**Section 2: Case Study Analysis**

*AI agent implementation strategy*

### *(i)* Quality control agent (Defect reduction)

- Uses computer vision and anomaly detection models to inspect precision components in real time.

- Flags defects immediately, reducing the 15% defect rate by enabling corrective action before faulty parts move downstream.

- Integrates with production dashboards to provide defect trend analytics.

### (ii) Predictive maintenance agent (Downtime mitigation)

- Monitors IoT sensor data from machines (temperature, vibration, energy usage).

- Applies predictive analytics to forecast failures and schedule proactive maintenance.

- Reduces unplanned downtime, improving throughput and stabilizing delivery schedules.

### (iii) Workforce optimization agent (Labor efficiency)

- Allocates tasks dynamically based on worker skill profiles and availability.

- Supports training recommendations by identifying skill gaps.

- Automates scheduling to reduce overtime costs and improve retention.

*Expected ROI and implementation timeline*

Quantitative benefits:

- Defect reduction: From 15% to ~5%, saving ~$2M annually in scrap and rework costs.
- Downtime reduction: 30–40% fewer delays, increasing production capacity by ~20%.
- Labor efficiency: 10–15% reduction in overtime costs, improved retention lowering recruitment expenses.
- Delivery speed: 20% faster fulfillment, boosting customer satisfaction and repeat orders.

Qualitative benefits:

- Enhanced reputation for quality and reliability.
- Improved employee morale through reduced stress and better training support.
- Stronger customer relationships due to customization responsiveness.

Implementation timeline:

- Phase 1 (0–3 months): Pilot quality control agent on one production line.
- Phase 2 (3–6 months): Deploy predictive maintenance agent across critical machines.
- Phase 3 (6–12 months): Roll out workforce optimization agent and integrate with HR systems.
- Phase 4 (12–18 months): Expand to customization agent and scale system-wide.

*Risks and mitigation strategies*

(i) Technical risks:

- Integration complexity: Legacy systems may resist agent deployment.

  Mitigation:

    - Use modular APIs and phased rollouts.
- Data quality issues: Poor sensor calibration or incomplete datasets.

  Mitigation:

    - Establish robust data governance and redundancy checks.

(ii) Organizational Risks:

- Resistance to change: Workers may fear job displacement.

  Mitigation:

    - Position agents as augmentation tools, provide retraining programs.
- Skill gaps: Staff may lack expertise in AI systems.

  Mitigation:

    - Continuous training and partnerships with AI vendors.

(iii) Ethical Risks:

- Bias in workforce allocation: Agents may inadvertently favor certain workers.

  Mitigation:

    - Regular fairness audits and transparent allocation rules.
- Privacy concerns: Worker performance data could be misused.

  Mitigation:

    - Implement strict access controls and anonymization policies.