

Supply Chain Risk Monitor: Autonomous AI Agent System for Proactive Disruption Prevention

Group- 5

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Github Link: <https://github.com/sakshat-patil/272-Project>

1) Empathize

Goal: Understand users and context deeply.

A. User research plan

Who we'll study (primary roles & contexts)

- **Global Supply Chain Director** (strategy; multi-region, multi-category portfolios)
- **Category/Sourcing Manager** (supplier relationships, RFQs, contracts)
- **Supplier Performance/Risk Analyst** (scorecards, risk signals, exposure)
- **Logistics/Network Planner** (ports, carriers, capacity, mode shifts)
- **Plant/Factory Materials Planner** (line-down risk, inventory buffers)

- **IT/Data Integrations Lead** (ERP/TMS/SCM/PLM owners; data access)

How we'll study

- **6–8 semi-structured interviews** (45–60 min; screen-share workflows, artifacts)
- **On-site shadowing** (2 sites × ½ day; control tower / planning war-room)
- **Artifact review** (supplier scorecards, incident logs, RFQ docs, lane maps, SOPs)
- **Contextual task walkthroughs** (triaging an alert, running a mitigation playbook)
- **Data trace review** (exported ERP/TMS logs for alert → action timelines)

What we'll study

- Daily/weekly monitoring routines and tools (email, spreadsheets, control towers)
- How risks are **detected, validated, assigned, resolved, post-mortemed**
- Hand-offs across procurement, logistics, plants, and suppliers
- Alert fatigue/noise, false positives/negatives, and SLA expectations
- Time to **impact assessment** (Which SKUs? Which POs? What \$ at risk?)
- Decision artifacts (playbooks, approval paths, comms to suppliers/customers)

B. Interview transcripts & observation notes (selected excerpts)

- **Sourcing Manager (EU Metals):**

“By the time we hear a port labor rumor is real, trucks are already queued. We spend hours just figuring out which POs are stuck.”

Observation: Maintains a vendor-by-vendor “watch” sheet; duplicates lane exposure in another file; manual mapping from news to POs.

- **Risk Analyst (NA Electronics):**

“90% of alerts are noise. If you tell me *which suppliers and SKUs* in 5 minutes, I’ll trust the system.”

Observation: Uses 4 browser tabs (news, weather, AIS/port feeds, carrier portal) + ERP queries; triage takes 30–90 min.

- **Logistics Planner (APAC):**

“Weather alerts are easy. The hard part is converting them into *reroutes I can actually book.*”

Observation: Keeps a personal “mitigation crib sheet” with carrier cutoffs and alternates.

- **Plant Materials Planner (EMEA):**

“A line-down hour costs us tens of thousands. Warn me three days earlier and I’ll pre-build.”

Observation: Uses email threads to chase supplier ETAs; no standardized “impact window” view.

- **IT Integrations Lead:**

“Anything that requires write access is a non-starter initially. Read-only with clear data lineage is fine.”

Observation: Prefers event-driven webhooks or scheduled pulls; insists on audit trails.

C. Empathy maps (summaries)

Supply Chain Director

- Says: “Resilience beats lowest unit cost.”
- Thinks: “Where’s my consolidated risk posture by region/category?”

- *Does*: Reviews weekly risk decks; approves major mitigations.
- *Feels*: Exposed when surprises hit; accountable for \$ impact.
- *Motivation*: Reduce disruption cost variance QoQ.

Sourcing Manager

- *Says*: “Tell me which suppliers are impacted today.”
- *Thinks*: “I can’t waste time chasing rumors.”
- *Does*: Tracks supplier health; negotiates alternates.
- *Feels*: Frustrated by alert noise & duplicate work.
- *Motivation*: Protect supply without blowing PPV.

Logistics Planner

- *Says*: “Give me bookable reroutes, not headlines.”
- *Thinks*: “Capacity and cutoff windows decide feasibility.”
- *Does*: Replans lanes; updates carrier bookings.
- *Feels*: Time-pressed near cutoffs.
- *Motivation*: Maintain OTIF while minimizing premium freight.

D. Journey map (risk → mitigation)

Phase	Actions	Emotions	Blockers
Signal surfaces	News/port/weather/geo event	Skeptical	Too many generic alerts
Validate	Check multiple sources; ping supplier/carrier	Rushed	No single truth; slow confirmations
Assess impact	Map to SKUs/POs/sites/customers	Anxious	Manual joins; data silos

Decide	Choose playbook (reroute, expedite, alt-source)	Focused	Who approves? What cost delta?
Execute	Book, communicate, adjust MRP/ATP	Stressed	Cutoff windows; capacity constraints
Review	Post-mortem; update playbooks	Reflective	No feedback loop into templates

E. Key insights (quotes, pain points, opportunities)

- **Noise vs. signal** blocks trust; supplier-specific impact is the fastest trust builder.
 - **Impact mapping is the bottleneck** (from headline → affected POs/SKUs/sites).
 - **Mitigation “last mile”** (bookable actions, approval paths) determines value realized.
 - **Time advantage needed:** 3–7 day early warning changes cost curve (buffers, pre-builds).
 - **Governance matters:** read-only integrations, audit trails, clear ownership.
 - **Opportunity:** autonomous multi-agent sensing + deterministic supply graph + guided playbooks = **15-min triage** and **50–80% disruption cost prevention** (target).
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2) Define

Goal: Synthesize insights into a clear, actionable problem statement.

A. POV statements (one user • one need • one insight)

- **Sourcing Manager** needs *supplier-specific* early warnings **because** generic alerts create noise and delay action.
- **Logistics Planner** needs *bookable* reroute options **because** feasibility depends on real capacity/cutoffs, not headlines.

- **Materials Planner** needs *fast impact windows (SKUs, lines, dates)* **because** buffers and pre-builds require ≥72-hour notice.
- **Director** needs a *single risk posture view* **because** decisions require quantified exposure and mitigation ROI.

B. How Might We (HMW) questions

- **HMW** detect emerging events 3–7 days early across news/weather/port/geo data while **minimizing noise**?
- **HMW** map any event to **affected suppliers, POs, SKUs, sites, and customers** in under 5 minutes?
- **HMW** auto-propose **feasible mitigations** (reroutes, alternates, expedite) with cost/OTIF trade-offs?
- **HMW** encode approvals and **turn mitigations into bookable actions**?
- **HMW** learn from outcomes to **continuously reduce false positives**?

C. Problem framing (concise)

Manual, reactive monitoring across fragmented tools causes late detection, slow impact assessment, and inconsistent mitigation—leading to avoidable premium freight, stockouts, and line-downs. We must deliver **trusted, supplier-specific early warnings** and **actionable, bookable mitigations** within **15 minutes** of signal detection.

D. User personas

Alex – Global Supply Chain Director

- *Goal:* Resilient supply; predictable cost.
- *Frustration:* Surprise disruptions; no consolidated posture.
- *Success:* 50–80% disruption cost avoided; fewer escalations.

Maya – Sourcing Manager (Tier-1 suppliers)

- *Goal:* Protect continuity without major PPV hit.
- *Frustration:* Alert noise; manual PO/SKU mapping.
- *Success:* Impact in <5 min; supplier comms w/ recommended actions.

Ken – Logistics Planner

- *Goal:* Keep OTIF; minimize expedites.
 - *Frustration:* Reroute feasibility not obvious; time to cutoff.
 - *Success:* Bookable plan in <15 min; on-time recovery.
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3) Ideate

Goal: Generate a wide range of creative solutions.

A. Brainstorming outputs / idea sketches (clustered)

Sensing (Agents)

- News/geo/weather/port labor **Watchers** with source credibility scoring
- AIS/port congestion **Signal Agent**; carrier schedule change detector
- Supplier social/financial **Pulse Agent** (optional opt-in)

Understanding (Graph & Reasoning)

- **Supply Exposure Graph** (supplier \Rightarrow site \Rightarrow SKU \Rightarrow PO \Rightarrow lane)
- **Impact Mapper** (event \rightarrow impacted objects; confidence + time window)
- **Criticality Scorer** (revenue, margin, single-source, lead time)

Acting (Playbooks)

- **Mitigation Recommender** (alt-supplier, pre-build, expedite, reroute, buffer)
- **Feasibility Checker** (capacity, cutoff windows, SLA constraints)
- **Approval Path Orchestrator** (stakeholders, cost thresholds, audit trail)

Learning (Quality)

- **Feedback Loop** (mark noise/true events; auto-tune thresholds)
- **Outcome Tracker** (time saved, \$ avoided, OTIF recovery)

B. Concept clusters / prioritization matrix (feasibility × impact)

Feature	Feasibility	Impact	Phase
Supply Exposure Graph (read-only ERP/TMS ingest)	High	High	Now – P1
Event Watchers (news/weather/ports)	High	High	Now – P1
Impact Mapper (PO/SKU/site mapping)	Med-High	High	Now – P1
Mitigation Recommender (rules + LLM)	Med	High	Next – P2
Feasibility Checker (capacity/cutoffs)	Med	High	Next – P2
Approval Orchestrator (read-only tickets)	Med	Med	Next – P2
Outcome/Feedback Learning	Med	Med-High	Later – P3
Supplier Pulse Agent (financial/social)	Low-Med	Med	Later – P3

C. Storyboard / concept cards for top ideas

Concept 1 — Supplier-Specific Early-Warning Agent

- **Problem:** Generic alerts create noise; users can't see *which* suppliers/SKUs are at risk.
- **Solution:** Multi-source Watchers + Impact Mapper to surface only supplier-specific alerts with confidence and time window.
- **Value:** Cuts triage from 2 hours/day to ~15 minutes; focuses attention.
- **Target users:** Sourcing Managers, Risk Analysts.
- **Success metrics:** ≥80% precision on actionable alerts; impact mapping in ≤5 min.

Concept 2 — Impact Analysis & Playbook Engine

- **Problem:** Mapping event → PO/SKU/site and choosing mitigation is slow and error-prone.
- **Solution:** Exposure Graph + rules/LLM engine generates **ranked mitigations** (alt-source, pre-build, reroute, expedite) with cost/OTIF trade-offs.
- **Value:** Prevents 50–80% disruption costs; standardized responses.
- **Target users:** Sourcing, Logistics, Plant Planning.
- **Success metrics:** Time to mitigation plan ≤15 min; premium freight ↓ 30–50%.

Concept 3 — Feasibility & Booking Assistant

- **Problem:** Recommendations fail without capacity/cutoff validation and approvals.
- **Solution:** Pulls carrier schedules/cutoffs; checks policy thresholds; drafts approvals/tickets/emails.
- **Value:** Turns recommendations into **bookable actions**.
- **Target users:** Logistics Planner, Director (approvals).
- **Success metrics:** 70%+ mitigations executable without rework; OTIF recovery time ↓ 40%.

