Artificial intelligence in operational technology

Sector focus: Heavy process industry

The oil & gas, mining and chemicals industries produce products central to modern life, but they face challenges from geopolitical uncertainties, decarbonization and regulatory complexity. AI in operational technology promises to help mitigate these risks.

Geopolitical disruption and increasing resource nationalization are significant challenges to the heavy process industries as they look to comply with complex global sustainability regulations. For example, the move towards electric vehicles and renewable energy is dependent on rare materials, such as lithium, cobalt, and rare earths. While the oil, gas and chemicals industries are trying to decarbonize their production and supply chain with carbon capture and oil alternatives.

Meeting challenges with AI in OT

To meet these challenges, the heavy process industries are looking for optimization opportunities and technology innovation across the entire organization. Increasing the resilience of production is vital in all industries, and AI can reduce unplanned downtime and mitigate the impact of any supply chain disruption. AI also plays a key role in helping optimize energy use in plants and simplify complex regulatory reporting.

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, heavy process industries reported high levels of IT/OT integration, with 90% of respondents having made significant progress with full or partial integration.

The chemical industries had the highest levels of IT/OT integration of the heavy process industries with half reporting full integration, which was one of the highest in our survey.

Rapid progress in AI/GenAI

Our survey also found that AI/ML is already deployed in heavy process industry OT environments by 34% of our respondents, with a further 48% reporting pilot projects or plans to deploy the technology within the next 12 months. In addition, around 55% of heavy process industries have deployed or are piloting GenAI in OT, with 14% of respondents having no GenAI plans.

This push towards AI in OT is generally backed by the C-suite, with 58% 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 heavy process industry executives in our survey are improved productivity, improved product quality and reduced equipment downtime.

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AI in OT use cases

The heavy process industries are deploying a wide range of AI and GenAI use cases across the board in OT. We look at three of the most popular: predictive maintenance, supply chain monitoring and condition-based monitoring.

Predictive maintenance

The age of infrastructure is a major challenge for the oil and gas industry, with many pipelines being over 50 years old. This increases the risks of corrosion, leakage and ruptures, which have both financial and environmental consequences. To mitigate this risk, one major oil and gas company deployed an AI-powered pipeline monitoring solution to predict failures based on a wide range of real-time and historical data, including sensor data, weather conditions and pressure trends.[1] This data informed a predictive model to identify potential pipeline failures: it was over 90% accurate in predicting corrosion failures and over 80% for equipment failures. By undertaking proactive maintenance, the company reduced downtime by 25% and maintenance costs by 30%, while also extending the lifetime of equipment.

Supply chain management

Chemicals company Dow used GenAI to optimize its complex freight invoicing and supply chain operations. It processes over 4,000 shipping invoices daily in multiple formats, including mailed PDFs, EDI transactions and paper. This complex, high-volume data made it challenging to identify billing errors. By integrating GenAI with human agents, Dow could automate invoice analysis to detect discrepancies in real time and streamline global logistics[2]. It hopes to unlock millions of dollars in cost savings by enhancing accuracy, reducing manual workload, and optimizing decision-making.

Condition-based monitoring

Drilling is a critical process in heavy process industries, such as oil and mining. A leading supplier of drilling equipment for the petroleum industry developed an AI-driven condition-based monitoring system for drill bit wear analysis and timely defect detection[3]. The system uses 3D cameras, image recognition software and machine learning to detect drill bit defects and provide recommendations on required drill bit replacement and maintenance. It can recognize blades and individual cutters while detecting blade surface and cutter wear. The solution displays the result as a wear percentage and provides an optimal date for drill bit replacement.

Overcoming AI challenges

Heavy industry executives have identified several challenges holding back the broader adoption of AI within the OT environment. The top three were lack of AI skills, budget constraints, and concerns over accuracy of findings.

To help them overcome issues around skills, many executives are turning to third-party assistance. The survey found that help was sought across the board, with the three most popular requests for assistance being improving data management, understanding the regulatory environment and developing an AI roadmap.

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 84% of heavy process industry respondents said they had the requisite IT infrastructure fully or partially in place for deploying AI in OT. Concerns over cybersecurity and cloud connectivity 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 and production safety is essential. In addition, oil & gas companies are already targets for both rogue nation states and environmental activists. As such, upgrading OT security is an investment priority for 77% of our heavy process industry respondents as part of the push to AI on OT.

Connectivity is vital for the success of AI in OT because the processing of data is largely carried out in the cloud. However, heavy process industries are 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 their IT/OT strategy.

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 heavy process 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.

Connect with Orange Business sales teams: Contact us

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1. https://superagi.com/optimizing-oil-and-gas-pipelines-with-ai-and-predictive maintenance-case-studies-and-best-practices/

2. https://www.microsoft.com/en-us/worklab/ai-impact-at-dow-copilot identifies-millions-in-cost-savings

3. https://www.scnsoft.com/artificial-intelligence/case-studies/development-of-defect-recognition-software-for-an-oil-drilling-equipment-manufacturer

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