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THE CLOUD IMPERATIVE FOR MINING

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Executive Summary

The mining industry has envisioned a future where business, human and environmental interests are not competing priorities, but complementary strengths: a "Triple Zero" future of zero harm, zero loss and zero waste. In this Triple Zero future, where zero harm is lived out day-to-day, the health and well-being of the workforce acts as a fulcrum for sustainable business operations. Zero loss focuses on leveraging a manufacturing mindset and continuously identifying losses and leakages in operational processes. Zero waste is centered on approaching business through a circular economy model.

Realizing this future is not easy. It calls for digital technologies—including artificial intelligence (AI), analytics, connected supply chains, IoT

and more—and central to successfully utilizing these technologies is cloud computing. The cloud is not new. It has long heralded lower costs, greater elasticity and innovation for organizations. And approximately 85 percent of mining and metals companies have adopted cloud in some form¹. But most stopped short of embracing the full promise of cloud technology to accelerate business strategy and drive digital transformation. Then the COVID-19 pandemic hit, and suddenly, cloud has a clear and important role to play as companies work to outmaneuver uncertainty.



Industry Context

If "business as usual" ever existed in the mining industry, those days are gone. Significant disruptions in logistics, supply chains, operations and more—COVID-19 is reshaping the landscape. This is in addition to wellknown industry challenges, including volatile commodity prices, fast-changing international trade relations and compliance with new environmental and safety regulations. A robust technology backbone enabled by cloud capabilities can help address these challenges. Cloud helps make new ways of working possible—from automated video analytics to pre-empt accidents, to optimizing processes intelligently through digital twins or smart sensors and integrated planning (Figure 1).

Figure 1. Visualizing a Triple Zero Future for Mining through Digital-, Edge- and Cloud-enabled Capabilities.

	Core/Native Cloud	Data	Edge				
Safe, Sustainable Operations	Smart wearables for alerts, fatigue and health monitoring Intelligent Tailings Management Video analytics-based surveillance	Waste and Emission control analytics Al-powered detection of potential structural failures (cavity formation)					
ۂ. Constant Coperations	AI-powered Decision Support Digital twin-based simulations Unified IoT with role-based visualizations Demand Sensing & Integrated Planning Autonomous Operations	Predictive Asset Maintenance Smart Stockyard Management Energy Optimization Analytics					
Intelligent Enterprise	EXEMPTE Operations Center E2E Customer Engagement Sales Force Automation Mobile Sales (B2B) Finance as a Value Architect Digital HR and Talent Management	Capital Project Analytics					
	Digital Supplier Collaboration Pricing Intelligence	Smart Warehouse Man	agement				
Digital Supply Chain	Autonomous Rail and Port Operations Connected Fleet – Logistics track and trace Supply Chain Control Tower						
Connected	Contractor Tracking Mobile-based solutions for inspections, remote data access AR/VR-based operator trainings						
WORKIOICE	Remote assistance, visualizations using immersive technologies						
	Zero Harm Zero Loss	Zero Waste					

Cloud will no Longer be an Option, but a Necessity

Path Forward

The new ways of working in a digital world rest on fit-for-purpose cloud instances and applications that can unlock latent value and secure the greatest benefits from these investments.

A smartly deployed cloud can host a combination of digital technologies, giving enterprises and workers full visibility across their mining operations on demand and laying a foundation for analytics, artificial intelligence (AI) and machine learning (ML) (Figure 2). This can translate into cost savings of approximately 3 to 5 percent in operating costs (for a midsized miner), realized from data harmonization, improved on-time decision making, optimized inventory and workforce allocations at a tactical level. Real-time device data (from IoTs, sensors) is aggregated with context data (IT) and applied to industry-specific analytical models to determine actionable insights. This increased visibility helps achieve better production throughput, asset utilization and operator performance.

Figure 2. Cloud-Based IOT Platform Enabling Operational Intelligence and Visibility Across Mining Processes



State of Cloud in Mining Today

According to Accenture research, the mining industry is still in the early stages of cloud adoption relative to peers². Today, the industry utilizes cloud largely for support and enablement functions like shared services. But the COVID-19 pandemic has created a sense of urgency to leverage cloud to cover business critical processes.

The move to hybrid cloud models like Platform as a Service/Software as a Service (PaaS/SaaS) will be prominent across processes like health, safety and environment (HSE), supply chain, manufacturing execution systems (MES) and legacy plant and operational systems. Adoption of cloud PaaS, SaaS and IaaS (Infrastructure as a Service) is all roughly the same at around 85 percent. And more than three-quarters are investing in cloud technologies at least annually³.

Some mining industry leaders are already on an accelerated cloud journey.

A leading global miner has started to utilize cloud and robotics to disrupt existing workings and innovate new ways for maintenance operations in order to maintain competitive advantage. Others like Freeport-McMoRan⁴ are building cloudbased IoT platforms to perform analytics real-time, while a global steel major is deploying cloud-based services for data, enterprise applications and infrastructure management.

A carefully orchestrated cloud adoption strategy is critical to attaining all of cloud's benefits. For example, a typical journey for most miners running SAP would involve building out the foundation of an intelligent enterprise in three steps: migrate SAP ECC to public cloud; migrate SAP ECC to S/4 HANA; and apply industry templates followed by implementation of automation initiatives. This transformation path offers additional value benefits—a flexible, operational excellence-based, low-risk approach for data conversion and simplified greenfield implementation of new industry template processes and SAP SaaS solutions like Ariba and SuccessFactors. With initiatives like SAP HEC 2.0 gaining ground, more miners are looking to execute cloudbased digital transformation programs on their legacy SAP environments.

 $^{\rm 2}$ Accenture Future Systems report – Mining and Metals results $^{\rm 3}$ Ibid

⁴ Connected Mine solution delivered by Accenture

Value Case for Cloud Now

The mining industry has begun to realize that cloud is not restricted to cost optimization but also can drive business agility and innovation. As per our analysis for an average mining company with \$40 billion revenue, a holistic digital transformation program—with key building blocks enabled through cloud—can generate incremental value, from cost savings and revenue gains, of up to 15 to 20 percent of total IT spend over the investment period.

Cloud-enabled technologies can help to:

- Create throughput improvement of up to 5 percent with increased revenue per ton by almost 2 percent via data aggregation, virtualization of roles and responsibilities, and scaling AI/ML services for operational decision making.
- Increase productivity by 10 percent while reducing lifecycle overheads by almost 75 percent via the use of virtual assistants and collaborative platforms rendered through mixed reality (augmented reality/virtual reality).
- Reduce logistics costs by up to 12 percent while improving key performance indicators like On Time, In Full (OTIF) by approximately 10 percent and fleet load factor by over 30 percent via a digital supply chain. Achieving 'On Time' in full delivery will also ensure that

we need sales commitments of time and quality. Generate new insights and build market intelligence capabilities through integration and exchange data with new commodity trading platforms to optimize trading decisions; e.g. achieving the right price premiums for spot contracts leading to a revenue uplift.

- Lower Lost Time Injury Frequency Rate (LTIFR) by up to 10 percent, reduce nearmiss incidents by more than 80 percent and reduce emissions via accelerated cloud adoption across shop floors.
- Help achieve sustainability goals and enable circularity in the value chain via automated intelligence and cost modelling of emissions, as well as emerging technologies (like IoT, sensors and edge devices) which run on a cloud environment.
- Ensure sustainable maintenance and assess technical compatibility for future cloud deployment through application modernization. The technology roadmap for this modernization can be achieved through a thorough and rational analysis of the application landscape.



Why Now?

While standard functionalities can be achieved by existing on-premises data center and servers, there are disadvantages to this approach. For example, an onpremises data center requires a significant investment in infrastructure and capital costs. In contrast, cloud services provide flexible subscription models. With an onpremises approach, both responsibility and accountability for maintenance of data security and recovery are in-house, resulting in higher overhead for non-core activities like technical support.

Furthermore, growth in data volume is expected to dramatically increase. To continuously run a single use case like predictive asset maintenance, for example, terabytes (TBs) of data processing and computation power—which is expensive to sustain in the long term—will be required. Additionally, on-premises integration efforts are significantly more complex than an integration architecture that is cloud enabled.

Cloud adoption makes data analytics scalable, easier and allows for a geographic distribution of infrastructure and applications for fault tolerance and business continuity. The ability to duplicate and bring to life virtual operations, with a few clicks, to remote locations and users, ensuring smooth operational continuity is more important than ever.

Moving to Action

One size does not fit all

Moving to the cloud is not a technology decision alone. It is guided by business priorities and expectations and driven by technology enterprise architecture guardrails.

Choosing the right cloud deployment model (private, public or hybrid) is vital. While private clouds provide security, privacy and high-computation requirements, they come with higher costs for implementation and maintenance. A public cloud is recommended for lowering costs, simplifying business processes and for small- to medium-scale enterprises. However, both sensitive data and control and management of the data and technology infrastructure might not be within the bounds of the enterprise. A hybrid cloud can offset some of the costs but introduces higher maintenance complexities and responsibilities on the hosting provider.

A hybrid approach, with private clouds for fixed workloads and public clouds for elastic workloads, allows continuance of on-premises systems and data centers to derive value from fixed investments while allowing flexibility for services that require varied performance at scale. A data center estate typically hosts thousands of applications which may need to be refactored and rehosted in a distributed manner combing private and public deployments, depending on the pattern of consumption of its data and services. See Figure 3 for an illustrative approach to designing cloud consumption services for a mining company.

Consumption of Cloud

Customer • S and Market Insights	Social Media Analysis	 Custor and Le Manag 	mer ead jement	Cai Ma	mpaign nagement	Bid and Auction Management	Systems of Insight/ Intelligence	Systems of Trust	Infrastructure	
Employee, Assets, Customer Collaboration Platforms		Remote Operation Centers	•	Supply Chain OC Control Tower		Connected ● Worker	Analytics • and Visualization	Identify and Access Management	Networking •	
Enterprise Integration		Data Manageme	ent	API Se API Ma	ecure Integratio anager	on –	Data Storage/ Ingestion/ Acquisition/ Orchestration/	Information Protection/ Encryption	Devices •	
Enterprise Strategy and Performance Management	Enterprise Strategy and Performance Management	 Hun Res Mar 	nan ources nagement	Finance and Accour	e 🔹	Business Process Lifecycle	Enterprise Risk Management	Abstraction Big Data/ Edge	Protection • Services	Storage (Servers/Cloud
		Proo and War	curement ● rehousing	Sales a Operat Plannin	ind tions ng	Projects and Engineering	R&D and ● Plan	Computing Artificial Intelligence/	Firewalls •	IOT Platforms
Reserve Modeling and Reconciliation	 Mine Plan Syst 	e • nning tems	Mine Operat Manage System	ions ement	Production Management	SCDA/ DCS/ Historians/ Sensors/GIS-	Machine Learning Automation/	Secure	Mobility	
Asset Management Systems	 Sup Mar Syst 	pply Chain● nagement tems	Energy Manage	ement	Quality Management	GPS Data HSEC Systems	Extended • Reality	Compliance	Blockchain ●	
	Customer Image: Second sec	Customer and Market InsightsSocial Media AnalysisEmployee, Assets, Customer Collaboration Platforms•Enterprise Integration•Enterprise Strategy and Performance Management•Reserve Modeling and Reconciliation•Reserve Modeling and Reconciliation•Asset Management Systems•	Customer and Market InsightsSocial Media AnalysisCuston and Le ManageEmployee, Assets, Customer Collaboration PlatformsRemote Operation CentersManageEnterprise IntegrationData ManagementManagementEnterprise Strategy and Performance ManagementData ManagementProcurement • and WarehousingReserve Modeling and ReconciliationMine Planning SystemsMine Planning SystemsAsset Management SystemsSupply Chain • Management SystemsSupply Chain • Management	Customer Social Customer and Market Media Analysis Customer Employee, Analysis Remote Operation Collaboration Platforms Data Management Enterprise Data Management Integration Data Management Enterprise Data Management Enterprise Management Finance Strategy and Performance Management Sales a Management Procurement on and Sales a Operation Reserve Modeling and Systems Mine Operation Asset Management Supply Chain (Systems) Energy	Customer and Market Insights Social • Customer and Lead Malysis Ca and Lead Management Ma Employee, Assets, Customer Collaboration Platforms • Remote Operation Centers • Supply Contro Centers • Supply Contro Enterprise Integration Data Management • API Se API M Enterprise Integration • Human Resources Management Finance and Accounts • API Se API M Enterprise Strategy and Performance Management • Human Resources Management Finance and Accounts • API Se Accounts Reserve Modeling and Reconciliation • Mine Planning Systems • Sales and Operations Management Systems • Mine Operations Management Systems	Customer Social Customer Campaign Analysis Management Management Management Employee, Analysis Remote Operation Control Tower Collaboration Platforms Data API Secure Integration Enterprise Data API Secure Integration Integration Data API Manager Enterprise Data API Manager Enterprise Data API Manager Enterprise Procurement Sales and Process Strategy and Procurement and Sales and Operations Projects and Reserve Mine Planning Systems Production Reset Supply Chain Systems Quality Asset Supply Chain Energy Quality Management Systems Energy Quality	Customer and Market InsightsSocial Media AnalysisCustomer and Lead ManagementCampaign ManagementBid and Auction ManagementEmployee, Asset, Customer Collaboration PlatformsRemote Operation CentersSupply Chain Control TowerConnected WorkerEnterprise IntegrationData ManagementAPI Secure Integration - API ManagerConnected WorkerEnterprise IntegrationData ManagementAPI Secure Integration - API ManagerEnterprise Resources ManagementEnterprise ManagementEnterprise Strategy and Performance ManagementHuman Resources ManagementFinance and AccountsBusiness Process LifecycleEnterprise Risk ManagementReserve Modeling and ReconciliationMine PlanningSales and Operations PlanningProduction ManagementSCDA/ DCS/ Historians/ Sensors/GIS- GPS DataAsset Management SystemsSupply Chain Management SystemsEnergy ManagementQuality ManagementHSEC Systems	Customer and Market InsightsSocial AnalysisCustomer and Lead ManagementCampaign ManagementBid and Auction ManagementDystems of Hauction ManagementEmployee, Assets, Customer Collaboration PlatformsRemote Operation CentersSupply Chain Control TowerConnected WorkerAnalytics and VisualizationAnalytics and VisualizationEnterprise IntegrationData ManagementAPI Secure Integration - API ManagerConnected WorkerManalytics and VisualizationEnterprise IntegrationData ManagementAPI Secure Integration - API ManagerData Storage/ Ingestion/ AccountsBusiness Process LifecycleEnterprise Risk ManagementData Storage/ Ingestion/ Acquisition/ Ochestration/ AbstractionReserve Modeling and ReconciliationMine PlanningProduction SystemsSCDA/ Dispiner ManagementBig Data/ PlanReserve Modeling and ResonciliationSupply Chain ManagementMine SystemsProduction ManagementSCDA/ ManagementAutomation/ Automation/ SystemsAsset Management SystemsSupply Chain ManagementEnergy ManagementQuality ManagementHSEC Systems	Customer Social Customer Customer Management Management Aud warket Management <	

The journey to the cloud will differ for each mining company depending on its existing technology architecture and maturity state in modernization—a single cloud journey or transformation roadmap may not fit all.



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