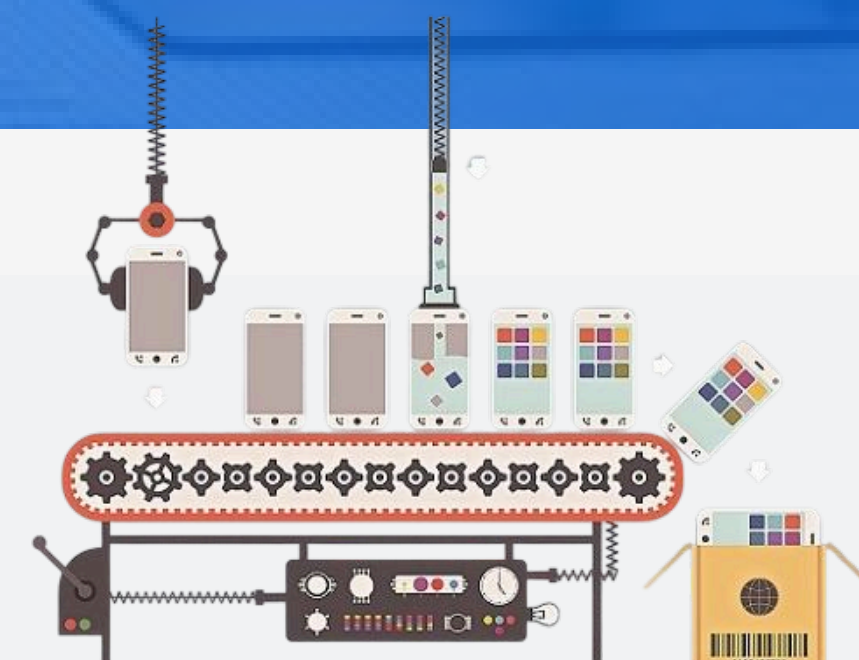


# Commonality & Traceability

## Analysis for Mobile Manufacturing Quality

Enabling end-to-end visibility and data-driven quality governance in phone manufacturing



### Problem Statement

#### Fragmented Quality Tracking Across Multi-Stage Production

The client, a leading phone manufacturer, operates a complex, multi-stage production environment involving CNC machines, fixtures, jigs, testing stations, and assembly lines running across multiple shifts.

Their existing quality control process faced major challenges due to fragmented data and limited traceability, resulting in:

- Inability to correlate defects across machining, assembly, and testing stages
- Delayed root-cause analysis due to lack of unified defect genealogy
- Inefficient containment of recurring defects
- Disconnected data between MES, IPQC, and traceability systems

This led to high rework rates, yield loss, and prolonged downtime in identifying & resolving process-level quality issues.



### Current State & Quality Gaps

- Disjointed trace data across MES, inspection, and production systems
- Manual defect analysis consuming 10+ hours per batch investigation
- No integrated view linking operators, machines, or fixtures to defect patterns
- Inconsistent trace coverage across machining and assembly lines
- Limited visibility into cross-stage defect propagation

### Strategic Solution Requirements

**Traceability Framework**

- Establish unified traceability from raw material to final assembly
- Integrate operator, shift, machine, fixture, and line data into a single model

**Commonality Analytics**

- Identify recurring defect patterns across machines, fixtures, and operators
- Enable rapid containment through automated correlation insights

**Real-Time Monitoring**

- Implement drill-down dashboards from finished product → defect → process stage → root cause
- Enable real-time updates through automated MES and IPQC data sync



### Our Solution

#### Integrated Traceability & Commonality Dashboard

We implemented a **Traceability and Commonality Analytics System** to digitize and unify production quality monitoring across machining, assembly, and inspection lines. The solution provides full part genealogy, defect traceability, and pattern-based quality analysis for faster decision-making.

#### Architecture Overview

**Data Integration Layer**

Automated data ingestion from MES, IPQC and Trace Systems

**Unified Data Model**

Common schema linking operator, shift, machine, fixture, process stage, and component ID

**Processing & Analytics Layer**

Commonality detection algorithms identifying recurring defect correlations

**Visualization Layer (Power BI)**

Dashboards enabling defect trend tracking, stage-wise yield, and RCA drill-downs

#### Core Solution Highlights

- Unified Trace Data Model:** Connected operator, shift, machine, and fixture details for full genealogy tracking
- Stage-Wise Process Mapping:** Linked machining, assembly, and testing operations for cross-stage defect visibility
- Commonality Analytics:** Detected recurring defect sources across equipment, shifts, or operators
- Real-Time Production & Quality Monitoring:** Drill-down from final assembly defects to root cause at process level
- Automated System Integration:** Continuous data synchronization across MES, IPQC, and Trace platforms



### Technology Stack



**Microsoft Power BI**

Visualization and analytics dashboards

**SQL Server / Data Lake**

Centralized trace data repository

**MES & IPQC Systems**

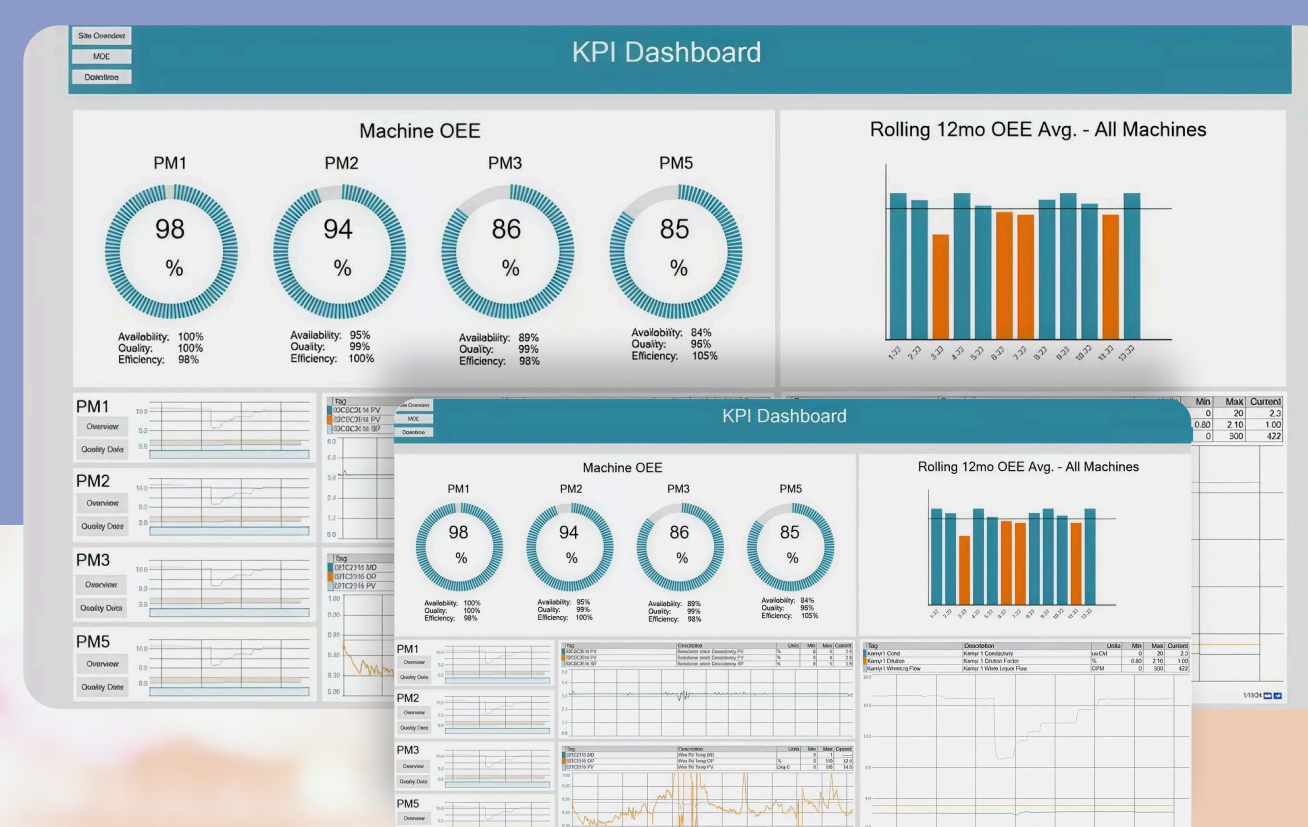
Real-time production and inspection data sources

**Power Automate / API Integrations**

Automated data sync and refresh

**Python / DAX Models**

Defect correlation and commonality computation



### Business Impact

**35%**

**Faster Root Cause Analysis**

Through automated correlation

**25%**

**Faster Defect Containment**

Improved response time

**20%**

**Reduction in Recurring Defects**

Via early detection

**100%**

**Traceability Coverage**

One-part-one-record coverage

#### Quantitative Outcomes

- 35% faster Root Cause Analysis
- 25% improvement in defect containment time
- 20% reduction in recurring quality issues
- Complete traceability across all process stages
- Strengthened compliance with audit-ready digital records