

# **Unearthing Operational Excellence: Maximizing Mining with Digital Transformation**

Hexagon's solutions can help your mining operations prepare for tomorrow, today!

## Introduction

For thousands of years, in almost every corner of the globe, humans have applied their ingenuity in various methods to mine and process ore bodies. Whether in search of fossil fuels, rare elements or precious metals, drilling the deep sea, boring massive tunnels, carving out open pits or moving mountains, mining has evolved and shaped our civilizations over the centuries. An issue that's been constant from the beginning of mining activities to the present day is the significant health, safety and environmental risks associated with this process.

The dangers associated with mining are multiple and include the hazardous environments people are exposed to and the use of often large and dangerous equipment. S&P Global Marketing Intelligence (2017)<sup>1</sup> reported that according to Joanne Farrell — who was representing Rio Tinto as the Group Executive HSE and Managing Director Australia at the Minesafe International 2017 conference — the mining industry was about seven or eight years behind the oil, gas and chemical industries when it came to process safety at that time:

**“As an industry, we in mining have not focused or talked about process safety as much as we could or should have. We all need to lift the conversation and talk about process safety in terms of getting our people out of harm's way and preventing catastrophic events.”**

Accenture and the World Economic Forum (2017)<sup>2</sup> argued that digital transformation initiatives embraced by the mining and metals industry over a ten-year period could result in an improvement in safety, with around 1,000 lives saved and 44,000 injuries avoided. This equates approximately to a 10% decrease in lives lost and a 20% decrease in injuries in the industry. These initiatives include automation, robotics and operational hardware, a digitally enabled workforce, integrated enterprise, platforms and ecosystems and next-generation analytics and decision support.

Mining is a billion-dollar global industry that's critical for other dependent markets, such as technologies and electronics, construction and infrastructure and green energy resources. According to Research and Markets (2021)<sup>3</sup> it is expected to grow from \$1641.67 billion (USD) in 2020 to \$1845.55 billion (USD) in 2021 at a compound annual growth rate (CAGR) of 12.4%. The market is expected to reach \$2427.85 billion (USD) in 2025 at a CAGR of 7%. This growth is mainly due to companies rearranging their operations and recovering from the impact of COVID-19 that led to restrictive containment measures involving social distancing, remote working and the closure of commercial activities that resulted in operational challenges. According to EY (2021)<sup>4</sup> changes enacted to respond to COVID-19 have created opportunities for miners to accelerate digital transformation and enhance safety and productivity:

**“COVID-19's impact has highlighted the benefits of various technologies, such as automation, AI and blockchain, to help ensure business continuity. Businesses that had already invested in advancing their digital journey are reaping the benefits now and will continue to have a competitive edge beyond the pandemic.”**

<sup>1</sup>SNL, “Mining industry needs to improve process safety, take lead from oil, gas sectors”

<sup>2</sup>World Economic Forum, White Paper, “Digital Transformation Initiative Mining and Metals Industry”

<sup>3</sup>Research and Markets, “Mining Global Market Report 2021: COVID-19 Impact and Recovery to 2030”

<sup>4</sup>EY, “Top 10 business risks and opportunities for mining and metals in 2021”





Accenture and the World Economic Forum (2017)<sup>5</sup> also highlighted the economic, environmental and productivity benefits that digital transformation could generate for the mining industry over a ten-year period (2015 to 2025):

- More than \$425 billion (USD) of value for the industry, customers, society and environment
- Over \$320 billion (USD) of industry value, with a potential benefit of approximately \$190 billion (USD) for the mining sector and \$130 billion (USD) for the metals sector
- A reduction of 610 million tonnes of CO<sub>2</sub> emissions, with an estimated value to society and environment of \$30 billion (USD)

Deloitte (2017)<sup>6</sup> also proposed the value of the digital mine nerve center that brings together data across the mining value chain in multiple time-horizons, to improve planning, control and decision making, in order to optimize volume, cost and capital expenditure and to also improve safety.

As a result, mining companies are looking to fast-track their digital transformation journey to manage new project ventures, remain competitive, reduce operational and health, safety, environment and community (HSEC) risks, maintain a social license to operate (SLO), decrease downtime, increase worker engagement and productivity and facilitate compliance with critical regulatory requirements. This is where Hexagon can help your organization prepare for the “next normal.” Whether you need to digitalize and transform operational systems and processes, accelerate your continuous improvement initiatives, improve decision making, maximize leadership time in the field, help prevent fatalities and injuries, drive compliance to processes, optimize alarm management, protect your digital investments with state-of-the-art cybersecurity or build out a comprehensive digital twin, we are here to support your digital transformation journey and prepare for tomorrow, today.

In today’s digital age where technology is being embraced at an exponential rate, personnel at many mines are still using hard-copy documents, siloed spreadsheets, scattered databases and other inadequate data collection and management tools for crucial day-to-day procedures such as shift handover. This can lead to miscommunication, mistakes, inefficiencies and major operational and safety risks — all of which can be avoided. Some of the common challenges faced by mining operators include:

- Deficient mobile technology and/or applications
- Detached real-time and process data from data historians, the CMMS, the DCS, EAM, PLC and SCADA systems

- Double handling of data
- Inadequate schedule compliance or compliance plan performance
- Insufficient leverage of the information collected in business value decision making
- Limited, singular add-on tools or point solutions that are costly and often incompatible with each other
- Missed opportunities to collect, store and structure more situational, qualitative and quantitative information
- Multiple data-entry systems for operations and HSE personnel
- Siloed information that’s inaccessible to employees across the operation
- Slow and expensive methods for making changes that impede operational continuous improvement efforts
- Sluggish uptake of multiple systems for new employees

Based on our own internal expertise and listening to our customers share their experiences, we have identified three principal business reasons why an organization should dig deep into its digital transformation journey (employee safety and fatality prevention, workforce productivity and asset productivity).

<sup>5</sup>World Economic Forum, White Paper, “Digital Transformation Initiative Mining and Metals Industry”

<sup>6</sup>Deloitte, “The digital mine - What does it mean for you?”

## Customer Spotlight

**AGL Energy** is one of Australia's leading integrated energy companies and the largest Australian Security Exchange (ASX) listed owner, operator and developer of renewable energy generation in the country. Its diverse power generation portfolio includes base, peaking and intermediate generation plants, spread across traditional thermal generation as well as renewable sources including hydro, wind, landfill gas, solar and biomass. The Loy Yang open cut brown coal mine in Victoria's Latrobe Valley, near Traralgon, is owned and operated by AGL Energy.

### Customer Challenges

The Loy Yang open cut brown coal mining operation uses four electric-powered bucket wheel dredgers that are 190 metres long and 50 metres high. Each one weighing around 5,000 tonnes and able to excavate 4,000 tonnes of coal an hour or over one tonne of coal a second. The coal is taken from the mine to the Loy Yang Power Station by 15 kilometres of conveyors that carry the coal at speeds of 5.3 metres a second to an 80,000-tonne capacity bunker. The coal is crushed by rotary crushers that can handle 2,500 tonnes an hour each before it is delivered to the Loy Yang Power Station. During each shift, the daily directions and targets need to be conveyed to the operations staff indicating the requirements in terms of quantity and quality of the coal required. Information detailing the status and availability of the major equipment is also needed. At the end of each shift, reports are required to indicate if objectives were met, comparing planned tonnage to actual tonnage. AGL Energy's objectives were to streamline the provision of daily requirements and combine that data with actual achievements to evaluate shifts production levels.

### Hexagon Solution

The Loy Yang open cut brown coal mine utilizes the j5 Operations Logbook, j5 Shift Handover, j5 Work Instructions, j5 Event Manager and the j5 Connector for the OSIsoft™ PI System™ throughout its operations along with j5 Dashboards, Reports and Views and j5 IndustraForm® Templates functionality to meet AGL Energy's extensive requirements. PI System current and future planning data is connected to j5 Operations Management Solutions to build the requirement details and the resulting shift production levels. This combined data provides four reports for each shift:

- **Coal Draw Directive Report:** Provides instructions to the dredger operators on the drawing positions for the shift, this data is also expanded on in the j5 Operations Logbook.
- **Shift Handover Report:** Generated at the end of each shift, this is a standard j5 Shift Handover report containing additional information including hazards, safety and planning issues.
- **Shift Leaders Report:** Generated at the end of each shift, this report compares planned and actual results, includes bunker levels, stocks at the start and end of shift, output and digging rates of individual dredgers and major events from PI Event Frames.
- **Shift Production Requirements Report:** This report provides the tonnage required and the rate per hour, major events on the dredgers, digging priority instructions, quality of the coal and the bunkering strategy.

j5 Operations Management Solutions are saving time by producing concise requirements and directions at the start of each shift and is making information available to the entire operations crew allowing for greater communication and direction within the group. The j5 Connector for the OSIsoft PI System enables the powerful combination of human operations processes and procedures with real-time data and is exposing the planning data to a larger audience, improving the operations workflow. The provision of this data at the start and end of each shift enables a group approach to daily production and shift handover meetings.



Photo: AGL Energy Loy Yang Mine





## Accelerate Your Digital Transformation Journey to Operational Excellence with Hexagon

Investing in a comprehensive, interoperable and enterprise-scalable digital transformation strategy will accelerate your continuous improvement efforts in this ever-changing economic landscape. It will also promote the long-term resilience of your company's safety performance, workforce and asset productivity and provides your business with the competitive edge it needs to perform at its best. As your trusted digital transformation partner, Hexagon's operations and maintenance solutions can help you create intelligent information from disparate sources including **unstructured** disconnected data, documentation, and **structured** digital data sources and existing databases. Hexagon's solution also help you find and resolve duplicate data and **consolidate** information to reduce operational risk, increase efficiency, decrease downtime, remove value leaks and meet internal and external compliance. Here is how we can work with you to implement your operational excellence digital transformation roadmap, step-by-step.



## Step 1 Digitalize Operational Processes, Procedures and Permits

The creation of a solid operations management data ecosystem by digitalizing your operational processes, procedures and permits is a strong first step on the road to digital transformation. Critical asset, situational, qualitative and quantitative information should be captured, structured and stored digitally and more importantly, organized and made available to support safety-critical operational processes. **j5 Operations Management Solutions** can take your shift, operator round, personnel, safety, maintenance and process information and make it visible and viable to users across the entire organization. This on-premise, or SaaS, solution is designed to foster greater communication, coordination, transparency and knowledge transfer between teams that in turn leads to improved safety and productivity, reduced operational risk and a more empowered and engaged workforce. j5 Operations Management Solutions offers a unique, straightforward digitalization approach with its patented spreadsheet-like configuration environment. This distinctive yet familiar low-code/no-code approach enables personnel to quickly manage changes without requiring expensive and slow vendor and IT services, accelerating operational continuous improvement so your information collection and sharing is always up to date and reflective of your operations. This distinction allows j5 Operations Management Solutions to be a quick-time-to-value investment, with high flexibility and a lower total cost of ownership.

Reinforcing this first step with an industry-leading knowledge management suite aimed at making human performance better through digital tools and connection to the modern process industry solutions used today is critical.

**AcceleratorKMS** is an industry-leading solution that expedites the digital transformation of paper-based, high-risk operational procedures and work processes. However, it also enables organizations to easily manage, govern, and distribute the up-to-date critical operational content field workers require to keep operations running optimally and learn faster. AcceleratorKMS is a purpose-built and industry-leading Knowledge Management System for critical operational content. The digital system includes Procedure Life-cycle Management (PLCM), a Connected Worker Platform (CWP), a Learner Experience Platform (LXP), and a Component Content Management System (CCMS). The combined capability facilitates solutions to many critical problems experienced in workplaces across America and around the World. The system provides an integrated digital content ecosystem in an easy-to-use and intuitive package focused on making the complex simple.

### Proven Business Outcomes

These are quantitative benefits that were reported by surveyed j5 Operations Management Solutions customers in 2020:

- Enhanced situational awareness (30%-50%)
- More accurate shift handovers (30%-50%)
- Increased asset availability (20%-50%)
- Better workforce productivity (20%-50%)
- Improved regulatory compliance (20%-50%)
- Reduced maintenance costs (10%-50%)

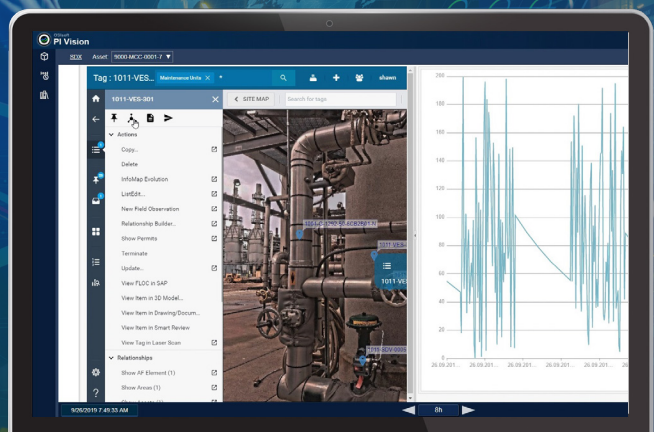
**The implementation of j5 Operations Management Solutions across the water control function has given greater visibility of ongoing issues and given us a consistent and accountable shift handover tool.”**

**- Ant Tyler, Systems Operations Compliance Manager, Thames Water, UK**



**“ To me it’s completely game-changing to have all this information readily available on one screen. This is the first time an end user can go to one place and get all the operations, maintenance, engineering and process data they need to do their duties. By having all this information readily available in a digital twin, I believe this is an industry first for the oil and gas industry, where it has been difficult to monitor remote assets and equipment in dangerous areas.”**

**- Michael Fry, President and CEO, Deepwater Subsea, USA**



## Connect Operational Data **Step 2**

Next, organizations must bridge the islands of crucial information and records in numerous formats on separate systems and digitally connect them to operational processes, procedures, permits and data to help reduce operational risk, increase efficiency, decrease downtime, remove value leaks and meet internal and external compliance. With PAS AlarmManagement™ you can easily implement industry-wide best practices to streamline and improve your alarm systems and operator effectiveness. PAS ControlWizard™ and PAS TuneWizard™ work together to monitor, assess and tune your control loops to ensure optimal performance, robust control, and improve overall safety and reliability. PAS InBound® helps you create a master database of operational limits. With it, you can ensure alignment across all your sources of record and analyze your performance against those limits. PAS IPL Assurance® provides visibility into your Independent Protection Layers (IPL), making it easier to assure your operations are safe to run. And the PAS Solution portfolio are interoperable with j5 Operations Management Solutions. Adding further value to organizations investing in a digital transformation roadmap guided by Hexagon. Companies can further enhance information connection and interoperability by aggregating operational data and enabling a digital thread framework with **HxGN SDx®**. This central asset lifecycle information management (ALIM) solution is strategically designed to capture, organize and link large volumes of information, in context and provides web-based access to your authorized personnel. Available as an on-premise or SaaS solution, it can be adopted by any facility without introducing new software or investments in IT infrastructure. HxGN SDx is a **CFIHOS**-compliant, ALIM digital platform that centralizes and unites operations, maintenance, safety, engineering and real-time data. HxGN SDx can be connected to Hexagon technology such as j5 Operations Management Solutions and third-party industrial data sources such as Aspen InfoPlus.21®, IBM Maximo®, SAP® Plant Maintenance (PM) and the OSIsoft™ PI System™ to provide a consolidated, role and context relevant view of information.

### Proven Business Outcomes

#### Contact Energy (New Zealand)

**60%** alarm rate improvements by adjusting alarm setpoints, deadbands, delay times and improving control logic and **65%** reduction in long-standing “stale” alarms, contributing to improvement of operators’ alarm-related workload

#### Deepwater Subsea (USA)

**70%** productivity savings in documentation and completion of inspections and **95%** saving in time retrieving and searching for quality evidence post inspection



### Step 3 Protect Your Digital Investments

On the journey to digital maturity, keeping your operations running safely, smoothly and protected from cyber threats is vital to prevent unnecessary interruption to your enterprise. There are no shortages of reports or news outlets raising the alarm on cybersecurity awareness. In fact, the ARC Advisory Group<sup>1</sup> (2019) reported that “many industrial operations remain at risk of costly, disruptive cyber incidents.” Its analysts recommended that “all industrial companies consider software like **PAS Cyber Integrity™** as a foundational element of a defense-in-depth cybersecurity strategy.” This solution also provides numerous significant customer benefits such as: discovers and automatically maintains a complete inventory of OT assets inventory and enables workflows and documentation for vulnerability remediations and compliance with ISA/IEC 62443, ISO 27001/2, NERC-CIP,<sup>2</sup> NIST and the NIS Directive, as well as other standards and regulations, accelerating recovery with backups of critical control system data and supporting in-depth forensic analysis. ARC Advisory Group also noted that the solution’s capabilities support execution of critical tasks in the “Secure Systems” and “Incident Management” processes identified in its “Industrial/OT Cybersecurity Maturity Model.” This includes functionality for developing and maintaining asset inventories, identifying, evaluating and managing system vulnerabilities, detecting and managing unexpected system changes and analyzing and visualizing system security risks.

#### Proven Business Outcomes

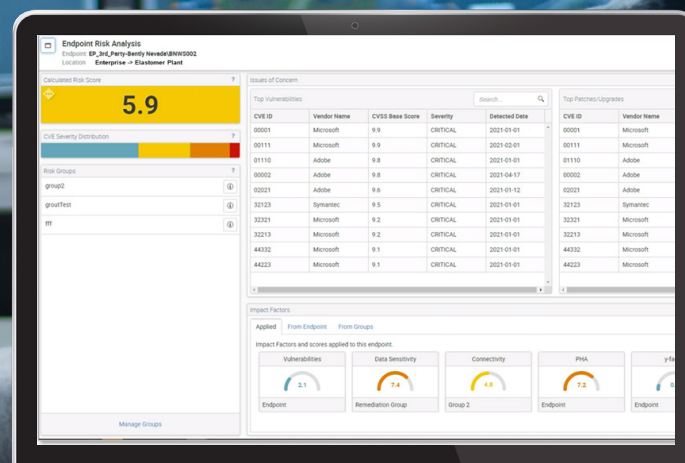
- Speeds time to recovery from major events, cyber incidents, and unplanned outages
- Reduces inventory and documentation effort by **70%** or more
- Improves productivity by **20%** to **50%** via always-on change management insight into OT/ICS configurations

<sup>1</sup> ARC Advisory Group, “PAS Global Cyber Integrity Helps Secure Industrial Control Systems”


<sup>2</sup> NERC, “CIP Standards”

“In industrial facilities, you typically find an array of proprietary ICS that are difficult to inventory, which subsequently makes monitoring for change and vulnerabilities a security challenge. As these systems have direct authority over process safety and production, there is unaddressed cybersecurity risk within a facility environment. Hexagon has architected its software to cover these systems, and its customers have testified to Hexagon’s effectiveness in reducing security risk.”

- Vikrant Gandhi, Industry Director, Frost & Sullivan, USA







“ Digital twins are becoming a business imperative, covering the entire lifecycle of an asset or process, and forming the foundation for connected products and services. Companies that fail to respond will be left behind.”

- Thomas Kaiser, Senior Vice President of IoT, SAP

## End Goal Build, Maintain and Evolve a Digital Twin

A **digital twin** enables asset owners and operators to build and maintain an information management data ecosystem throughout the asset lifecycle, allowing for a continuous journey of operational excellence. By deploying a comprehensive digital twin, complex data can be analyzed and transformed into actionable information. The significance of this ultimate digital platform is that it opens the door to the competitive advantages made possible by using predictive and prescriptive analytics, artificial intelligence (AI), machine learning and automated decision making across the mining value chain. As mentioned in an article published by Forbes (2017),<sup>12</sup> digital twin technology helps companies improve the customer experience by better understanding customer needs, develop enhancements to existing products, operations and services and can even help drive the innovation of new business. **Hexagon's Situational Awareness solution** — powered by **Luciad** — boosts your operations and empowers your workforce by delivering to them a valuable, data-driven experience that encapsulates easily consumable, timely information regarding past events (what's happened), present facts (what's happening now) and future predictions (what could happen/what should happen/what's scheduled to happen). Therefore, seamlessly connecting your safety-critical operations processes, procedures and permits, alarm management methodology, maintenance work orders, real-time and historical process data, engineering schematics and technical documentation with 3D models, laser scans and cybersecurity safeguards enables a robust and comprehensive digital twin for your entire operation.



<sup>12</sup> Forbes, "What Is Digital Twin Technology - And Why Is It So Important?"



## Connect

A digital twin is a dynamic digital depiction comprised of physical entity information. It is the single version of the truth unique to a user's perspective for a point in the lifecycle with many digital levels.



## Think

Data is diffused seamlessly between the digital depiction and physical entity to enable co-existence. Then advanced technologies bring data, algorithms and context together.



## Do

With this comes understanding, prediction and optimization for the physical entity to drive improved business outcomes.

## About HxGN SDx

HxGN SDx is a modular, on-premise or SaaS ALIM solution that digitally transforms facilities and allows companies to build a digital twin to optimize efficiency, reliability, predictability and safety across the lifecycle of an asset.

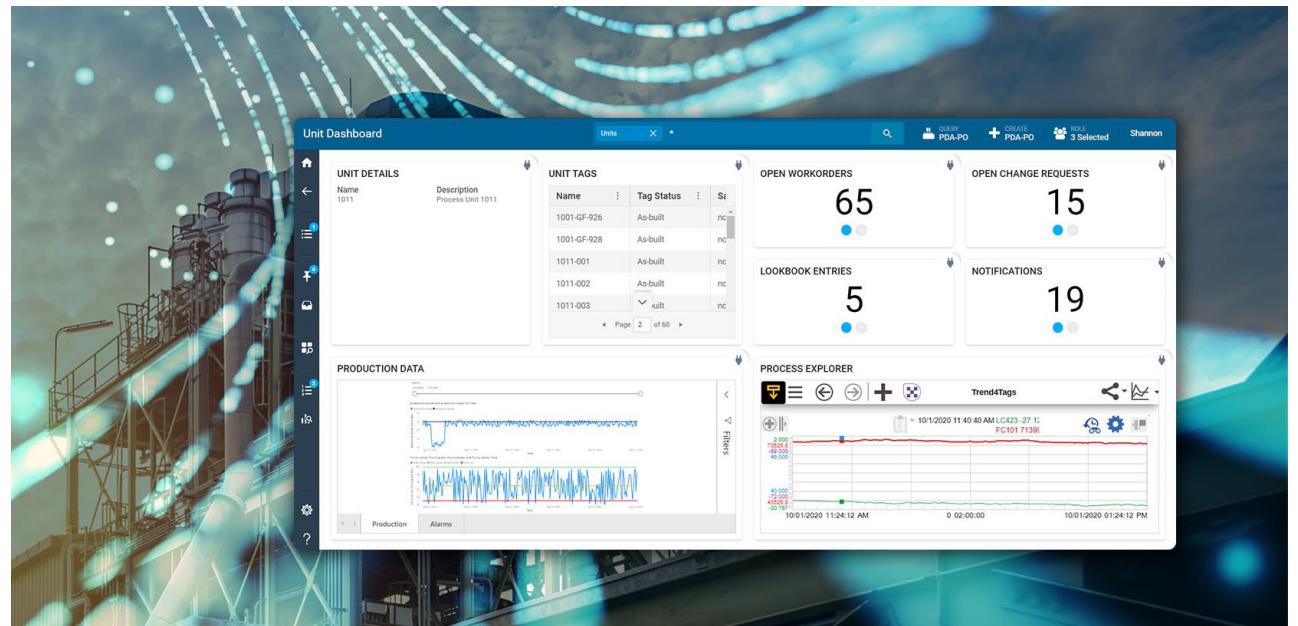
HxGN SDx is comprised of two independent, yet integrated modules that address the major asset lifecycle stages of an industrial facility. Each module provides work processes, roles and content tailored to address a specific phase of the asset lifecycle. Each module also includes a comprehensive set of capabilities with additional options that can be licensed as needed:

### HxGN SDx Projects

Enables better projects planning and review, ensuring effective information aggregation and collaborative project execution, improving project efficiency and reducing risk.

### HxGN SDx Operations

Increases operations and maintenance efficiency, safety and internal and external regulatory compliance through templated work processes and manages change and interoperability with other industrial systems of record.





# Achieve Operational Excellence in Mining

## Employee Safety and Fatality Prevention: Risk Mitigation and Workforce Accountability

Digitalizing and automating operational processes such as area and shift handovers, permitting and inspections enables an additional level of situation data to be collected and insights into workforce compliance and efficiency. These new insights help close operational gaps that create safety risks and help improve your operations to save time and money.

## Employee Safety and Fatality Prevention: Meet Compliance

When you need clear, concise and current records for local, state or federal regulatory compliance requests and procedures, having your data locked in a physical paper trail to can lead to unnecessary delays and misinformation. Digital records allow you to instantaneously deliver accurate, current and complete information to internal and external regulators.

## Workforce Productivity: Decrease Operating Expenses (OpEx)

Optimized assets, reduced downtime, enhanced productivity and better safety compliance all contribute to lower OpEx and higher profitability. Technology is now allowing a larger percentage of an operational workforce to work remotely, which has been shown to increase employee engagement and happiness while reducing hazard exposure hours.

## Workforce Productivity: Save Time

From the office to the field, personnel can save hours each day with digital access to the right information at the right time. Instead of spending precious time sorting through paper documents or multiple systems to track, access and manage vital operational information your personnel can put your data and their skills to work optimizing and improving operations.

## Asset Productivity: Increase Efficiency

Empower your workforce to make informed decisions in real-time with the information they need, when they need it and where they need it — via desktop, laptop or mobile devices. With digitalize processes, the information you need is always on hand, there's no need to search for paperwork from a previous shift or interrupt a co-worker who's on break or on vacation.

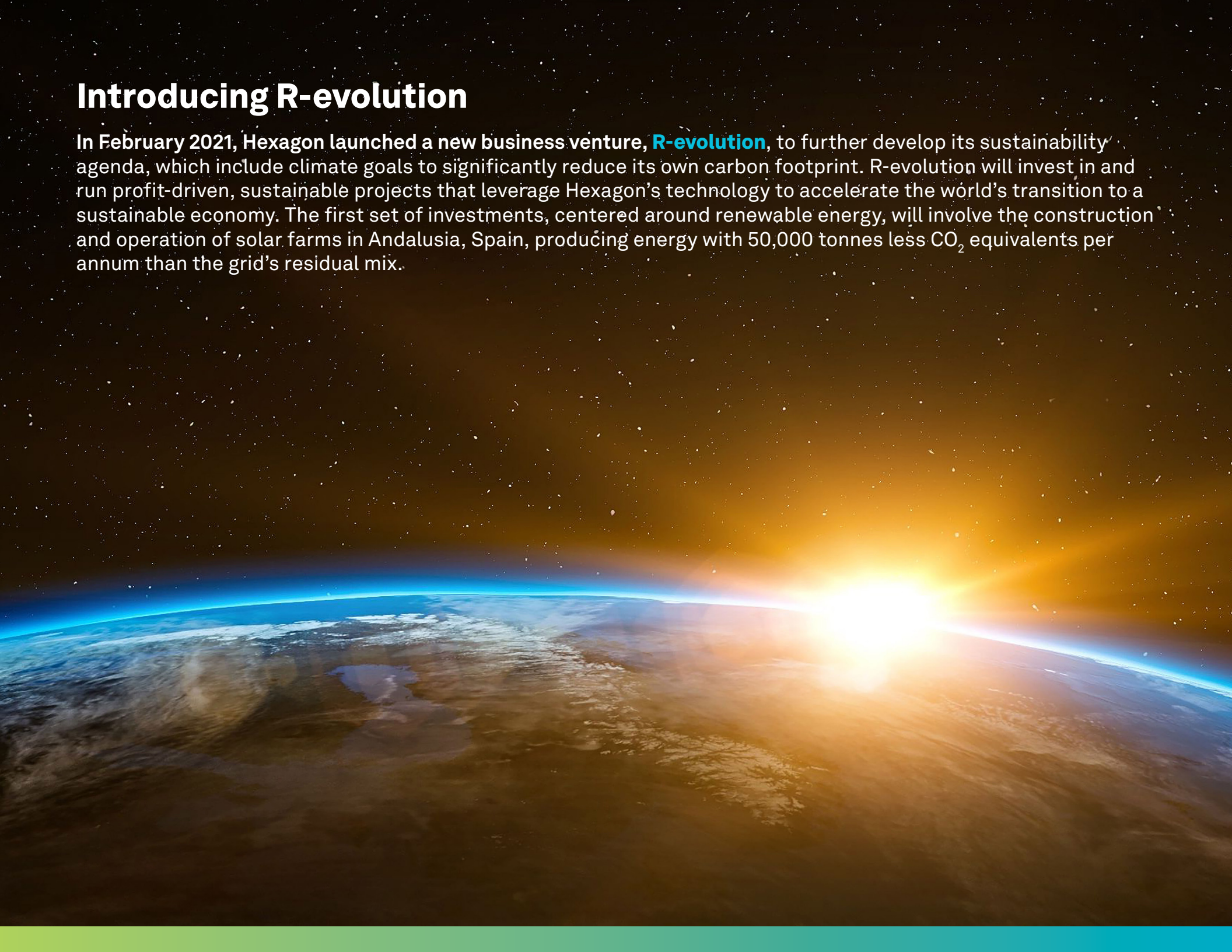
## Asset Productivity: Reduce Operational Risk

Workforce safety is improved when you reduce the chances of human error due to reliance on physical paper, especially when it comes to equipment inspections and shift handovers. Digitalizing these processes ensures the right equipment and readings are inspected at the right time and assists employees to quickly highlight when equipment is operating out of its specified ranges.



# Introducing R-evolution

In February 2021, Hexagon launched a new business venture, **R-evolution**, to further develop its sustainability agenda, which include climate goals to significantly reduce its own carbon footprint. R-evolution will invest in and run profit-driven, sustainable projects that leverage Hexagon's technology to accelerate the world's transition to a sustainable economy. The first set of investments, centered around renewable energy, will involve the construction and operation of solar farms in Andalusia, Spain, producing energy with 50,000 tonnes less CO<sub>2</sub> equivalents per annum than the grid's residual mix.





# Working With a Trusted Digital Transformation Partner

As **YOUR** trusted digital transformation partner, we provide evolving solutions that allow people to design, engineer, construct, operate and maintain industrial assets with state-of-the-art technology backed by a team of global experts and research. Together, we are co-creators of the smart solutions that improve today, work tomorrow and empower adaptive change. Putting data to work — to boost safety, efficiency, productivity and quality outcomes — are values we share with you.



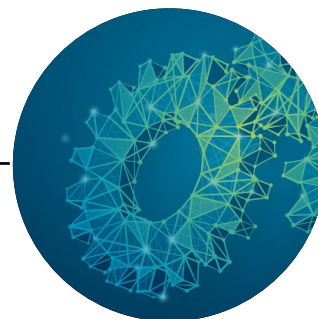
## **Our focus is on autonomy**

Leveraging data to its fullest potential is the outcome we want – **moving beyond automation to autonomy**



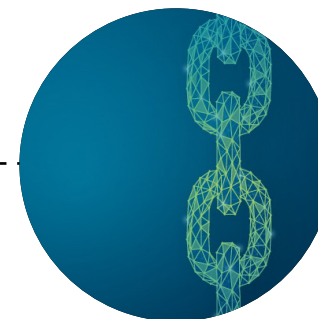
## **Our commitment is to innovation**

With **nearly 4,000 employees in R&D and more than 3,700 active patents** our technology leadership is clear



## **Our value is strategically vital**

**Efficiency, productivity and quality** results in scalable sustainability – fewer resources, less waste, less pollution



## **Our stability is consistently proven**

Sales growth from €500 million in 2000 to **€4.3 billion** in 2021 with **approximately 20,000 employees across 50 countries**



## About Hexagon's PPM Division

Hexagon's PPM division is the leading global provider of enterprise engineering software, enabling smarter design and operation of plants, ships and offshore facilities. With 50+ years of experience in delivering innovative industrial software, Hexagon solutions transform unorganized data into intelligent, actionable information that enables smarter design, construction and operation of industrial projects across the asset lifecycle.

## Revenue Distribution

34%

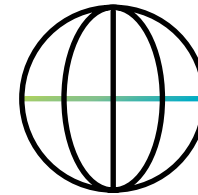
37%

29%



### Awarded Solutions Provider

**Ranked No. 1** over 13 consecutive years, across **5 different categories**, recognized in 2019 by ARC Advisory Group



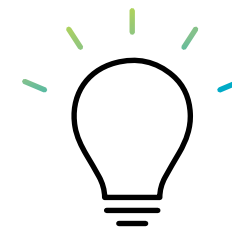
### Global Presence

More than **4,000 employees**, with offices in **50 countries**



### R&D Focused

More than **19%** of total revenue invested in 2021



### Innovative

More than **40 registered patents** around the world



## About Hexagon

Hexagon is a global leader in digital reality solutions, combining sensor, software and autonomous technologies. We are putting data to work to boost efficiency, productivity, quality and safety across industrial, manufacturing, infrastructure, public sector, and mobility applications.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build, and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 22,000 employees in 50 countries and net sales of approximately 4.3bn EUR. Learn more at [hexagon.com](https://hexagon.com) and follow us @HexagonAB.

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