

PROJECT MONITORING

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PMG333

Lecture 10

AI in PROJECT MONITORING

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- 1. Introduction to AI
- 2. AI in Time, Cost, and Scope Monitoring
- 3. AI in Quality Monitoring
- 4. AI in Risk Monitoring



Introduction to AI



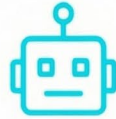
From Myth to Reality: The Journey of AI

An Exploration of Artificial Intelligence's Evolution

- Humans have long dreamed of creating thinking machines
- The idea began as myths and sci-fi in ancient times
- Today, AI is a tangible reality in our daily lives
- From smartphones to complex surgical rooms
- This presentation takes you on a journey through this incredible evolution

**1914**

First chess machine (El Ajedrecista) powered by electromagnets

**1921**

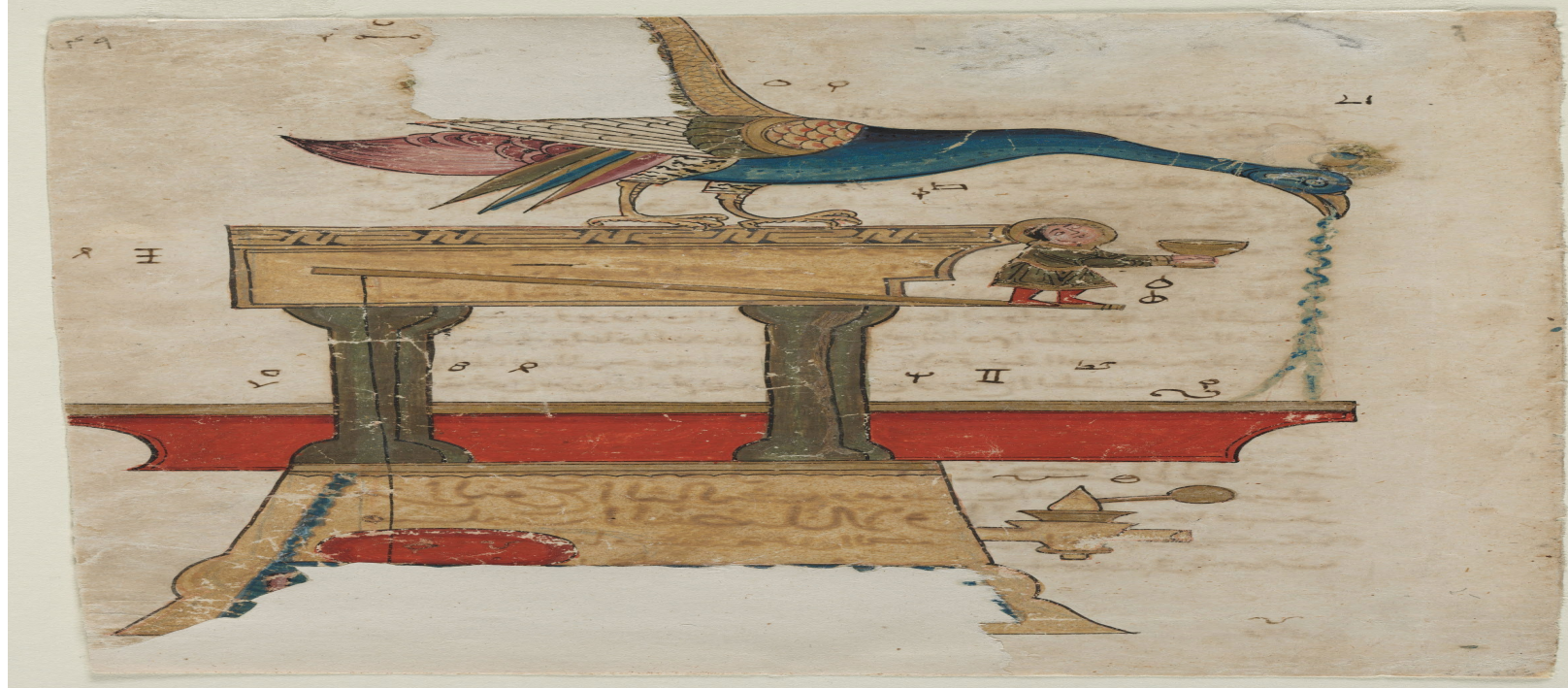
The term "robot" coined from a Czech play

**1943**

Discovery of artificial neural networks (McCulloch & Pitts)

**1950**

The famous Turing Test - "Can machines think?"



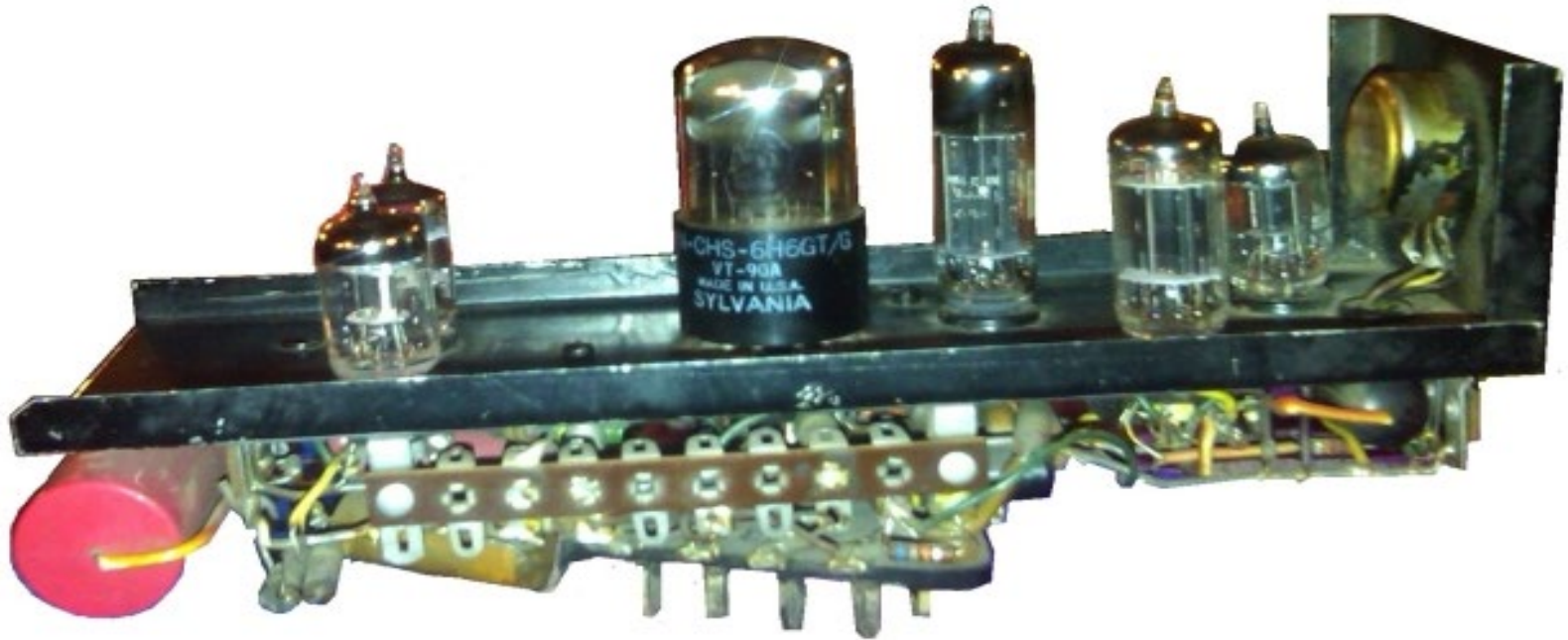
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El Ajedrecista

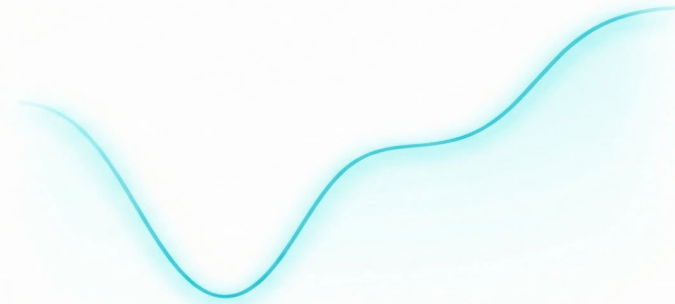


- **1956:** Dartmouth Conference - Official founding of AI as an academic discipline
- Gathered elite scientists who became leaders of the field
- **1951:** First actual neural network (SNARC) using 3,000 vacuum tubes
- Checkers and chess programs achieved high levels of performance
- An era filled with optimism and massive research investments



Ups and Downs: The AI Winter and the Comeback

- **1970s-1980s:** 'AI Winter' – decline in funding and interest
- **Cause:** Limited computing power and unmet high expectations
- **1980s:** Emergence of "Expert Systems" simulating human experts
- **1990s:** Early resurgence with improved computer technology
- **Lesson learned:** Technology requires time and gradual evolution



The Real Revolution: Data, Computing, and Deep Learning

- **2005-2017**: Availability of massive data and powerful computing
- **2012**: Deep Learning breakthrough in image recognition
- Deep Learning outperformed all other traditional methods
- **2017**: Introduction of the “Transformer” architecture - a paradigm shift in NLP
- This era saw successful practical applications in industry and academia



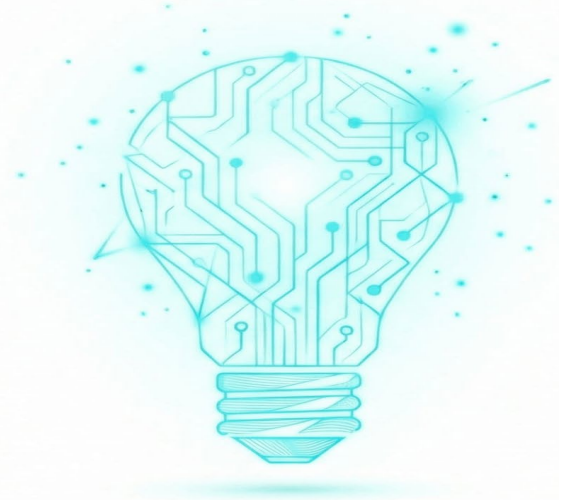
The Golden Age: Large Language Models and Broad Applications

- **2020:** Launch of GPT-3 with 175 billion parameters, a quantum leap in capabilities
- **2022:** Emergence of ChatGPT and unprecedented rapid mass adoption
- **90%** of notable AI models in 2024 originated from the industry sector
- Diverse applications: Copywriting, coding, artistic creation, and analysis
- We are currently living in the fastest period of AI growth in history

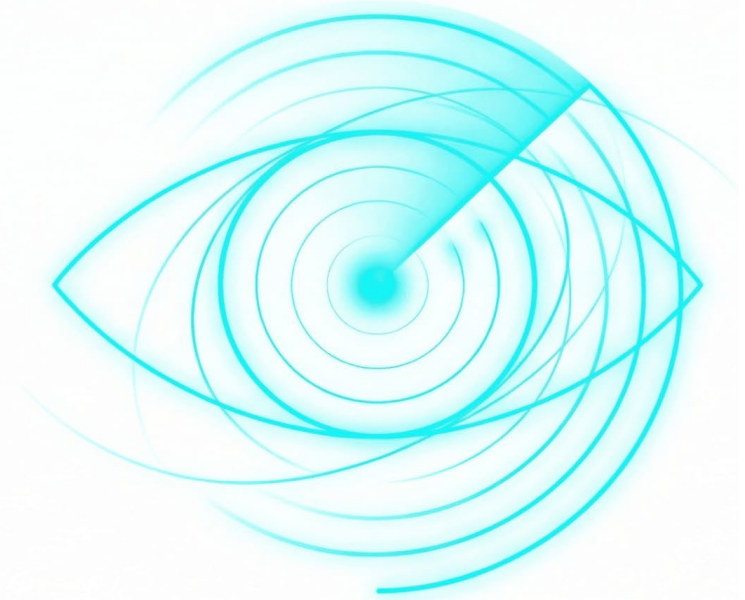


What You Don't Know About AI: Fascinating Facts

- Can "smell" molecules and predict scents accurately
- Decodes ancient languages and damaged manuscripts
- Economic impact: **\$15.7 trillion** expected by **2030**
- Job market shift: **97M** new jobs created vs. **85M** replaced
- Medical breakthroughs: Alzheimer's triggers and cancer treatments
- **77%** of devices currently in use feature some form of AI

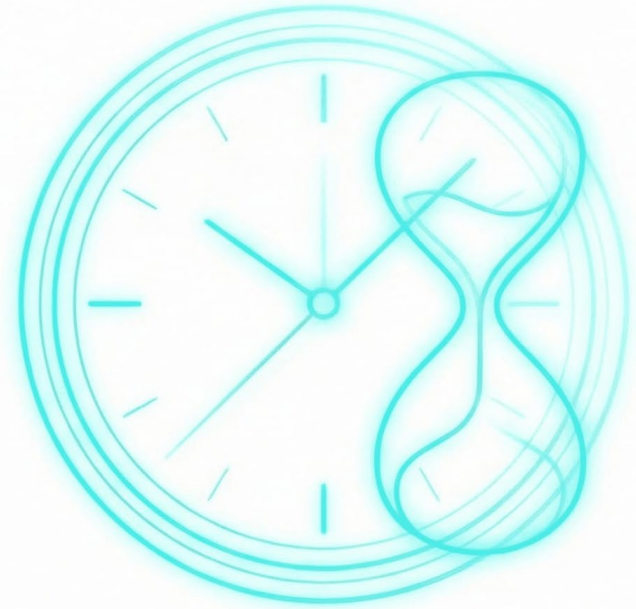


- Shifts project monitoring from reactive to proactive prediction.
- Acts as a strategic partner, not a replacement for managers.
- Analyzes endless data to detect risk patterns early.



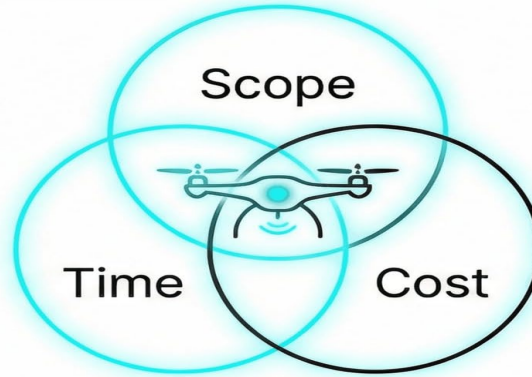
AI in Time, Cost and scope monitoring

- Predictive Scheduling: Anticipates real task durations instead of optimistic estimates.
- Example 1: ALICE Technologies simulates millions of scenarios for construction.
- Example 2: TimeCamp automates time tracking in Agile software development.



- Accurate Cost Forecasting:
Dynamic real-time budget tracking.
- Practical Example: STACK Assist automates takeoff, reducing manual errors.
- Resource Optimization:
Simulates staffing models for cost-efficiency.





- Balances scope, time, and cost simultaneously.
- AI scenario simulation reveals optimal trade-offs.
- Example: Firmatek drones analyze aerial images for proactive risk monitoring.

AI in Quality Monitoring

Traditional quality control methods suffer from significant limitations, relying primarily on manual human inspection and statistical sampling. Research indicates these approaches can miss up to 30% of defects due to fatigue and attention lapses.

In contrast, AI represents a fundamental shift through deep learning and computer vision, analyzing products with consistent precision and uninterrupted monitoring.

Criterion	Traditional Quality Control	AI-Powered Quality Control
Inspection Scope	Sampling (Statistical)	100% Complete Inspection
Accuracy	Variable (Subject to fatigue)	Consistent & Reliable (Algorithms)
Speed	Limited by Human Capacity	Extremely Fast (Thousands/hour)
Response Type	Reactive (After defects occur)	Predictive (Before defects occur)

1920s (Manual Inspection)

Oskar Keller manually stamping 'O.K.' on cars. Highly error-prone and severely limited by human fatigue.

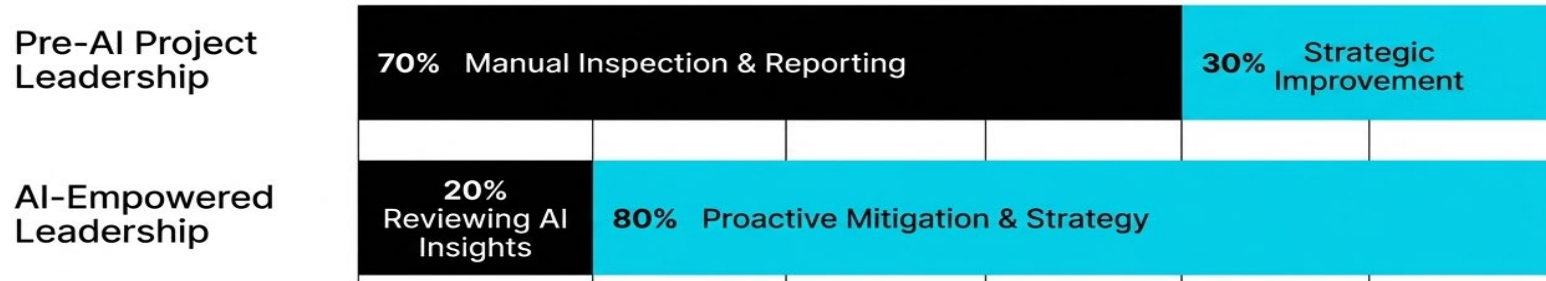
2000s (Basic Image Processing)

Rule-based cameras. Rigid, tailored to single variants, hard to adapt, and carrying massive implementation costs.

Today (Visual Inspection AI)

Deep Learning image processing. Adaptable, highly accurate, and easily deployed across multiple product lines and variants.

Elevating the Project Manager from Inspector to Strategist



The Game-Changer

The integration of AI into quality assurance is a fundamental shift for project execution and control.

Role Evolution

Equips PMs to step away from manual oversight and focus entirely on high-level optimization.

The Ultimate Outcome

Ensures deliverables consistently meet or exceed expectations while optimizing resource use and timelines.

The Project Manager's Essential AI Toolkit



Automate Inspection

Use AI to handle repetitive inspection tasks, freeing up critical time for strategic quality improvements.



Continuous Metrics

Utilize analytics to continuously monitor quality metrics and adjust project controls instantly.



Predictive Modeling

Employ AI-driven models to anticipate quality risks and implement mitigation plans early.



QMS Integration

Integrate AI directly into Quality Management Systems to streamline documentation, audits, and compliance tracking.

Forecasting Quality Failures to Prevent Costly Rework



The Mechanism

AI analyzes historical and current data trends to model the future trajectory of the project.

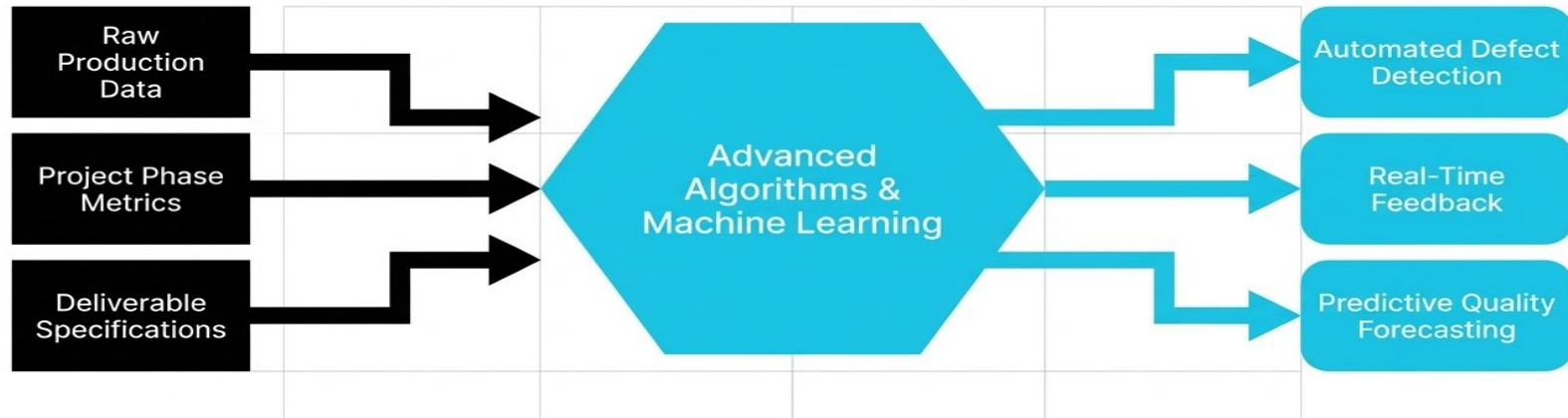
The Proactive Shift

Forecasts potential quality failures before they manifest in the physical deliverables.

The Impact

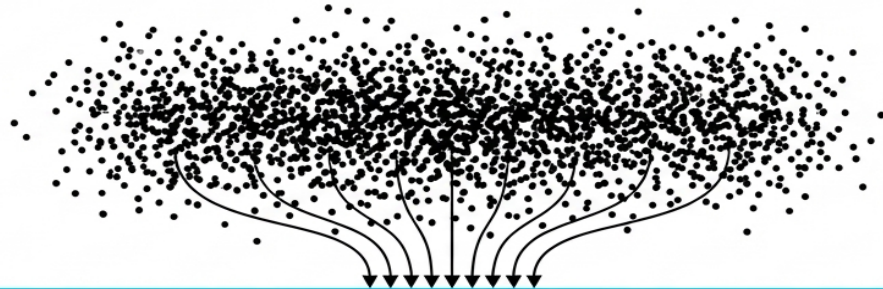
Enables targeted preventive actions, effectively minimizing expensive rework and preventing project delays.

The Engine Powering Continuous Quality Inspection



This continuous analysis boosts **efficiency, accuracy, and consistency** across all phases of project execution and control.

Processing massive volumes of complex, quality-related project data.



AI Data Processing Filter

Pattern Recognition

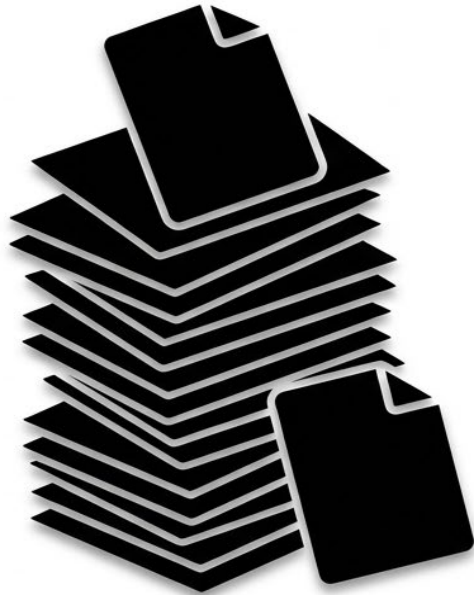
Identifying hidden trends across deliverables.

Root Cause Identification

Tracing surface-level defects back to systemic origins.

Resource Allocation

Optimizing team and material deployment based on data-backed risk management.



Administrative Burden



Automated AI Report

Automated Generation

Instantly creates comprehensive, highly accurate quality reports.

Regulatory Assurance

Maintains strict regulatory compliance by eliminating human data entry errors.

Team Impact

Radically reduces the administrative documentation burden, allowing project teams to focus on execution rather than paperwork.

AI in Quality Control: Global Success Stories

Real-world applications transforming
manufacturing across industries

Defect detection
accuracy: Up to
99.99%

Cost reduction:
30%+
improvement

24/7 consistent
monitoring

Leading
companies
worldwide



Automotive Sector: BMW's Leading Experience

Key Performance Indicators (KPIs)
after AI Implementation

Defect Rate:

↓ **30%**

Customer Satisfaction:

↑ **15%**

Inspection Speed:

Instant

Inspection Coverage:

100%

Explanatory Text

- BMW is a global model in applying computer vision systems, successfully reducing defect rates in production lines by **30%** within just one year of implementation.
- The company uses smart cameras distributed along the assembly line to ensure every part is installed correctly and to exact specifications, ensuring infinite assembly accuracy.
- This digital transformation led to a noticeable **15%** increase in customer satisfaction, as a result of tangible improvements in final vehicle quality and reduced post-sale issues.

Electronics Sector: Samsung & Semiconductors



Micro-Defect Challenge

Detecting defects at very early stages of manufacturing before they become costly or impossible to fix.



Multi-Data Analysis

Combining visual images with electrical test results to ensure processor and chip efficiency.



Yield Optimization

Identifying root causes of recurring problems and adjusting the manufacturing process to increase the yield of good products.

In the precision electronics industry, the power of AI shines in dealing with semiconductor defects that are smaller than the naked eye can see. Samsung implemented advanced machine learning systems that radically contributed to improving production quality.

31%

Reduction in customer return
rate within 18 months of smart
system application

Construction & Future: From Detection to Prevention

Construction Quality Control:

- ✈️ • AI-powered drones scan sites
 - Detects structural defects & thermal leaks
 - Real-time reporting

Key Benefits:

- ⌚ • Speed: Thousands of images/sec
 - Accuracy: Invisible defect detection
 - Cost Efficiency & Safety

Future Trends:

- 🏗️ • Edge AI & Robotic Integration
 - Federated Learning
 - Predictive Maintenance

Impact Summary:

- 🕒 • 24/7 consistent monitoring
 - Predictive quality & traceability

Food Safety & Textile Quality: Real-time Monitoring

Food Industry Applications

- AI detects adulteration in milk, oils, and honey
- Computer vision identifies spoilage and contamination
- Real-time quality monitoring throughout production

Textile Manufacturing

- Convolutional Neural Networks detect fabric defects
- Identifies broken threads, loose threads, and weaving errors
- Consistent accuracy surpassing human inspectors

Siemens Amberg Plant

- Smart factory model with human-in-the-loop AI
- 99.99885% defect-free production rate
- Machines learn from human workers and vice versa

Practical Deployment: Two Complex Cases



Case 1: The 'Cookie' Case

Challenge:

Inspecting high-speed lines to ensure correct cream filling inside a closed cookie.

Solution:

Deploying infrared cameras to see inside the product, paired with an AI model.

Result:

Reached 98% accuracy in POC, preventing brand-damaging defects.



Case 2: The Glass Bottle Case

Challenge:

Detecting 12+ defect types (scratches, dents) on hot, fast-moving glass immediately off the line.

Solution:

Complex, uniform illumination hardware paired with advanced AI defect classification.

Result:

A game-changer for production optimization, catching errors before the cooling phase.

HAZARD: Hallucinations
& Garbage In



MITIGATION: Expert Review

Limit AI use to expert users who can immediately spot falsehoods. Never use AI to manage risks you do not fundamentally understand.

HAZARD: Data Leakage



MITIGATION: Enterprise Security

Mandate closed, secure Enterprise IT instances of AI (compliant with ISO 27001). Ban personal account usage for company data.

HAZARD: Validation
Nightmares

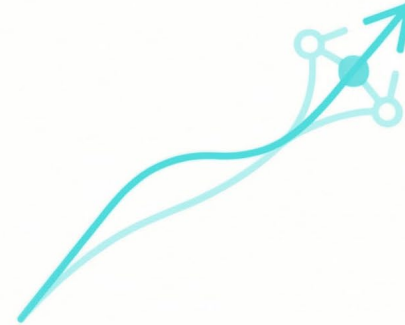


MITIGATION: Bound the Scope

Adhere to AI guidance frameworks (e.g., ISO TR 34971) and strictly exclude AI from automated final decision-making.

AI in Risk Monitoring

- Moving from reactive problem-solving to proactive prediction.
- AI analyzes millions of data points to uncover hidden patterns.
- Generative AI and NLP identify risks before they occur.
- Predictive analytics and Monte Carlo simulations quantify impact.



- **Identification:** Generative AI & NLP scan project data to uncover hidden risks (e.g., Auto-Risk Miner for scope creep).
- **Analysis:** Predictive Analytics & Machine Learning run complex simulations (like AI-enhanced Monte Carlo) for accurate quantitative assessment.
- **Practical Application:** Predicting cost and schedule overruns before they happen, and using Cognitive Analytics to understand unstructured data context.



- **Automation:** AI automates monitoring via Predictive Dashboards and Smart KPIs, issuing early warnings for risk triggers.
- **Mitigation Simulation:** AI simulates strategies (e.g., diversifying suppliers) to calculate expected costs and efforts.
- **Proactive Safety:** Computer Vision detects unsafe behaviors in real-time, while Drones scan for structural defects early to prevent costly rework.



Case Study 1: PwC - AI Agents for Compliance

- **Challenge:** Increasing regulatory complexity and fragmented risk data.
- **Solution:** Integrated custom AI agents into the existing risk management platform.
- **Results:** Reduced manual data processing work by **60%**.
- **Improved** compliance alignment by **25%**.
- **Lesson:** AI agents free teams to focus on high-value strategic decisions.



Case Study 2: Construction - Resource Optimization

- Challenge: Scheduling delays and budget overruns in a major construction firm.
- Solution: AI analyzed historical data to predict optimal resource allocation.
- Result 1: 20% reduction in project completion time.
- Result 2: 15% decrease in overall costs.



-20% Time

-15% Cost

1. BIAS & DISCRIMINATION

- Algorithms reflect human biases
- Unfair outcomes in hiring, lending, criminal justice

2. PRIVACY & DATA SECURITY

- Massive data collection and storage
- Risk of unauthorized access and misuse

3. LACK OF TRANSPARENCY

- "Black Box" problem
- decisions unexplainable
- Difficulty in auditing and accountability

4. ENVIRONMENTAL IMPACT

- Enormous energy and water consumption
- Carbon footprint of AI training

1. DATA QUALITY

- "Garbage In, Garbage Out" principle
- Poor data leads to unreliable predictions

2. TRUST & RELIABILITY

- Fear of depending on AI recommendations
- Lack of confidence in AI-driven decisions

3. SKILLS GAP & CULTURAL RESISTANCE

- Insufficient training for team members
- Fear of automation and job displacement

4. ETHICAL & ACCOUNTABILITY CHALLENGES

- Privacy concerns in project data
- Responsibility for AI-driven decisions

- AI is a strategic partner, not a replacement for human judgment.
- Transforms project monitoring from reactive to proactive.
- Enhances control over Time, Cost, Scope, Quality, and Risk.
- Empowers teams to make faster, data-driven decisions.





AI will be the best or worst thing ever for humanity, so let's get it right

Thank You