

# E-Commerce Order Distribution Optimization Report

## Introduction

Our e-commerce company, based in Lome, Togo, serves customers in Ghana through multiple delivery centres. However, we faced order distribution inefficiencies, leading to:

- Uneven truck utilization: Some trucks were overloaded while others traveled nearly empty.
- High pending orders: Large backlog.
- Slow logistic process: Due to inefficient truck assignments.

To solve these problems, we conducted data analysis, optimization, and visualization to improve our logistics operations.

## Part 1: Data Analysis & Key Findings

### Dataset Overview

We analyzed three datasets:

1. **Orders Table:** 526,945 records, tracking order status, assigned trucks, and volumes.
2. **Centres Table:** 5 delivery hubs across Ghana (Accra, Tema, Koforidua, Bolgatanga, Kintampo)
3. **Trucks Table:** 35 trucks with varying capacities.

### Key Findings

#### 1. Truck Utilization Problems

- Some trucks are over 100% capacity, leading to overloading and possible delays.
- Many trucks are below 50% capacity, meaning inefficient space usage.
- This means there can be even distributions of volume for trucks in multiple trips.

#### 2. Centre-Level Congestion

- Accra (235,077 orders) & Tema (162,403 orders) were overloaded.
- Pending Orders:
  - Accra → 111,379 pending orders.

- Tema → 109,622 pending orders.
- Smaller centres (Koforidua, Bolgatanga, Kintampo) had less workload.

### **3. Slow Order Processing**

- Large number of orders stuck in PENDING status due to slow truck assignment.
- Some centres had low in-transit order movement, worsening delays.

## **Part 2: Optimized Order Distribution Strategy**

### **Key Strategies Implemented**

#### **1. Dynamic Load Balancing & Partial Order Assignments**

- Orders assigned based on available truck capacity instead of overloading a few trucks.
- Instead of waiting for full truck space, orders were split across multiple trucks.

#### **2. Centre-Level Order Prioritization**

- Moved 6,000 pending orders from Accra & Tema to Koforidua, Bolgatanga, and Kintampo.

#### **3. Dynamic Reallocation for Future Orders**

- Orders will be automatically redistributed as space frees up.

### **Reassigned Orders Data**

- 6,000 orders successfully reassigned.

## **Part 3: Results Demonstration & Visualization**

### **1. Pending Orders Per Centre (Before vs. After)**

**Visualization: Bar Chart**

- Significant decrease in pending orders at Accra & Tema.
- Smaller centres received more orders, improving load balance.

## 2. Truck Utilization Before vs. After

### Visualization: Heatmap & Pie Chart

- Before: Cumulated loads of all trucks overloaded (100%+ utilization).
- After: Balanced load distribution across fleet.
- Before: Higher number of pending orders
- After: pending orders was significantly reduced

## 3. Percentage of Orders Successfully Reassigned

**KPI:**  $6,000 / 310,775 = \sim 1.9\%$  Reassigned

- This is a strong first step toward efficiency.
- Future automation will increase reassignment dynamically.

# Conclusion & Recommendations

- Reduced congestion at major centres (Accra & Tema).
- Balanced truck utilization by dynamically redistributing loads.
- Enabled future automation for real-time order reallocation since only 1.9% of orders were reassigned.
- Reassigned Orders Dataset available in CSV (reassigned\_orders.csv)

## Recommended Steps for Full Automated Optimization

- ❖ Automate truck rebalancing further (ensure no truck exceeds 70% utilization).
- ❖ Expand reassignment rules (move more orders to smaller centres).
- ❖ Ensure automatic order reallocation to centres
- ❖ Monitor real-time performance in dashboard.