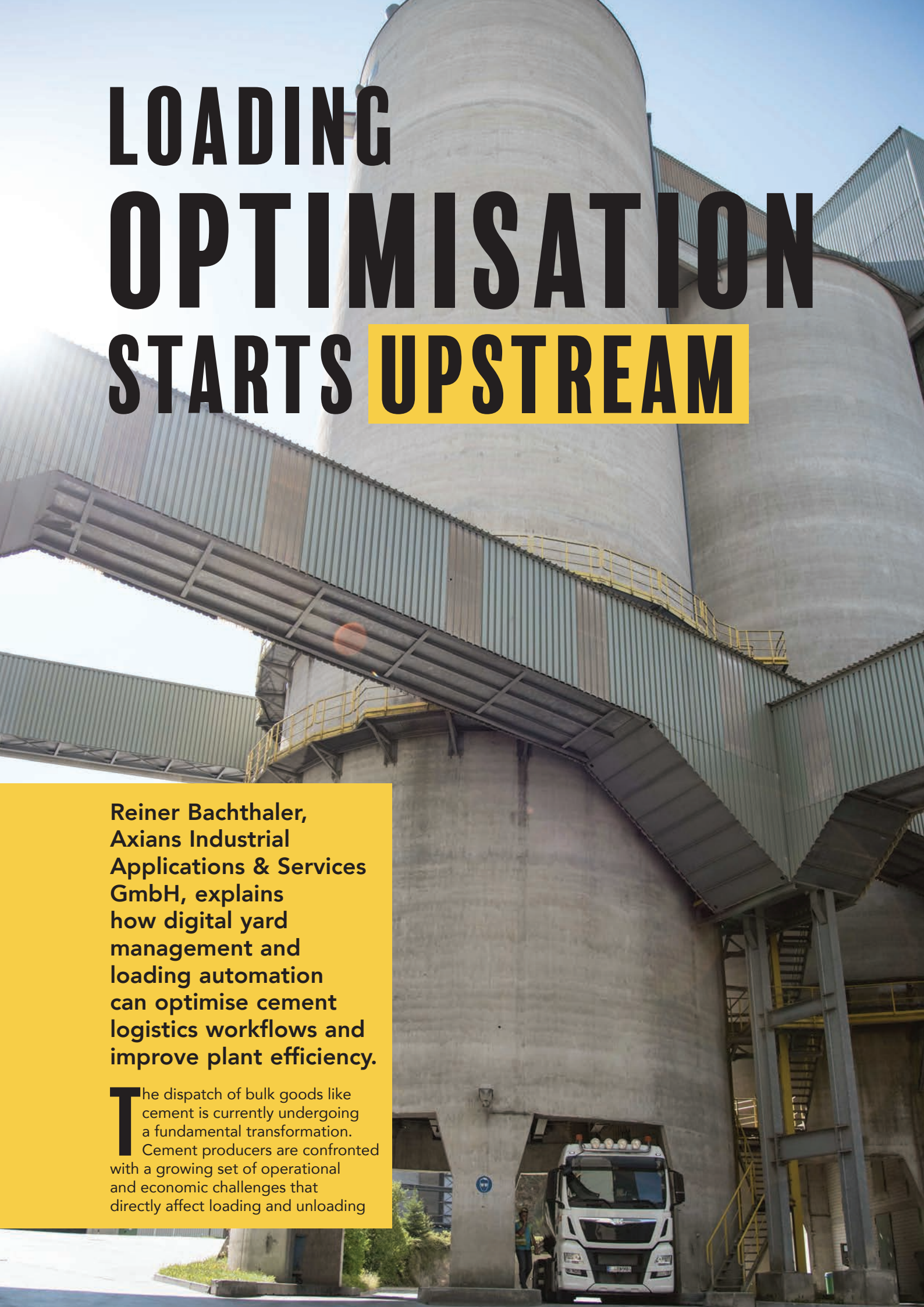


LOADING OPTIMISATION STARTS **UPSTREAM**



Reiner Bachthaler, Axians Industrial Applications & Services GmbH, explains how digital yard management and loading automation can optimise cement logistics workflows and improve plant efficiency.

The dispatch of bulk goods like cement is currently undergoing a fundamental transformation. Cement producers are confronted with a growing set of operational and economic challenges that directly affect loading and unloading

processes at their plants. While production itself has reached a high level of automation and efficiency, dispatch workflows are often still characterised by manual steps, isolated systems, and local optimisations.

One of the most pressing issues is the ongoing lack of skilled workers. Experienced personnel for weighing,

loading supervision, and yard coordination are increasingly difficult to recruit and retain. At the same time, customers expect significantly shorter delivery times and greater flexibility.

In parallel, cement plants are required to handle a growing number of transactions using the same infrastructure. More

deliveries per day, more product variants, and more customer-specific requirements all increase complexity without necessarily increasing available space or resources. Finally, strong cost pressure across the industry forces operators to optimise every process step and to eliminate inefficiencies wherever possible.

These factors create a clear demand for professional digital yard and logistics management, especially loading automation. However, to successfully optimise and digitise bulk goods loading, it is necessary to take a step back and examine the entire cement logistics workflow.

The cement logistics workflow

The dispatch workflow starts long before the truck enters the plant. As soon as an order is placed, the loading process is affected. The subsequent transport planning, which can include coordination with carriers and assigning delivery slots, already determines which materials need to be picked up, when, from which plant, and in what quantities by which truck.

Once the truck arrives at the plant, all roads – or, in this case, processes – do

not lead to Rome, but rather to bulk material loading, as it is the core step of the delivery workflow.

At plant check-in, the truck needs to be identified and weighed. Accurate weighing is crucial, as it provides the data basis for calculating the maximum allowed loading weight – a direct influence on the loading process. Lastly, the truck is assigned to a loading station and can proceed with the delivery workflow. This is when the check-in runs smoothly. In reality, poor planning, manual



Automated loading at cement silo.



Overview: where VAS automates and optimises processes in the cement plant.

processes, and long waiting times can slow the check-in process and reduce throughput at the loading station and beyond.

The key insight here is that processes that take place well before the actual loading station have a measurable impact on loading, emphasising the importance of early planning and orchestration. Focusing optimisation efforts solely on the loading process will not have the desired positive impact.

The loading process itself also adds complexity, with different loading scenarios and specific challenges that must be taken into consideration.



VAS loading terminal.



Cement bag loading with forklift trucks.

Loading and unloading scenarios in cement plants

Cement plants typically have to support a wide range of loading and unloading scenarios.

- ▶ The most common use case is silo loading, with trucks or rail wagons, requiring high precision, reliable weighing, and fast throughput.
- ▶ Another important scenario is palletised loading of cement bags using forklift trucks. This process is complex due to manual handling, pallet management, and coordination between drivers and forklift operators.
- ▶ Direct bag loading enables packed goods to be loaded directly without intermediate pallet handling, but also requires a deep integration between packing and loading systems and the logistic workflow.
- ▶ Unloading workflows (inbound processes) handle raw bulk materials such as clinker, gypsum, slag, or alternative fuels often requiring material identification and additional quality checks.

Typical challenges in loading and unloading workflows

Despite their importance, loading and unloading processes are often still associated with high manual efforts and poorly integrated processes, accompanied by excessive paperwork:

- ▶ Operators supervise multiple loading stations simultaneously, increasing the risk of errors and safety incidents. Weighing data is sometimes transferred manually or not fully integrated into delivery workflow.
- ▶ Uncontrolled vehicle movements frequently lead to traffic jams, long waiting times, and inefficient use of yard space.
- ▶ The number of deliveries per day is constantly rising thereby requiring a higher throughput, most of the time with the same infrastructure. But continuous availability (up to 24/7) is difficult to achieve when processes rely heavily on manual intervention.
- ▶ At the same time, plants should support – as outlined above – multiple loading and unloading scenarios with one system, rather than maintaining separate island solutions causing high complexity, higher handling efforts and lower efficiency.



VAS Mobile Terminal on forklift truck.

How loading automation addresses these challenges

It is clear now that the loading process is influenced by all steps of the logistics workflow. Therefore, the order taking and planning process must be seamlessly integrated into the plant's logistics workflow to ensure an optimised loading process. What such an end-to-end workflow might look like is explained below using Axians' VAS Cloud Logistics and VAS Yard Management as examples.

Step 1: centralised order taking and order and transport planning processes

A central success factor for efficient dispatch operations is accurate pre-planning. Central order taking and planning solutions like VAS Cloud Logistics enable all relevant stakeholders (customer, dispatcher, and carrier) – to be actively involved in the order process e.g. by placing orders independently 24/7, defining the required materials and quantities, and booking loading slots in advance.

Automated transfer of relevant data between all involved parties further streamlines the process by eliminating delays and miscommunications. Preparation for plant check-in can be simplified by providing the driver with tools for a quick check-in (e.g. QR code or TANs).

Step 2: time slot management

Waiting lists and slot management reduce traffic congestion and waiting times at the plant. By creating digital end-to-end workflows, e.g. with VAS Cloud Logistics and Yard Management, customers or carriers can pre-book loading timeslots.

This provides planning security and improves on-time deliveries, as customers and carriers arrive and load just-in-time.

Step 3: driver self-service check-in

But this preparation would be useless if the plant check-in process was manual, slow, and error prone. Thankfully the check-in process can be easily automated with a solution like VAS Yard Management and driver Self-Service Terminals. The Self-Service Terminals do not only provide a 24/7 availability, they

also accelerate the process and eliminate miscommunication and errors:

- ▶ Drivers can authenticate themselves using various identification methods like QR-Codes or automated number plate recognition, reducing check-in times and eliminating manual verification.
- ▶ The driver can directly perform the entry weighing via a connected weighbridge, which automatically transfers the weighing data to VAS Yard Management.
- ▶ The 'best-fit' loading station is automatically assigned based on configurable rules like current stock levels or product availability.

To assign the loading station with regards to the actual loading capacities, the yard management system should be integrated with the leading ERP or warehousing system. Otherwise, an error-prone 'double bookkeeping' must be maintained across both systems.

Step 4: administrated loading station access

When the truck has checked in at the plant, it can directly proceed to the loading station, or pass through additional checkpoints that ensure that the time spent directly at the loading station is minimised, increasing the loading station's capacity:

- ▶ A 'loading station pre-check-in station', where the driver has to perform and confirm all preparation tasks, like opening the tank manlid, before proceeding to the loading station.
- ▶ Administration of a local waiting list directly at the loading station.

Step 5: automate the loading process

As described above, the loading process itself is complex and requires, depending on the material or the loading method, different approaches for automation:

Step 5.1: automated silo loading

By connecting silo PLCs to VAS self-service terminals at the silo, drivers can control the silo loading process autonomously. This removes the need for permanent operator support and enables true 24/7 operation:

The truck driver can position the silo's loading spout independently, start the loading process by himself and can constantly monitor the progress on the terminal – a perfect example of IT/OT integration in the cement logistics workflow.

Step 5.2: precise loading quantity control

Starting the loading process autonomously is one thing, automatically controlling the loaded quantity without manual intervention to avoid over- or underloading is a different story. VAS Yard Management permanently monitors and controls the loaded quantity and automatically adjusts the flow rate according to fineflow settings. Configurable backlash settings in VAS ensure a precise loading quantity by dynamically calculating the time to stop the flow.

Step 5.3: direct bag loading

Direct bag loading can also be fully automated through the integration of self-service terminals, the yard management system and the PLC, eliminating the need for manual handling processes. The yard management system can start the loading process, control the number of bags to be loaded, the 'loading pattern' (how the bags are arranged on the loading area), and the load securing check.

Step 5.4: Forklift truck loading

For scenarios with forklift loading, mobile loading terminals provide a highly efficient solution. Fully integrated with the yard management system, they eliminate paperwork and ensure real-time data capture.

The forklift truck is provided with an overview of all planned deliveries including

delivery details. Additional functions such as pallet handling, batch tracking, and connections to packaging machines can be integrated seamlessly.

Step 6: ready for check-out

The lion's share is done. The loading process itself and all preceding planning and coordination tasks are automated and optimised.

But the check-out should not be overlooked, as it offers optimisation potential in conjunction with loading. Exit weighing and delivery note creation can take place directly at the silo loading station, preventing congestion at plant exit.

In any case, online weighbridge connection and paperless delivery document creation are crucial for seamless delivery processes.

Operational results and business benefits

The impact of loading automation is clearly measurable. Manual effort and dependency on skilled workers are significantly reduced, while process reliability increases through tight IT and OT integration. Supporting multiple use cases with one system becomes a competitive advantage and directly improves customer satisfaction.

Faster throughput times lead to lower waiting times and reduced transport costs.

The elimination of paperwork saves time, improves data quality and traceability and reduces the carbon footprint. Overall, cement plants achieve higher efficiency, better asset utilisation, and improved profitability.

Outlook: loading reloaded

Loading automation will continue to evolve. AI will support process analysis and optimisation by identifying patterns and improvement potential across large volumes of logistics data. Driver self-service will move to mobile devices, enabling even more flexible and user-friendly interaction at the plant.

For cement producers, loading is no longer just an operational necessity. With the right digital foundation, like the VAS solutions from Axians, it becomes a strategic lever for competitiveness in an increasingly demanding market environment. ■