

# The rise of industrial AI

AI is reshaping the core of how industrial systems operate, from reactive operations to **intelligent, data-driven decision-making**

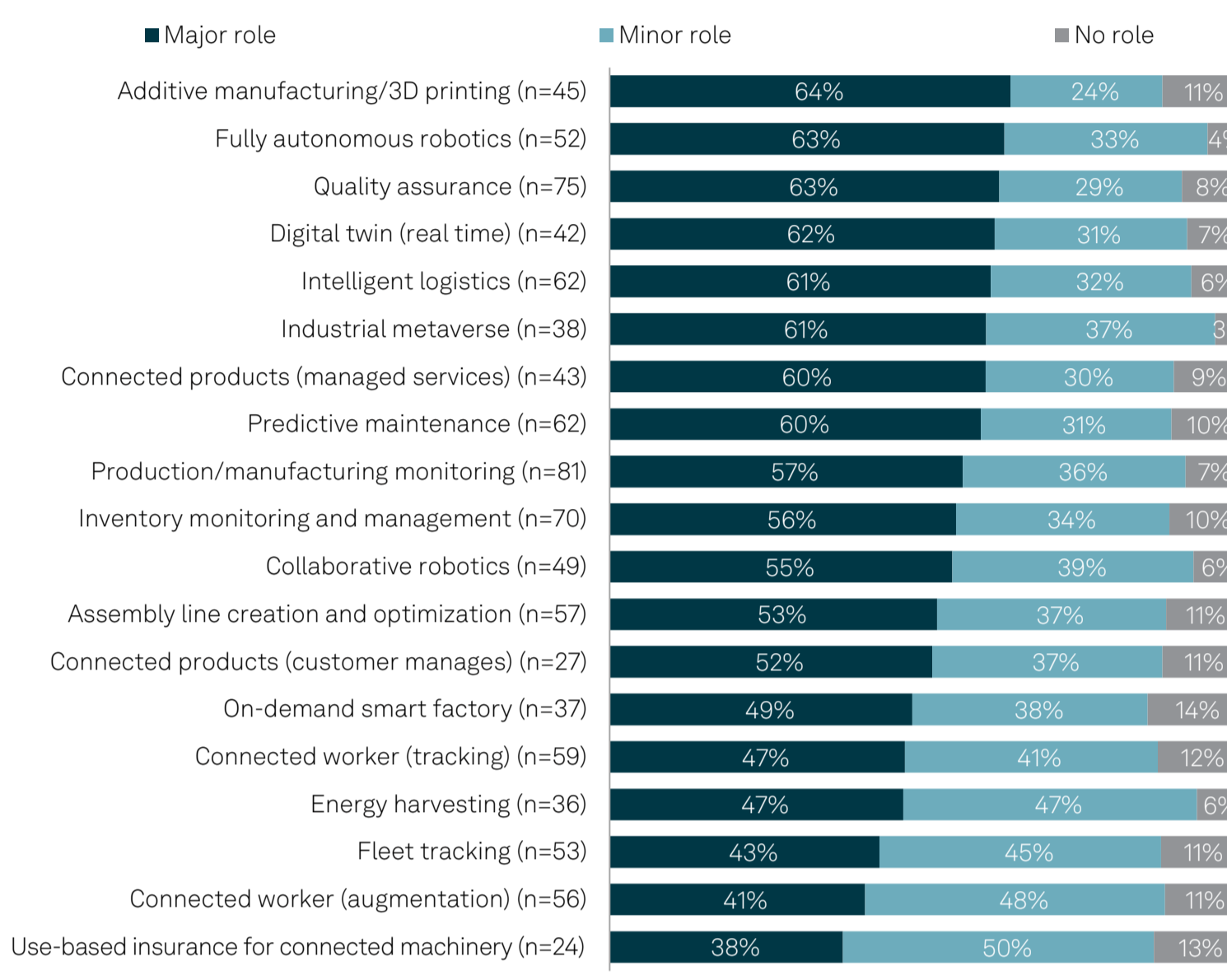
## The need for industrial AI

Challenge	Need
High cost of errors	Ultra-accurate, validated models
Hallucinations	Grounded, explainable AI with domain data
Machine-human language mismatch	AI trained on sensor tags, control logs, OT/IT semantics
Complex industrial acronyms	Industry-specific fine-tuning of AI
Multimodal input (text, diagrams, sensors)	AI that fuses visual, numeric and textual modalities
Edge deployment constraints	Small, efficient, domain-specialized models

Industrial environments typically require **lightweight, domain-specialized foundation models that can operate locally**, offering rapid, context-aware insights while respecting constraints on latency, data privacy and systems integration.

**Demand for AI in manufacturing is driven by a convergence of operational challenges and rising performance expectations**

## Expected role of AI in manufacturing



Q. For the same use cases, what role do you expect artificial intelligence (AI) technologies to play in their deployment?  
 Base: Organizations that deploy or plan to deploy a use case.  
 Source: 451 Research's Voice of the Enterprise: Internet of Things, OT Perspective, Use Cases and Outcomes 2025.

## Predictive maintenance and quality control are among the most impactful applications of industrial AI

**Predictive maintenance** can forecast equipment failures before they occur, reducing unplanned downtime, extending machinery lifespan and minimizing repair costs — critical benefits in capital-intensive sectors.

**Quality control** using computer vision and machine learning to detect defects or anomalies is far more accurate and consistent than human inspectors. Only high-quality products reach customers, reducing waste and rework.

## The key stakeholders shaping AI strategy

### The AI manufacturing landscape

**Predictive maintenance**  
Uses machine learning on sensor data to predict equipment failure

**Robotics & autonomous systems**  
AI for autonomous decision-making in industrial robots and automated guided vehicles

**Quality inspection (vision AI)**  
AI-based image/video analysis to detect defects in real time

**Industrial natural language processing**  
Extracts insights from manuals, logs and reports using natural language

**Digital twins**  
Real-time digital models of physical assets or systems, powered by AI

**Supply chain & logistics AI**  
Forecasting, routing and warehouse optimization using AI/ML

**Process optimization**  
AI analyzes operational data to optimize production variables and efficiency

**Edge AI & industrial IoT**  
AI deployed on edge devices for real-time processing close to machines

**Energy optimization**  
AI manages and forecasts energy usage, demand response and load balancing

**Safety & compliance monitoring**  
Real-time monitoring for safety, personal protective equipment compliance and risk detection

As the industrial AI vendor landscape is evolving rapidly, vendors are specializing across a range of use cases that reflect the diverse needs of modern industrial environments.

Rather than offering one-size-fits-all solutions, vendors increasingly focus on **targeted applications** where AI can deliver measurable outcomes.

## Challenges remain...

- ▶ **Scarcity and fragmentation of high-quality industrial data**  
Siloed, proprietary and tightly controlled
- ▶ **Sensitivity of industrial data**  
Operational data often linked to intellectual property
- ▶ **Lack of shared datasets**  
Limits the ability to train generalized and reliable industrial foundation models
- ▶ **Interpretability and explainability of AI models**  
Black-box models cannot provide the clear, traceable logic required for safety-critical applications
- ▶ **Scalability and adaptability**  
AI must function on edge devices with limited resources. Models must be efficient, adaptable and usable in harsh, real-time environments

