**Week 1, Day 4: Demand Forecasting Basics**

Goal: Understand how to predict future demand accurately to reduce stockouts and overstocking.

**1. What is Demand Forecasting?**

Demand forecasting = **Predicting future customer demand** based on historical data, market trends, and other influencing factors.

Helps with:  
1. Reducing inventory holding costs  
2. Avoiding stockouts and overstocking  
3. Improving customer satisfaction  
4. Better production and procurement planning

**2. Types of Demand Forecasting**

| **Type** | **Description** | **Example** | **Best Use Case** |
| --- | --- | --- | --- |
| **Qualitative** | Based on expert opinions, market research, and customer surveys | New product launch | When historical data is limited |
| **Quantitative** | Based on historical data and statistical models | Using sales data from the last 3 years | When reliable data is available |
| **Time Series** | Analyzes patterns over time (trends, seasonality) | Increased demand for ice cream in summer | When demand follows a clear pattern |
| **Causal Models** | Considers external factors (weather, holidays, economic trends) | Demand increase during Diwali or Christmas | When external factors strongly influence demand |
| **Machine Learning Models** | Uses algorithms to detect complex patterns and predict demand | AI-based sales forecasting | Large data sets with complex variables |

**3. Time Series Models**

**Time series models** are widely used in supply chain forecasting because they capture trends and seasonality over time.

**Moving Average** – Averages demand over a fixed period.  
 **Exponential Smoothing** – Similar to a moving average but gives more weight to recent data.  
 **Seasonality Adjustment** – Adjusts for recurring patterns (e.g., winter clothing demand).

👉 **Example:**

* Sales data for the past 3 months:
  + January = 100
  + February = 120
  + March = 110

**3-Month Moving Average**:

**Exponential Smoothing**:

* Smoothing Factor (α) = 0.5
* March forecast = (0.5 × 110) + (0.5 × 120) = **115**

**4. Regression Models**

**Regression models** analyze relationships between demand and external factors (like pricing, weather, marketing).

**Simple Linear Regression:**

* **Y** = demand
* **X** = independent variable (e.g., price)
* **m** = slope of the line
* **b** = intercept

**Example:**

* If demand increases by 20 units for every ₹10 decrease in price:

If price = ₹40 → demand = **-2(40) + 150 = 70**

**5. Seasonality Adjustment**

Adjusting forecasts based on recurring seasonal trends:  
 Ice cream sales spike in summer  
 Umbrella sales increase in monsoon  
 Winter jackets spike in winter

**Example:**

* Average monthly sales = 500 units
* Sales during July (peak season) = 700 units

**Seasonality Index**:

Adjust future July sales by multiplying forecast by **1.4**.

**6. Tools for Forecasting**

1. Excel (Moving Average, Regression)  
 2. Google Sheets  
 3. Python (Pandas, Statsmodels)  
 4. Power BI (Trend & Seasonality Analysis)

**Action Step:**

Try calculating a **3-month moving average** and a **simple linear regression** in Excel.  
 Try adjusting for seasonality using a seasonality index.