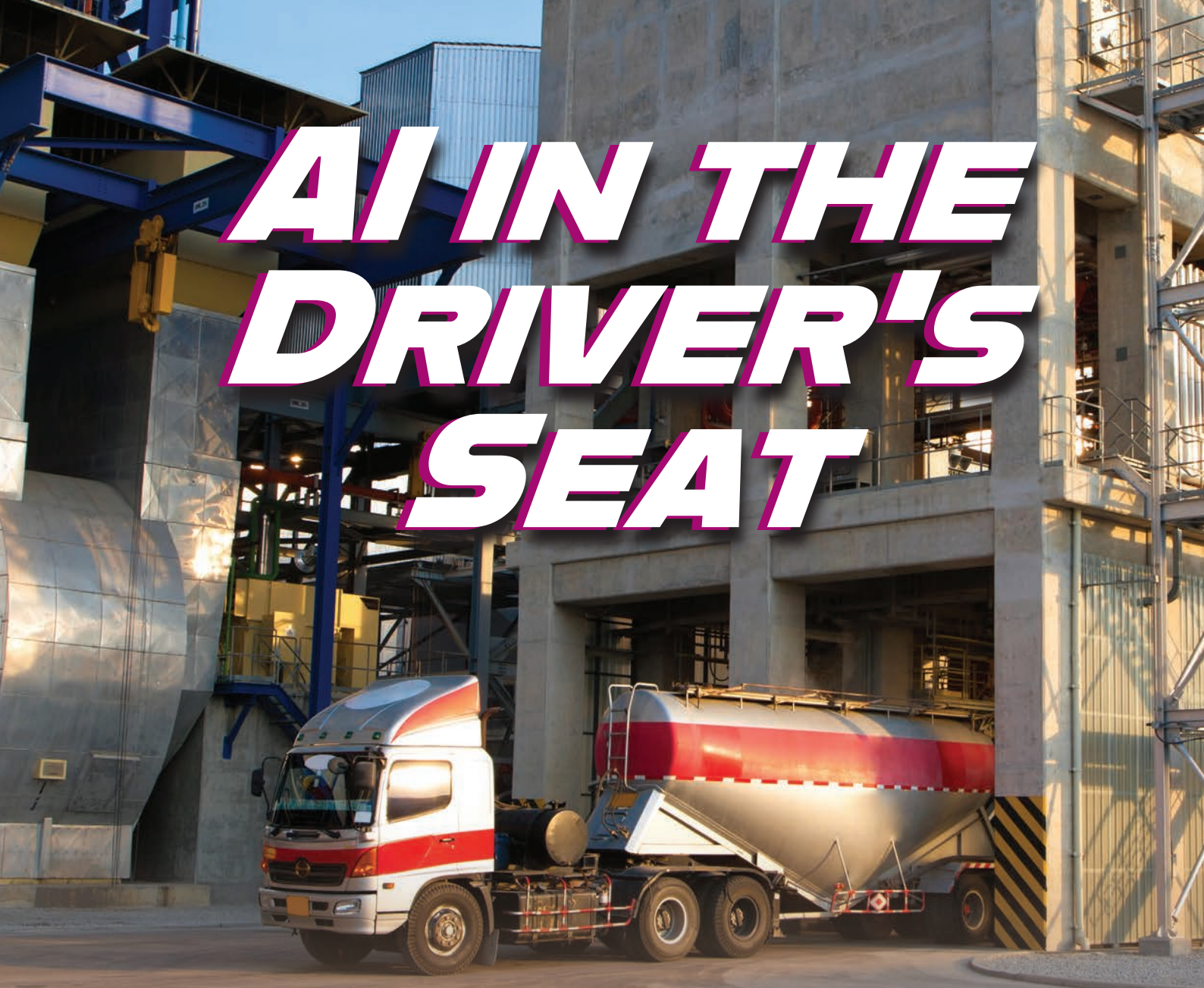




AI IN THE DRIVER'S SEAT

Reiner Bachthaler, Axians, unpacks how AI can transform logistical challenges into opportunities for innovation and competitive advantage in the cement industry.

Artificial intelligence (AI) has become a key topic across industries, with new advancements and applications appearing almost daily. While AI is commonly associated with text generation, research, and image recognition, its potential in industrial environments is just as significant. In particular, AI-driven digitalisation offers vast opportunities for logistics in the cement industry, where there is a growing need for automation, process reliability, and addressing the shortage of skilled workers.

AI can significantly improve logistics processes in cement plants by enabling smarter delivery planning, optimising loading and unloading processes, creating paperless workflows, and forecasting material needs. This article explores how AI is transforming logistics in cement plants, from intelligent slot management to

predictive maintenance. By implementing AI-based automation, cement manufacturers can improve supply chain reliability, maximise productivity, and adapt to the increasing digitalisation of industrial logistics.

AI uses in cement plant logistics

Automatic image recognition and interpretation with webcams and cameras

One of the most straightforward applications of AI in cement logistics is automatic vehicle identification. By using automatic number plate recognition at the plant entrance, cement plants can significantly speed up the check-in process for vehicles, such as silo trucks. When deliveries are pre-planned using yard management systems (e.g., Axians VAS), the check-in

process can be fully automated, and thus massively accelerated. This integration into a plant logistics solution, alongside the selection of a suitable camera system that offers the highest AI-based recognition rates, is the guarantee of success for this use case.

Beyond vehicle identification, webcams and cameras provide other valuable applications in bulk goods logistics. AI can monitor loading areas for cleanliness (e.g. detecting dirt at trucks and refusing to load), or assess the condition of rail wagons during loading. For bagged goods, AI can confirm whether proper load-securing measures have been followed and automatically document this through image analysis.

AI based camera and image processing solutions can also be used in plants with bulk storage (e.g., sand, gravel, or calcium carbonate) to measure and monitor material volume in storage areas. Professional setups with permanently installed cameras are the high-end solution, but even material volume measuring with smartphone cameras works quite well. The results can then be provided in real-time to connected yard management systems, ensuring accurate material scheduling.

AI-assisted transport optimisation

Transport optimisation is another key area where AI can improve logistics in cement plants. AI algorithms analyse historical data, planned deliveries from multiple sites, real-time traffic conditions, and truck



Optimised loading processes with AI.



Intelligent control for logistics in landfill and recycling.

locations to plan deliveries more efficiently. In a dynamic environment, these systems continuously optimise routes, ensuring the most efficient transport with minimal delays.

AI solutions, such as INFORM Syncrotess, use simulations to compare different optimisation parameters like delivery punctuality, fleet size, or distance travelled. These systems can also calculate delivery times and optimise routes in real time, ensuring more reliable and cost-effective transport.

For this to work effectively, a reliable and precise data foundation is needed. Centralised, cloud-based solutions like Axians VAS Cloud Logistics integrate order entry, pre-planning, material flow definition, and delivery feedback. This seamless integration allows the AI system to make real-time adjustments and optimise transport, reducing costs by up to 30% while improving customer satisfaction.

Reducing loading and unloading times

Truck throughput times, specifically the time it takes for loading and unloading, can also be optimised with the help of AI algorithms. AI-based solutions access various data sources, such as historical arrival times, real-time traffic information, and loading station utilisation. Based on this data, AI can predict the arrival time of trucks and allocate specific loading and unloading times, enabling improved resource utilisation. It dynamically adjusts resources based on current plant conditions, allowing faster and more efficient handling of trucks. This reduces delays and improves overall throughput.

At Axians, tools like the VAS Yard Management System already provide key performance indicators (KPIs) to identify bottlenecks. This includes material flow analyses, evaluations of the material status, the traffic situation at the plant, and the technical condition of systems. As an outcome, the best triggers to optimise truck loading and delivery processes can be identified. With such KPI driven adjustments, customers already achieved a reduction of door-to-door delivery times by up to 20%, improving overall efficiency.

Optimised slot management with waiting lists and call systems

Building on intelligent delivery planning, AI can also optimise slot management for vehicles already in the plant or just arriving. AI algorithms could automatically select the best loading stations and time slots based on factors like traffic, station availability, and fill levels. Suitable parking positions can be assigned to trucks scheduled for later loading slots to avoid traffic jams at the plants.

All these measures help reduce vehicle downtime and improve resource utilisation.

In connection with this slot management, penalties to haulage companies due to avoidable downtime and waiting times can also be reduced. By identifying bottlenecks in the process at an early stage, manual

adjustments can be made to avoid such penalties and ensure a smoother process. Here too, an AI-based analysis of historical data helps to evaluate the specific causes of penalties, obtain optimisation suggestions, and enable experts to select these in a targeted manner.

Of course, the solutions mentioned here work best when they are fully integrated into a plant logistics solution, such as the truck queuing system in Axians VAS Yard Management.

Integrating these capabilities into a plant's logistics infrastructure, like the Axians VAS Yard Management System, streamlines the overall process and ensures efficient vehicle handling.

Demand forecasting and production planning

Integrating AI into demand forecasting and production planning is another area where it can enhance logistics efficiency. AI can analyse current orders, historical data, and material consumption to automatically predict demand for certain materials. Based on these predictions, it can suggest optimised ordering or material relocation strategies.

However, studies, such as a 2024 Bitkom study in Germany, show that only a small percentage of companies have adopted AI solutions in this area. This highlights significant untapped potential for optimisation.

Use case in other bulk goods areas: improving landfill planning

A relevant example from another bulk goods sector is the planning of landfills for mineral waste disposal. Many European countries face shortages of landfill space, and recycling is not always a valid option. AI can be used to improve the planning of landfill projects by recommending the most suitable landfills for specific materials, quantities, and locations.

AI systems can analyse material characteristics, the location of the material, quantities, cost factors, and the landfill's contractual relationship to optimise disposal plans and suggest the best-fit target landfill area. This improves flexibility, reduces transport costs, and accelerates the disposal process. Integrating this into a yard management solution of the landfill plant as well as transport optimisation systems ensures more efficient waste management.

Predictive maintenance and maintenance planning

AI's role in predictive maintenance is a promising application in cement plant logistics. By continuously monitoring plant equipment through sensors, AI can analyse data in real time and predict when maintenance is needed. This allows plant managers to schedule maintenance in advance, minimising unplanned downtime and ensuring optimal equipment performance.

Such systems can also integrate maintenance schedules with logistics workflows. For example,

AI can inform plant logistics systems that a certain loading point will be unavailable due to maintenance, allowing for better planning and resource allocation. Predictive maintenance combined with logistics optimisations enables a smoother, more efficient plant operation.

AI in software development: relief for software developers

AI's potential extends beyond logistics and into software development, particularly in the construction materials industry. AI-powered tools automate routine tasks such as code generation, analysis, and error detection, relieving developers of repetitive work. This enables senior developers to focus on more complex tasks and solution development, ultimately leading to faster and more efficient software production.

For end-users, the benefits of AI are clear: faster feature releases and updates. Developers can focus on defining and evaluating new functionalities, improving the software's relevance to customers. However, while AI accelerates development, industry expertise remains essential. AI supports the work of developers but cannot replace the process and industry knowledge required for successful software development.

Conclusion

AI is reshaping industrial logistics, offering cement plants the ability to optimise operations, reduce costs, and enhance efficiency. From automated vehicle recognition to predictive maintenance and demand forecasting. AI-driven solutions enable smarter decision-making and seamless integration into existing logistics systems. By leveraging these technologies, cement manufacturers can cut delays, improve resource use, and create a more reliable and scalable logistics framework.

In a competitive and digitalised market, companies that embrace AI will gain a significant edge – reducing operational inefficiencies while boosting sustainability and profitability. Yet, successful AI implementation requires industry expertise and the right technological approach.

Cement manufacturers should now evaluate their logistics challenges and consider AI-driven solutions designed to meet their specific operational needs. Partnering with experienced industry experts like Axians IAS can ensure a smooth transition to AI-powered logistics. Thus, unlocking long-term benefits and positioning companies for future success in the bulk material sector. ■

About the author

Reiner Bachthaler has his roots in industrial software-based automation projects and a long-term experience in Software Product Management. Reiner is a Senior Product Manager at Axians Industrial Applications GmbH.