

Case study

CIMPOR pioneers Industry 4.0 in cement manufacturing with private 5G

Transforming century-old facilities
into digital powerhouses



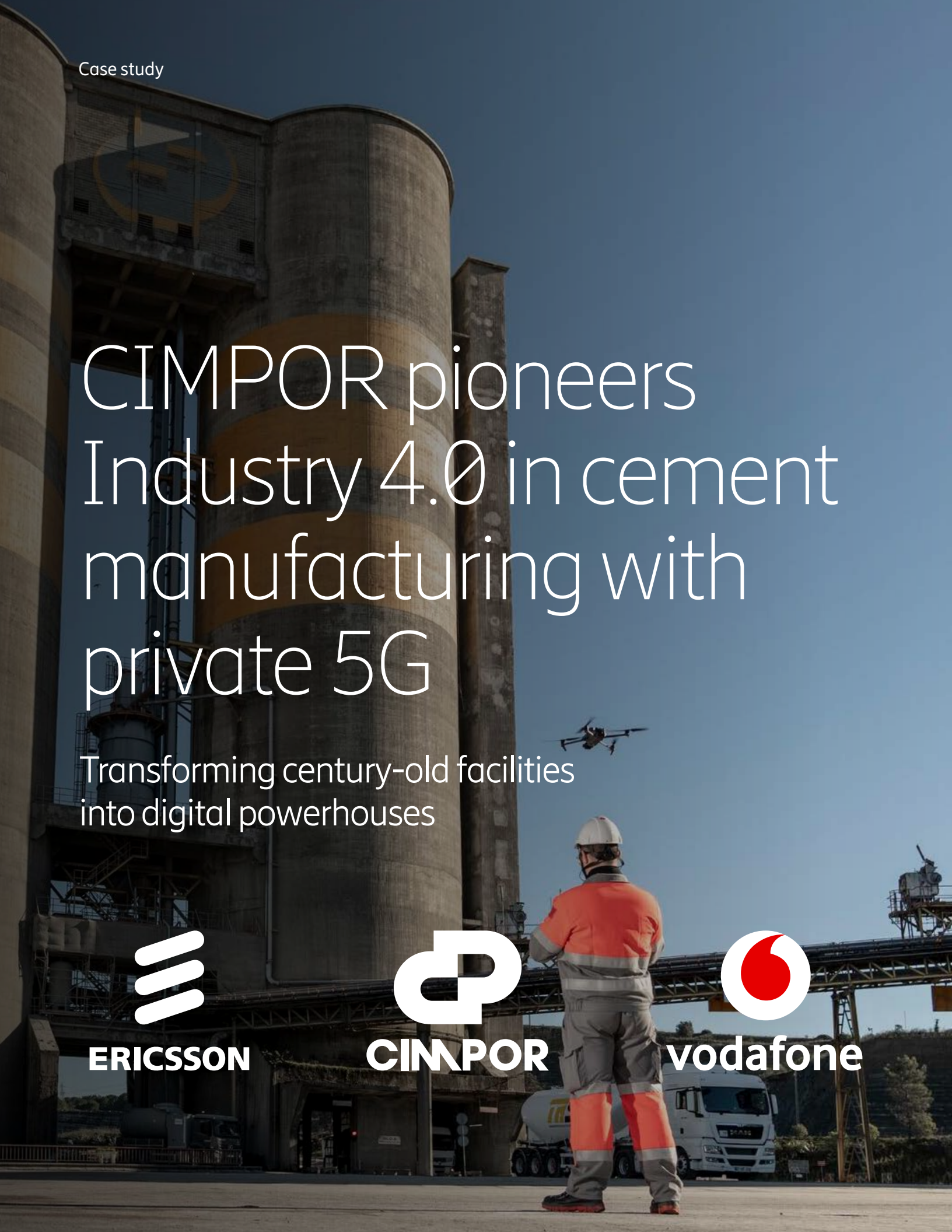
ERICSSON



CIMPOR



vodafone



Executive summary

Cement manufacturing is one of the world's most traditional industries—capital-intensive, energy-heavy, and slow to change. Yet CIMPOR Global Holdings, one of Europe's leading cement producers, is proving that even century-old operations can become digital powerhouses.

In partnership with Vodafone Portugal and Ericsson, CIMPOR deployed 5G private networks across multiple plants in Portugal, establishing the largest industrial IoT (IIoT) implementation in the global cement industry. The deployment connects more than 10,000 sensors across all plants of the group—in Portugal, Turkey, and Africa—supports autonomous drone inspections, and enables advanced mobile and augmented reality-based operations, establishing a foundation for Industry 4.0.

Nowhere is this transformation more relevant than at CIMPOR's Alhandra plant, which has operated in the same location for over 130 years, making it Europe's oldest continuously operating cement

facility. Once constrained by legacy infrastructure, the plant now serves as a showcase for industrial digitalization, delivering sub-10 ms latency, 1 Gbps throughput, and 100 percent coverage across indoor, outdoor, and confined industrial environments.

The results are both measurable and material: approximately a 1 percent increase in overall efficiency, translating to estimated savings of up to 10 million USD, directly and indirectly, in annual economic impact. Based on CIMPOR's internal assessments, improved inventory and maintenance optimization could translate into up to 1 million USD in annual savings per plant through avoided downtime and asset failures. The same efficiency gains are associated with a reduction of approximately 140,000 tons of CO₂ emissions. What began as a connectivity upgrade has become a platform for safer operations, lower emissions, and scalable Industry 4.0 transformation.

Case study:
CIMPOR

Industry:
Cement Manufacturing / Building Materials

At-a-glance

Goal:

- Digitalize cement manufacturing operations to improve safety, efficiency, and sustainability.

Approach:

- Deploy private 5G networks across multiple production facilities in Portugal
- Connect IIoT sensors for comprehensive equipment monitoring
- Implement drone inspection systems
- Enable Augmented Reality / Virtual Reality (AR/VR) remote assistance capabilities
- Integrate mobile SAP applications for paperless operations

Results:

- Up to 10 million USD annual economic impact, directly and indirectly, from approximately 1 percent efficiency improvement
- Up to 1 million USD per plant annual savings through avoided downtime and asset failures
- Approximately 140,000 tons CO₂ emissions reduction associated with efficiency gains
- Sub-10 ms latency with 1 Gbps throughput
- 100 percent coverage including challenging indoor environments



The 100-year-old challenge: Connectivity barriers in cement manufacturing

The cement industry is under mounting pressure to digitalize operations that have remained largely unchanged for decades. CIMPOR's facilities in Portugal—including the 130-year-old Alhandra plant, the Souselas plant, and the Loulé plant—exemplify this challenge.

These plants span massive areas: indoor production halls, outdoor quarries, silos, galleries, and confined equipment interiors. Delivering reliable wireless connectivity across environments like these is an extraordinary challenge. Steel structures and reinforced concrete block radio signals. Constant site modifications make fixed cabling impractical. Fiber would require

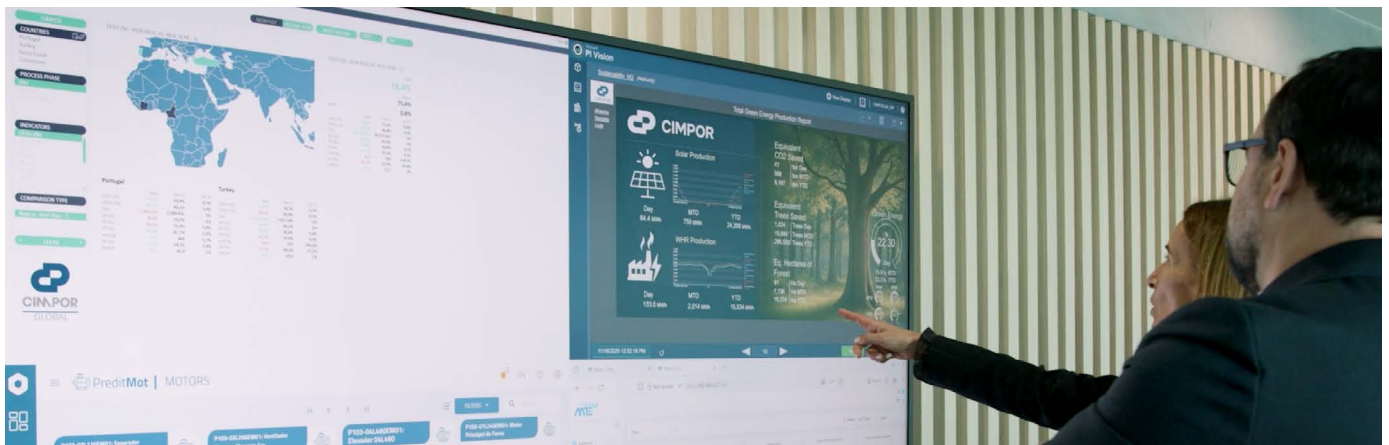
kilometers of cabling—only to be disrupted by the constant digging and adapting inherent to cement production. Traditional Wi-Fi struggled with coverage gaps, interference, and daisy-chain architectures that create single points of failure.

CIMPOR's digital ambitions demanded real-time data for vibration monitoring, energy optimization, mobile workers, drone inspections, and AI-driven control systems. Connecting more than 2,000 sensors across three plants—with plans to scale globally—required low latency, complete coverage, data sovereignty, and deterministic performance. Private 5G was the only logical solution.

"Our plants cover very large areas, making traditional Wi-Fi difficult and not cost-effective to implement. We have production areas and storage on a massive scale, plus heavy machinery and metal structures that interfere with wireless signals."

Tiago Soares, IT Director,
CIMPOR





The solution

CIMPOR, Vodafone Portugal, and Ericsson formed a partnership to deliver a private 5G network engineered for cement manufacturing. After proof-of-concept tests validated the approach, CIMPOR successfully deployed the solution at its Alhandra, Souselas, and Loulé operations in Portugal.

The network uses the Ericsson Private 5G system, optimized for industrial deployments. The solution incorporates Ericsson Radio

Access Network (RAN) and core technologies, including the Multi-Operator Core Network (MOCN), enabling Vodafone and CIMPOR to share radio infrastructure while dedicating resources to industrial use cases. The network is managed through Ericsson's cloud-based management portal, allowing CIMPOR to operate all three sites centrally. Each site features four directional antennas configured to optimize coverage for each plant's industrial layout.

The configuration delivers sub-10 ms latency, 1 Gbps throughput, and 100 percent coverage—including environments with steel and concrete structures where Wi-Fi fell short. The network is segmented into distinct VLANs, where bandwidth and priority are allocated based on use case and quality of service (QoS) requirements. This approach guarantees predictable performance for critical applications, even during periods of heavy traffic.



"We have a longstanding relationship with Ericsson—we've been working together for 33 years. Vodafone provided the spectrum, network design, and managed services, while Ericsson provided the core network and RAN. All three of us worked together to bring this network to life."

Henrique Fonseca, Executive Board Member,
Enterprise Business Unit, Vodafone Portugal



From connectivity to capability through industrial applications powered by private 5G

With a reliable private 5G network in place, CIMPOR moved quickly to deliver:

Predictive maintenance at scale

More than 10,000 sensors measure vibration, acoustics, temperature, and rotational data from motors, drives, kilns, and mills. AI models analyze this data continuously, detecting anomalies weeks or months before equipment failure occurs. Real-time process controls optimize energy consumption.

Drone inspections

Indoor and outdoor drones use real-time video over 5G to inspect massive ducts, silos, and other confined spaces. Inspections that once required days of scaffolding setup and dangerous climbs now take hours, keeping workers safely outside.

AR-enabled remote assistance

AR glasses stream live video over 5G, letting off-site experts guide on-site technicians through complex repairs. Problems that once required flying in a specialist can now be solved remotely. The same glasses record procedures on video, preserving institutional knowledge before experienced workers retire.

Paperless, mobile operations

Workers who once printed work orders each

morning now access SAP on tablets over 5G from anywhere in the plant, logging jobs, photographing equipment, and ordering parts directly from the field. Data quality improves because information is entered at the source rather than transcribed later. All three Portuguese plants have gone fully paperless.

Measurable business impact

With the network operational across Alhandra, Souselas, and Loulé, CIMPOR has transformed how it monitors equipment, protects workers, and manages energy consumption.

Based on CIMPOR's internal assessments, improved inventory and maintenance optimization could translate into up to 1 million USD in annual savings per plant through avoided downtime and asset failures. Real-time process control optimizes energy consumption, the company's largest operating expense.

Early improvements across CIMPOR's

connected production systems have delivered approximately a 1 percent increase in overall

efficiency, translating to estimated savings of up to 10 million USD, directly and indirectly, in annual economic impact.

Reducing cement manufacturing's carbon footprint

The environmental gains follow directly from operational ones. The efficiency gains achieved are associated with a reduction of approximately 140,000 tons of CO₂ emissions, reinforcing the role of digitalization in supporting both productivity and sustainability objectives.

The reduction stems from multiple sources: lower energy consumption through optimized process control, reduced waste through improved quality management, prevented equipment failures that eliminate restart emissions, and reduced clinker—the calcium compound formed by heating limestone—in the cement mix.

Real-time monitoring enables CIMPOR to create tighter process control margins, reducing the energy buffer the company traditionally maintained to ensure product quality.



How 5G helps protect heavy industry workers

Drones have eliminated many of the facilities' most dangerous inspection tasks. At Alhandra, drones now navigate silos and massive ducts where workers once climbed or rappelled. Workers no longer enter spaces that drones can inspect.

HD cameras throughout the facilities detect personal protective equipment violations and risky behaviors in real time, warning workers immediately via mobile apps. The system catches problems before they become incidents. In the quarries, collision prevention systems protect workers around heavy trucks and loaders.

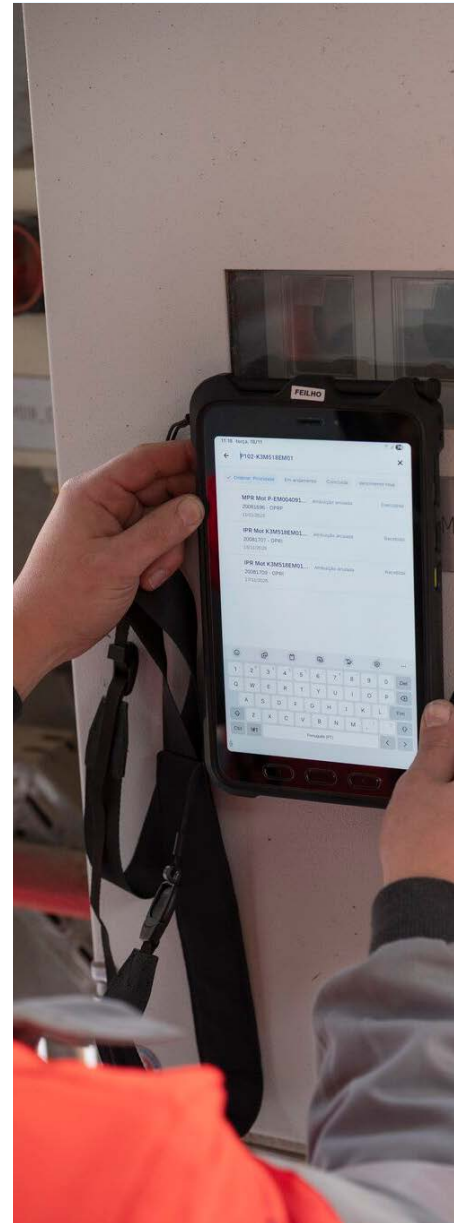
Recruiting the next generation to cement manufacturing

Cement manufacturing has traditionally struggled to attract young graduates, who associate the industry with dust, noise, and outdated conditions. That perception is changing. New hires now join CIMPOR expecting to work with drones, robotics, sensors, and AI—the same technologies that draw talent to tech companies.

The technology also bridges generations. Through CIMPOR Academy, experienced workers wear AR glasses while performing maintenance, recording procedures for new hires to follow. Veterans contribute decades of institutional knowledge; younger workers bring fluency with digital systems. Both sides learn from each other.

"We're attracting more young talent now. They can work with drones, robotic systems, sensors, and data systems. One new worker told me, 'When I left college and heard CIMPOR was rolling out 5G, I thought this sounds like a futuristic company to work with.'"

Berkan Fidan, Global Chief Technical Officer & Board Member, CIMPOR



A model for global expansion

Building on the success in Portugal, CIMPOR has already awarded Vodafone and Ericsson the contract for a fourth site—and plans to replicate the model far beyond Portugal. With 16 units, between plants and grinding centers, across three continents, CIMPOR sees the Portuguese implementation as a proving ground for global expansion.

Learnings from the first deployment accelerated implementation at subsequent sites, providing a model CIMPOR can duplicate and extend across additional areas of its operations. This flexible foundation enables wider integration throughout the group's production processes and positions the company to adopt future innovations in IIoT, AI, automation, digital twins, and autonomous vehicles.

"We began with a dream two years ago, and today we have a real solution perfect for our internal and external clients and for our business. When we installed 5G, we achieved total mobility in the plant—throughout production equipment, and across outdoor facilities."

Ana Cristina Ramos, Director, Operational Excellence, CIMPOR

Proving what's possible

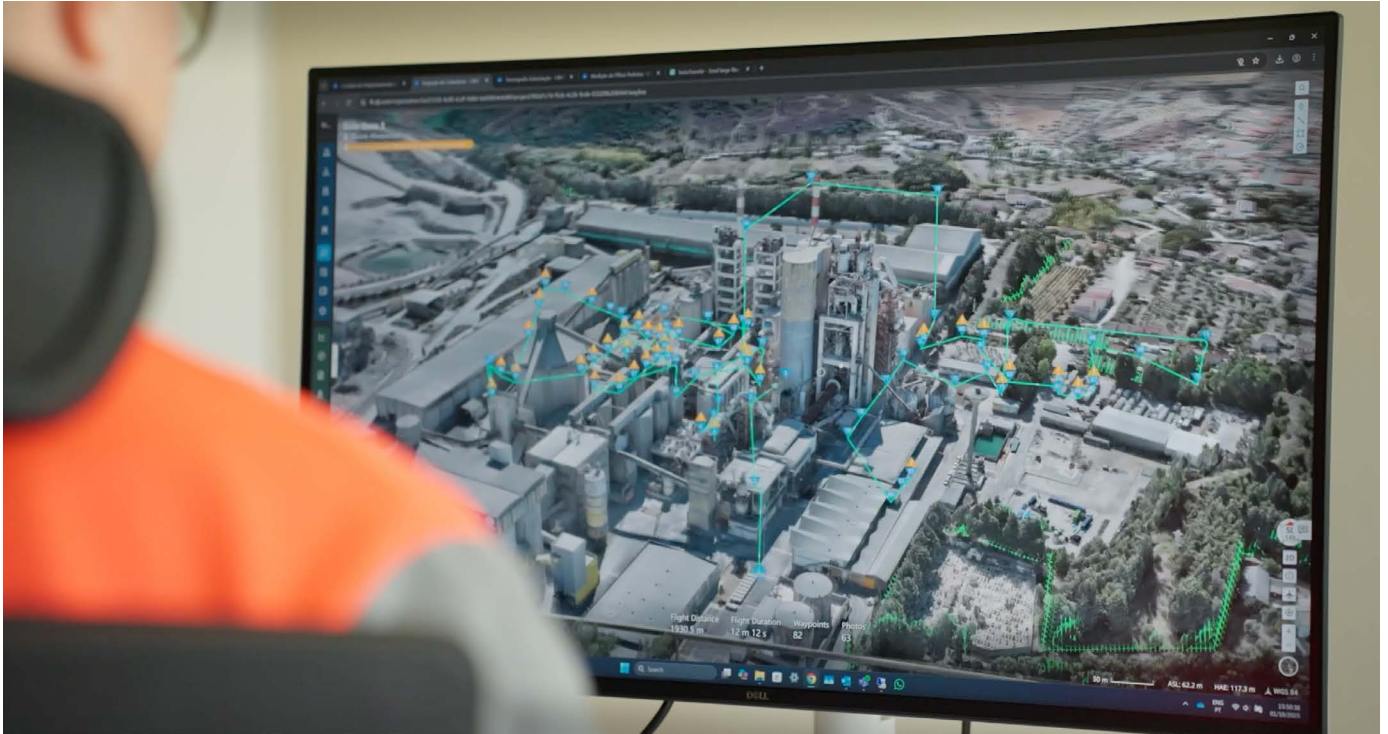
CIMPOR's transformation demonstrates that digital innovation can thrive in even the most challenging industrial environments. Concrete walls, steel structures, vast outdoor areas, confined spaces inside equipment, and constant modification all conspire against connectivity.

Vodafone Portugal and Ericsson proved those obstacles can be overcome, establishing a compelling business case for similar deployments across heavy industry. Competitors in Portugal and internationally have already expressed interest in understanding how the technology works and whether they can replicate these results.

By combining private 5G with IIoT, AI, and mobility, CIMPOR turned one of the world's oldest industrial processes into a forward-looking, data-driven operation. The result is a safer workforce, lower emissions, stronger financial performance, and a roadmap other manufacturers are already asking to follow.

"This implementation of private 5G networks across our production units marks a decisive step in strengthening the resilience, efficiency and safety of our industrial operations. This technology lays the foundation for a new generation of digital applications and enables us to operate with greater precision and responsiveness. This is only the beginning of a wider journey."

Berkan Fidan, Global Chief Technical Officer &
Board Member, CIMPOR



Technical specifications

- **Coverage:** 100 percent including galleries, equipment interiors, and outdoor areas
- **Latency:** Sub-10 milliseconds
- **Throughput:** 1 Gbps
- **Infrastructure:** Four directional antennas per site
- **Network design:** Multiple VLANs segmented by use case priority
- **Management:** Centralized, cloud-based subscriber and SIM management across all sites

Key statistics

- **Infrastructure:** Sub-10 ms latency | 1 Gbps throughput | 100 percent coverage
- **Financial Results:** Up to 10 million USD annual economic impact | Up to 1 million USD per plant through avoided downtime and asset failures
- **Sustainability:** Approximately 140,000 tons CO₂ emissions reduction associated with efficiency gains

About the partners

About CIMPOR

CIMPOR is a multinational cement and industrial materials producer operating across three continents with market leadership in Portugal and Turkey. Part of TCC Group Holdings, CIMPOR produces 35 million tons of cement annually across 16 units, between plants and grinding centres, on three continents. With roots dating to 1894, CIMPOR combines industrial heritage with cutting-edge innovation.

www.cimpor.com

About Vodafone Portugal

Vodafone Portugal is one of the country's leading telecommunications providers, serving consumers and businesses for over 33 years. As part of Vodafone Group, Vodafone Portugal provides 5G coverage to 99 percent of the population and has deployed more than 100 mobile private networks globally.

www.vodafone.pt

About Ericsson

Ericsson enables communications service providers and enterprises to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovative investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

www.ericsson.com

