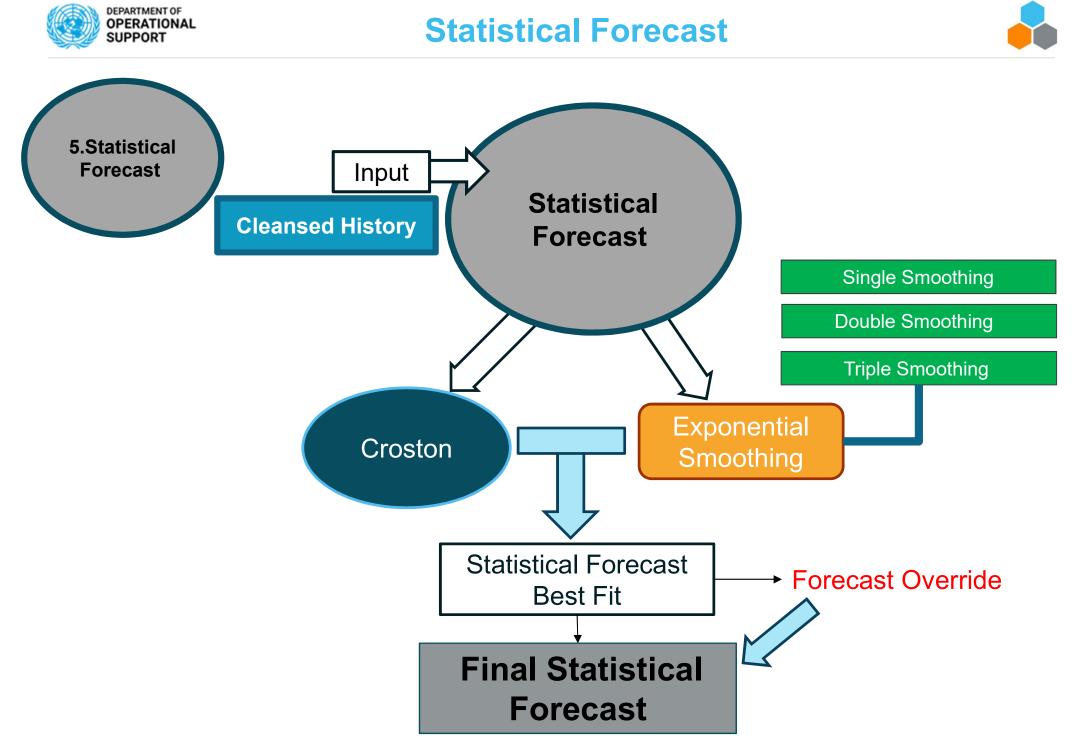




- Forecast is calculated using Forecasting Algorithms (mathematical formulas).
- Different formulas could be used depending on the type of Data we are analyzing:

DPSNP Solution selected below best forecast models:

| Constant | Trend | Seasonal | Intermittent |
|-------------|-------------|-------------|----------------|
| model | model | model | model |
| Single | Double | Triple | Croston Method |
| Exponential | Exponential | Exponential | |
| Smoothing | Smoothing | Smoothing | |







- The Single Exponential Smoothing is used to calculate the Forecast when Data are classified as Continuous.
- The Double Exponential Smoothing is used for the Forecast when Data are classified as <u>Continuous and Continuous with Trend</u>; while the Triple Exponential Smoothing is used for the Forecast when Data are classified as <u>Continuous</u>, <u>Continuous with Seasonality and</u> <u>Continuous with Trend</u>.





11-17 12-17 01-18 02-18 03-18 04-18 05-18 06-18 07-18 08-18 09-18 10-18 11-18





- The Forecasting Algorithm Exponential Smoothing calculates the Forecast assigning an exponentially decreasing weights from newest to oldest Data, hence the name "exponential smoothing".
- The weight is given by a parameter, α (Alpha), the smoothing factor, which is set to a vale between 0 and 1.
- More recent data will be associated with value closer to 1, as to say that more importance is given to the most recent data, which will therefore influence the Forecast more.
- Alpha value will exponentially decrease as older data are included in the calculation of the Forecast.





The Single Exponential Smoothing Algorithm: the Formula

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

Ft new Forecast
Ft-1 Previous period Forecast
At-1 Previous period actual demand
α smoothing parameter

Starting from the Forecast of the previous period Ft-1, apply a smoothing parameter (α), adjustable between 0 and 1, to the difference between the Actual Demand of the previous period (At-1) and its forecast (Ft-1).

 \geq The difference (At-1 - Ft-1) is the Error in the forecast of previous period. (t-1).





 \geq Both are an exstension of the Simple Esponential Smoothing.

In addition to the smoothing parameter Alpha:

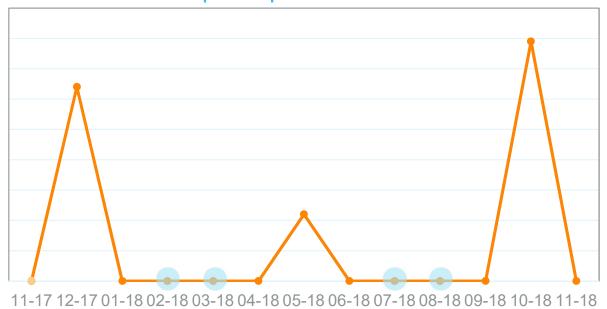
Double Smoothing introduces smoothing parameter to control the influence of the Trend in data. The increasing or decreasing pattern will be represented by a Line or Curve.

Triple Smoothing introduces the smoothing parameter to control te influence of Seasonality in data. In this case a regular and predictable changes recurs every given period.





The Time Series are classified as Intermittent when a product experiences several periods of zero demand, also referred to as Sporadic Demand. In this case, the best algorithm to use is Croston.



Example: Sporadic Demand





- This algorithm determining how frequently a good is requested and the typical amount requested, assumes that a constant Demand of size Y, occurs every P periods.
- It calculates the Average Demand level when there is a demand occurrence simply utilizing the size of non-zero demands and the time interval of those demands occurred.

 $Y_t = F_t/P_t$

 Y_t = Average demand per period A_t = Actual Demand period P_t = Forecast Demands Interval





- 1. Evaluate when Demand is zero o non-zero.
- 2. Calculate the average size of demand and apply simple exponential smoothing.
- 3. Calculate the average time interval between two demands occurrences and apply simple exponential smoothing.
- 4. Use the form of the constant model to predict the future demand: Forecast the demand as the demand level (when there is an occurrence) multiplied by the probability to have an occurrence.





At this time, the system will produce two Forecast Values, one as result of applying Exponential Smoothing and the other as result of applying Croston.

➤The Best Fit will be the value between the 2 with the lowest Mean Absolute Percentage Error (MAPE). The calculation of the Error is based on past data.





How the planner knows if a Forecast is a good one? An error factor between 0,3-0,4 could be quite reasonable.

The planner can adjust the Final statistical forecast manually if he/she thinks it does not represent the right sublocation requirement.







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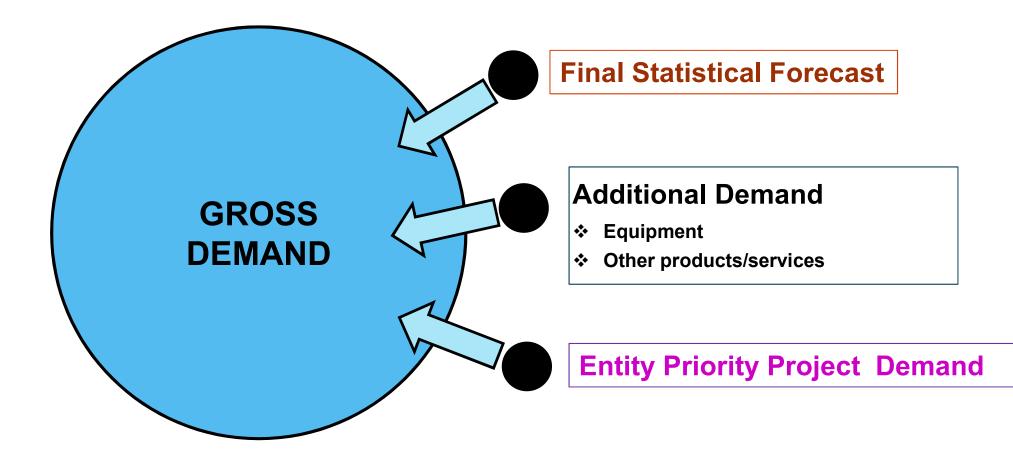
Adjustment of the Best Fit Statistical Forecast



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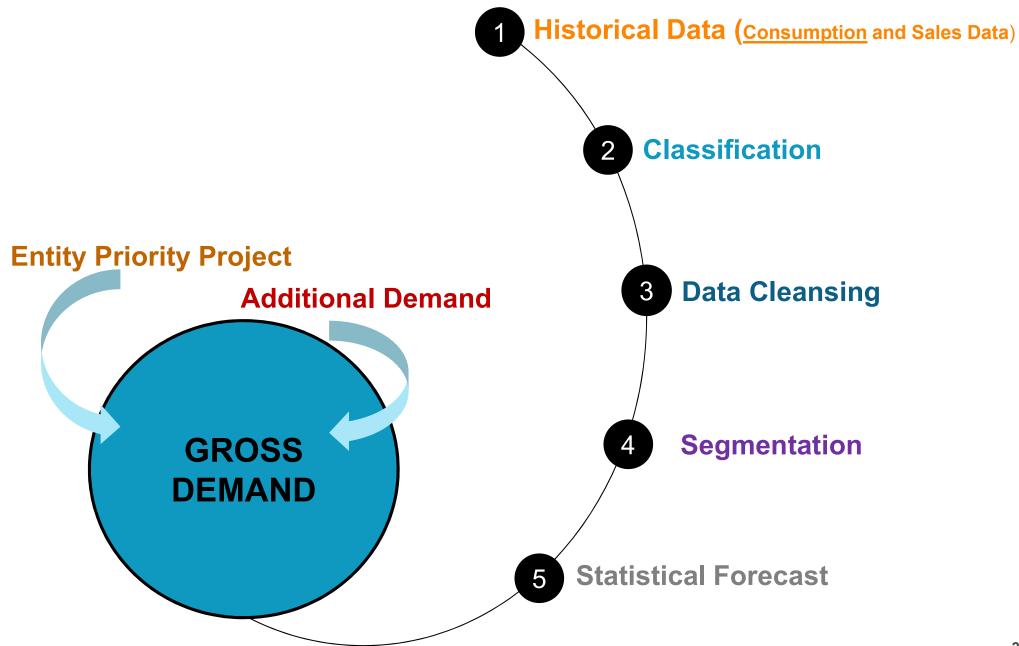




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Thank you!