**Case Study 1: Logistics – Delivery Network Optimization**

**1. What factors would you analyze to identify the causes of late deliveries?**

1. **Delay data:** Analyze the time difference between the actual and expected delivery times for each order, Calculate the delay duration in minutes per order, extracting averages and deviations, Identify time periods with increased delays (e.g., peak hours or specific days of the week).
2. **Driver schedules:** Compare shift start and end times with peak demand and delivery volume, Check whether some drivers leave before the delivery window ends, causing pending or delayed orders.
3. **Number of Trips per Driver:** Analyze if some drivers are overloaded with a high number of orders compared to others, look for imbalanced order distribution that might lead to fatigue and delays.
4. **Pickup and Drop-off Zones**: Identify geographical areas with the highest delay rates, Compare the average delivery time across neighborhoods or postal codes.

, Investigate if some areas are congested or hard to access, such as commercial zones or poorly connected locations.

1. **Weather and traffic conditions:** Identify time and weather patterns consistently associated with increased delays, Study the relationship between city traffic conditions (e.g., rush hours) and delivery delays, Compare delay rates on normal days vs. rainy or foggy days.

**2. How would you determine if the issue is driver capacity, routing inefficiency, or external factors (e.g., weather)?**

**1. Driver Capacity Analysis**

* **Measure daily order volume over time:**  
  Collect daily order data across several weeks or months and check if there’s a noticeable increase in recent demand.
* **Check driver coverage against order growth:**  
  If daily orders have increased significantly, assess whether the current number of drivers can handle the additional volume within their scheduled shifts.
* **Calculate orders per driver and compare them with theoretical limits:** Determine the average number of trips assigned to each driver per day, Use the average delivery time per trip to estimate the maximum number of trips a driver can complete in an 8-hour shift , If some drivers exceed this threshold , it signals overcapacity, likely leading to delays.
* **Analyze shift time: Active vs. Idle time:** Compare each driver’s actual driving time with their total shift duration, subtract driving time from shift length to calculate idle time, If idle time is very low, and delays still occur, this suggests that drivers are overloaded and unable to meet delivery targets.

**2. Routing Inefficiency Analysis**

* **Examine average distance per trip and zones covered:**  
  Collect actual route data using GPS logs for each trip, then calculate the average distance a driver travels from pickup to delivery. Compare these distances with the “ideal route” suggested by a mapping system (such as Google Maps). If the difference is large, this indicates a routing-planning issue.
* **Analyze backtracking patterns and repeated zone visits:**  
  Monitor whether the driver “returns” to the same neighborhood or street more than once during a single shift. If deliveries are spread across scattered areas instead of following a logical geographic sequence (for instance, first in Zone A, then Zone B, then Zone A again), this increases travel time and reduces efficiency.
* **Review address data accuracy and quality:**  
  In some cases, poor routing efficiency is caused by incorrect recipient addresses (for example, missing apartment numbers or misspelled street names). If a large percentage of trips return to the same area due to address errors, improving data accuracy and implementing an “address verification” process before dispatch is necessary.

**3. External Factors Analysis**

* **Link delay data with weather conditions:**
  + Collect daily/hourly weather data in the city (e.g., temperature, sky conditions), Create a table linking “delay rates” with “weather conditions” for each day or hour, use statistical correlation analysis or simple visual graphs to observe whether delays increase significantly on rainy or foggy days.
* **Link delay data with traffic conditions:**
  + Retrieve historical traffic data (from a Traffic API), showing peak hours and congestion indexes, compare traffic peak times with delivery delay rates during the same periods, if delays consistently increase during peak traffic hours regardless of the driver or route, traffic congestion is likely a strong external factor.
* **Compare performance across geographic zones:**
  + Identify if certain areas consistently experience more delays than others (e.g., neighborhoods with chronic congestion or frequent road work), Analyze average delivery time per zone over a long period to pinpoint consistently underperforming areas.

**3. If 20% of drivers handle 50% of delayed orders, what might this indicate? What actions would you suggest?**

**- What This Might Indicate:**

1. **Driver Performance Variability:**

These drivers may lack route familiarity, speed, or time management skills, some might be new, less trained, or not adhering to delivery protocols.

1. **Unfair or High-Stress Route Assignments:**

They may be repeatedly assigned to difficult areas (e.g., high-traffic zones, far-off neighborhoods), Their delivery schedules might overlap with peak traffic hours or complex routes.

1. **Operational Fatigue or Low Engagement:**

Repetitive late shifts or lack of motivation may cause burnout or disengagement, impacting performance.

**- What actions would you suggest?**

**1. Conduct Individual Performance Audits**

Review GPS logs, delivery patterns, and timing data for the underperforming 20%, Identify if delays are due to personal inefficiencies or external obstacles.

**2. Provide Targeted Coaching & Support**

Offer refresher training on navigation tools, time efficiency, and customer service, Pair lower-performing drivers with top performers for a brief mentoring phase.

**3. Optimize Route & Shift Allocation**

Use route optimization tools to ensure fair, efficient assignments, rotate drivers across zones to balance exposure to high-delay areas.

**4. Improve Data-Driven Assignment Logic**

Incorporate driver history, traffic patterns, and weather data into shift planning algorithms, avoid overloading specific drivers with bulk or complex orders.

**5. Introduce Performance-Based Incentives**

Reward top-performing drivers with bonuses, recognition, or priority shift selection, set clear KPIs (e.g., <5% delay rate) and offer monthly improvement bonuses.

**4. Propose non-technical solutions that could reduce delays without hiring more drivers.**

**1. Improve Shift Scheduling & Break Management**

**Distribute drivers more strategically** across high-demand hours (e.g., morning and evening peaks), Avoid overloading certain time slots while others are underutilized.

**2. Zone-Based Delivery Assignments**

Assign drivers to **specific geographic zones** they know well, Familiarity with local shortcuts, traffic flow, and building layouts improves speed and reduces navigation errors.

**3. Provide Route Familiarity Training**

Offer **onboarding walkthroughs** for new or underperforming drivers on high-traffic zones, Include common delivery obstacles (e.g., difficult building access, roadblocks).

**4. Introducing Incentive Programs**

Offer small rewards for drivers with low delay rates (e.g., gift cards, early shift choices, recognition), Gamify performance with friendly competitions (e.g., “Driver of the Week”).

**5. Use Helper Staff During Peak Hours**

Assign **non-driving helpers** (e.g., interns, part-time staff) to assist with sorting, loading, or navigating buildings, this helps drivers focus solely on delivery, improving efficiency.

**6. Offer Customers Delivery Time Windows**

Let customers select delivery slots in advance, helping distribute demand across the day, reduces last-minute rushes and prevents traffic congestion at peak times.

**7. Encourage Contactless or Drop-Off Options**

Promote use of **safe drop-off points** (e.g., building lobbies, lockers), Reduces time spent waiting for customer response at the door.

**9. Regular Feedback & Check-Ins**

Hold weekly team huddles to share best practices and gather feedback from drivers, Identify delay causes early and collaboratively find quick fixes.

**5. How would you measure the impact of your proposed changes?**

**1. Compare Delay Rates Before and After Changes**

* Analyze the percentage of delayed orders on a daily or weekly basis.
* Calculate the average delay duration (in minutes) before and after implementing changes.
* Use charts or tables to clearly illustrate time differences and trends.

**2. Analyze Driver Performance**

* Examine the number of trips that exceeded the expected delivery time for each driver.
* Evaluate improvements in operational efficiency, such as:
  + Number of orders completed per shift.
  + Percentage of orders delivered on time by each driver.
* Link performance improvements to scheduling adjustments or better zone allocation.

**3. Measure Customer Satisfaction**

* Analyze the number of complaints received before and after implementation.
* Review customer ratings in the app or gather feedback through short surveys.
* Track the percentage of 4-star and above ratings as an indicator of service quality.

**4. Monitor Key Operational Metrics**

* Average time per order (from pickup to delivery).
* Number of orders per driver, compared to total working hours.
* Idle time vs. active driving time.
* Number of complaints or re-delivery incidents.

**5. Set Up Ongoing Review and Continuous Improvement**

* Establish a weekly or monthly review schedule to monitor performance, Use findings to evaluate whether the changes are effective or need adjustment, Maintain a continuous improvement loop based on data insights and customer feedback.