I. Industry Applications

i. Supply Chain Management

- **Forecast Accuracy Tracking:** SQL compares forecast vs. actuals; Power BI visualizes MAPE trends across SKUs, plants, or regions.
- **Demand Segmentation (ABC/XYZ Analysis):** SQL performs consumption and variability segmentation; Power BI clusters SKUs for tailored planning.
- **Lead Time Variability Analysis:** SQL quantifies actual vs. quoted supplier lead times; Power BI shows variability impact on forecasts.
- **Reorder Point Analysis**: SQL retrieves sales, lead times, and stock levels to calculate reorder points; Power BI automates planner alerts.
- **Safety Stock Optimization**: SQL models demand/supply variability; Power BI visualizes cost vs. service-level trade-offs.
- **Obsolescence & Excess Stock**: SQL flags low-demand or aging SKUs; Power BI highlights carrying-cost implications.
- **Inventory Health Monitoring**: SQL detects high DOH, negative inventory, and frequent adjustments; Power BI displays inventory risk heatmaps.
- **Packaging & Container Tracking**: SQL tracks container movements, cycle times, and losses; Power BI highlights dwell-time hotspots and exceptions.
- **Supplier Management**: SQL monitors supplier lead times, defects, and pricing; Power BI creates supplier scorecards for comparison.
- **Procurement Spend Analytics**: SQL aggregates PO cost, price trends, and contract terms; Power BI visualizes maverick spend and category insights.

- **Quality & Defect Analytics**: SQL analyzes recurring supplier/process defects; Power BI displays Pareto and trend charts.
- **Capacity Planning & Line Balancing**: SQL analyzes production rates, uptime, and bottlenecks; Power BI visualizes capacity gaps across lines/plants.
- **Order Fulfillment Tracking**: SQL retrieves ERP shipment/production statuses; Power BI visualizes fulfillment and backorder trends.
- **Transportation & Logistics Performance**: SQL integrates freight cost, carrier performance, and transit data; Power BI maps delays and consolidation opportunities.
- **OTIF (On-Time In-Full) Monitoring**: SQL calculates supplier and customer OTIF; Power BI highlights route, carrier, and product patterns.
- **Network Optimization Inputs**: SQL combines demand, inventory, and routing data to feed optimization models; Power BI visualizes baseline vs. optimized flows.
- **Warehouse Operations Analytics:** SQL analyzes put-aways, picks, and cycle counts; Power BI shows SKU velocity, space utilization, and picking efficiency.
- **Idle Container & Aging Alerts:** SQL evaluates dwell time; Power BI triggers alerts and visualizes idle inventory.

ii. Manufacturing Operations

- **Production Throughput:** SQL aggregates output by shift, line, or operator; Power BI highlights throughput vs. targets and bottleneck stages.
- **Cycle Time & Takt Time Analysis:** SQL calculates actual vs. standard cycle times; Power BI visualizes gaps against takt time and identifies imbalance.

- **WIP Monitoring:** SQL extracts intermediate production statuses; Power BI shows WIP aging and constraints across work centers.
- **Bottleneck Identification:** SQL detects slowest production stages through queue lengths and wait times; Power BI highlights capacity constraints.
- **Machine Utilization & Downtime**: SQL extracts idle time, setup time, and breakdown events; Power BI visualizes uptime trends across machines/lines.
- **OEE (Overall Equipment Effectiveness)**: SQL calculates Availability, Performance, and Quality; Power BI visualizes OEE by line, shift, and SKU.
- **Predictive Maintenance**: SQL stores IoT sensor readings like vibration, temperature, noise etc; Power BI identifies anomalies for early maintenance.
- **Quality Control & Defect Analytics**: SQL retrieves scrap, rework, and non-conformance data; Power BI trends defects by product, operator, or process.
- **Process Capability (Cp/Cpk) Monitoring**: SQL stores measurement data from QC systems; Power BI visualizes control charts and process stability.
- **First Pass Yield (FPY) & Rolled Throughput Yield (RTY)**: SQL calculates FPY and RTY across production steps; Power BI highlights yield loss contributors.
- **Root Cause Analysis (5 Why / Fishbone Data Insights)**: SQL correlates defect drivers (machine, operator, material); Power BI displays interactive RCA dashboards.
- **Workforce Productivity**: SQL consolidates labor hours and operator performance; Power BI displays efficiency, overtime, and labor cost/unit.
- **Line Balancing & Staffing Requirements**: SQL evaluates workload distribution; Power BI simulates optimal staffing based on demand.

- **Material Consumption & Variance Tracking**: SQL compares BOM requirements vs. actual consumption; Power BI highlights variances for cost control.
- **Kanban & Replenishment Monitoring**: SQL tracks Kanban signal triggers and card movements; Power BI visualizes replenishment cycle performance.
- **Scrap & Waste Reduction Analysis**: SQL retrieves material scrap logs; Power BI identifies patterns causing high waste generation.
- **Production Scheduling Adherence**: SQL compares planned vs. actual production schedules; Power BI identifies schedule slippages and causes.

iii. Process Improvement

- **Bottleneck Identification**: SQL merges ERP/MES process times; Power BI highlights constraints delaying throughput and supports line balancing.
- **Cycle Time Reduction**: SQL captures timestamps for each production stage; Power BI compares actual cycle times vs. takt time and identifies delays.
- **Process Variability Analysis**: SQL analyzes cycle time variance; Power BI visualizes trends to drive standardization and SOP improvements.
- **Throughput Improvement Tracking**: SQL monitors output before/after process changes; Power BI quantifies impact of improvements on throughput.
- **Defect & Rework Waste**: SQL extracts quality records; Power BI tracks rework trends, defect hotspots, and associated costs.
- **Cost Analysis & Reduction**: SQL integrates material, scrap, labor, and overhead cost data; Power BI highlights overruns by product or process.

- **Cost of Poor Quality (COPQ)**: SQL quantifies scrap, rework, returns, and warranty claims; Power BI visualizes COPQ trends and savings from improvements.
- **SPC (Statistical Process Control) Monitoring**: SQL feeds control limits and measurement data; Power BI displays control charts for proactive process stability.
- **Audit & Compliance Tracking**: SQL stores audit scores; Power BI highlights trends and areas needing corrective action.
- **SOP Compliance Monitoring**: SQL compares actual process execution vs. standard steps; Power BI highlights deviations that cause variation.
- **Automation Opportunity Identification**: SQL examines manual steps, frequency, and duration; Power BI identifies processes with highest automation ROI.
- **Six Sigma Projects**: SQL supports data extraction for DMAIC phases. Power BI creates real-time dashboards to monitor defect reduction progress.
- **Kaizen Tracking**: SQL maintains continuous improvement logs. Power BI visualizes savings achieved, project timelines, and employee participation.

II. Scenarios and Typical KPIs

Inventory Turnover Analysis

SQL Task: Query historical inventory + sales to compute turns and DOH.

Power BI KPIs: Inventory Turns, DOH, Stockout Frequency, Carrying Cost %.

Safety Stock Optimization

SQL Task: Calculate demand variability, lead time variability, service levels.

KPIs: Suggested Safety Stock, Fill Rate Impact, Cost vs. Service Curve.

Excess & Obsolete Inventory Monitoring

SQL Task: Identify aging items, zero-movement SKUs, slow movers.

KPIs: Excess Inventory $, Aging Buckets, Scrap Risk Score.

Reorder Point (ROP) Automation

SQL Task: Join sales, lead time, and on-hand tables to compute reorder triggers.

KPIs: ROP Compliance, Reorder Alerts, Avoided Stockouts.

ABC / XYZ Segmentation

SQL Task: Categorize items by consumption value and variability.

KPIs: Category Mix %, Strategy Recommendations, Forecast Difficulty.

Inventory Accuracy Tracking

SQL Task: Compare system quantity vs. physical cycle counts.

KPIs: Accuracy %, Adjustment Trends, Root Cause Breakdown.

Demand vs. Supply Analysis

SQL Task: Combine demand history with supplier/production availability.

KPIs: Forecast Accuracy, Fill Rate, Backorder Levels.

S&OP (Sales & Operations Planning) Alignment

SQL Task: Consolidate sales forecast, capacity, supply risk.

KPIs: Demand–Supply Gap, Build vs. Buy Decisions, Projection Scenarios.

Forecast Accuracy & Bias Tracking

SQL Task: Compute MAPE, MAD, Bias across SKUs and plants.

KPIs: MAPE Trend, Bias %, SKU Forecastability Score.

Lead Time Variability Analysis

SQL Task: Calculate actual vs. expected supplier lead times.

KPIs: Variability %, Reliability Trend, Risk Zones.

Supplier Performance Scorecards

SQL Task: Combine OTD, defect rate, pricing, responsiveness.

KPIs: Supplier Score %, OTD %, PPM, Lead Time Compliance.

Spend Analytics

SQL Task: Summarize PO spend by category, SKU, and vendor.

KPIs: Total Spend, Cost Savings %, Maverick Spend %, Price Trends.

Cost Reduction Opportunity Identification

SQL Task: Identify high-spend SKUs with cost variance or volume leverage.

KPIs: Price Variance, Cost Avoidance $, Negotiation Opportunity Score.

Supplier Risk Monitoring

SQL Task: Track delays, defects, communication lag.

KPIs: Risk Score, Defect Trend, Delay Probability.

Overall Equipment Effectiveness (OEE) Monitoring

SQL Task: Aggregate machine uptime, downtime, cycle counts.

KPIs: OEE %, Availability, Performance, Quality %.

Production Throughput Analysis

SQL Task: Analyze units produced per line/shift vs. targets.

KPIs: Throughput Rate, Cycle Time, Bottleneck Map.

Capacity Utilization

SQL Task: Calculate actual output vs. rated machine capacity.

KPIs: Capacity %, Lost Capacity, Shift Utilization.

Predictive Maintenance Analytics

SQL Task: Process IoT/sensor vibration and temperature data.

KPIs: Anomaly Index, MTBF, MTTR, Maintenance Due Alerts.

Scrap & Waste Analysis

SQL Task: Track scrap quantity and source by machine, product, operator.

KPIs: Scrap %, $ Loss, Process Defect Map.

Labor Productivity & Workforce Efficiency

SQL Task: Combine time-clock data with production units.

KPIs: Units per Labor Hour, Overtime %, Productivity Index.

On-Time Delivery (OTD) Tracking

SQL Task: Extract shipment timestamps, calculate delays.

KPIs: OTD %, Avg Transit Time, Carrier Score.

Freight Cost Optimization

SQL Task: Analyze carrier invoices and cost-per-mile.

KPIs: Cost/Shipment, Carrier Variance, Accessorial Charges.

Route Performance & Delay Hotspots

SQL Task: Merge GPS or scan logs with shipment data.

KPIs: Delay Heatmaps, Lane Reliability %, Driver Performance Score.

Load & Trailer Utilization Analysis

SQL Task: Extract weight/volume utilization per shipment.

KPIs: Utilization %, Empty Miles, Consolidation Opportunity Score.

Warehouse Operations & Space Utilization

SQL Task: Analyze bin occupancy, travel distance, pick logs.

KPIs: Space Utilization %, Pick Accuracy %, Cycle Time.

Order Fulfillment SLA Tracking

SQL Task: Compare picking/packing times vs. promised SLA.

KPIs: SLA Adherence %, Order Cycle Time, Delay Drivers.

Inventory Movement & Traceability

SQL Task: Track inbound, outbound, and internal moves (WMS).

KPIs: Move Accuracy, Dwell Time, Audit Exceptions.

Slotting Optimization Insights

SQL Task: Analyze item velocity & storage patterns.

KPIs: Optimal Bin Location Suggestions, Velocity Clusters, Pick Path Time Saved.

Defect and Quality Tracking

SQL Task: Query logs to count defects by type, cause, supplier.

KPIs: DPUs, PPM, FPY, Supplier Defect Contribution.

Warranty & Field Failure Analytics

SQL Task: Integrate service claims and failure logs.

KPIs: Failure Rate, Cost of Quality, Product Reliability Index.

Root Cause Analysis Dashboard

SQL Task: Correlate defect drivers (machine, operator, batch).

KPIs: RCA Categories, Pareto %, Containment Status.

Budget vs. Actual Performance

SQL Task: Compare operational spend with budget allocations.

KPIs: Variance %, Over-budget Areas, Forecasted Spend.

Process Cycle Time vs. Takt Time

SQL Task: Track timestamps for every production step.

KPIs: Takt Compliance %, Waiting Time, Cycle Time Breakdown.

SPC (Statistical Process Control) Monitoring

SQL Task: Record process measurements at intervals.

KPIs: Control Charts, Cp/Cpk, Out-of-Control Signals.

Waste Identification

SQL Task: Pull data from MES, WMS, mobility systems.

KPIs: Waste Categories %, Motion Waste, Waiting Time %, Transportation Loss.