OTD Improvement in Last-Mile Grocery Deliveries

Quality Engineering and Lean Six Sigma

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Background

Over the past several weeks, the last-mile delivery network began showing a series of inconsistencies that signaled a growing operational concern for the company and a noticeable experience gap for customers. Clusters started reporting delays in closing delivery batches, wider variation in route completion times, and an increasing number of orders spilling over into the next cycle. These irregularities disrupted daily planning, made resource allocation harder, and created uncertainty for on-ground teams who struggled to predict how long delivery runs would actually take.

Overview

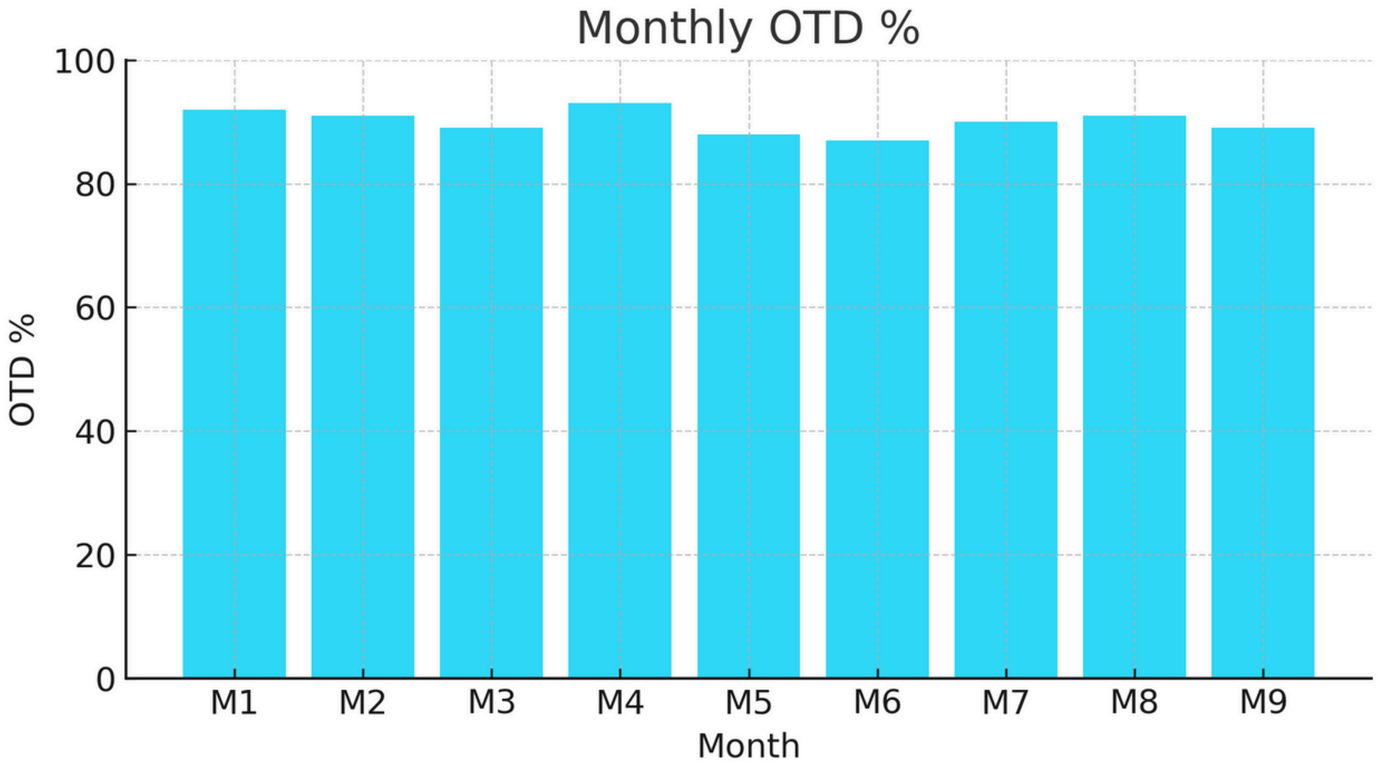
During the same period, customers began experiencing more late deliveries, mismatched delivery windows, and higher instances of rescheduling. Customer support teams noticed a rise in complaints linked to delayed arrivals, along with increased follow-ups for delivery status. As these patterns persisted across otherwise stable zones, it became evident that the variability in last-mile execution was impacting both operational flow and customer experience, signaling the clear need for a structured improvement effort.

Voice of Customer

- Orders delivered after slot time
- ETA not matching actual delivery
- Tracking updates unreliable
- High delays during peak slots

CTQ Elements	Primary Metrics	Secondary Metrics
On-Time Delivery (%)	On-Time Delivery (%)	Customer complaint rate
ETA Accuracy	ETA Accuracy %	Refund cost per day
Driver readiness at dispatch	Driver readiness score at dispatch	Delivery cost per order
GPS/Tracking uptime	Tracking uptime %	Tracking-related complaint rate

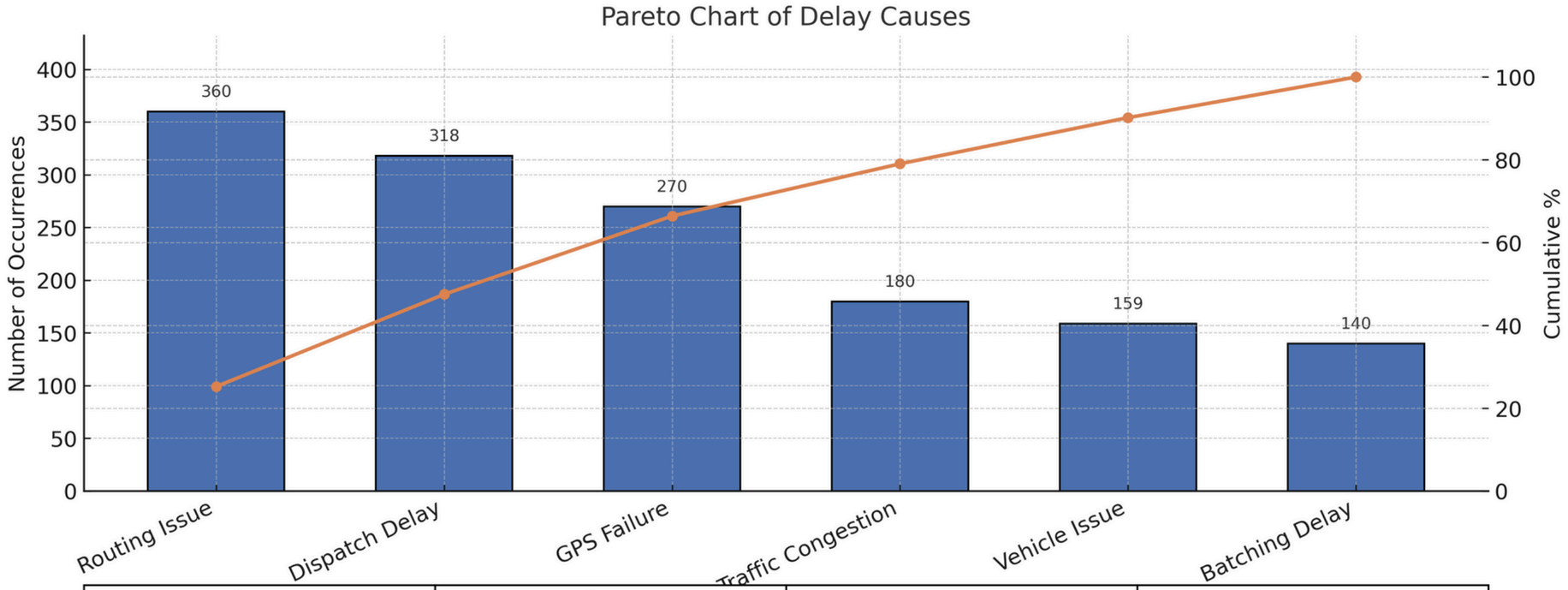
Baseline Performance of Primary Metric (9 months data as Bar chart)



Inference:

- Below SLA target of 95%
- Variation persists in peak hours
- Evening slots show highest delay frequency

Pareto Chart



Cause	Count	Percent	Cumulative %
Routing Issue	360	25.2	25.2
Dispatch Delay	318	22.3	47.5
GPS Failure	270	18.9	66.4
Traffic Congestion	180	12.6	79.0
Vehicle Issue	159	11.1	90.2
Batching Delay	140	9.8	100.0

Inferences:

- Routing Issues, Dispatch Delays, and GPS Failures together contribute to nearly 80% of total delivery delays.
- These top 3 causes clearly indicate that the improvement project should focus on routing accuracy, dispatch readiness, and tracking stability.
- By addressing these high-impact areas, the organization can significantly improve OTD performance and reduce delay-related customer dissatisfaction.

SIPOC

Suppliers: Warehouse, Routing Team, Fleet Ops

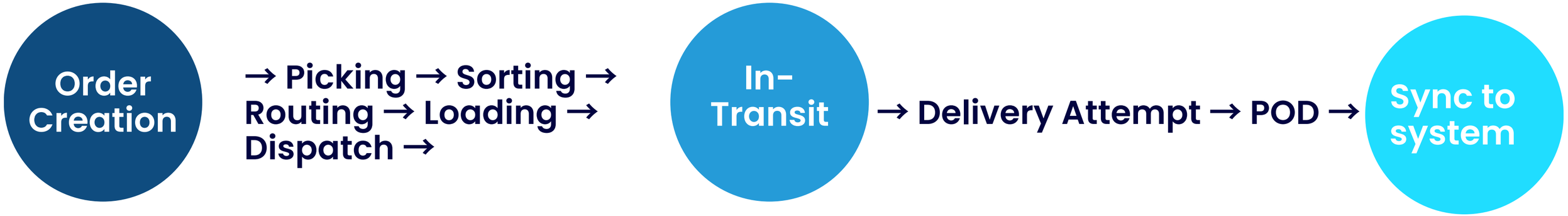
Inputs: Packed orders, route data, GPS devices, vehicles

Process: Load → Route → Dispatch → Transit → Delivery → POD

Outputs: Delivered orders, timestamp logs

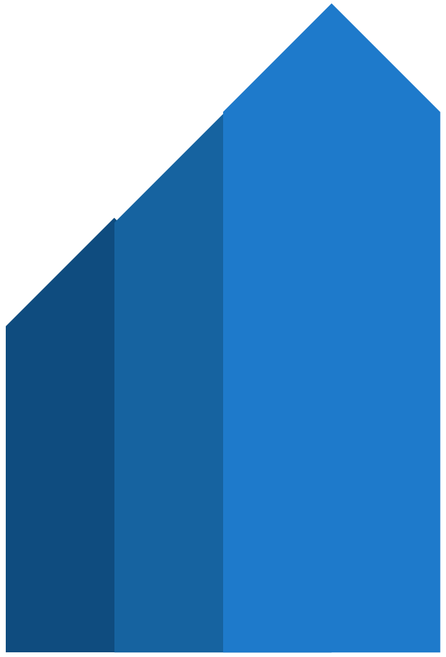
Customers: End customers, platform partners

High Level Process Map



Project Charter

Goal : Within 16 weeks, improve last-mile process stability in pilot clusters by enhancing dispatch readiness, increasing ETA accuracy, and raising GPS uptime—resulting in measurable reductions in reattempts, customer complaints, and daily refund costs.



Problem Statement : Last-mile delivery performance in pilot clusters shows high variability in dispatch readiness, route completion times, ETA accuracy, and tracking uptime. This inconsistency is driving increased customer complaints, reattempts, and refund costs, indicating an urgent need to stabilize and standardize the delivery process.

Tangible Benefits
- Refund cost reduction (~₹10,00,000/month)
- Reduced reattempts
- Better capacity utilization

Intangible Benefits
- Improved customer trust
- Increased repeat purchases
- Higher operational reliability

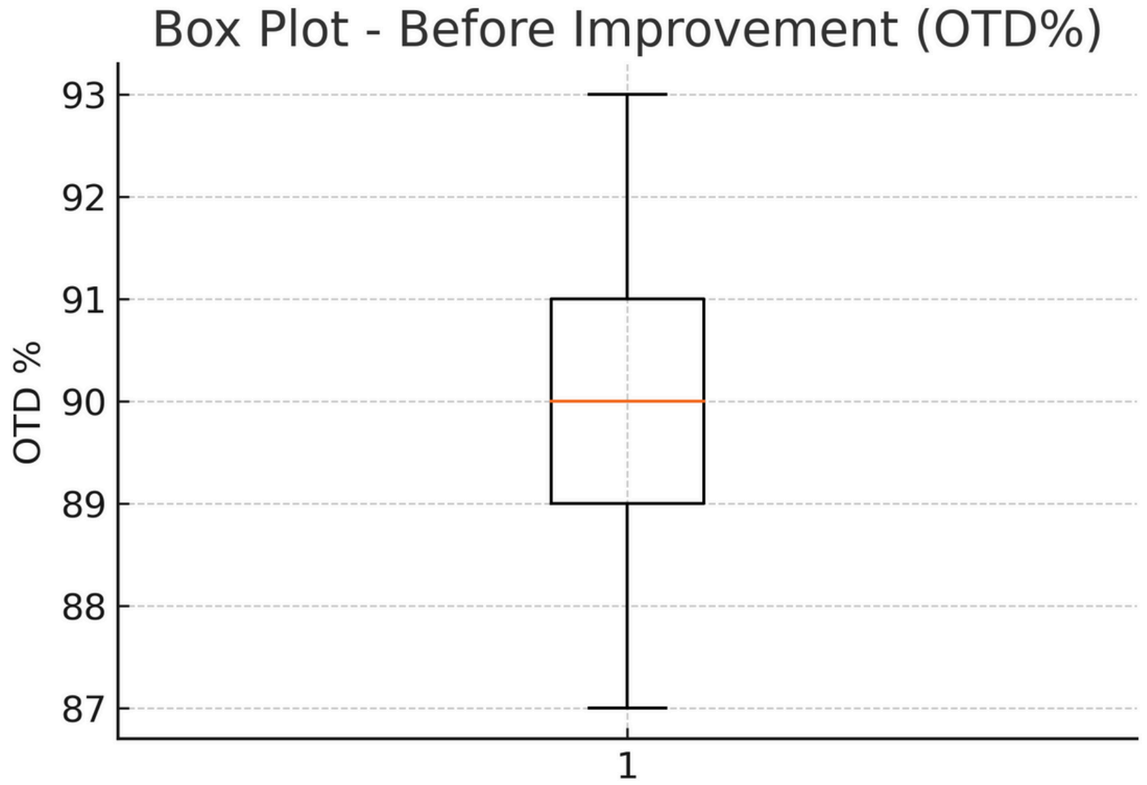
Risks to Success
- Rider absenteeism
- GPS instability
- Traffic/weather events
- Incorrect address data

In Scope
- Routing logic
- Dispatch readiness
- ETA improvement
- GPS uptime
- Pilot clusters

Out of Scope
- Picking/packing
- Upstream supply chain
- Procurement delays

Timeline
Define (Week 1–2)
Measure (3–4)
Analyze (5–7)
Improve (8–14)
Control (15–16)

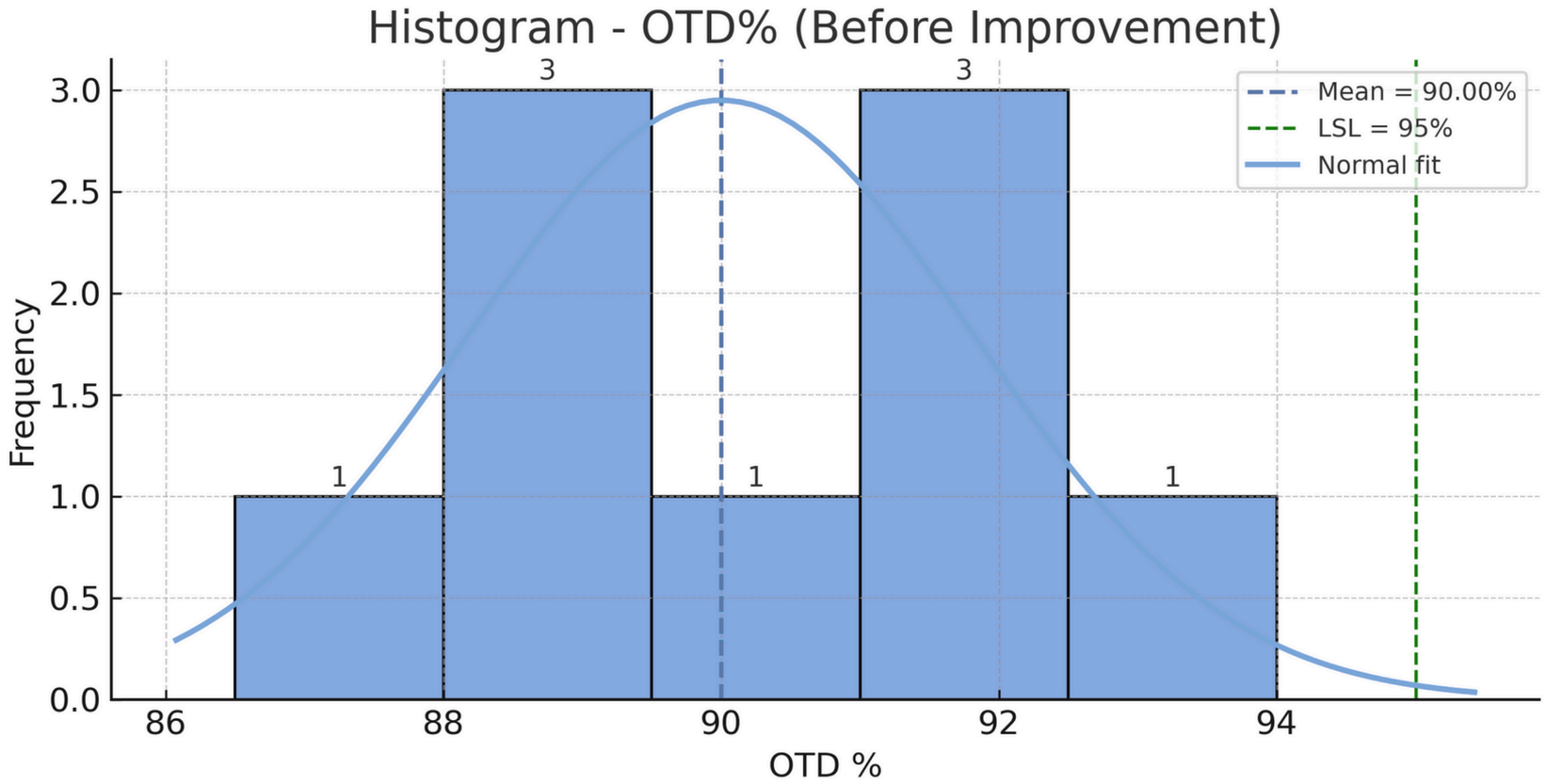
Data collection – Box Plot (Before improvement)



Inference:

- OTD% distribution shows high variability around the median.
- Lower whisker reaching 87% indicates recurring under-performance.
- Median (~90%) is well below the SLA target of 95%.
- Spread confirms inconsistent route planning & dispatch behavior across months.

Data collection – Histogram (Before improvement)



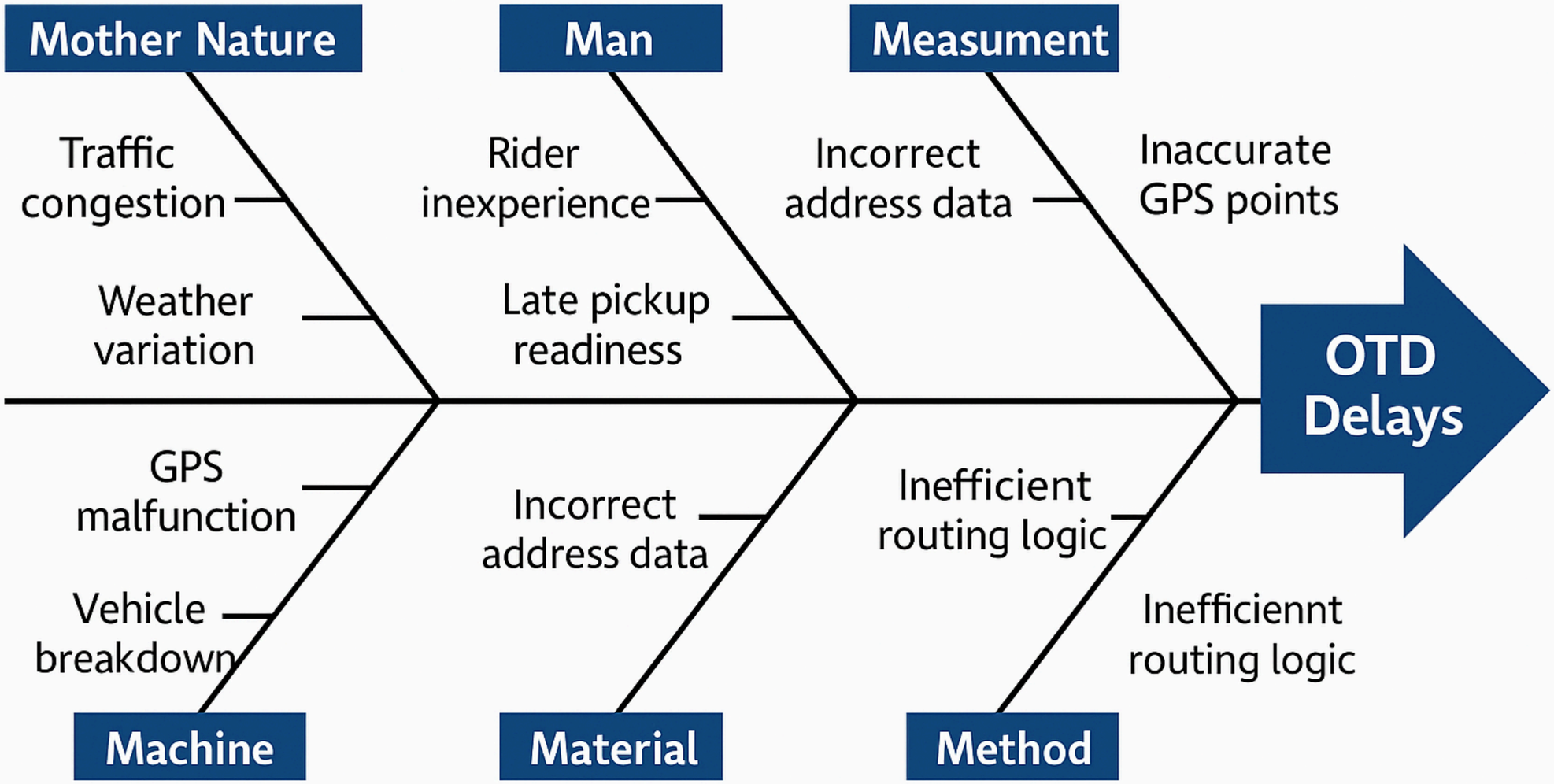
Inferences:

• The OTD% data shows moderate spread with values ranging from 87% to 93%, indicating month-to-month inconsistency.

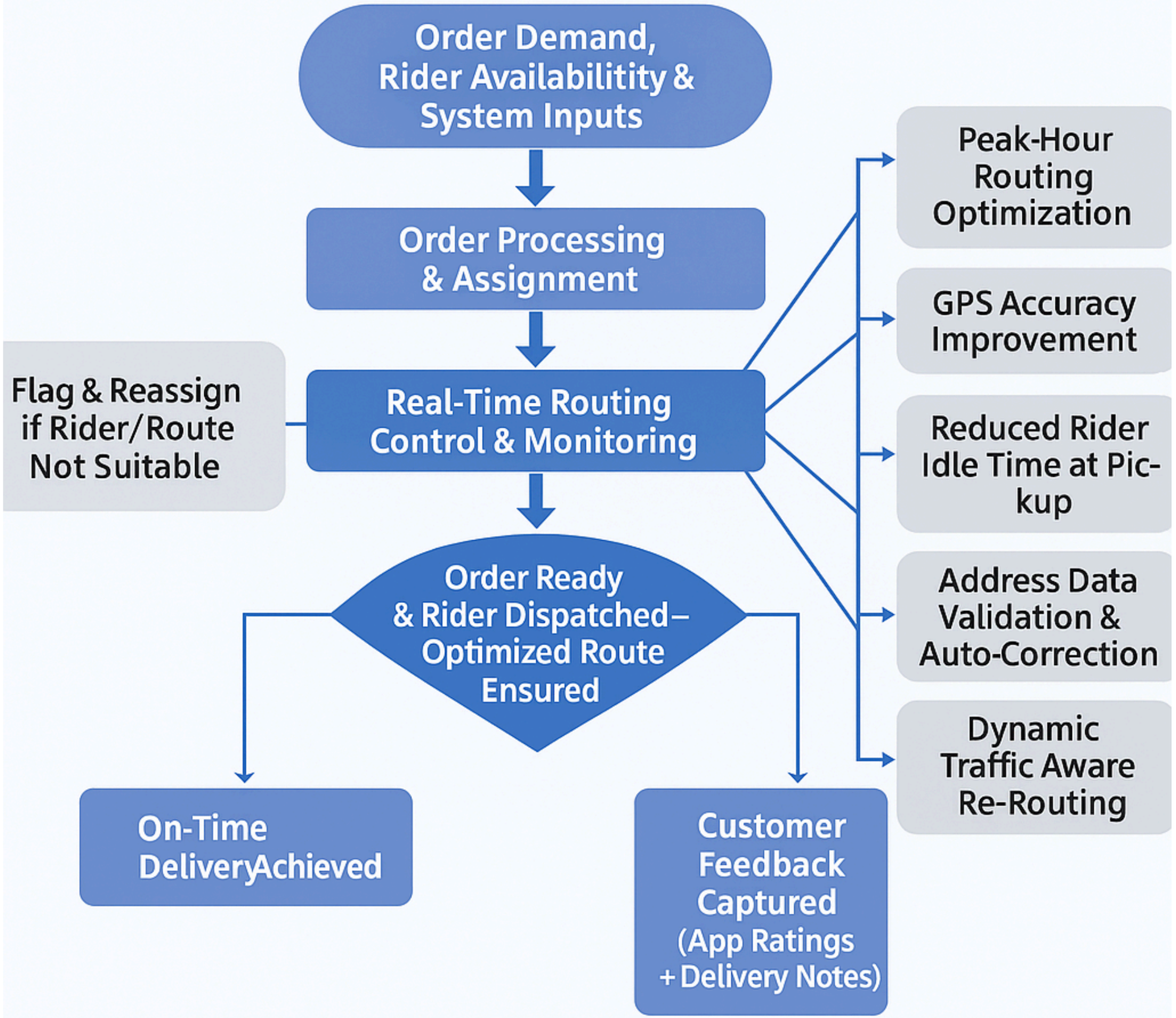
• No extreme outliers are present, but the median lies well below the 95% SLA, confirming the process is not capable.

• Variation suggests instability in routing, dispatch timing, and transit conditions.

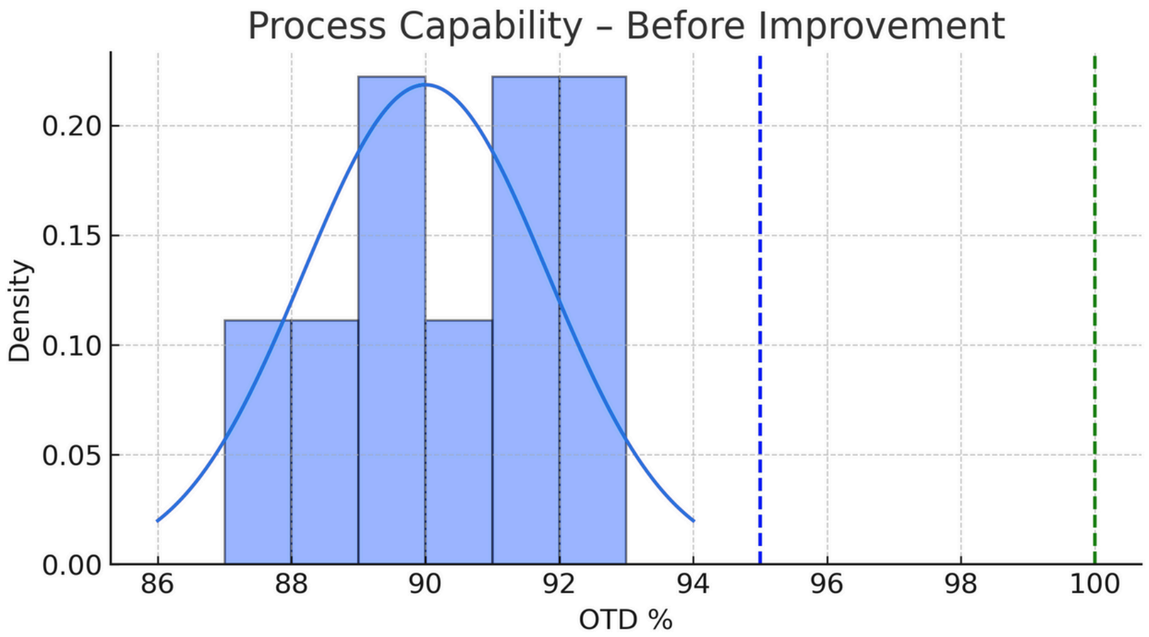
Analysis – Fish Bone Diagram

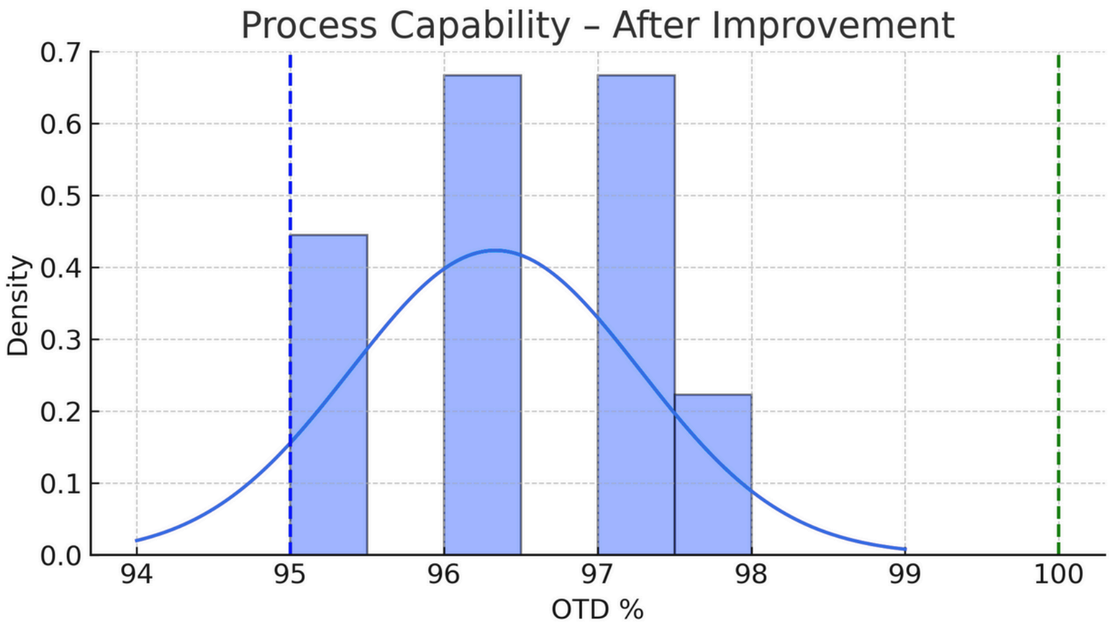


Improve – Process Mapping (After Improvement)



Improve – Process capability – Before & After Improvement

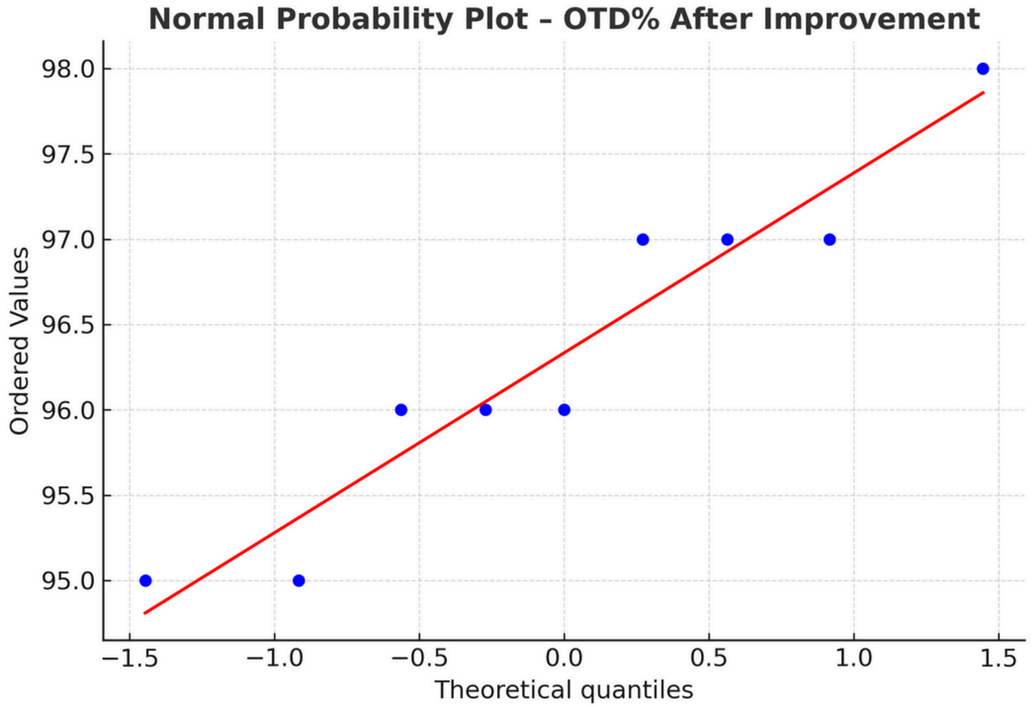




Inference: • The process mean (~90%) is below the LSL of 95%, indicating the process is centered incorrectly.
• Cp = 0.43 and Cpk = –0.861, showing the process is not capable of meeting customer expectations.
• High spread and left shift indicate poor consistency in routing, dispatch timing, and in-transit management.
• Significant proportion of data falls outside the specification limits, leading to delays and SLA misses.

Inference: • The process mean (~96%) has shifted above the LSL of 95%, indicating effective improvement.
• Cp improved to 0.833 and Cpk improved to 0.444, showing the process is moving toward capability.
• Reduced variation reflects better routing optimization, improved dispatch handover, and stable app/GPS performance.
• Majority of data points now fall within spec, resulting in higher OTD and reduced complaints.

Improve – Process capability – Before & After Improvement



Inference – Run Chart (After Improvement)

- The OTD% trend remains consistently above 95%, indicating a stable post-improvement performance.
- No abnormal spikes or drops are observed — no special-cause signals.
- The mean line stays tightly aligned with individual observations, showing reduced month-to-month variation.
- This confirms the process shifted upward and became more predictable after intervention.

Inference – Normal Probability Plot (After Improvement)

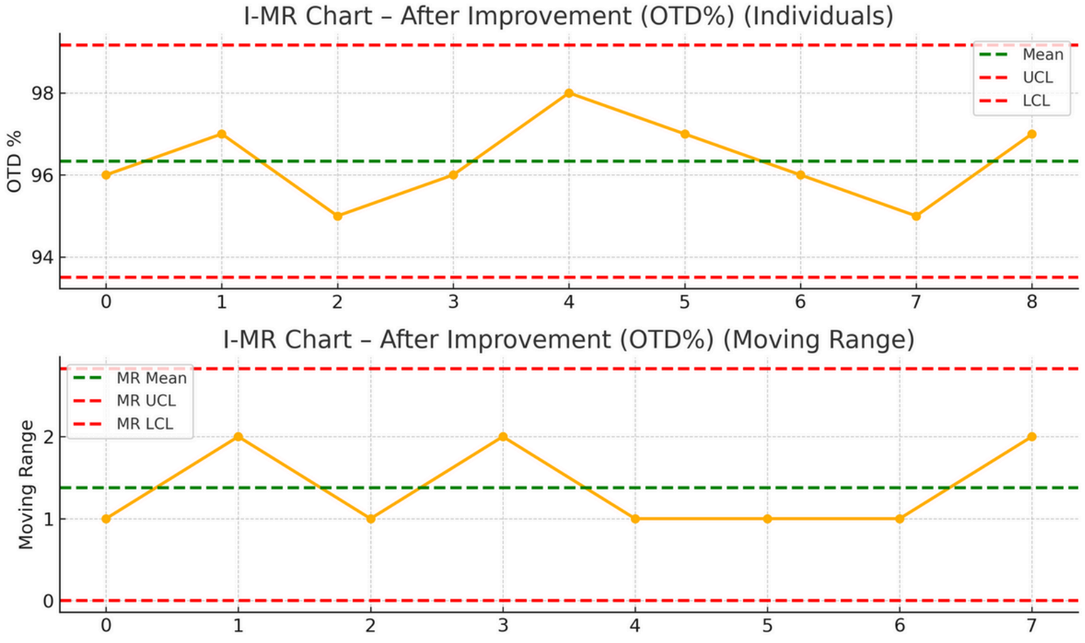
- Points closely align with the straight reference line → data follows a normal distribution.
- No curvature or scattering at tails → no evidence of outliers or non-normal behaviour.
- Supports validity of capability analysis and hypothesis testing results.
- Indicates that the OTD process, after improvement, is statistically stable and normally distributed.

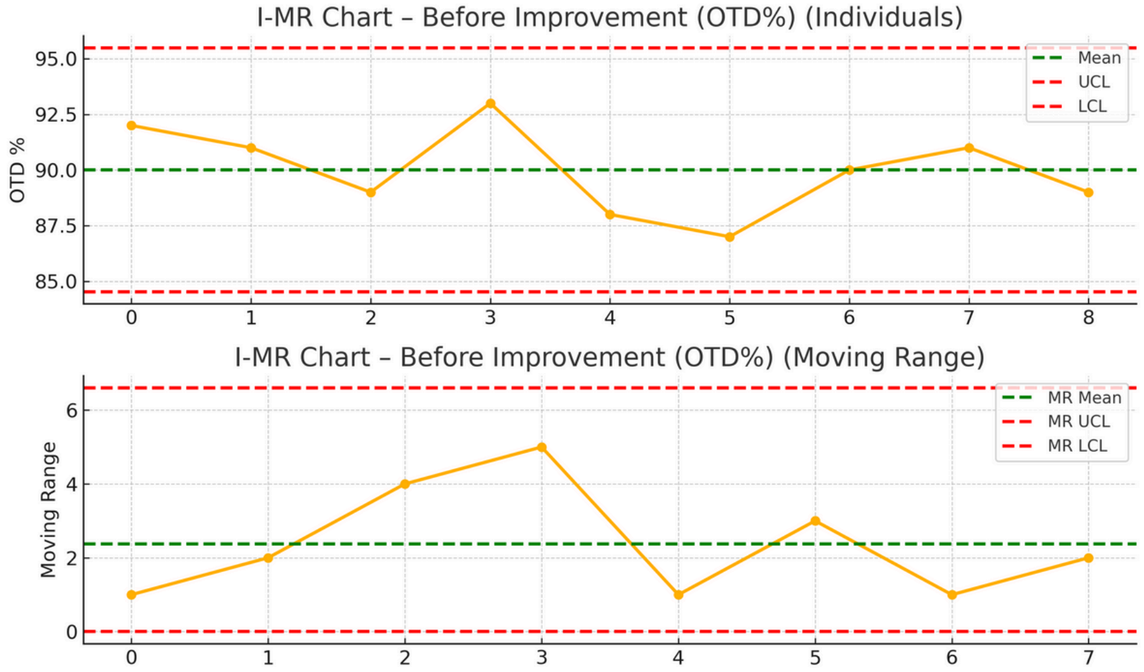
FMEA

Process Function	Potential Effects of Failure	Potential Effects of Failure	S	Potential Cause(s) / Mechanism of Failure	Current Process Controls	D	Recommended Action (s)	Action Results (S / O / D/RPN)		
Delivery process	Customer dissatisfacti-on, SLA brea. ch, refund risk	Porr route planning	7	Poor route planning	Basic routing logic only	6	1. Introduce AI-based routing improvement	5	2 / 2	20
Delivery process		Rider inexperiencee / slow pickup	6	Rider inexperience / slow pickup	Manual assignment & monitoring	5	1. Rider SOP training 2. Auto pickup reminders	4	2 / 2	16
Delivery process	Wrong location: artival:	Incorrect address data	5	Incoplation addressestefore dispatch	No validation of addresses before dispatch	5	1. Auto-validation of address 2. Address correction	4	2 / 2	16
Delivery process	Delay during navigation	Poor GPS accuracy	5	Poor GPS accuracy	1.GPS calibration fixes	5	1. GPS calibration fixes 2. Multi-source GPS fusion	4	2 / 2	16
Delivery process	Longer travel time during peak	Longer travel time during hours	5	Traffic conge-stion in peak ho	1.Add peak-hour optimi-zed routing	6	1. Add peak-hour optimized routing	4	2 / 2	16

Control – Control Chart for % OTD

Before & after improvement





Inference: Before Improvement

- OTD% shows high point-to-point variation (large moving ranges).
- Several points fluctuate near or below the 95% target, indicating an unstable delivery process.
- Wide control limits reflect high inherent process variability.

Inference: After Improvement

- OTD% values are tight, stable, and consistently above 95%.
- Moving ranges have significantly reduced, showing less fluctuation.
- Control limits have tightened, indicating the process has become statistically stable and predictable.
- Clear evidence of sustained improvement in OTD performance.

Thank you