

Artificial intelligence in operational technology

Sector focus: Semiconductors and electronics



At the heart of the tech revolution, the semiconductor and electronics industry is adopting AI in its manufacturing operations to manage dynamic supply chains, deal with skills shortages and oversee increased manufacturing complexity.

The semiconductor and electronics industry plays a crucial role in the development of new technologies, including artificial intelligence. Ever more high-technology facilities are needed to produce modern semiconductors and electronics equipment that power this revolution. But the industry is also struggling with a skills shortage in semiconductor design, fabrication, and testing, while needing to reduce its environmental footprint of energy and water use.

Meeting challenges with AI in OT

Technology can help meet these challenges, and AI promises to help solve multiple manufacturing and environmental issues. Increasing the resilience of production is vital in all industries, and AI can help reduce unplanned downtime and mitigate the impact of any supply chain disruption. AI can also play a key role in checking the quality of products produced – down to the microscopic level – and machine learning can help improve the manufacturing process.

The first step in bringing AI into the OT environment is to integrate IT and OT systems. This is already happening widely. In our manufacturing survey carried out by GlobalData, semiconductor and electronics manufacturers reported some of the highest levels of IT/OT integration, with 88% of respondents having made significant progress with full or partial integration.

Rapid progress in AI/GenAI

Our survey also found that AI/ML is already deployed in electronics manufacturing OT environments by 34% of our respondents, with a further 46% reporting pilot projects or plans to deploy the technology within the next 12 months. In addition, around 48% of electronics manufacturers have deployed or are piloting GenAI, with just 14% of respondents having no GenAI plans.

This push towards AI in OT is partially backed by the electronics C-suite, with 50% of executives saying it is either “essential” or “very important”. Like most other sectors, this initiative is being led by the IT department as part of an IT/OT convergence strategy.

AI in OT benefits

In terms of identified AI benefits, the top three chosen by electronics executives in our survey are improved productivity, improved product quality and reduced equipment downtime. With manufacturing becoming ever more complex, improving processes and productivity are critical, along with ensuring the quality of products produced.

AI in OT use cases

The electronics industry is deploying various AI and GenAI use cases. The top three identified in our survey were predictive maintenance, supply chain management and automated inventory. Examples of their use are described below.

Predictive maintenance

AI-powered predictive maintenance is transforming semiconductor manufacturing by minimizing unscheduled downtime and enhancing equipment efficiency. Through smart sensors, in-situ metrology, and digital twins, electronics manufacturers can anticipate failures and schedule timely interventions. Data can be drawn from multiple sources, such as sensor data and production logs to provide early warning signals of equipment failures. Predictive maintenance enables self-monitoring, self-correcting, and even self-healing, thereby reducing reliance on manual diagnostics and scheduled maintenance. The benefits are significant: one study found that a major semiconductor fab achieved annual savings exceeding \$50 million through AI-based predictive maintenance.¹

Supply chain management

The semiconductor and electronics industry faces various supply chain issues, both for components and raw materials, such as gallium, germanium and graphite. AI can monitor supply chain data to identify potential disruptions caused by export bans, port congestion, worker shortages, or natural disasters and recommend actions to take. AI can also simulate different scenarios and evaluate strategies to mitigate supply chain disruptions, helping design optimal solutions. For example, Samsung uses AI in its supply chain management to extract logistics risk data from more than 60,000 global news articles daily. It uses this to predict supply chain disruptions and take steps to mitigate it, such as using different ports.²

Automated inventory

The electronics industry has suffered from a range of semiconductor shortages for several years, with the supply of key components such as analog integrated circuits being limited. This makes inventory management key to electronics companies looking to meet market demand. AI can help manufacturers manage their inventory much more effectively. For example, AI can use historical sales data, customer behavior, and market trends to produce accurate sales forecasts that allow manufacturers to plan their inventory levels properly to meet demand. With machine learning, manufacturers can also optimize their inventories by calculating optimum reorder points and replenishment levels to prevent overstocking and running out of key components. Combining this approach with a digital control tower that integrates information from across the supply chain, manufacturers can reduce excess inventory by more than 30%.³



Overcoming AI challenges

Electronics executives have identified several challenges holding back the broader adoption of AI within the OT environment. The top three were a lack of AI skills, concern over cybersecurity, and the ability to monitor real-time data.

The general lack of AI skills affects all industries, and many companies are turning to third-party assistance. Improving data management was identified by 50% of electronics industry respondents as the main area they were seeking external help when scaling their AI projects, followed by deploying AI at the edge (38%) and responsible AI practices (36%).

Cybersecurity is a particular concern in the semiconductor industry given the importance of the intellectual property of the chip design, which is a prime target for cybercriminals.

Focus on digital infrastructure

Digital infrastructure plays a key role in enabling AI in OT projects, with foundational technologies such as networks, cloud and security helping drive the convergence of IT and OT. Our survey found that 86% of electronics respondents said they had the requisite IT infrastructure fully or partially in place for deploying AI in OT. Concerns over security dominated among those who didn't.

These worries are shared with many other industries. Manufacturers are increasingly the target of cyberattacks, which can shut down operations or steal business-critical information. Downtime is so damaging to business that ensuring resilience is essential. As such, OT security is an investment priority for 70% of our electronics respondents.

Connectivity is vital for the success of AI in OT because the processing of data is largely carried out in the cloud. However, the electronics industry is increasingly looking to edge computing to bring processing closer to the factory, with 68% of respondents either using it or planning to use it within 12 months as part of the IT/OT strategy – and many are looking for external help to achieve this, as mentioned earlier.

Why Orange Business

Orange Business can help you take advantage of these AI opportunities and support you in your data quality, integration, and infrastructure requirements.

We have a unique skill set as a global integrator, communications operator, and service provider and genuine industrial experience. Our individual approach is designed to make your business outcomes a reality. Our consultants have extensive electronics and semiconductor industry experience and are supported by best-in-class partner ecosystems.

We can answer your transformation challenges at every stage of the data journey using a secure, scalable, flexible approach. With our business approach, methodology, and skills, we will work closely with you to outline business goals, organize efficient and secure data sharing, and accelerate innovation.

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1. <https://www.electronicshive.com/insights/expert-talk/how-ai-is-revolutionizing-the-semiconductor-industry-in-2025/>
2. <https://www.samsungds.com/en/news/cellosquare-mediaday-20240520.html>
3. <https://www.mckinsey.com/industries/retail/our-insights/ten-steps-retailers-can-take-to-shock-proof-their-supply-chains>



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