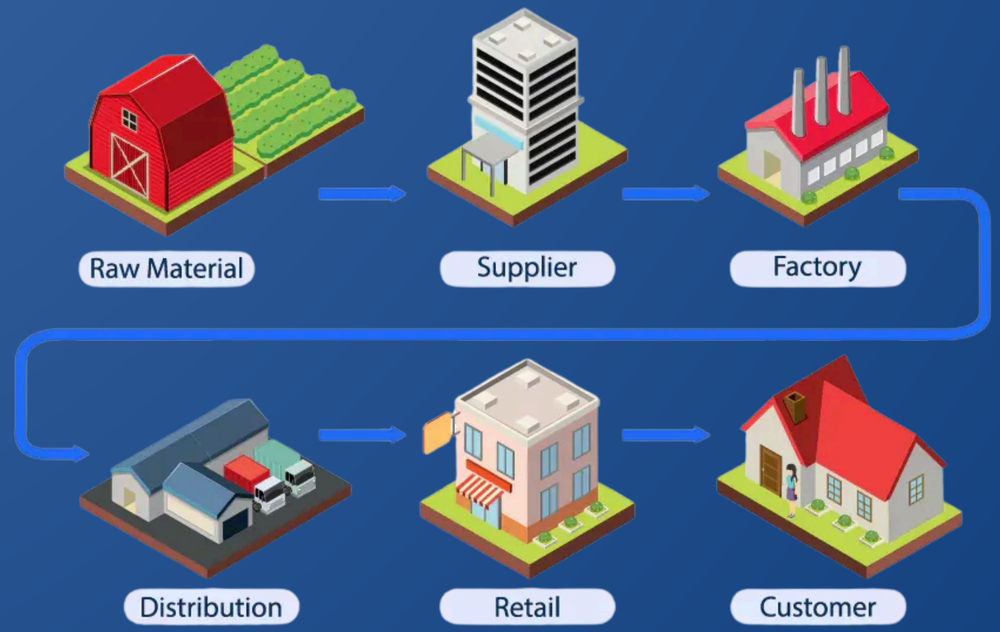
# SUPPLY CHAIN ANALYSIS

Team Statisfaction



# TABLE OF CONTENT

# PROBLEM STATEMENT

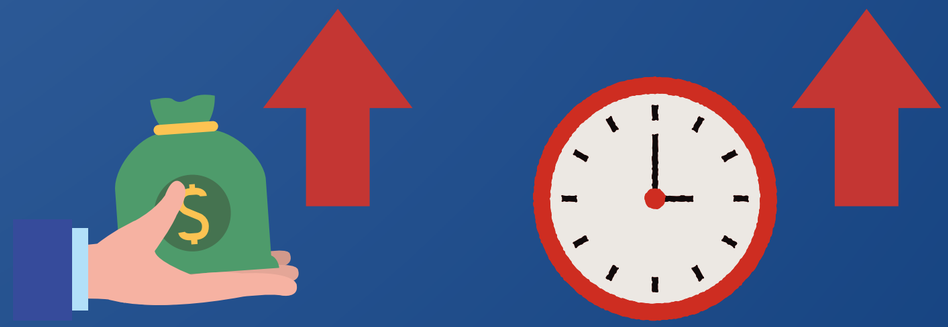
GRB Co., a mid-sized consumer goods firm in Southern California, has seen steady revenue decline since 2021, despite strong market demand, due to supply chain inefficiencies.

Logistics data (Jan 2021 - Aug 2024) reveal rising costs and poor service performance driven by shipment delays and inefficient resource allocation.

Risk exposure, rather than equipment availability, is a dominant factor. Without risk-based routing and smarter resource allocation, GRB will face higher costs and erode client trust due to unreliable service.

# 🚨 KEY FINDINGS: NETWORK HEALTH SNAPSHOT

- **Network-Level View:** Each record reflects the entire logistics network per hour - not individual trips or shipments. Variables are aggregated, meaning results capture system-wide stress rather than isolated events.
- **Rising Costs & Declining Service:** Costs trend upward while on-time rates trend downward (correlation ≈ −0.7) → GRB is paying more for worse service.

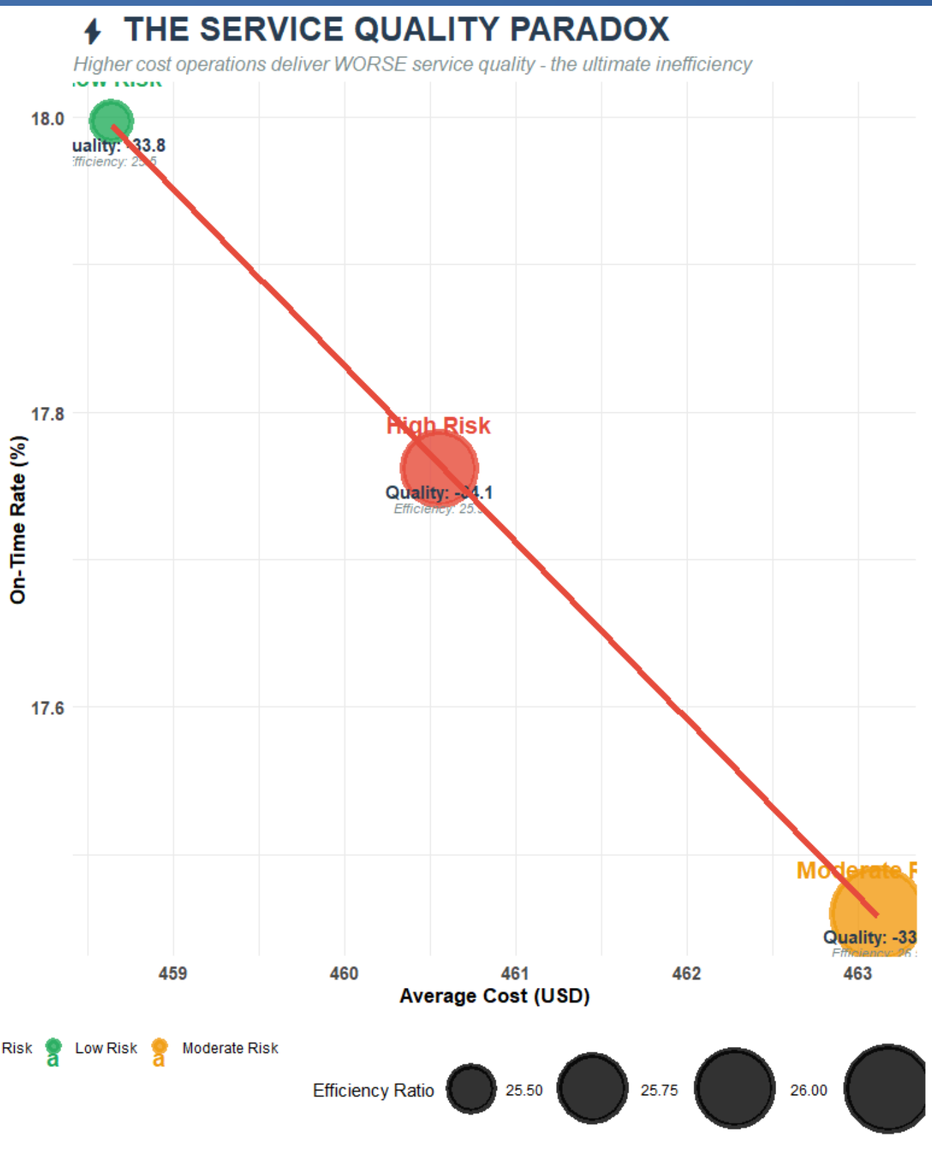


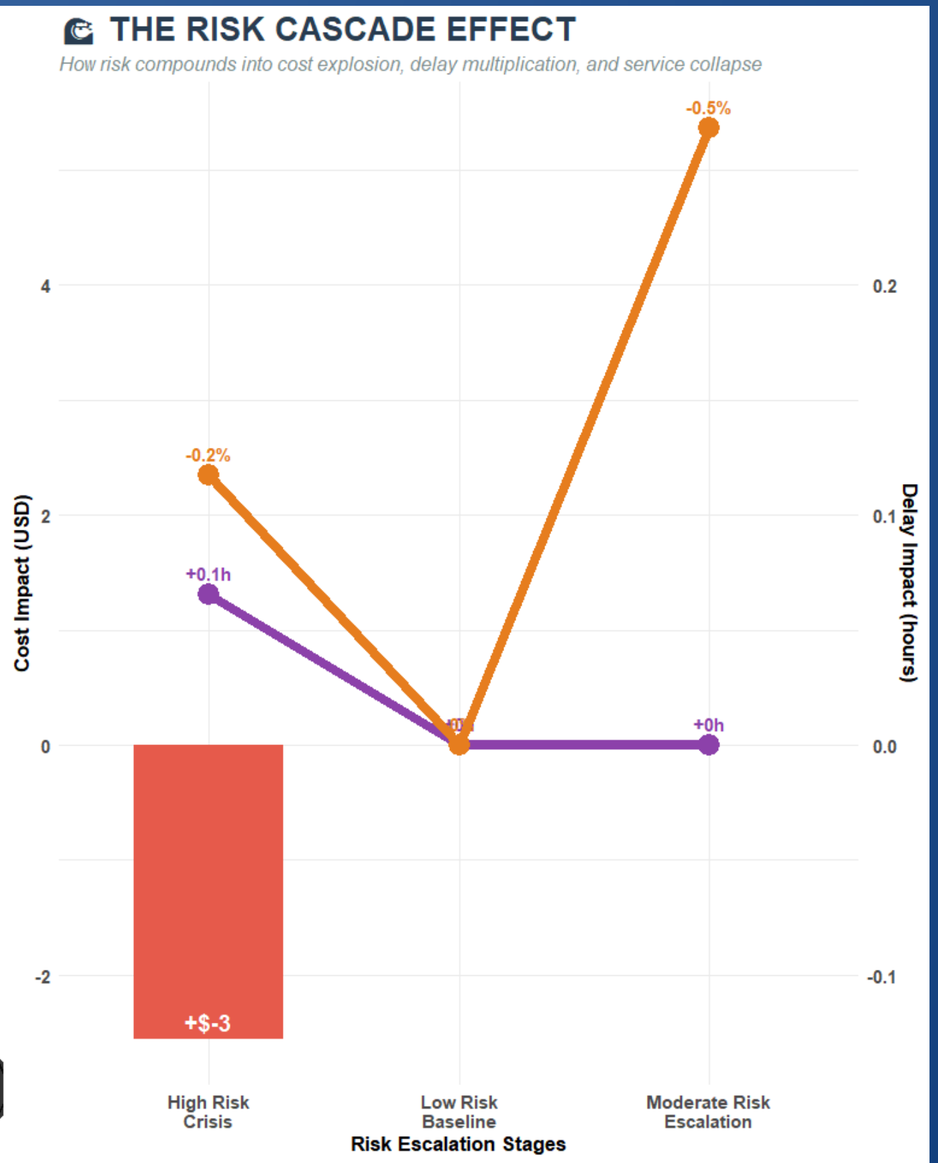
# 🚨 KEY FINDINGS: NETWORK HEALTH SNAPSHOT

- **High-Risk, Low-Performance Norm:** Most of the time, the network operates in a bad or terrible state across multiple dimensions:
  - ETA variation: Only **23.8%** acceptable (<=1 hr), median delay 3.9 hrs.
  - Inventory mismatch: **17.7%** stockouts (inventory < 5).
  - Order fulfillment: **86.9%** below industry benchmark (<0.8), median 0.68.

- **Implication:** Instead of isolated disruptions, GRB's logistics system faces structural inefficiencies, ongoing risks, increasing costs, and declining service reliability.

# 1. HIGH RISK = HIGH COST, WORSE SERVICE



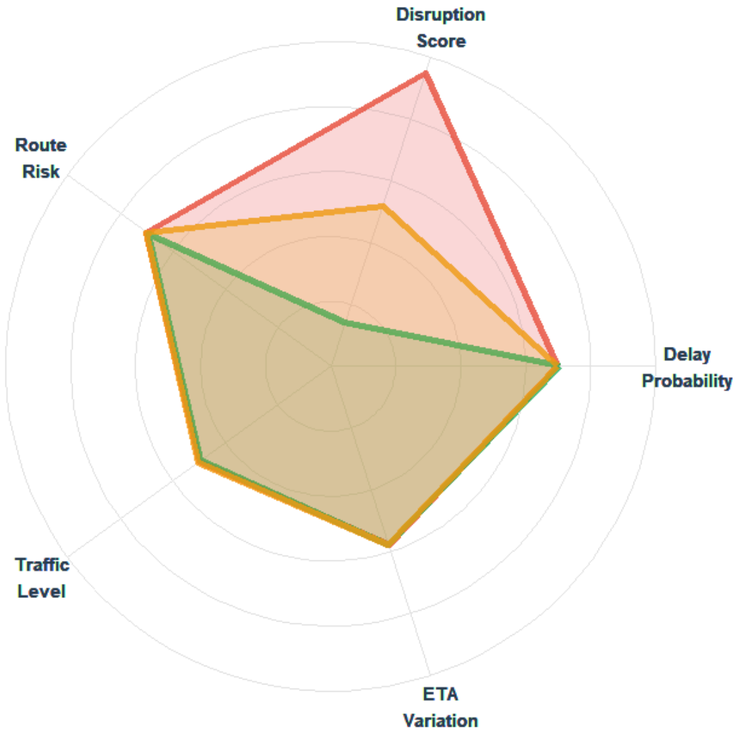



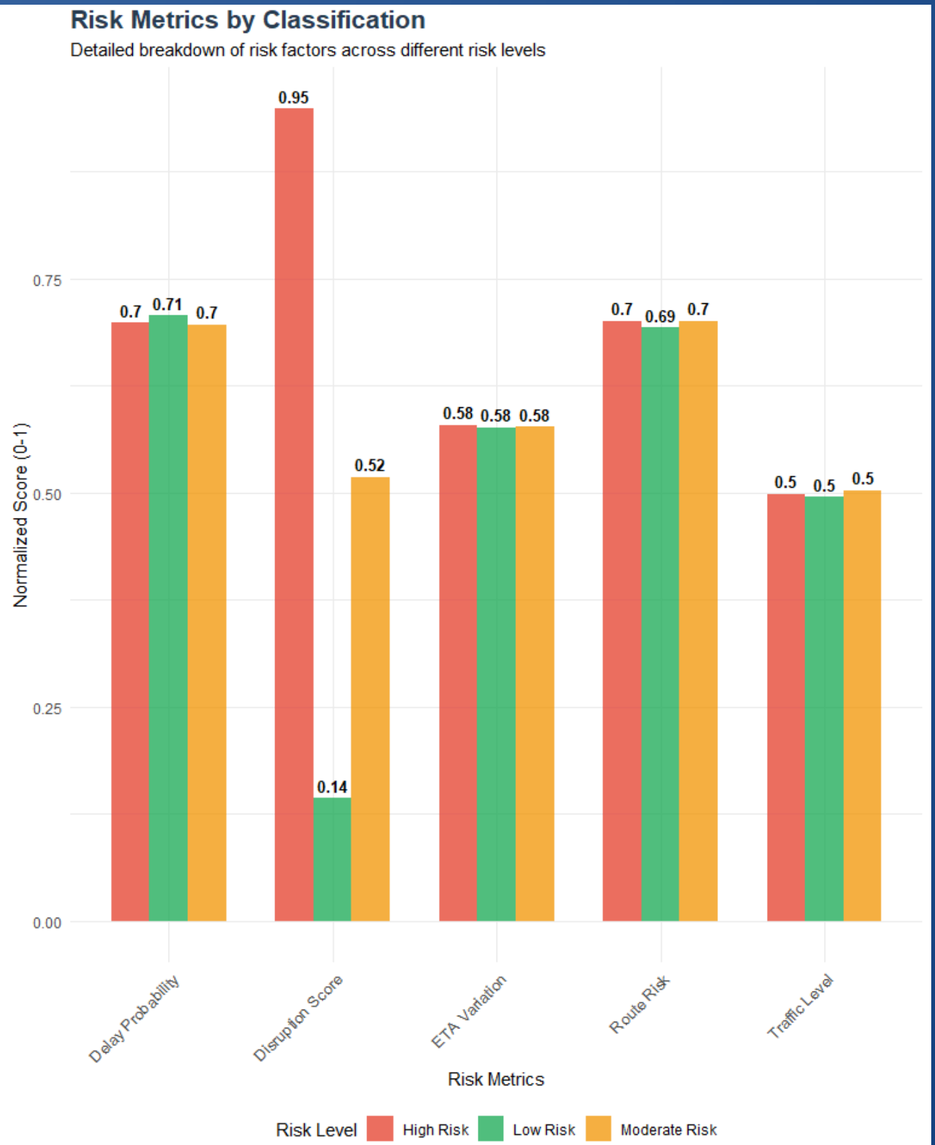

- High-risk operations cost about **3-4%+** more than low-risk but **~5%** more delay, and on-time rates drop sharply.
- As risk rises, cost per on-time performance worsens.

***Insight:***

**Reducing exposure to high-risk routes and periods is the single biggest lever for margin and service quality.**

# 2. EQUIPMENT AVAILABILITY: MINIMAL IMPACT

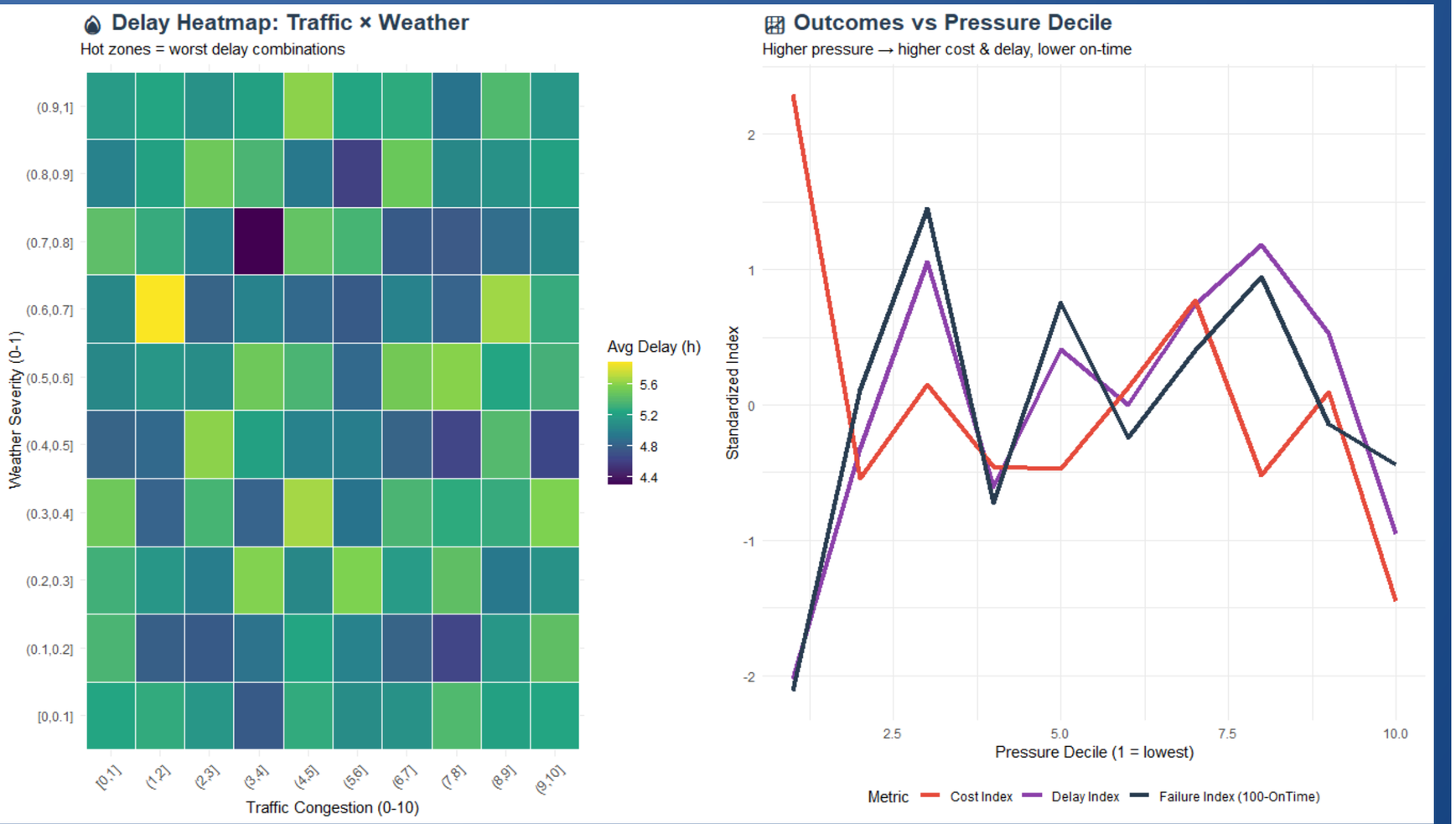



***Insight:***

Risk profiles reveal distinct operational patterns across risk classifications. **High-risk** operations show **elevated scores** across all dimensions (delay probability, disruption likelihood, route risk, traffic congestion, and ETA variation), creating a **compounding effect** that drives both cost escalation and service degradation.

# 3. NETWORK PRESSURE DRIVES DELAYS & COST CODE



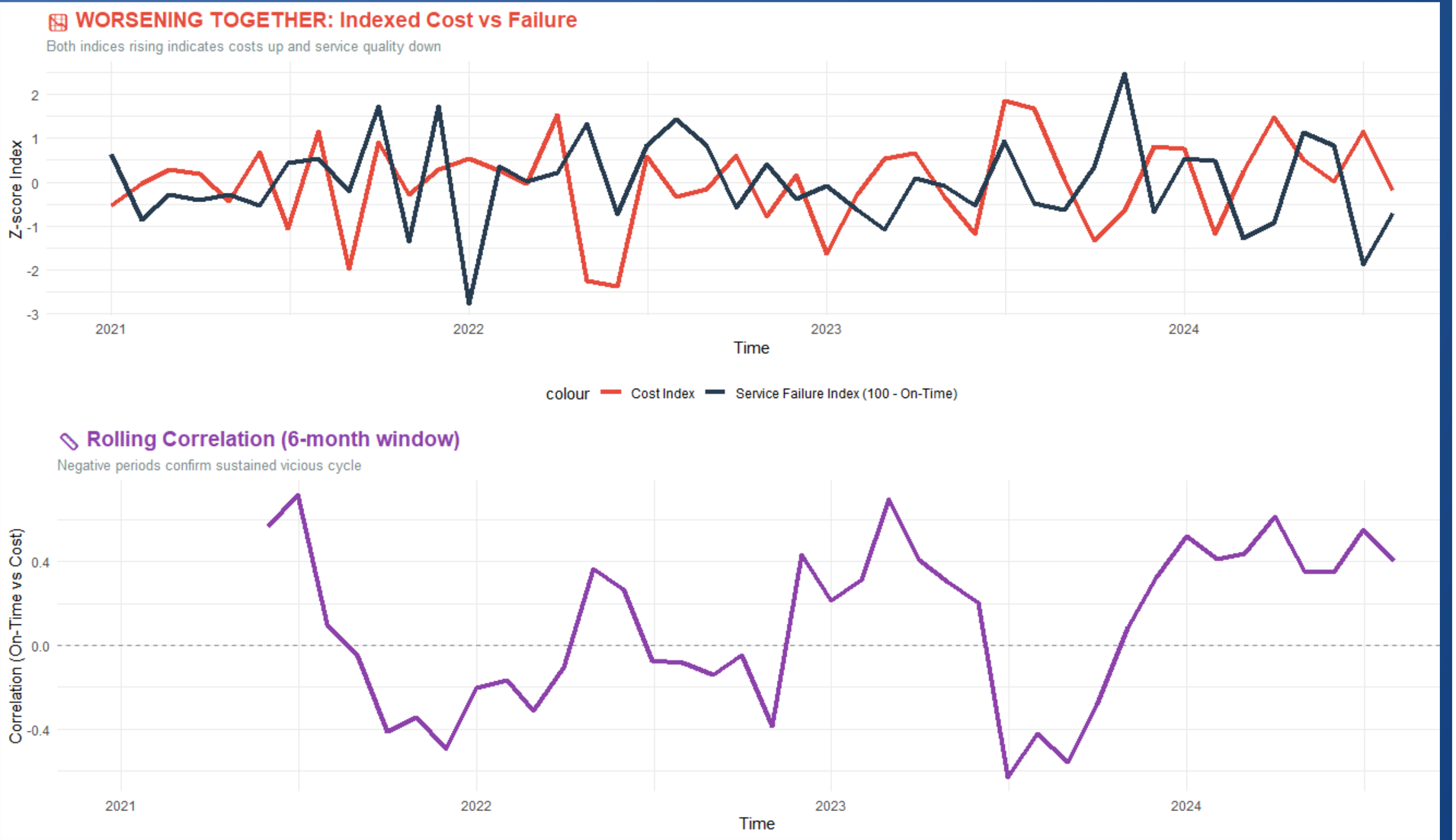




***Insight*:**

- Specific traffic+weather combinations (moderate traffic + severe weather) cause 5.6+ hour delays, not just high traffic or bad weather alone.
- Pressure Cascade Effect: As operational pressure increases, costs, delays, and failures all worsen together, with critical breakdown points at pressure deciles 3.5 and 7.5.

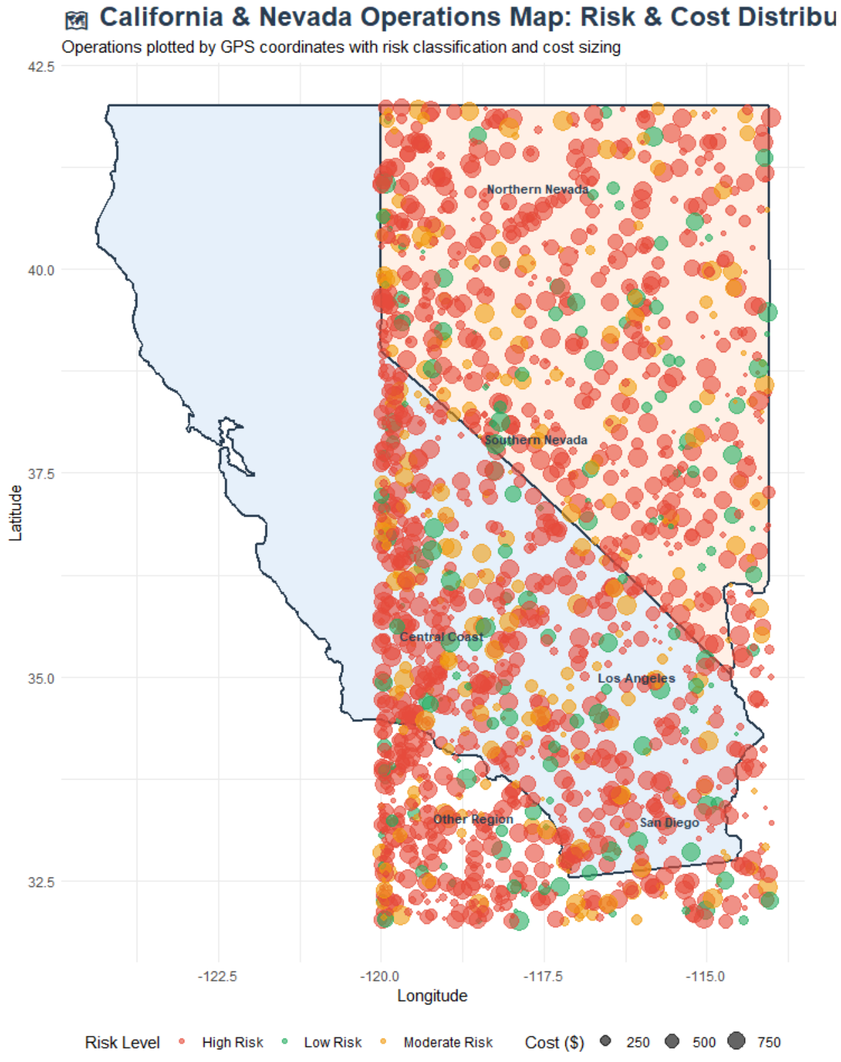
# 4. PERFORMANCE DEGRADING OVER TIME

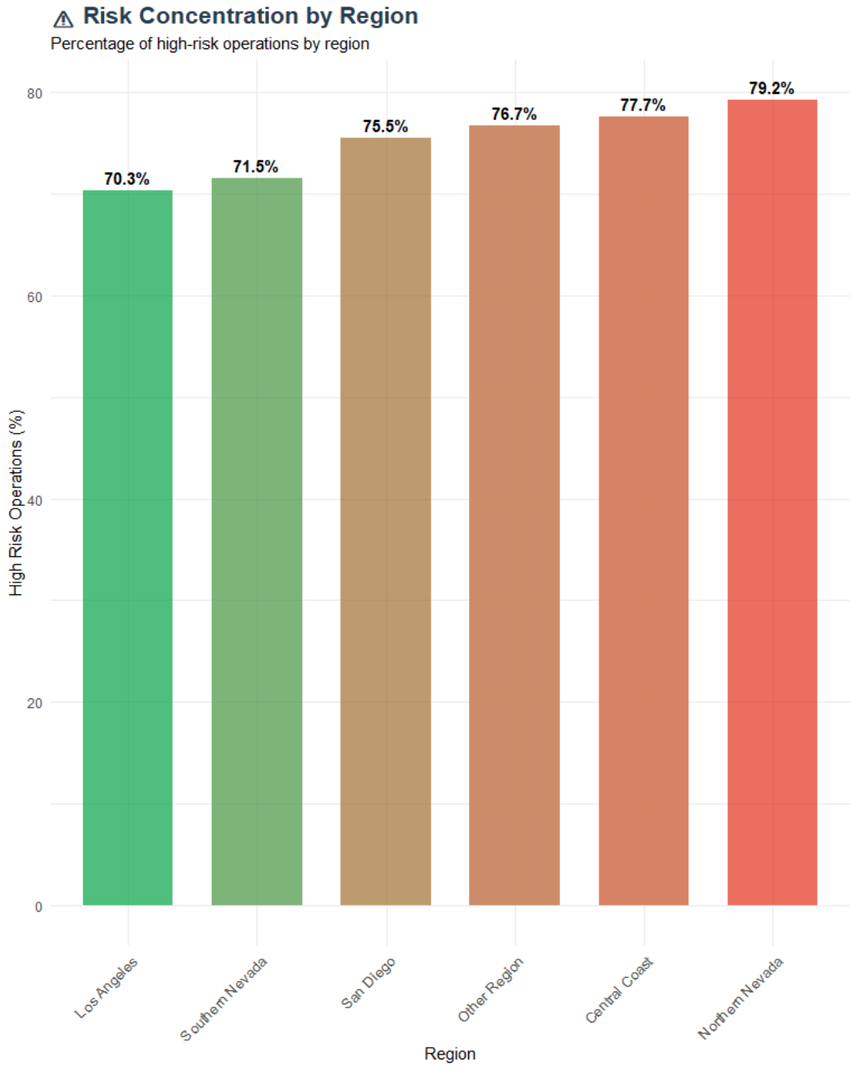



***Insight:***

- Rising costs directly correlate with increased service failures over time.
- Rolling correlation shows periods where declining on-time delivery strongly correlates with escalating costs, confirming a persistent efficiency breakdown.

# 5. GEOGRAPHIC RISK & COST ANALYSIS




***Insight*:**

- Risk is geographically concentrated across California, with certain regions showing **70%+** high-risk operations.
- California operations show distinct risk patterns, indicating that cross-state route optimization and geographic diversification could significantly reduce overall risk exposure.

# COURSE OF ACTIONS

## Immediate

- Risk-based route optimization: Avoid high-risk corridors/times; enable dynamic rerouting with traffic and weather signals.
  - Expected: **15–20%** cost and ~**20%** on-time improvement.
- Driver safety and performance: Enforce rest windows, coaching for low behavior scores, targeted incentives.
  - Expected: ~**15%** fewer incidents, better on-time, and fuel efficiency gains.
- Focus equipment efforts narrowly: Since equipment impact is modest here, prioritize quick reliability fixes, not heavy capex.

# COURSE OF ACTIONS

## Medium term (3–12 months)

- Predictive analytics: Forecast disruption risk and delay probability; feed routing and scheduling.
  - Expected: **20–25%** cost reduction and **30%** planning accuracy improvement. (Oloko, 2024)
- Dynamic pricing and slotting: Incentivize off-peak, price high-risk windows appropriately to shift demand and margin.
- Inventory and warehouse optimization: Use demand forecasting to reduce stockouts that cascade into delays and expedites.

## Long term (12+ months)

- Tech integration and automation: IoT telemetry for vehicles/cargo, automation where ROI is clear.
- Strategic network diversification: Partnerships that reduce exposure to the highest-risk geographies and ports.

# BUSINESS IMPACT AND TARGETS

If we execute the near-term actions and predictive routing:

- **On-time:** move from **~65% to ~85%**
- **Average cost:** **~25%** reduction
- **High-risk exposure:** from **~75%** toward **~30–40%** through smarter routing and scheduling.

**Customer Impact:**
Improve the on-time record will increase the retention rate of the customer → boosting the revenue and brand popularity.

**Industry Trend:**
Optimizing routes not only saves cost but also reduces fuel burn (~15% expected) → focusing on sustainability trend to capture more customer.

# APPENDIX

Oloko O. (2024) Dynamic Route Optimization in Last-Mile Delivery Using Predictive Analytics: A CaseStudy of E-commerce in the U.S., European Journal of Logistics, Purchasing and Supply Chain Management, Vol.12No.3, pp.1-32

Hussain, K. (2025). Revolutionizing Route Optimization Systems with Artificial Intelligence for a Smarter, Sustainable Logistics Ecosystem. International Journal of Computer Science and Mobile Computing, 14, 66-68.- claims 98 % on-time delivery under AI-driven routing systems

Pourmohammad-Zia, N., & van Koningsveld, M. (2023). Urban Logistics in Amsterdam: A Modal Shift from Roadways to Waterway. arXiv preprint arXiv:2309.00345.- reports ~28 % cost savings when switching to hybrid route strategies in an urban logistics context

Predictive Maintenance for Logistics. (2025). Thedatacrunch.com. https://www.thedatacrunch.com/case-studies/predictive-maintenance-logistics - reports a 50 % reduction in unplanned downtime in logistics operations via predictive maintenance, which mitigates risk of disruptions

Keshavdas M. (2020, January 29). 10 Ways Route Optimization Reduces Cost and Increases ROI. Fleetroot -. https://www.fleetroot.com/blog/10-ways-route-optimization-reduces-cost-and-increases-roi/ - claims fleets using advanced route optimization see 10–30 % transportation cost savings over 3–6 months.

Reducing Fuel Costs through Driver Behavior Monitoring and Coaching for a Logistics Fleet — logistics firm cut fuel consumption by ~12 % in six months through behavior monitoring and coaching.

# THANK YOU FOR LISTENING

Repository