



**Rockwell
Automation**

The **connected mine**

Rockwell Automation® solutions for mining





The world needs mining

THE WORLD IS SEEING INCREDIBLE CHANGES

that require resource-intensive goods of all sorts. Overall population is growing and shifting to urban areas. The middle class is expanding, infrastructure development is increasing and with this growth comes a need for resources. Metals like iron, copper, aluminum and nickel will come with a much higher demand. In addition, the quest for a less carbon-intensive future has spurred growth in electric vehicles – and lithium, magnesium, cobalt and other minerals used in battery production. Likewise, bigger and better energy storage batteries are flooding the marketplace to support wind, solar and other clean sources of power.

Our world is changing before our eyes, and these changes must be met through the support of mining.

The connected mine
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Increase operational
efficiency
PG 12

Mine-to-market
visibility
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Modernize and empower
your workforce
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Design, build and upgrade
with confidence
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MARKET VOLATILITY IS THE NEW NORMAL

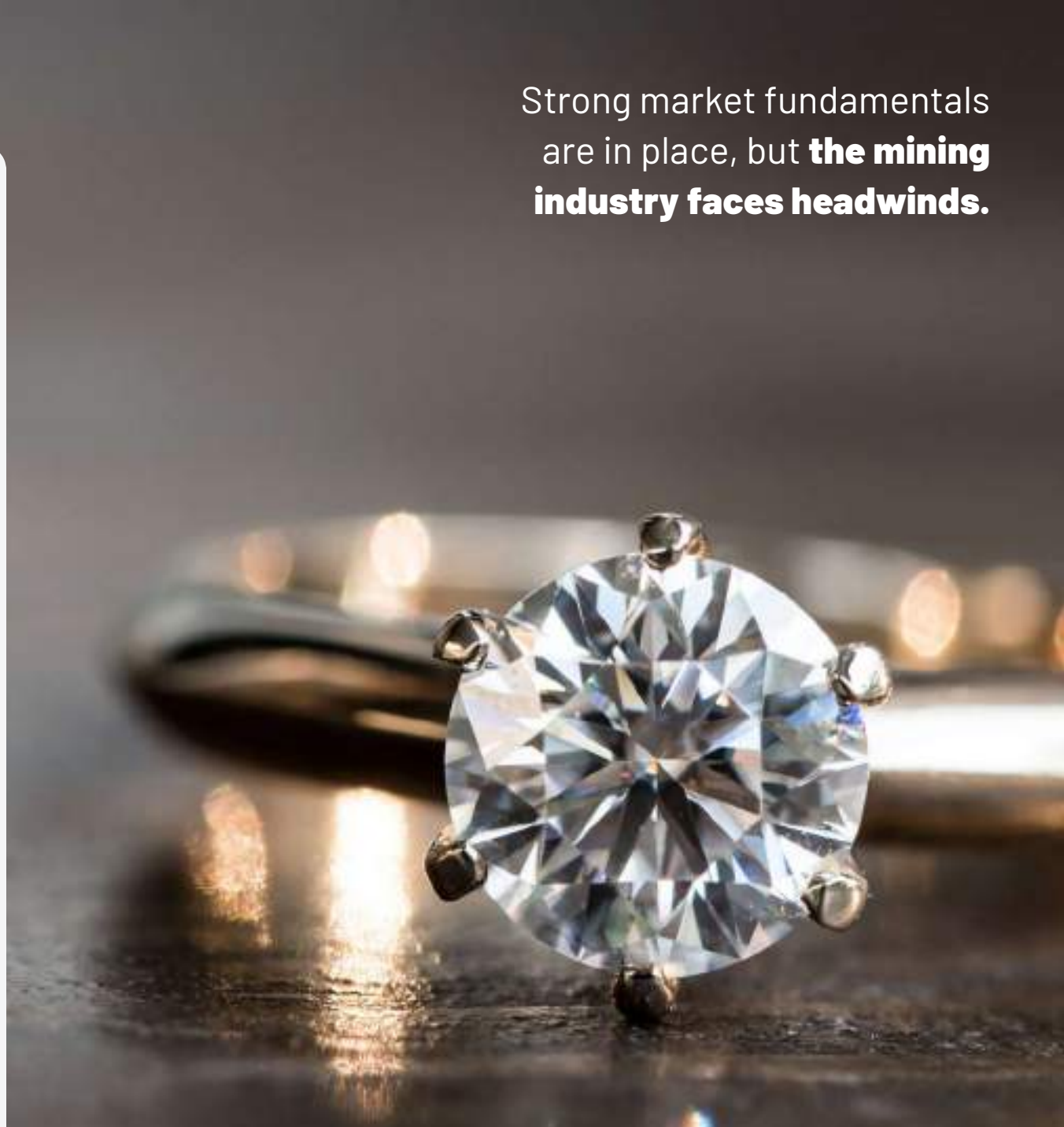
Even with projections of higher demand, the mining industry is still facing many challenges. Market volatility and uncertainties directly impact business - which adds complexity to long-term planning for new projects or upgrades to existing sites.

Ever-evolving legal and governance regulations are keeping mining companies on their toes. Not to mention the constant need to satisfy shareholders while working in partnership with stakeholders to earn their social license to operate.

Optimizing operations and assets is critical and bridging the skills gaps and addressing the changing workforce demographics is key for companies to stay afloat.

By focusing on and putting a plan in place to address these key areas, many other challenges can be resolved as a result.

Strong market fundamentals
are in place, but **the mining
industry faces headwinds.**




Operational challenges

Mining is, by nature, complex. And it's getting more complex as companies are forced to dig deeper and go farther to access better ore grades.

Mining companies continue to be challenged with identifying process efficiencies, keeping equipment operating properly, effectively using water and energy, and ensuring workers stay safe.

Controlling these variables is crucial to remaining profitable, and each one can be devastating to a mining company if a misstep occurs.

- **PROCESS EFFICIENCY** (General costs pressures, grade decline)
- **COST** (Equipment maintenance)
- **ACCESS** (Effective use of land, energy and water)
- **WORKER HEALTH & SAFETY**
- **ENVIRONMENTAL IMPACT**



More than 60% of the total mine workforce can be almost exclusively focused on servicing or repairing assets in the mine.

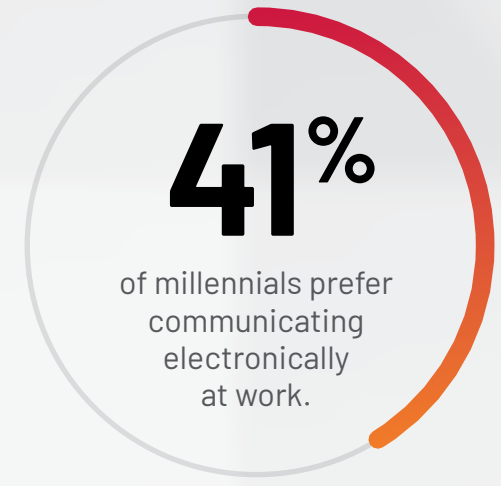
Source: Miningglobal.com

The workplace challenge

How to attract and retain the next generation of workers

Mining companies are working with a rapidly changing workforce. With interest in mining dwindling and a boom in technological knowledge, mining companies are required to up their game to attract, train and keep the best talent.

8 mining engineering enrollments at University of NSW in 2017, **the lowest in 40 years**



Source: Forbes; PwC; Chairman Jake Klein (Evolution Mining)

Opportunity in digital transformation

DIGITAL TRANSFORMATION PROVIDES A MAJOR OPPORTUNITY

to address industry challenges. The projected realized value from digital transformation initiatives from 2016 to 2025 could equal \$320 billion USD, according to the World Economic Forum. There is broad consensus across the industry that digital technologies are key to better performing mines. However, many challenges stand in the way to true digital transformation. Without a clear strategy in place that includes a business case and expected ROI, many companies jump in head first without a picture of what they're hoping to achieve. Some companies cannot evolve due to their legacy technology infrastructure or their workforce lacks the skills necessary to adapt to the change. Or maybe the challenges lie within company culture, upfront funding or the ability to keep up with changing technology.

The truth is, **85% of big data projects fail** today as a result of one or more of these challenges.* But there are ways to anticipate and overcome these challenges to continue on your journey to digital transformation.

**Source: Gartner*

Why Rockwell Automation?

Your journey toward achieving the connected mine is unique. Rockwell Automation has the capabilities and experience to support your digital transformation, no matter where you stand in your journey. Our people and partnerships are at the heart of what we have to offer:





HOW DO WE OVERCOME THESE CHALLENGES?

Rockwell Automation® helps miners plan their digital transformation journey from start to finish. Proper planning and project management allows challenges to be identified and addressed in the early stages of a project - before the entire project is derailed. Adhering to a project plan keeps your digital transformation initiatives on budget and on schedule.

1. ASSESS

Evaluate and understand the status of your mine.

2. STRATEGIZE

Develop a future vision of what you would like to achieve through digital transformation.

3. IDENTIFY OPPORTUNITY

List problems, potential solutions and associated technologies that can help you on your journey.

4. DOCUMENT

Draft a business case and define quick wins and ROI you expect to achieve.

5. COMMIT

Select cases and define your targets, teams and partners that will help you on this journey.

6. PILOT

Test and evaluate the results through the initial stages of implementation.

7. SCALE

Multiply and scale the successes you are seeing across your target area.

8. REVIEW

Revise the project and assess results based on the initial goals of your project.



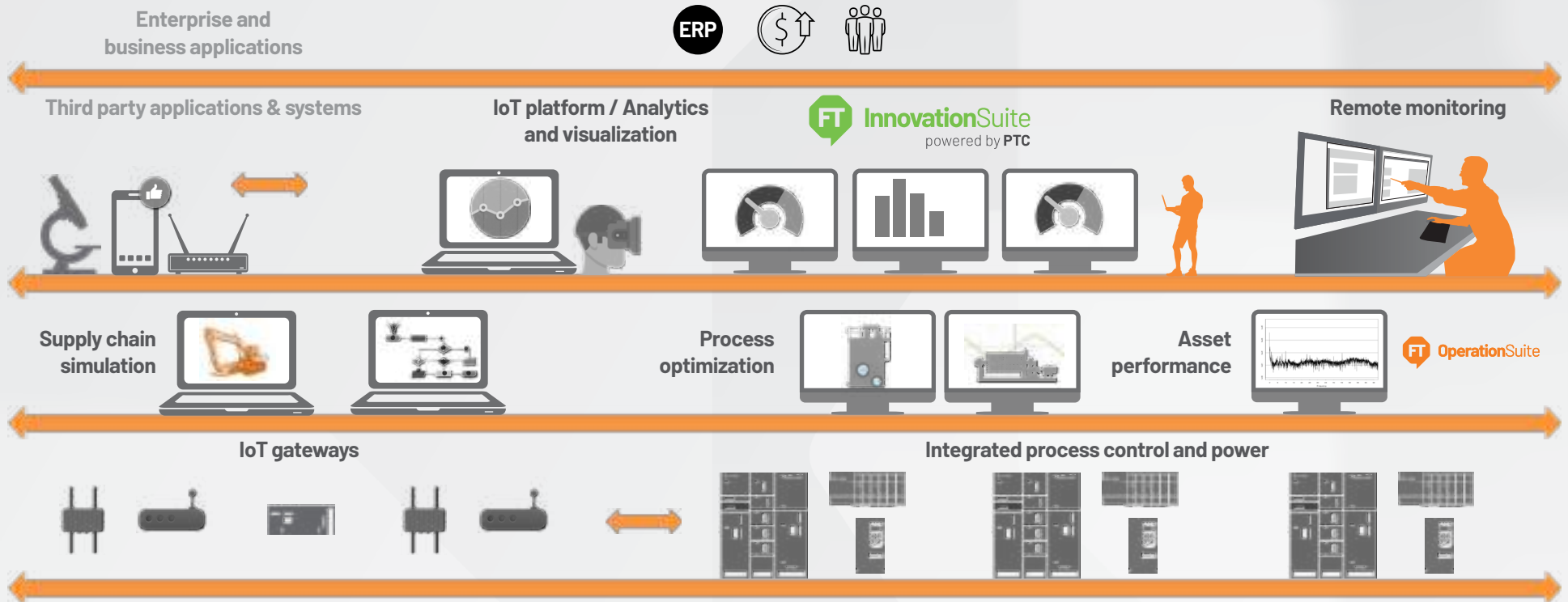
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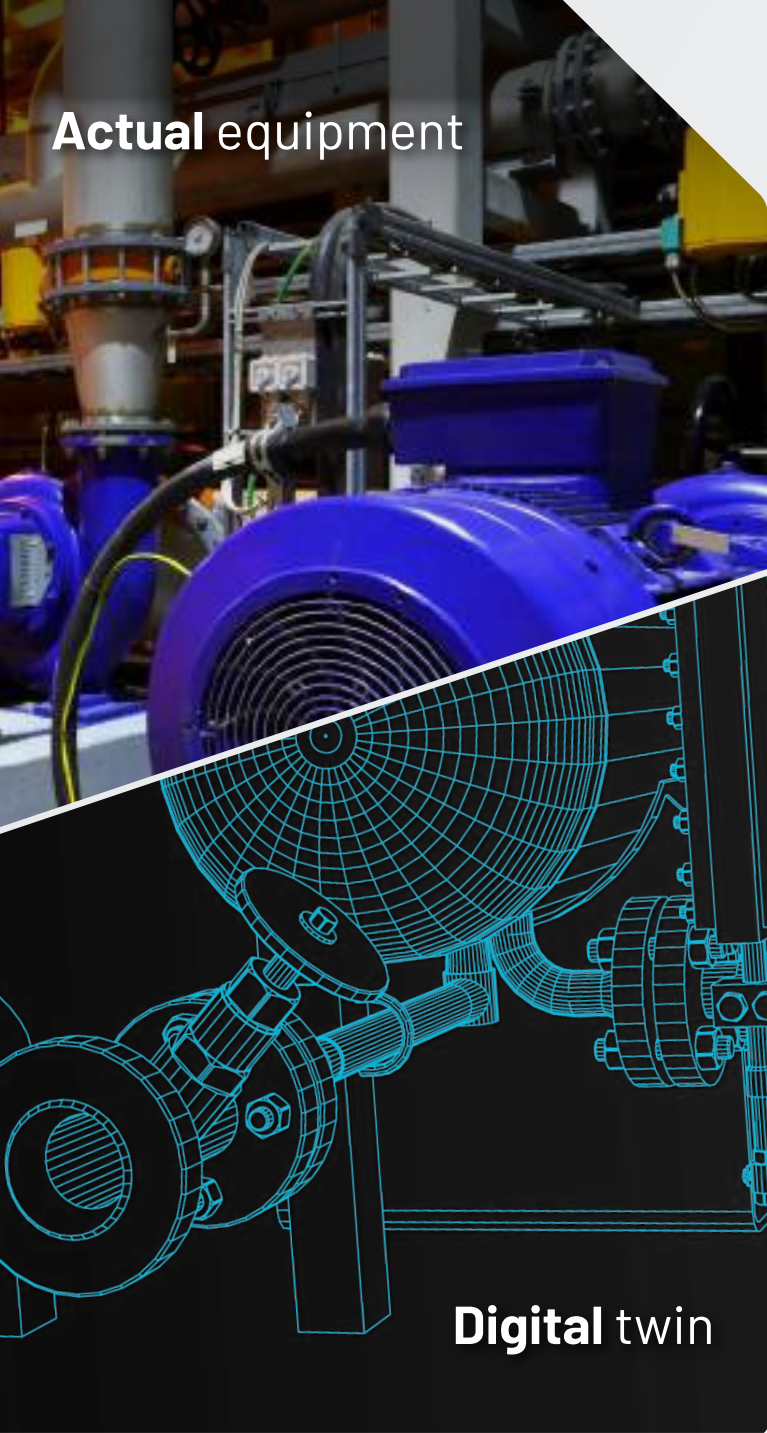
The **connected** mine

Integrated systems and scalable analytics enable mine-to-market visibility and allow for better decision-making.

The connected mine

End-to-end architecture and systems integration





Actual equipment

Digital twin

The connected mine

DIGITAL TWIN CONCEPT

Enabling reduced capex and opex optimization

DIGITAL TWIN FEATURES

Mechanical CAD

Process simulation

Virtual commissioning

Virtual operation

Electrical CAD

Mathematical modeling

Mobility

Operator training

DIGITAL TWIN BENEFITS

Better prototyping

Easily design and build the next generation of equipment with confidence.

Validate your strategies

Optimize throughput with simple, real-time 3D simulation of complex dynamic processes.

Virtual commissioning

Design, test, validate and commission systems before they are put into service.

Operator training

Reduce risk and improve operations by training workforce in a safe virtual environment.



Increase operational efficiency

Tested and validated architectures and dedicated functionalities for mining operations help you get the most out of your process and equipment, and improve your overall productivity.

MINE

EXTRACTION EQUIPMENT

Powering and enabling analytics for mobile equipment

Equipment reliability is dependent on the drive system and with remote monitoring and diagnostics available, you can keep tabs on your equipment from anywhere. We offer high-performance drive solutions for shovels and draglines, including technology for extreme conditions and high availability, providing data acquisition and telemetry.



MINE

CRUSHER AUTOMATION

Improved control and monitoring for crushers

By integrating process and motor control, you can get the most from your equipment – reducing mechanical stress, causing fewer disturbances, and lowering maintenance costs – all while maximizing performance, maintaining production consistency, and saving energy.



PROCESSING PLANT

MILL AND CONCENTRATION

Solutions that help you meet your plant objectives

An integrated control system reduces engineering risks and is easier to operate, maintain and modify, and delivers a unified view of the typical processing plant areas. Seamless integration between critical areas of your plant allow you to connect process, discrete, power, information, and safety control into one plant-wide infrastructure. This provides an integrated environment for configuration, operation and maintenance.



PROCESSING PLANT

METAL REFINING AND PYROMETALLURGY

High performance systems for process and energy intensive applications

The PlantPax® system provides a modern approach to distributed control for metal refining applications. An open standards, high-availability DCS means more flexibility and efficiency for complex and large metal processing applications, and redundancy across systems all while operating on an integrated architecture.



PROCESSING PLANT

DEDICATED APPLICATIONS FOR MINING PROCESS CONTROL

Standardized methodology and functionalities for mining controls

Standardized methodology and pre-engineered content for control, monitoring, visualization, alarms and reporting allows for the multiplication of tested and validated best practices across all sites. Libraries and advanced functionalities have been developed specifically for the mining industry.



PROCESSING PLANT

ADVANCED PROCESS CONTROL

Reduce variability and stabilize complex processes

Model Predictive Control (MPC) optimizes complex processes and delivers more throughput, better recovery and less variability all while minimizing use of energy and reagents.



MATERIAL HANDLING

CONVEYORS AND STACKER RECLAIMERS

Information-enabled machines and equipment deliver real-time performance and operating data

Lower engineering costs, improve machine efficiency and reduce maintenance costs by using integrated architectures for conveyor systems and stacker reclaimers with remote monitoring from anywhere, anytime.



MATERIAL HANDLING

HOISTING

Productivity and safety for hoisting can be a critical part of an underground mine, demanding solutions that address productivity without risking safety

A combination of automation, safety solutions, and intelligent motor control delivers safer, more reliable, high-performing hoisting systems.

We partner with top mechanical suppliers to deliver best-in-class hoist solutions.



UTILITIES

MINE ELECTRIFICATION

Intelligent packaged power; single supplier, single backbone

Reduce downtime and improve safety by integrating process controls with power distribution, substation automation and motor management.



UTILITIES

SUPPORT AREAS

Improved control and visibility across your entire mine site

We provide solutions and integrated architectures for supporting areas, such as ventilation, compressor systems, pumping systems, water telemetry and fuel management for mining.





Mine-to-market visibility enables **better business decisions**

When you collect, aggregate and analyze data across operations, you can spot trends and interdependencies that are missed when data lives in silos. With this type of information, you can make more informed decisions.



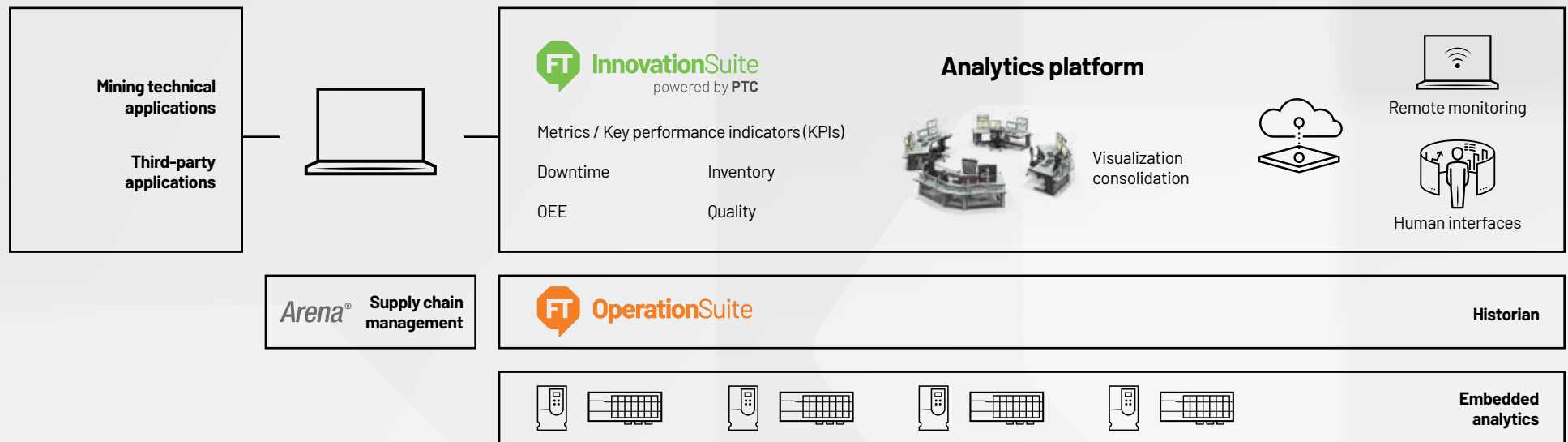
The power of analytics

ONE MAJOR CHALLENGE mining companies face is disconnected and siloed information. It's a constant struggle to find ways to aggregate and contextualize information from various areas of the business to enable better, more holistic decision-making.

FactoryTalk® InnovationSuite, powered by PTC enables data collection and aggregation, surfaces contextualized information so you can take action, and offers powerful visualization tools that bring data to life and enable better decision-making.

Mine-to-market integration

Our FactoryTalk® solution allows mining companies to collect data from nearly any source within the enterprise and quickly build applications and decision tools.



The most important data at your fingertips

Integrate information from any data source

Track production and inventories

Benchmark different mines and operations

Contextualize and display KPIs (OEE, downtime, energy and water consumption)

Create powerful mash-ups with any relevant information for the business



Supply chain simulation

Mining supply chains are an intricate sequence of material movements and processes, and there are several potential combinations of material movements across the value chain — extraction, conveyance, stockpiles, processing plant, rail and port.

Simulation tools can help mining companies analyze potential changes to their operations and supply chains, and even incorporate the impact of external factors like weather, market demand and commodity prices.

Our Arena® solution enables discrete event modeling, the process of depicting the behavior of a complex system as a series of well-defined events. This works well in virtually any process where there is variability, constrained or limited resources, or complex system interactions.

Discrete event simulation allows users to analyze the behavior of a process or system over time. Users can ask “why” or “what if” questions, and test designs or changes to processes or systems without any financial implications.



Modernize and **empower your workforce**

New technologies are expanding human possibility. Incorporating these technologies into your worker's daily lives can ease workforce transitions, increase worker productivity, foster collaboration, and provide a safer, more engaging environment for all employees.

WORKER SAFETY AND EFFICIENCY

MOBILE REAL-TIME INFORMATION

By nature, mining operations are spread out geographically. Field workers often find themselves servicing or operating equipment without a direct view into how the specific piece of equipment is performing. This lack of visibility and information can reduce productivity and result in unsafe operations.

Our mobility solutions extend visualization and real-time decision capabilities to browser-based remote users including mobile devices. With on-demand, real-time access from anywhere, every team member benefits from this visibility into the mine.

57%

greater employee
productivity/efficiency
possible with mobile
technology

Source: Motorola / mobientech.com

Our mobility solutions **extend**
visualization and real-time
decision capabilities.



WORKER SAFETY AND EFFICIENCY AUGMENTED REALITY

Superimpose digital information onto real objects or equipment, providing field personnel with real-time information in context of the true process. This technology helps mining companies enable remote expert advice for equipment maintenance and augment the training process to create customized, memorable instruction for new workers.

SEE THE RESULTS

- Better employee productivity
- Safer operations
- Remote collaboration
- Expert advice

51%

of respondents said that their company had already seen a measurable ROI when it came to using AR for employee training / knowledge transfer

Source: PTC / IDC





Design, build and **upgrade** **with confidence**

New projects and upgrades can be risky to undertake. Reduce your risk of overspend and delays with better up-front planning, fewer vendors, and tested project methodology and architectures.

Projects **lifecycle support**

Reducing risk and creating value throughout your production lifecycle



Feasibility & conceptual studies

- Feasibility studies
- Conceptual design
- Consulting services
- Workforce readiness

Front end engineering & design

- Information, control, power, safety
- Process optimization
- Instrumentation
- Electrical
- Packaged equipment

Design & engineering

- Design & implementation
- Construction, fabrication
- Testing (FAT)
- Training
- Network and security

Installation & commissioning

- Installation management
- Start up / commissioning
- Training
- Documentation
- Parts management

Operation & maintenance

- Remote system monitoring
- Service agreements
- On-site engineering
- Asset management
- Reliability

Upgrades & migrations

- System audits
- Obsolescence risk mitigation
- Hardware / software upgrades
- DCS / control & safety system migration

Cybersecurity

Solutions and services

VALIDATED SOLUTIONS / ARCHITECTURES

Comprised of a collection of Cisco® and Rockwell Automation® validated designs, our architectures are tested for performance, availability, repeatability, scalability and security. This means you get fast, tested access to 'future-ready' network design.

CYBERSECURITY SERVICES

From assessment to a response plan deployment, we can provide a full lifecycle service focused on industrial security. Our experts understand how to securely bring together IT and OT, and help secure your infrastructure, protect assets, and maintain network availability.



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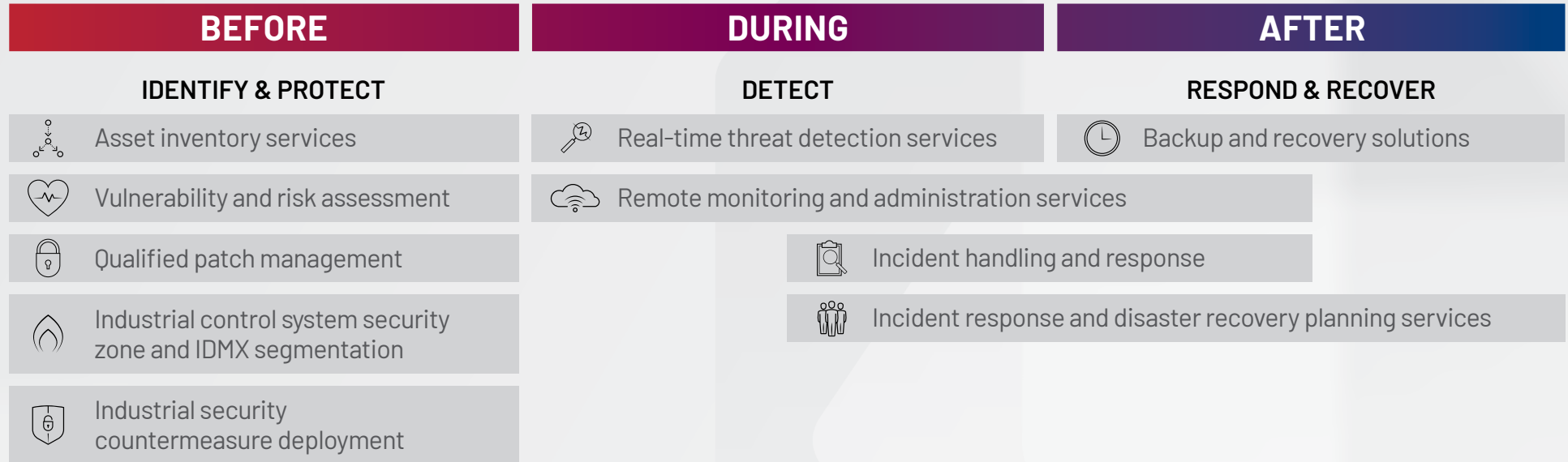
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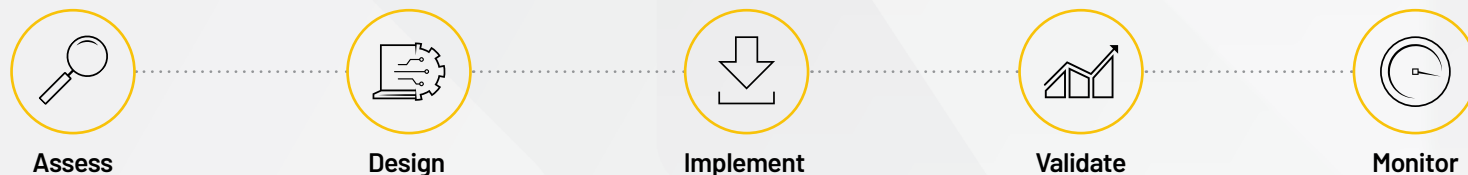
**Design, build and upgrade
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PG 26

A proactive approach to industrial cyber security

Attack continuum



BUILD A SECURE, ROBUST, FUTURE-READY NETWORK FOR YOUR CONNECTED MINE



A holistic approach to help you design, deploy, and **manage your network infrastructure**

rockwellautomation.com

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Publication MIN-BR004A-EN-P - May 2019

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