

Introduction to Supply Chain Analytics

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Key concepts, tools, and practical steps for turning data into actionable supply chain insights.

1. What Is Supply Chain Analytics?

Aspect	Description
Definition	The systematic use of data, statistical methods, and modeling techniques to understand, predict, and improve the performance of a supply chain.
Goal	Turn raw data from suppliers, manufacturers, distributors, and customers into decisions that reduce cost, increase service level, and enhance resilience.
Scope	Covers demand forecasting, inventory optimization, transportation planning, supplier risk assessment, network design, and performance monitoring.

2. Why It Matters

- **Cost Reduction** – Identify waste, excess inventory, and inefficient routes.
- **Service Improvement** – Better forecast demand ? higher fill?rate, lower stock?outs.
- **Risk Management** – Detect supplier disruptions, geopolitical impacts, and capacity bottlenecks early.
- **Strategic Agility** – Simulate “what?if” scenarios (e.g., new plant, tariff changes) before committing resources.
- **Sustainability** – Quantify carbon footprint across logistics and optimize for lower emissions.

3. Core Analytical Techniques

Technique	Typical Use	Key Outputs
Descriptive Analytics	Summarize past performance (e.g., on?time delivery, inventory turns).	Dashboards, KPI reports, variance analysis.
Diagnostic Analytics	Explain <i>why</i> something happened (e.g., root?cause of a demand spike).	Correlation analysis, drill?down reports, Pareto charts.

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Technique	Typical Use	Key Outputs
Predictive Analytics	Forecast future demand, lead times, or failure probability.	Time-series forecasts, regression models, machine-learning classifiers.
Prescriptive Analytics	Recommend optimal actions (e.g., reorder quantities, routing).	Optimization models, simulation results, decision rules.
Prescriptive? Simulation (What?If)	Test the impact of strategic changes (e.g., new warehouse location).	Scenario analysis, Monte-Carlo simulation, cost-benefit tables.

4. Data Foundations

Data Source	Examples	Typical Frequency
Transactional	Purchase orders, shipping manifests, sales invoices.	Real-time to daily
Operational	Machine sensor data, labor schedules, warehouse slotting.	Near-real-time
External	Weather forecasts, commodity prices, trade tariffs, social media sentiment.	Hourly to weekly
Master Data	SKU master, supplier contracts, product hierarchy.	Static / periodic updates

Best Practices

1. **Data Quality** – Clean, de-duplicate, and standardize fields (e.g., unit of measure).
 2. **Integration** – Use a data lake or warehouse to consolidate ERP, TMS, WMS, and external feeds.
 3. **Governance** – Define owners, access controls, and data lineage.
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5. Typical Analytics Workflow

1. Define Business Question

- Example: “How can we reduce safety-stock while keeping service > 98%?”

2. Collect & Prepare Data

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- Extract ? Transform (normalize, handle missing values) ? Load (ETL/ELT).

3. Explore & Visualize

- Use histograms, heat maps, and KPI cards to spot patterns.

4. Model Selection

- Choose statistical (ARIMA, exponential smoothing) or ML (XGBoost,