**🏭 Warehouse Performance Analysis using SQL & Excel Dashboard**

**🎯 Objective:**

To analyze warehouse performance data using SQL and visualize key metrics in Excel dashboard.  
The goal is to monitor cost efficiency, optimize manpower, reduce errors, and improve warehouse operations.

**📘 SQL Analysis Requirements / Topics**

**🧩 Basic Level (Data Understanding & Simple Queries)**

1. Show all data from the Lease Cost table.
2. Retrieve the total lease cost allocated and used for each month.
3. Display all unique months available in the dataset.
4. Find total outbound quantity from the Reduce Wrong Issuance table.
5. Show the list of all KPIs and their values from "KPI's" sheet.
6. Retrieve all columns from the Space Utilization table where space used is less than space allocated.
7. Calculate the total claims for each month.
8. Display total overtime percentage for all months.

**⚙️ Intermediate Level (Aggregations, Joins, Logic Building)**

1. Find the average lease cost used across all months.
2. Calculate monthly savings by subtracting lease cost used from lease cost allocated.
3. Get the total wrong issuance quantity per month and the average outbound quantity.
4. From Space Utilization, find space utilization efficiency = (Space\_Used / Space\_Allocated) × 100 for each month.
5. Combine Reduce Overtime and Reduce Claims data to compare claims amount vs overtime % by month.
6. Create a query to rank months by highest savings (from any cost-based table).
7. Join Inbond and Outbond tables to get total inbound and outbound quantity per month.
8. Find which month had the lowest inventory turnover ratio and show its cost of goods sold (COGS) and average inventory.

**🧠 Advanced Level (Analytics, CTEs, Window Functions, KPIs)**

1. Use a CTE to calculate cumulative lease cost used over months.
2. Write a query to compute YoY growth in savings (if multiple years exist).
3. Create a Window Function to find the month-over-month change in SCL\_Efficiency.
4. Calculate correlation or trend between space utilization % and total outbound quantity (if numeric data available).
5. Use a CASE WHEN statement to categorize months as:
   * “High Saving” if saving > 10000
   * “Medium Saving” if between 5000–10000
   * “Low Saving” otherwise
6. Build a combined performance summary (using JOINs and aggregations) showing:
   * Month
   * Total Lease Cost Used
   * Space Utilization %
   * Inventory Turnover Ratio
   * Wrong Issuance %
   * Total Claims
7. Rank all KPIs by performance score using a window function (RANK() or DENSE\_RANK()).
8. Create a view called Warehouse\_Performance\_Summary combining key metrics (cost, space, efficiency, outbound).

**📊 Final Dashboard (Excel / Power BI Visualization)**

**🎯 Dashboard Objective**

The **Warehouse Dashboard** is designed to provide a clear and data-driven view of overall warehouse operations.  
It helps management **monitor cost efficiency, manpower utilization, space optimization, and process performance** — all in one view.

This dashboard converts SQL-driven KPIs into **interactive visuals** to support faster and more accurate decision-making.

**🧭 Key Performance Indicators (KPIs)**

Each KPI represents an important operational or cost performance metric derived through SQL analysis.

| **KPI Name** | **Description** | **Purpose** |
| --- | --- | --- |
| **Total Savings ($)** | Shows total financial savings compared to budgeted cost | Measures cost reduction efficiency |
| **SCL Baseline ($)** | Represents the base standard cost for comparison | Used for variance and efficiency benchmarking |
| **SCL Charges ($)** | Displays total cost incurred for logistics operations | Helps track expenditure trend |
| **SCL Efficiency (%)** | Calculated using performance ratio of output vs cost | Measures overall warehouse productivity |
| **Target vs Actual Savings** | Shows target cost, actual cost, and achieved savings percentage | Monitors target achievement and cost control |
| **Inventory Turnover Ratio** | Ratio of Cost of Goods Sold (COGS) to Average Inventory | Indicates inventory efficiency and movement |
| **Manpower Optimization (Cost/MS)** | Compares manpower cost vs total outbound quantity | Identifies operational efficiency and resource allocation |
| **Space Utilization (%)** | Ratio of space used to space allocated | Helps in optimizing warehouse space usage |
| **Wrong Issuance Reduction** | Number of incorrect issuances per month | Measures accuracy and process reliability |
| **Claim Reduction ($)** | Monthly value of claims raised | Reflects quality and accuracy of dispatches |
| **Overtime Charges (%)** | Monthly overtime percentage | Tracks manpower workload and cost overrun |
| **Savings % by Quarter** | Trend of cost savings over Q1–Q4 | Displays performance improvement over time |

**📈 Charts & Visual Components**

The dashboard is visually organized into multiple sections — each representing a specific operational domain.

**1. Cost Efficiency Overview**

* **Charts:** Column charts for *Lease Cost Allocated vs Lease Cost Used vs Savings*
* **Purpose:** Understand how efficiently the warehouse controls lease costs month-over-month.

**2. SCL Efficiency Trend**

* **Charts:** Combo chart (bar + line) for *Efficiency vs Savings* across quarters (Q1–Q4)
* **Purpose:** Analyze quarterly performance and improvement in cost efficiency.

**3. Manpower & Process Optimization**

* **Charts:** Horizontal bar chart comparing *Actual Manpower Cost* vs *Total Outbound Units*
* **Purpose:** Identify whether manpower utilization is aligned with outbound activity volume.

**4. Space Utilization**

* **Charts:** Bar chart comparing *Space Used vs Space Allocated*
* **Purpose:** Detect space under-utilization or over-utilization in warehouse capacity.

**5. Reduce Wrong Issuance**

* **Charts:** Clustered bar chart for *Total Outbound vs Wrong Issuance Quantity*
* **Purpose:** Evaluate accuracy in outbound operations and track monthly error reduction.

**6. Reduce Claims**

* **Charts:** Vertical column chart showing *Claim Amount ($)* by month
* **Purpose:** Track trends in claims and ensure product handling and dispatch quality.

**7. Reduce Overtime Charges**

* **Charts:** Bar chart displaying *Overtime % per month*
* **Purpose:** Monitor workforce productivity and avoid excessive overtime costs.

**8. Inventory Turnover Ratio**

* **Charts:** Dual bar chart for *COGS vs Average Inventory*
* **Purpose:** Understand how efficiently inventory is moving and being utilized.

**9. Overall Summary Cards**

* **Visuals:** KPI Cards for Total Savings, Efficiency, Baseline, and Charges.
* **Purpose:** Provide at-a-glance insight into warehouse financial and operational performance.

**⚙️ Dashboard Interactivity**

* **Filters Available:** Quarter (Q1–Q4), Month (Jan–Mar)
* **Functionality:**
  + User can switch between months or quarters to analyze period-wise performance.
  + Visuals are dynamically linked with backend SQL outputs or data models.

**💡 Insights Derived**

* Warehouse achieved **26.98% actual savings**, close to the target.
* **SCL Efficiency improved** in Q4 compared to Q3, showing process recovery.
* **Wrong issuance reduced drastically** in March.
* **Lease cost and space utilization trends** show scope for cost optimization.
* **Overtime peaked in March**, suggesting manpower adjustment needed.
* **Inventory turnover remained strong**, with stable cost-to-inventory ratio.

**🧰 Tools Used**

* **SQL** – for Data Extraction, Aggregation, and KPI Calculations
* **Excel (with VBA/Power Query)** – for Data Modeling and Dashboard Visualization
* **Optional:** Power BI (for automation and live updates in future versions)