TheMathCompany

DTZ – Improving Forecasting Accuracy

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Problem Statement and Assumptions

Problem Statement

DTZ is the fastest grocery delivery service. Nowadays, people do not want to waste their valuable time shopping or waiting in lines; this is where DTZ comes in, making people' life simpler while generating revenue for them. They are facing trouble keeping up with the fast expansion of its online channel due to poor precision in demand forecasting at its distribution centers.

Assumptions

- DTZ is an **online grocery delivery** with no offline stores
- Online grocery has ~4000 SKUs, out of which few are perishable and others are non-perishable
- Presence in major Indian Cities such as Bangalore, with each distribution center covering around ~4 KM in densely populated neighborhoods to deliver within half an hour
- Distribution centers are owned and operated by DTZ
- Expansion is happening in a number of distribution centers
- **Consumer preference varies** depending on the region and demography
- Delivery will happen in 2-time slots - one within 30 minutes and the other within a day
- E-grocery has been operational and hence the **point of sales data from each centre is available**
- **Mobile app** is the **preferred** option to order groceries but **customers can also order from the website**
- Service level (**SL**) of **90%** to be achieved

Industry Analysis

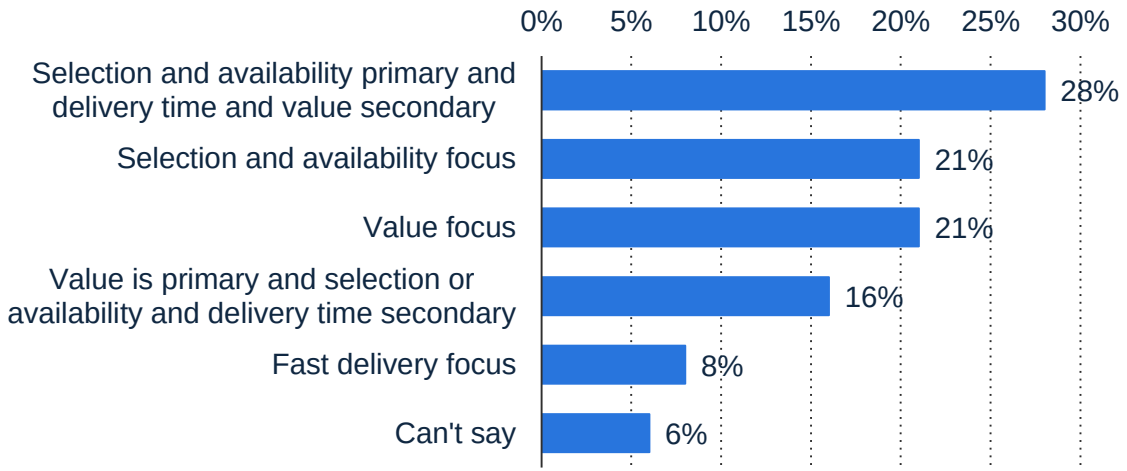
Growth drivers

- Rise of consumers disposable income and busier lifestyles
- Increasing urbanization
- Shifting consumer preferences
- Digital payment infrastructure development
- A tech-savvy population
- Availability of smartphone and data

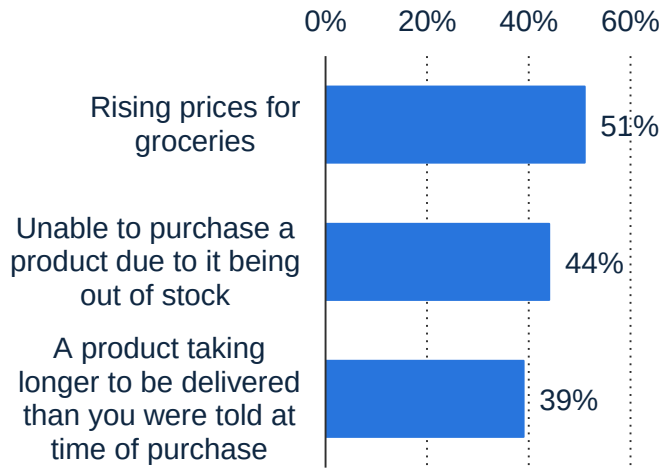
Emerging Trends

- Omni channel presence – Increasing customer touchpoints
- Analytics driven customer engagement personalized offering
- Increasing penetration of M-commerce and social commerce
- Express Delivery and In-house logistic

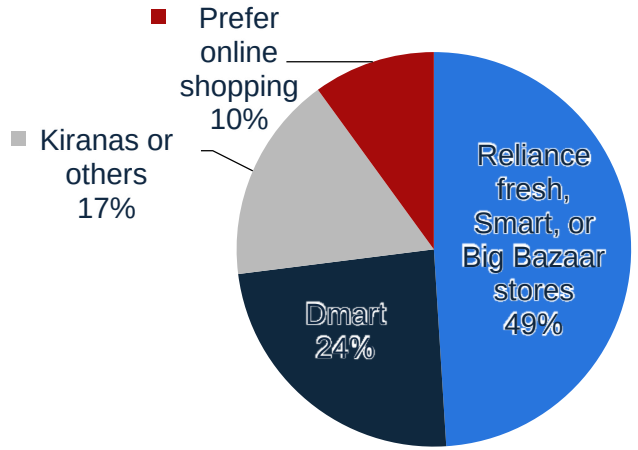
Most important criteria for consumers when shopping groceries



Problems experienced in online grocery

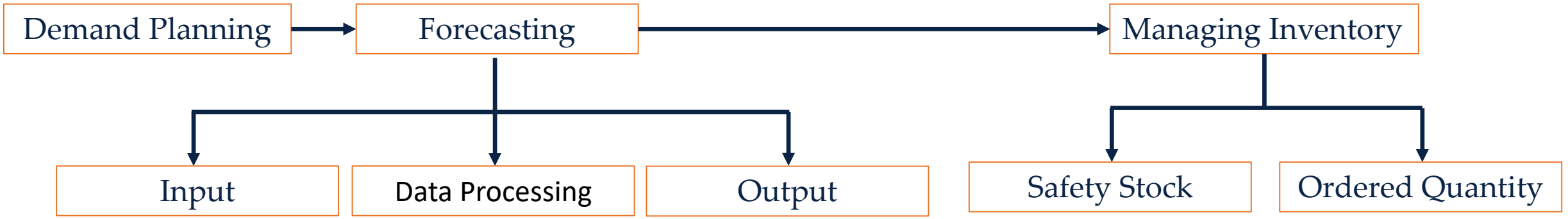


Preference for household shopping

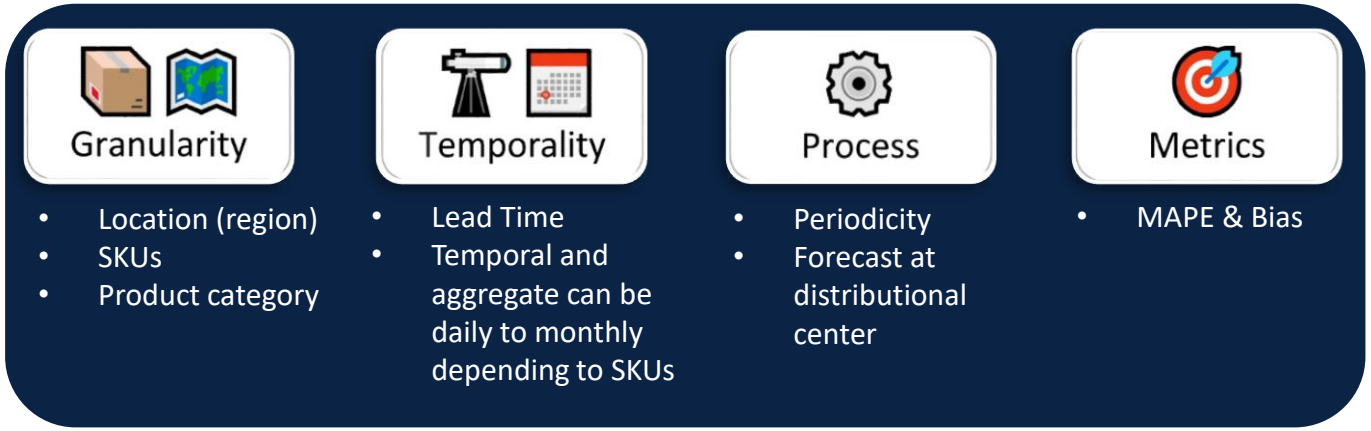


Approach for problem solving

To improve the Demand planning of e-grocery, there are two main parameters to be considered i.e., forecasting and Inventory management. A deep-dive into each of these parameters will help us to identify and address the roots of the challenge



Improving Forecasting



Achieve Desired service level

Increase the forecasting accuracy

Framework for Improving Forecasting

Improving forecast

Internal Data to be considered:

- Point of sale location specific at distribution centre
- Inventory Data
- Pricing
- Promotion
- SKUs specific Data (perishability & shelf-life)
- Personalized and curated Products specific to customer
- Expansion factor

External Data to be considered:

- Weather
- Seasonality
- Holidays/Weekend
- satiate factor (-ve factor)
- Day of the week
- Time
- Social/Economic (macro) Sentiments
- Competitor pricing

Pattern Recognition:

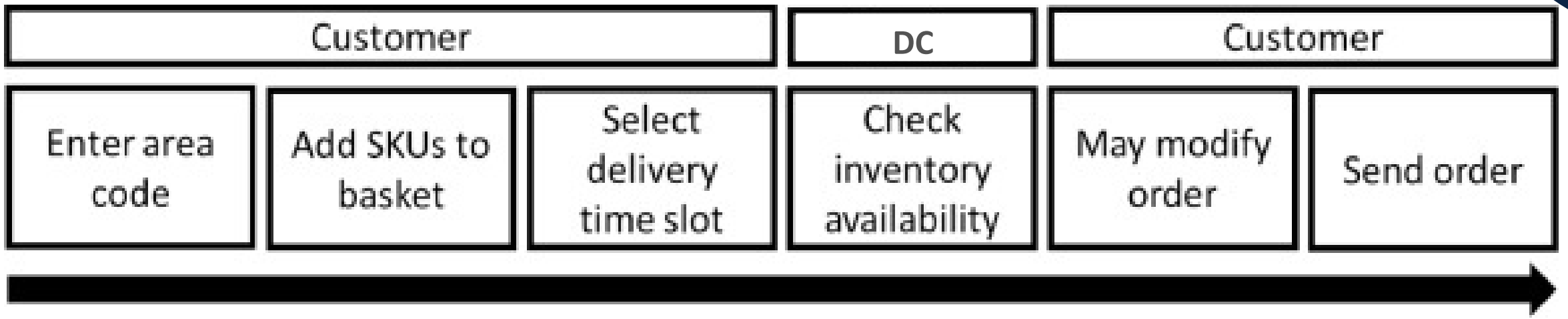
- Use of ML for Weekly Pattern recognition and daily Pattern recognition for sales
- Use of ML for Pattern recognition for expansion
- Use of ML for Pattern recognition for SKUs and complementary/substitute products
- Understanding the pattern for personalised preference ex: product/delivery

Output:

- Forecast will be following bottom-up approach
- Forecast is distribution center specific
- Models need to be tailored individually to each stock keeping unit.
- Use of MAPE as a forecasting metric
- Causal method: Multivariate linear regression with point of sale data integrated with Promotion factor, expansion factor, satiate factor

Data Sourcing through customer Journey

Customer Journey



Map the Data only for particular region and distribution center

Map to the product/SKUs favored by the demographic

Personalized Bundle/complementary and Promotional offers

no inventory information is provided

Desired SKU can simply be added to the basket, without restrictions from its availability status.

Capture preferences *before* stock -out information

2- options for suitable time slot:

30-mins delivery fee will be removed above min. order

Standard one day delivery at time-slots with offers on perishable SKUs

At the customer checkout, an algorithm checks the inventory availability of the requested SKUs for the selected delivery time slot

In case of missing inventory, a suitable substitute is offered to the customer, who can then modify the order

Stock-outs affecting the individual purchase. Missing SKU also affects demand data for complementary SKUs that are not purchased although available and demand data of selected substitutes that generate sales without original demand. Once product is available the forecast will have huge variation. This way variation can be removed

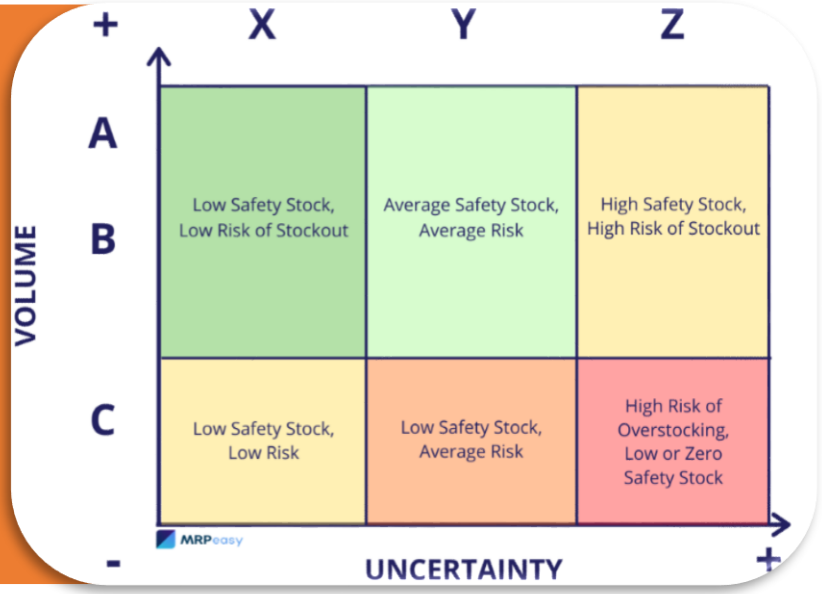
Achieve the desired service level | Demand Handling

Categorize Good for safety stock and ordering

- **Perishable Goods**
  - SINGLE PERIOD MODELS
- **Non-Perishable Goods**

Non-Perishable Goods

ABC Categorization of SKUs as per Fast movement of good, self-life/perishability and uncertainty in forecast

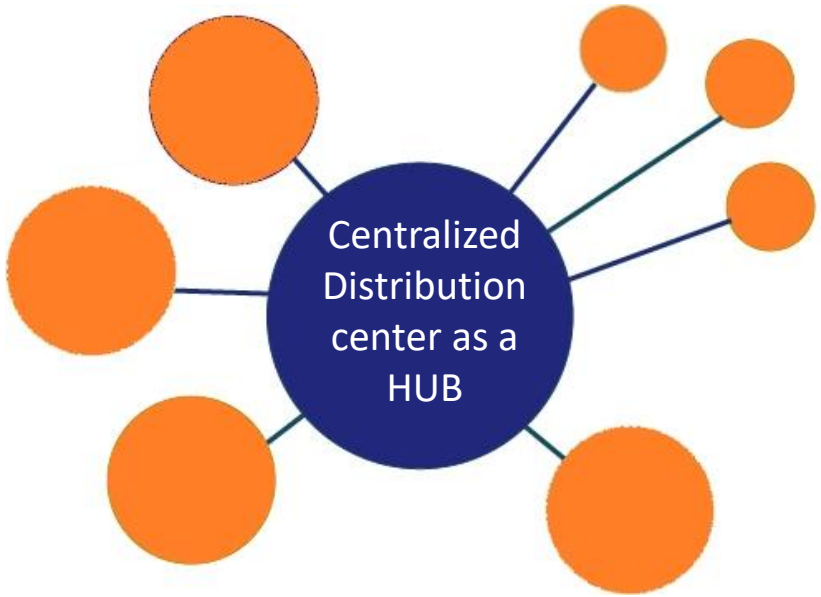


Categorize based on Demand

- **Peak Hours**
  - Consolidated order
  - Advance peak-hour inventory management
- **Non-Peak Hours**
  - Consolidate delivery routes
  - Conduct stock reallocation btw HUB & Spoke

Centralization reduces the variability in the demand and improves the forecasting efficiency

ML can be used to predict the orders/customers with real-time data and dispatch to respective dark stores before ordering



- Hub – Centralized distribution center
- Spokes with distribution/dark stores

Recommendations

Curated Product

- Develop recommendation engine based on historical orders, search and inventory of that location. Forecast will improve if people buy similar product and quantity
- Recommend the complementary product & past bought product that is not in cart

Personalised offering

- ML algorithms can be used to determine specialized and personalized promotional offer and time of delivery as a result you force customer to buy specific product at specific time
- Bundle offers as per the customer past data will further boost forecasting

Forecast Optimization

- AI/ML algorithms can be employed to make predictive forecast of customer demand based on factors discussed
- Forecast order schedule of repeat customers and their preferences such as delivery time, send push notifications for order to improve forecasting

Hub and Spoke

- Real-time inventory data along with ML to predict orders in each distribution center-DC- (spoke). If inventory is not available, dispatch from central DC(hub) to respective DC (spoke)
- Centralization reduces the variability in the demand improving forecasting

Subscription Model

- Predictable and recurring orders that will improve the forecasting and inventory management
- Feedbacks at multiple touch points and the continuous improvement process will be deployed to improve the forecasting model

Data and segmentation

- Inventory availability of the requested SKUs for the selected delivery time slot only at the customer checkout to avoid Stock-outs affecting the data collection for customer preference/orders.
- ABC Categorization of SKUs for forecasting and safety stock at SKU level

Roadmap

Quarter 1

- **Data collection** - Sales, SKU, pricing, inventory & promotional data
- **Categorization of SKUs** using ABC methodology - divide SKUs based on forecasting uncertainty and volume sold
- Pattern recognition to identify purchase trends
- Identification of peak hour / non-peak hours for each distribution center

Quarter 2

- Deployment of ML-driven **inventory forecasting** model
- Trend recognition to identify peak hour/non-peak hour stockouts
- Distribution network analysis to understand peak hour demand patterns
- Regression analysis to understand forecast deviation during peak hours
- MVP of AI-based model for peak demand forecasting

Quarter 3

- **Optimization** of inventory forecasting model based on seasonality and user order patterns from Q1 & Q2
- Development of **spoke distribution centers** based on predicted inventory data patterns
- Analysis of peak-hour demand cancellation patterns
- Consolidation of delivery routes based on demand forecasting and cancellation for peak hour **demand handling**

Quarter 4

- **Development of centralized hubs** based on inventory turnover and inventory holding in spoke distribution centers
- **Integration of peak demand forecasting data with inventory forecasting data** for improved capacity planning and inventory optimization
- Identification of trends across the hub and spoke models **to optimize the ML-based inventory and demand handling algorithms**

Thank You

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