Section 2: Case Study Analysis

Case Study: Smart Manufacturing Implementation at AutoParts Inc.

Challenges: 15% defect rate, unpredictable downtime, rising labor costs, customization pressure.

AI Agent Strategy (Three Core Agent Types)

1. Quality Control Agent: Computer-vision inspection on lines; root-cause analysis from sensor + SPC data; auto-adjust process parameters.

2. Maintenance Agent: Predictive maintenance using vibration/temperature; schedules micro-stops; orders spares.

3. Production Planning Agent: Real-time scheduling, demand-aware batching, customization configuration.

4. Workforce Assistant (optional): Skill matching, shift optimization, guided work instructions.

ROI and Timeline

Phase 1 (0–3 months): data readiness, pilots on one line. Phase 2 (4–9): scale CV + predictive maintenance. Phase 3 (10–18): enterprise scheduling and mass customization. Quantitative benefits: defects ↓ 30–50%; downtime ↓ 20–40%; labor productivity ↑ 10–20%; inventory ↓ 10–15%. Qualitative: higher customer satisfaction, resilience, safer operations, knowledge retention.

Risks and Mitigations

1. Technical: data drift, integration → Mitigation: MLOps, staged rollouts, monitoring.

2. Organizational: resistance → Training, change champions, co-design.

3. Ethical: surveillance/bias → Governance, transparency, minimal data, human override.

Simulation (n8n / Make.com – Conceptual Workflow)

Trigger: Machine telemetry webhook → Validate → Predict model node → If risk>threshold → Create maintenance ticket → Notify supervisor → Update dashboard. Quality loop: Camera upload → Vision API → Defect classifier → Rework queue → Root-cause ticket. Planning loop: Orders → Optimizer → ERP update → Customer ETA.