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# DATA ANALYTICS CASE STUDY


## FMCG Warehouse: Optimizing Amazon's Distribution Efficiency

**Presented BY**
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# Content

# Introduction: Background And Problem

## Introduction

This project involves analyzing data from Amazon's network of warehouses to identify inefficiencies affecting the supply chain. These inefficiencies have led to frequent stockouts, delivery delays, and increased operational costs.

## BackGround

You are a data analyst at Amazon, which has an extensive network of warehouses across various regions. The company is facing challenges in ensuring efficient warehouse operations, resulting in frequent stockouts, delays in deliveries, and increased operational costs. The management has tasked you with analyzing the data from these warehouses to identify key issues and provide actionable insights to enhance warehouse efficiency.

## Problem

You are a data analyst at Amazon, which has an extensive network of warehouses across various regions. The company is facing challenges in ensuring efficient warehouse operations, resulting in frequent stockouts, delays in deliveries, and increased operational costs. The management has tasked you with analyzing the data from these warehouses to identify key issues and provide actionable insights to enhance warehouse efficiency.


# Solution

o solve Amazon’s warehouse inefficiencies as a data analyst, we can take a systematic approach involving data exploration, root cause analysis, and optimization strategies.

**1. Understand the Problem & Define Key Metrics**

- Stockouts → Lost sales & customer dissatisfaction
- Delivery delays → Reduced Prime efficiency & SLA breaches
- Increased costs → Inefficient labor & warehouse space usage

**2. Collect & Analyze Warehouse Data**

**Data Sources:**

- Warehouse Management System (WMS) logs
- Labor productivity records
- Historical order & shipment data
- Inventory records & demand forecasts

# Solution

### 3. Identify Root Causes of Inefficiencies

🔍**Potential Issues & Data Insights**

| Issue | Data Indicators | Possible Solution |
|---|---|---|
| Stockouts | High demand volatility, poor forecasting | AI-driven demand prediction |
| Delivery Delays | Long pick & pack times, inefficient layout | Optimize warehouse zoning & automation |
| Inventory Inaccuracy | Mismatch between WMS and physical stock | RFID-based real-time tracking |
| Poor Labor Productivity | High idle time, overtime costs | Workforce optimization & task scheduling |
| Underutilized Space | Low storage density, poor slotting | Dynamic slotting & vertical storage |

### 4. Implement Data-Driven Optimization Strategies

Improve Inventory Management

Optimize Warehouse Layout & Storage

Enhance Order Fulfilment Process

Improve Workforce Productivity

# Project Scope And Methodology

## 📌Project Scope

This project aims to analyze Amazon’s warehouse operations to identify inefficiencies contributing to stockouts, delivery delays, and increased costs. The focus will be on diagnosing operational bottlenecks, leveraging data analytics for insights, and proposing data-driven solutions to optimize performance.

## Objectives

1. **Identify key inefficiencies** in inventory management, order fulfillment, and warehouse operations.
2. **Analyze warehouse data** to uncover root causes of stockouts, delays, and cost escalations.
3. **Develop predictive models & optimization strategies** to enhance warehouse efficiency.

**Implement data visualization**

# Project Scope And Methodology

🔍**Key Focus Areas:**

- **Inventory Management**: Stock replenishment, demand forecasting, inventory accuracy.
- **Order Fulfilment**: Picking, packing, sorting, and shipment processing times.
- **Warehouse Layout & Storage**: Space utilization, item placement, and traffic flow.
- **Labor Productivity**: Workforce allocation, task scheduling, and operational efficiency.
- **Technology & Automation**: RFID tracking, robotics, and real-time monitoring.

## 🛠 Methodology

**Phase 1:** Problem Definition & Data Collection

**Phase 2**: Exploratory Data Analysis (EDA) & Root Cause Analysis

**Phase 3:** Predictive Modelling & Optimization

**Phase 4**: Implementation & Data Visualization

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# Goals And KPI’s

## 🎯Project Goals

The primary goal is to **optimize warehouse efficiency** by analyzing data to identify bottlenecks, reduce costs, and improve order fulfilment.

## ✅ Specific Goals:

**Reduce Stockouts** → Improve inventory accuracy and demand forecasting.
**Minimize Delivery Delays** → Optimize order picking, packing, and dispatch.
**Decrease Operational Costs** → Enhance labor productivity and space utilization.
**Improve Warehouse Throughput** → Reduce order processing time and increase automation.
**Enhance Customer Satisfaction** → Faster and more accurate deliveries.

## 📊Key Performance Indicators (KPIs)

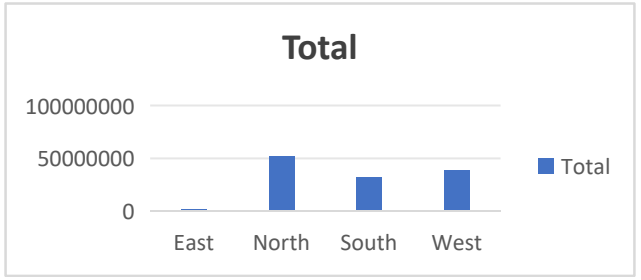
To measure the success of warehouse optimization, we track **efficiency, accuracy, and cost-related KPIs**.

# KPI's

## Inventory Management KPIs

The total number of retail shops served by each zone?

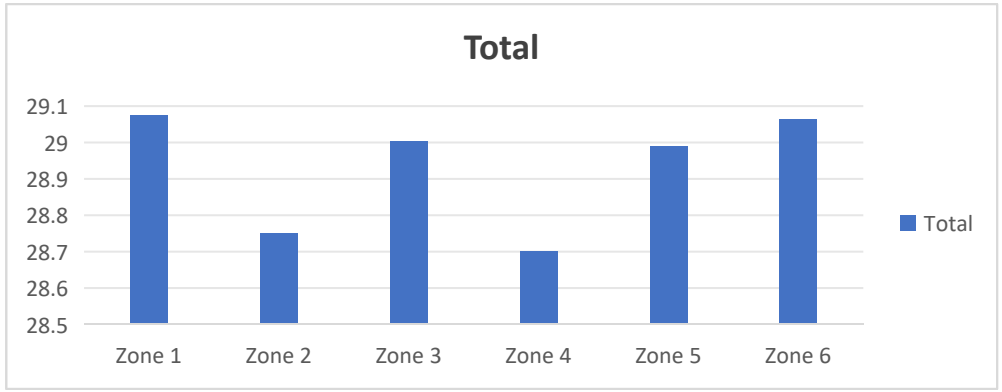
| zone | Sum of retail_shop_num |
|---|---|
| East | 2061277 |
| North | 51869267 |
| South | 31932776 |
| West | 38779469 |
| Grand Total | 124642789 |




## Warehouse Operations KPIs

The average number of workers per warehouse.

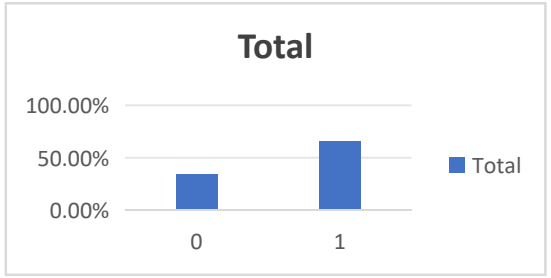
| WH_regional_zone | Average of workers_num |
|---|---|
| Zone 1 | 29.07643622 |
| Zone 2 | 28.7522781 |
| Zone 3 | 29.00312392 |
| Zone 4 | 28.70138889 |
| Zone 5 | 28.98931764 |
| Zone 6 | 29.06343686 |
| Grand Total | 28.9466 |



# KPI's

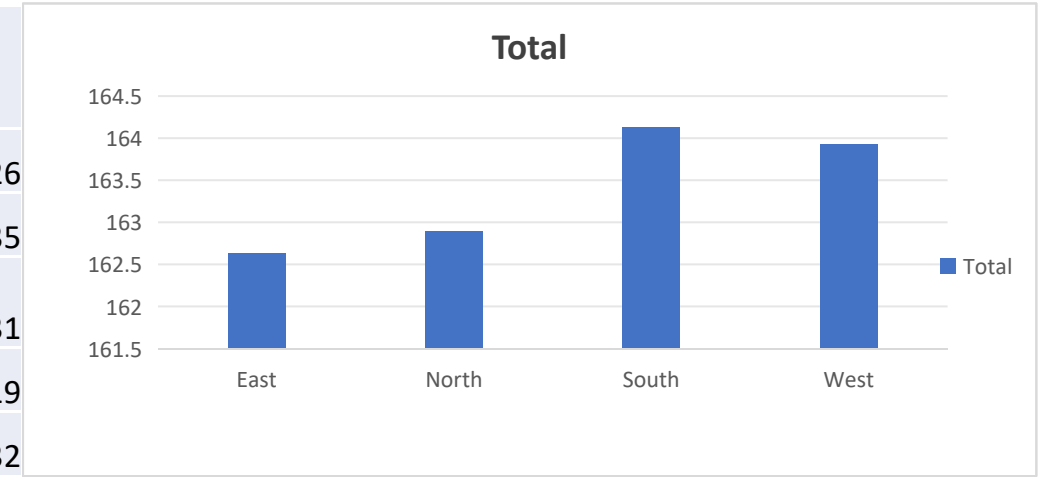
## The percentage of warehouses with electric supply.

| electric_supply | Count of electric_supply |
|---|---|
| 0 | 34.31% |
| 1 | 65.69% |
| Grand Total | 100.00% |




## The average distance of warehouses zone & regional zones from the central distribution hub?

| zone | WH_regional_zone | Average of dist_from_hub |
|---|---|---|
| East | | 162.6340326 |
| North | | 162.9009535 |
| South | | 164.1287331 |
| West | | 163.9364519 |
| Grand Total | | 163.53732 |

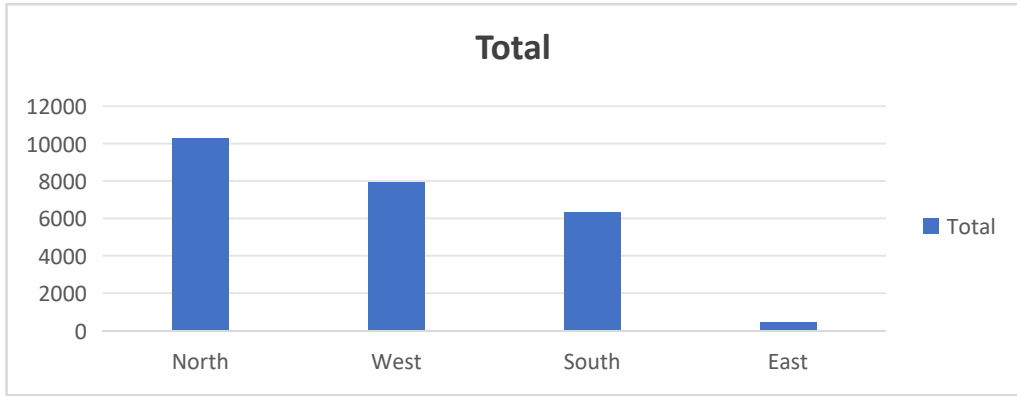


# KPI’s

## 🚚Order Fulfilment KPIs

The top 3 zones with the highest number of refill requests in the last 3 months

| zone | Count of num_refill_req_l3m |
|---|---|
| North | 10278 |
| West | 7931 |
| South | 6362 |
| East | 429 |
| Grand Total | 25000 |



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# Technical Process

To analyze and optimize Amazon's warehouse operations, we apply various **data-driven methodologies, optimization techniques, and predictive analytics**. Below is the core concepts used:

## 📌Concepts Used:

- **Exploratory Data Analysis (EDA)** → Identifies patterns, trends, and outliers in warehouse data.
- **Descriptive Analytics** → Summarizes current warehouse performance through KPI tracking.
- **Data Visualization** → Power BI, Looker Studio, Tableau dashboards for real-time monitoring.

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# Conclusion

After analyzing Amazon's warehouse operations, the key findings highlight inefficiencies in **inventory management, order fulfilment, warehouse layout, labour productivity, and logistics**. These inefficiencies contribute to **stockouts, delivery delays, and rising operational costs**.

By leveraging **data-driven solutions**, such as **demand forecasting, AI-powered automation, warehouse layout optimization, and predictive labour scheduling**, Amazon can significantly **enhance efficiency, reduce costs, and improve customer satisfaction**.


Project Owner

**THANK YOU**

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