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Industrial Artificial Intelligence

Challenges, Opportunities and Use Cases in Industrial Services

Electro- and Digital Industry Association

Artificial Intelligence in Industrial Services

Artificial Intelligence (AI) is not the future; it is already reshaping industry at its core. Yet much of today's public discourse focuses narrowly on generative AI: tools that create text, images, or code. While these technologies are powerful, they represent only a fraction of what AI can achieve in industrial contexts.

Industrial AI goes far beyond generative capabilities. It is the application of AI within real-world, physical systems like machines, production lines, infrastructure, and industrial services where reliability, safety, real-time performance, and domain expertise are critical. Unlike generic AI, Industrial AI is deeply embedded in engineering processes and operational environments. It combines data-driven models with domain knowledge, physics-based understanding, and system integration.

In industrial services, this distinction is crucial. Industrial AI is not just about generating content but about enhancing how services are delivered, scaled, and continuously improved across the entire lifecycle of industrial products. It enables:

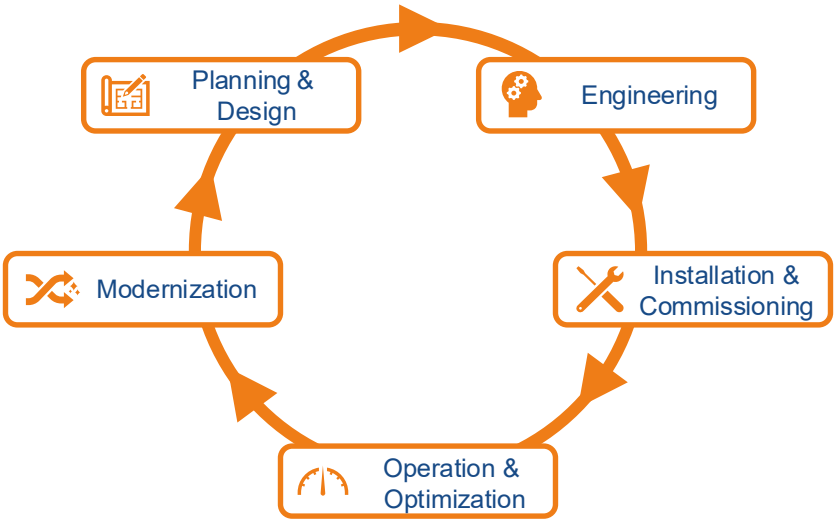
- **Service intelligence:** Transforming reactive support into proactive, predictive, and autonomous services.
- **Operational augmentation:** Supporting engineers, technicians, and operators with context-aware insights.
- **Lifecycle integration:** Connecting engineering, deployment, operation, and maintenance into continuous feedback loops.
- **New service models:** Enabling outcome-based offerings such as performance-as-a-service or predictive maintenance.

By harnessing data-driven algorithms and adaptive systems, Industrial AI enables automation, optimization, and intelligent decision-making across industrial processes and services. Its mission is not only efficiency but also resilience, scalability and continuous learning across complex systems. Therefore, enhancing quality and flexibility can be achieved through advanced analytics, pattern recognition, and predictive insights.

Today, AI is already redefining industrial services by disrupting business models, streamlining processes and elevating customer expectations. This impact will accelerate as Industrial AI matures and integrates further into core operations. Key focus areas include:

- **Technological potential**
- **Servitization**
- **Impact on work, skills, and organizational structures**

The *Working Group Services* within ZVEI's Section Automation has developed a five-phase lifecycle model for products, classifying and structuring both traditional and digital industrial services[1]. Within this framework, AI use cases can be assigned to lifecycle phases, illustrating where AI creates measurable value for companies and customers in industrial services.



[1] ZVEI (2015): https://www.zvei.org/presse-medien/publikationen/zvei-leitfaden-industrie-services

For factory and process automation, Industrial AI unlocks enormous potential: optimizing complex value chains, expanding business opportunities, and strengthening competitiveness. However, realizing this potential requires addressing challenges such as data protection and governance, cybersecurity, workforce transformation, and technological dependencies. Managing these factors will be critical for sustainable success.

From Vision to Practice: AI Use Cases in Industrial Services

The transformative potential of Industrial AI becomes most tangible when applied to real-world industrial services use cases. The following use cases illustrate how AI is not an abstract concept, but a practical enabler of smarter, faster, and more scalable industrial services. What unites these examples is not a single technology, but a shared paradigm shift:

- From manual to **augmented service delivery**
- From reactive to **predictive and autonomous operations**
- From isolated tools to **integrated service ecosystems**

Each use case from early adopters of AI in industrial services represents a specific entry point into Industrial AI, yet together they demonstrate how AI capabilities can systematically enhance service performance across the entire lifecycle.

Use case: Talk to your data AI agent

Bosch Connected Industry, Robert Bosch GmbH

Situation:
A high threshold for retrieving complex data exists due to technical query language barriers and the difficulty of intuitively interacting with complex digital twins and aspect models, which limits the effective utilization of valuable data.

Task:
Provide an AI capability to enable employees to query complex, cross-domain datasets using natural language.

Solution:
An AI agent, based on natural language processing and the Bosch Semantic Stack, understands intent, delivers immediate, precise insights, and learns from interactions to optimize response quality over time.

Impact:
Instant, intuitive access to industrial data for all employees allows for faster, data-driven decision-making across the organization and reduces reliance on specialized data experts.

Use case: AI-based technical support service across the entire lifecycle

Weidmüller Interface GmbH & Co. KG

Situation:
Planners, engineers, installers, and service technicians struggle to quickly find accurate information needed for product selection, installation, and updates.

Task:
Create an AI-assisted conversational interface that can instantly deliver the right technical data, instructions, and troubleshooting guidance.

Solution:
An AI-powered support service integrates domain data into a compliant conversational platform that interprets user needs and provides targeted, context-aware answers.

Impact:
Users resolve issues significantly faster and experience higher engagement through intelligent, guided conversation flows.

Use case: AI-based Industrial Copilot service for automation engineering
Siemens AG

Situation:
Engineers must handle growing system complexity, tight timelines, and scattered information when developing automation solutions.

Task:
Provide an AI-powered engineering assistant that can generate, validate, and refine engineering content such as code, documentation, and system configurations.

Solution:
The Industrial Copilot delivers context-aware suggestions, automation, and insights directly within existing tools and workflows to address these challenges.

Impact:
Engineering cycles accelerate, output quality improves, and teams achieve substantial productivity gains across automation projects.

Use case: AI-based pressure sensor calibration service
Endress+Hauser SE+Co. KG

Situation:
Sensor calibration is slow and costly because long heating and cooling cycles require many individual measurement points.

Task:
Develop an AI capability that can reliably reconstruct calibration curves from historical data using significantly fewer reference measurements.

Solution:
An AI-driven calibration service uses a purpose-built artificial neural network to predict sensor behaviour and generate automated calibration recommendations or correction values, reducing the need for extensive physical measurements.

Impact:
Calibration time can be reduced by up to two-thirds because far fewer measurement points must be collected.

Use case: Shopfloor AI agent
Bosch Connected Industry, Robert Bosch GmbH

Situation:
Unexpected equipment failures lead to production downtime and unclear prioritization of multiple urgent maintenance tasks.

Task:
Provide an AI capability to create high-quality, user-friendly tickets without language barriers and provide clear, actionable solutions.

Solution:
Employees report equipment issues, e.g. via voice. A shopfloor AI agent, based on a cross-plant knowledge base, provides immediate, actionable solutions and continuously learns.

Impact:
High-quality tickets and extended knowledge sharing across locations enable faster problem solving due to direct, expert-level solution proposals. This significantly reduces machine downtime due to improved resolution time and assistance at the machine operator level.

Use case: Smart maintenance AI agent
Bosch Connected Industry, Robert Bosch GmbH

Situation:
Inefficient maintenance schedules that are not aligned with the actual needs of the equipment, the capacities of the technicians, and the availability of spare parts.

Task:
Provide an AI capability to minimize downtime and maximize asset longevity by autonomously optimizing maintenance schedules.

Solution:
An AI agent analyzes sensor data, historical performance, available resources, and production forecasts to predict failures dynamically, prioritize tasks, allocate resources, and initiate actionable work orders.

Impact:
Proactive failure prediction and optimized maintenance planning lead to better uptime, reduced maintenance costs and optimized workforce efficiency.

Use case: AI-based welding edge detection service
Endress+Hauser SE+Co. KG

Situation:
Manual identification of welding edges is slow, repetitive, and prone to human error.

Task:
Provide an AI capability that can automatically detect the optimal welding edge from images of joined parts.

Solution:
An AI-powered welding-edge detection service uses a specialized model (e.g. a customized U-Net) trained on proprietary data to deliver precise, automated edge predictions within existing workflows.

Impact:
Manual effort and processing time are significantly reduced while welding accuracy and quality improve.

Use case: AI-based predictive maintenance service
Siemens AG

Situation:
Industrial operators face unexpected machine failures and lack transparency regarding real-time equipment health.

Task:
Provide an AI capability that detects anomalies, predicts failures, and prioritizes maintenance actions based on machine data.

Solution:
An AI-driven condition-monitoring service continuously analyses equipment condition using advanced machine-learning models to deliver actionable maintenance recommendations.

Impact:
Downtime and maintenance costs decrease while overall asset reliability and operational stability improve.

Use case: AI-based flood prediction service
Endress+Hauser SE+Co. KG

Situation:
Existing systems for monitoring and predicting flooding events rely heavily on manual processes and often produce inaccurate assessments.

Task:
Provide an AI capability that uses real-time sensor data from wide geographic areas to reliably predict potential flooding events.

Solution:
An AI-enabled flood-prediction service aggregates diverse sensor streams via a cloud platform and applies deep-learning models to deliver timely, accurate risk forecasts.

Impact:
Communities and authorities can prevent disasters more effectively, reducing risks to lives, infrastructure, and economic assets.

Shaping the Future Together

Industrial AI marks a fundamental shift in how industrial services are designed, delivered and evolved. It transforms services from static, predefined offerings into dynamic, learning systems that continuously improve through data, feedback, and real-world interaction. Looking ahead, five strategic directions will define how successfully organizations shape this future:

1. **From isolated use cases to scalable ecosystems**

   The true value of Industrial AI lies not in individual applications, but in scaling them across systems, sites, and value chains. This requires interoperable data infrastructures, standardized interfaces, and integration into existing automation and IT architectures.

2. **From tools to intelligent service architectures**

   AI should not be treated as an add-on, but as a core design principle of industrial services. Future services will be inherently AI-enabled combining sensing, analytics, and decision-making into seamless, end-to-end solutions.

3. **From human vs. machine to human-AI collaboration**

   Industrial AI does not replace human expertise; it amplifies it. The future of industrial services lies in collaborative intelligence, where engineers and service professionals are supported by AI systems that provide insights, recommendations, and automation.

4. **From data usage to data value creation**

   Data becomes a strategic asset only when it is translated into actionable intelligence. Organizations must move from collecting data to systematically leveraging it for new services, business models, and customer value.

5. **From experimentation to industrialization**

   Many AI initiatives remain in pilot phases. The next step is industrialization: making AI robust, secure, compliant, and scalable in real-world environments with high reliability requirements.

Industrial AI is not just a technological evolution but a strategic capability that will define competitiveness in industrial services. Companies that succeed will be those that:

- **integrate AI deeply into their service offerings,**
- **build the necessary data and system foundations,**
- **invest in skills and organizational transformation, and**
- **actively shape ecosystems and standards.**

By embracing Industrial AI holistically, industrial service providers can move beyond incremental improvements toward fundamentally new ways of creating value for customers, industries, and society.

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