I. **Industry Applications**

i. **Supply Chain Management**

- Reorder Point Analysis: SQL retrieves sales, lead times, and current stock to calculate when new orders should be placed. Power BI automates alerts and dashboards for planners.

- Safety Stock Optimization: SQL models variability in demand and supply. Power BI visualizes safety stock trade-offs (cost vs. service levels).

- Forecast Accuracy Tracking: SQL compares forecasted demand with actual consumption. Power BI visualizes Mean Absolute Percentage Error (MAPE) trends across SKUs, plants, or regions.

- Obsolescence & Excess Stock: SQL flags low-demand SKUs, while Power BI highlights aging inventory and carrying cost implications for finance teams.

- Order Fulfillment Tracking: SQL queries retrieve order statuses from ERP systems, helping identify late shipments, backorders, and pending approvals. Power BI dashboards visualize fulfillment rates across regions or customer segments.

- Transportation & Logistics: SQL integrates shipment data (carrier performance, freight costs, delivery times). Power BI maps highlight route delays, carrier reliability, and opportunities for consolidation.

- Supplier Management: SQL enables monitoring of supplier lead times, defects, and pricing changes. Power BI dashboards generate supplier scorecards for vendor comparison and contract negotiations.

- Warehouse Operations: SQL queries on warehouse transactions (put-aways, picks, cycle counts) provide granular inventory visibility. Power BI highlights slow-moving vs. fast-moving SKUs, space utilization, and picking efficiency.

ii. Manufacturing Operations

- Machine Utilization & Downtime: SQL queries from MES logs identify machine idle times, setup times, and breakdown frequencies. Power BI visualizes uptime vs. downtime by machine or line.

- Production Throughput: SQL aggregates production volumes per shift, operator, or machine. Power BI dashboards highlight throughput variance against targets.

- Quality Control: SQL queries extract defect logs, rework orders, and scrap counts. Power BI trends defect rates by process, product family, or operator.

- Predictive Maintenance: SQL stores IoT sensor data (temperature, vibration). Power BI visualizes anomalies, enabling proactive maintenance scheduling.

- Workforce Productivity: SQL consolidates labor hours per job or shift. Power BI visualizes operator efficiency, overtime trends, and labor cost contribution per unit.

iii. Process Improvement

- Bottleneck Identification: SQL merges process times from ERP. Power BI highlights which steps delay throughput, enabling line balancing.

- Cycle Time Reduction: SQL captures time stamps for production stages. Power BI visualizes process cycle times against takt time.

- Cost Analysis: SQL integrates raw material costs, scrap, and labor inputs. Power BI highlights cost overruns by department or product line.

- 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 and sales data to calculate turnover ratios.

Power BI KPI Metrics: Inventory Turns, Days of Inventory on Hand, Stockout Frequency, Safety Stock Levels.

On-Time Delivery Tracking

SQL Task: Extract shipment and order data, calculate delivery delays.

Power BI KPI Metrics: On-Time Delivery Rate (OTD), Average Transit Time, Late Shipment Count, Carrier Performance Score.

Demand vs. Supply Analysis

SQL Task: Combine historical demand data with production or supplier data.

Power BI KPI Metrics: Forecast Accuracy, Fill Rate, Backorder Levels, Lead Time Variability.

Overall Equipment Effectiveness (OEE) Monitoring

SQL Task: Aggregate machine uptime, downtime, and production output data.

Power BI KPI Metrics: OEE %, Machine Utilization, Downtime by Machine/Shift, Scrap Rate.

Defect and Quality Tracking

SQL Task: Query production logs to count defects, categorize by type or supplier.

Power BI KPI Metrics: Defect Rate, Parts Per Million (PPM), Supplier Defect Contribution, Rework Percentage.

Production Throughput Analysis

SQL Task: Analyze completed units over time, by production line or shift.

Power BI KPI Metrics: Units Produced per Hour, Cycle Time, Bottleneck Identification, Capacity Utilization.

Freight Cost Optimization

SQL Task: Consolidate carrier invoices, calculate cost-per-mile, identify outliers.

Power BI KPI Metrics: Average Freight Cost per Shipment, Cost Variance by Carrier, Accessorial Charge Frequency, Route Efficiency.

Warehouse Operations and Space Utilization

SQL Task: Extract WMS data on stock location, pick/pack/ship times.

Power BI KPI Metrics: Warehouse Utilization %, Order Picking Accuracy, Cycle Time, Inventory Accuracy.

Supplier Performance Scorecards

SQL Task: Combine supplier delivery, quality, and pricing data.

Power BI KPI Metrics: Supplier On-Time Delivery %, Defect Rate, Cost Variance, Lead Time Compliance.