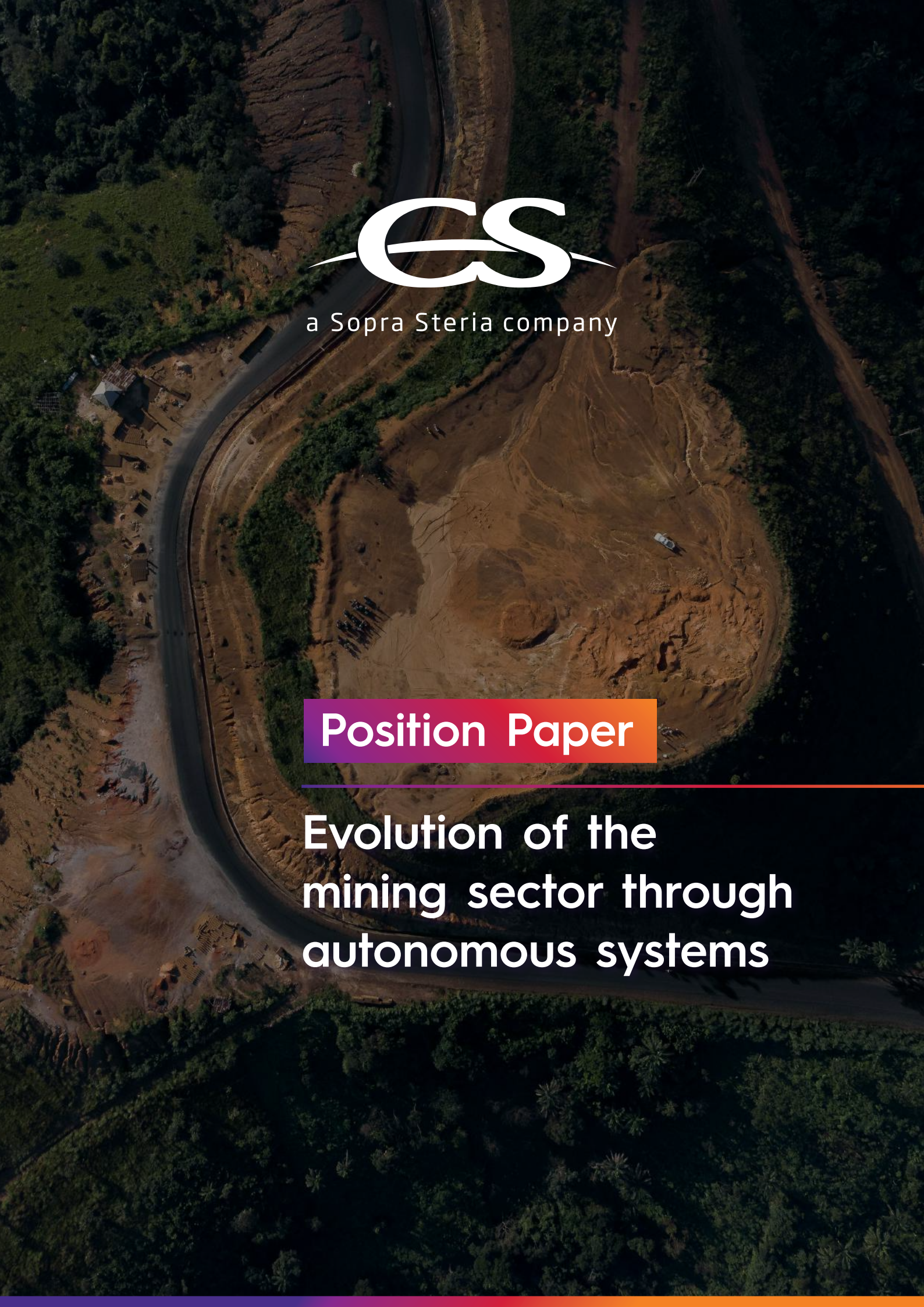


a Sopra Steria company

Position Paper

Evolution of the mining sector through autonomous systems

Today, mining automation has become a key element of companies' digital transformation strategies and is redefining the mining landscape. It promises significant improvements in safety, productivity, and reduction of labor-related costs.

Whether in the fields of exploration, extraction, loading, or transportation, the integration of autonomous systems effectively meets the growing demands of the market, particularly in terms of performance and safety. However, behind these promises lie challenges that must be addressed.

Benefits of autonomous systems

In the same way that the automotive industry develops autonomous vehicles capable of traveling safely thanks to advanced navigation technologies, the mining sector is positioning itself as a pioneer in automation. Autonomous equipment plays a crucial role in **minimizing risks while significantly increasing the performance of operations.**

The key success factors for this market include:

Security

Safety is a top priority

By removing operators from hazardous environments, autonomous systems reduce risks associated with human errors and unpredictable conditions. These systems ensure constant monitoring and proactive interventions in case of anomalies through incident detection and prevention technologies. Thus, automation plays a key role in creating a safer work environment for employees while protecting company assets.

Optimization

An optimized use of resources

Automated solutions enable unmatched operational efficiency. By eliminating constraints related to schedules or human fatigue, autonomous systems operate continuously, ensuring optimal productivity. Moreover, real-time data analysis allows for adjustments to operations based on site conditions, whether it is equipment status, terrain, or weather conditions. These dynamic adjustments ensure maximum resource utilization and a reduction in unplanned interruptions.

Costs

A significant reduction in costs

The integration of automation, while requiring initial investments, offers substantial savings in the medium and long term. More precise equipment management extends their lifespan, while optimized operations help reduce maintenance and fuel costs.

Furthermore, the reduction in labor requirements for certain specific tasks alleviates costs related to hiring, training, and managing teams. These savings strengthen the competitiveness of mining companies in an ever-evolving market. However, it is important to note that, although automation allows for significant long-term savings, in some cases, such as for Autonomous Haulage Systems (AHS), overall costs do not actually decrease. Instead, they shift from labor to the IT/OT infrastructure needed to operate the systems.

Despite well-established benefits, the adoption of autonomous vehicles remains limited. A recent estimate indicates that less than **3%** of mobile mining equipment is currently autonomous. However, this proportion is rapidly increasing, driven by numerous OEMs offering solutions such as trucks, haul loaders, drills, and much more.

The expansion of autonomous technologies in the mining sector is a clear sign that this transformation is set to become the norm, redefining standards of safety, productivity, and sustainability.

Current challenges and opportunities

As mentioned earlier, automation in the mining sector aims to improve safety, performance, and operational efficiency. To achieve these objectives, **functional safety plays a central role**. It controls risks by ensuring that each component operates safely, even in the face of unforeseen conditions or failures.

By reducing human errors, limiting interruptions, and maximizing precision, functional safety ensures that autonomous systems respond correctly to the challenges of the terrain. Considering safety life cycles from the design phase is essential to creating systems capable of meeting the growing demands for reliability and performance.

Why is functional safety crucial?

1

Protecting people and assets

By eliminating risks related to failures, functional safety ensures a safer work environment and minimizes material losses.

2

Enhancing compliance and trust

Systems that meet international standards strengthen the credibility of companies with users, partners, and regulators.

3

Optimizing operational performance

Better management of component interactions reduces downtime and improves overall efficiency.

Thus, functional safety is not only a technical or regulatory imperative, but a strategic lever that aligns safety, performance, and sustainability. It is key to maximizing the benefits of autonomous systems discussed in the previous chapter while minimizing their risks.

Other challenges in the sector

Automation in the mining sector comes with additional significant challenges.

High initial costs

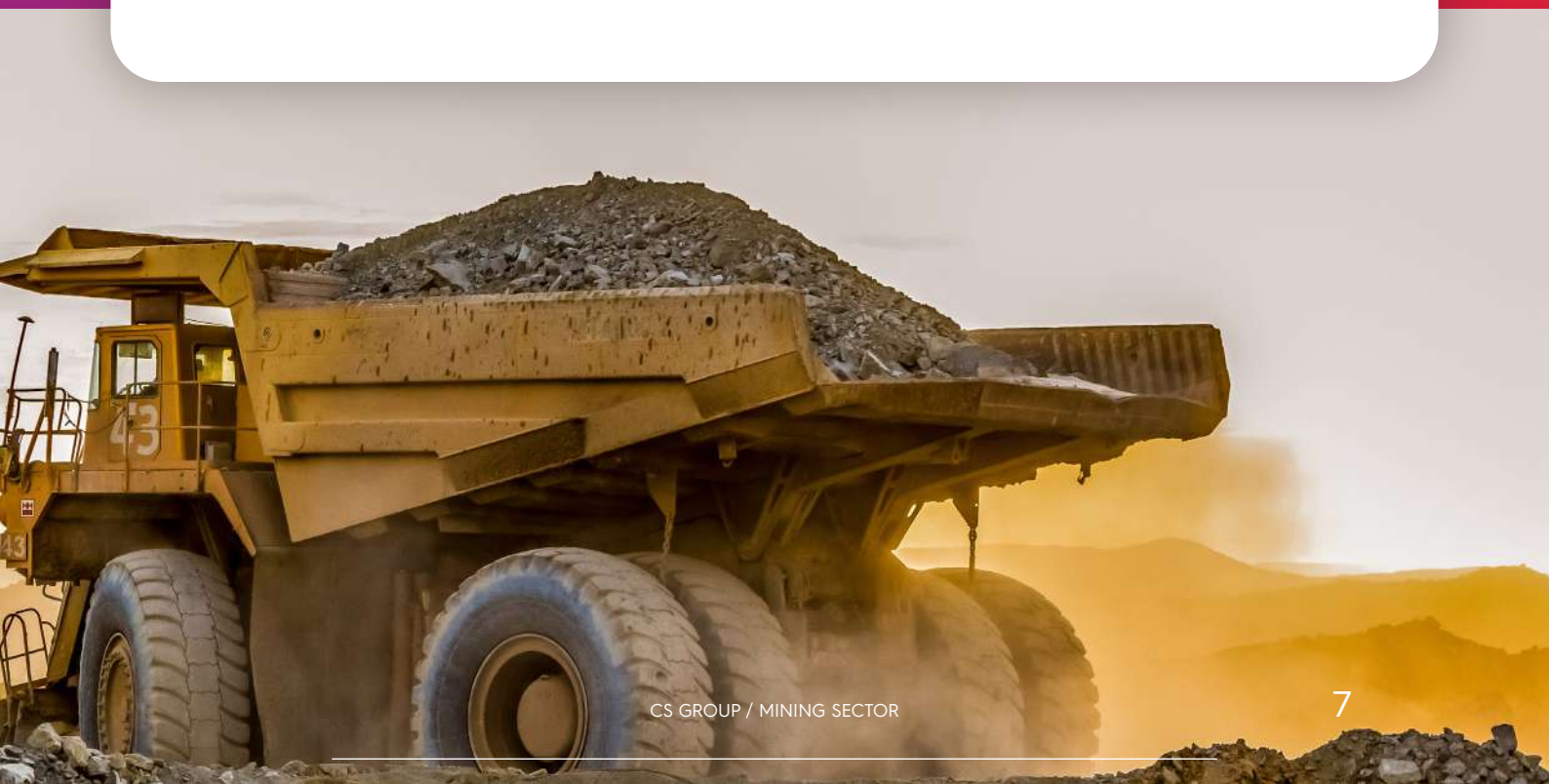
Integrating autonomous systems requires significant investments, particularly for infrastructure modernization, purchasing compatible equipment, and developing control centers.

Impact on the workforce

The transition to autonomy raises concerns about the displacement of traditional jobs. However, it also opens the door to new opportunities in maintenance, autonomous system management, and data analysis. Investing in training and retraining programs is essential to support this transition.

Technological and operational challenges

Autonomous systems rely on a complex ecosystem of sensors, real-time data, and advanced algorithms. The integration of autonomous systems presents a major challenge for the mining industry. OEMs have historically sought to lock their systems to limit external interventions. However, a trend toward gradual openness is emerging, allowing for closer collaborations and increased interoperability. This evolution remains complex and requires significant efforts from stakeholders.



CS Group North America's response

a Sopra Steria company

For over 20 years, we have been leveraging our expertise in systems and safety to serve the aerospace, automotive, and off-road equipment industries. At CS Canada, we are at the forefront of integrating autonomous systems, functional safety, and cybersecurity in:

- Using advanced methods and tools to tackle the challenges posed by increasingly complex software.
- Establishing a trusted relationship with over 50 OEMs, Tier 1 companies, and startups.
- Adopting a customer-centric approach and offering tailored solutions that align with their goals and compliance requirements.

The integration of autonomous systems and functional safety is redefining performance and sustainability standards in the mining industry. Discover how to fully leverage these innovations, anticipate challenges, and build a competitive, safe, and sustainable future by clicking here.