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## Mining at a Crossroads

IDC White Paper

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## Introduction

In this White Paper, IDC Energy Insights will provide an assessment of how the global and local trends impacting organisations within the mining industry are affecting the outlook of miners for ICT investments and programme. Productivity, efficiency, and process transformation are the critical focus areas that miners have, and these will create opportunities for IT vendors to help their customers frame the journey they need to take. Miners, large and small, must tackle the challenges associated with the enormous change this will mean within their businesses in order to achieve the efficiency improvements that are possible. Leading miners and organisations in many other industries have already demonstrated the potential that exists; the mining sector must look forward and prepare for a future very different from the last ten years.

# 02

## Situation Overview

### Trends in the Global and South African Mining Industry.

The mining industry is facing very serious challenges. Although there are local variations, the issues facing companies operating in Asia, Africa, Europe, and the Americas are similar. The sector, led by iron ore, has just emerged from a sustained price boom that has continued for the last ten years. This has effectively masked other very serious issues that have been developing for some time, such as declining labour productivity, declining operational efficiency, increasing challenges and costs in reaching ore bodies, and increasing challenges in accessing capital for new projects and other investments. These issues in combination, and other more localised challenges, are presenting some serious operational problems for miners operating all over the world. Figure 1 illustrates the movement in key commodity prices over the past eight years.

Commodity prices are driven by macroeconomic supply and demand factors played out globally, in particular the overall slowdown in global economic growth, economic growth in

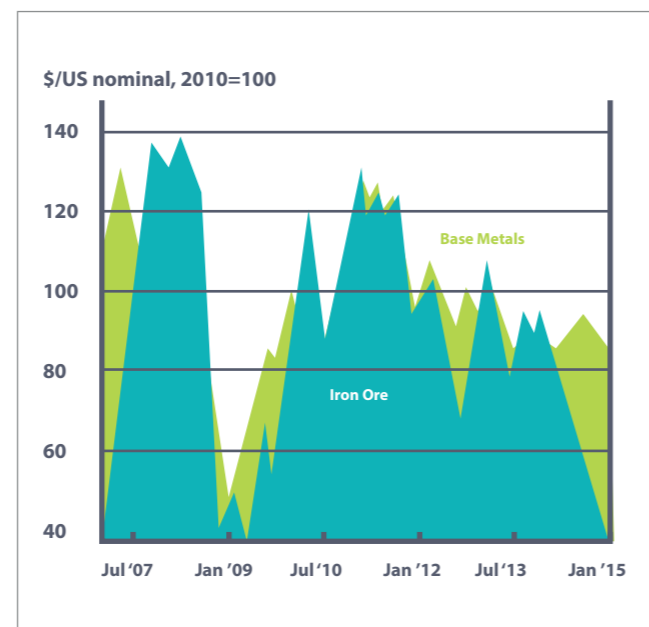
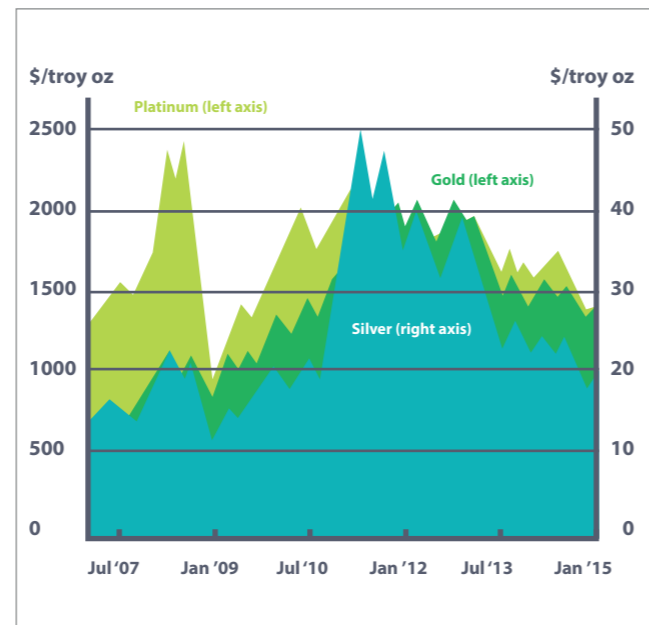


Figure 1 Commodity Prices 2007 to 2015  
Source: The World Bank, 2015

China and other developing nations. On the supply side, increases in international production and supply, have a very significant impact on resulting commodity prices. Mining companies are commodity price takers; they have very little ability to influence global commodity prices or the revenue their activities generate, they do, however, have some control over their operating costs. The costs miners face are very often driven by local and national factors, local taxes, local employment challenges, local operational risk factors, and factors relating to the operational structure of the mine. Local variations to one side, mining companies operating in different countries globally are experiencing a very similar set of challenges as the physical nature of mining operations become much more difficult. Falling commodity prices have exposed the extent of operational challenges that some miners have and these are now receiving a focus of increasing urgency. South African mining is particularly cost pressured, for example in 2011 the average cash cost in the tier 1 gold miners in South Africa was US\$862/0z, making this the highest-cost gold operations globally. The platinum industry is also facing serious cost challenges with many of the existing platinum mines being very deep, very labour intensive, and very costly.

The two biggest issues challenging miners in almost all geographical locations are labour productivity and increasing labour costs and the increasing difficulties of extracting materials for sale.

Labour costs - Although different markets have different issues, what is common across markets internationally is that labour productivity in the mining industry has been falling sharply and labour costs are increasing. Among the top mining companies reported headcount grew by 2% in 2012 and average employee costs grew by 13%. In Australia and in Chile, for example, mining employees earn twice the average wage of the rest of the economy. Australian mining, particularly, has serious challenges with declining labour productivity and increasing labour costs; Australia's average mining wage is US\$122,000, more than double that of the United States.

Difficulties in accessing ore bodies - Declining ore grades and the increasing depth of mines are driving growth in operational costs by making the operation of mines more difficult. As ore grades decline, more ore must be processed to get the same quantity of metal. For example in the mid 1800s copper grades were around 10% in Australia and 8% in Canada, and now some ore grades are less than 1% and are forecast to drop further. This has a big impact on the level of activity required to mine the same quantity of metal. Similarly, as miners seek to take advantage of existing mine operational investments and go deeper at a particular mine site, extraction costs become more expensive and operations more complicated.

### Implications of Shifting Economics in the Mining Sector

The shifting economics of the mining sector have sharply changed the outlook for mining companies across most



commodity classes and their priorities going forward. Miners are taking steps to reoptimise their organisations for cost management rather than to maximum production at any cost. These internal changes are difficult and painful, and the industry is rife with announcements from miners large and small of planned shutdowns, discontinued investments, and substantial workforce reductions. Regardless of location, mining companies are faced with the same questions — how to reduce operational costs, which operations to exit from, and how to dramatically improve operational efficiency and improve productivity. Further driving cost management and efficiency, as commodity prices have fallen, so too have the market capitalisation of most mining companies, this is dramatically impacting the ability of miners to access capital as the willingness of investors to take risk in the mining sector has dropped sharply. In its analysis of the top business risks facing the metals and mining sector in 2013–2014 Ernst and Young ranked capital allocation and capital access as the top risk factor faced by mining and metals companies.

Mining companies are looking to a future that is quite clearly no longer about driving investment to take advantage of historically high prices, but about creating competitive advantage through more efficient and productive operations. Most of the large diversified global miners had a change in leadership over the last 18 months or so to leaders known for and focused on efficiency, savings and tight capital management. Across the sector, miners are looking at new approaches that can be used to support these changes. Technology is just part of this, but it will be an increasingly important part of the process transformation, automation and modernisation that will take place over the next 10 years. Those miners that are successful in doing this will be better protected against market turbulence, and in the strongest position to take advantage of the next cycle when commodity prices increase again.

# 03

## Future Outlook

The Requirement for Optimisation in the Mining Sector Technology has a very big part to play in enabling miners to change their approaches and create operations that are optimised for efficiency rather than maximising production at any costs. Leaders from large diversified global miners, for example Rio Tinto, BHP, and Anglo American, recognise this and have taken steps to progress the technology innovation-led transformation their organisations need to undertake to varying degrees. Some progress has been made across the sector, but for most this is an extremely challenging journey. It will involve very significant internal change, realignment of the type of skills required and an enormous amount of leadership. Mark Cutifani, CEO of Anglo American has been one of the most vocal in his analysis of the mining sector's need to raise its game and recognise that it is many years — possibly 20 to 30 years — behind other industries in terms of productivity and business practices. Many mining companies are now looking at the experiences and approaches of leading manufacturing and oil and gas companies particularly as they seek to create competitive advantage in their own organisations through applying those approaches in the mining context.

The mining sector is a relative laggard when looking at its ICT spending as a function of total company revenues. It is a long way behind industries like banking and telecommunications that have intensively applied technology to automate deep within their backend processes and customer channels. The years of the commodity price boom saw strong growth in technology investment in mining compared to other sectors even if off a low base. For example, in Australia the resources sector led by mining has been the highest growth industry for the last few years. Mining has looked to ICT technology as an increasingly important operational enabler, but technology spending within the mining sector is still relatively small compared to other industrialized sectors and more focused on getting the foundations right. Looking globally, technology investments have been particularly focused on communications networking and services, putting consistent ERP systems in place and ensuring consistency across technologies deployed and particularly software across different mine

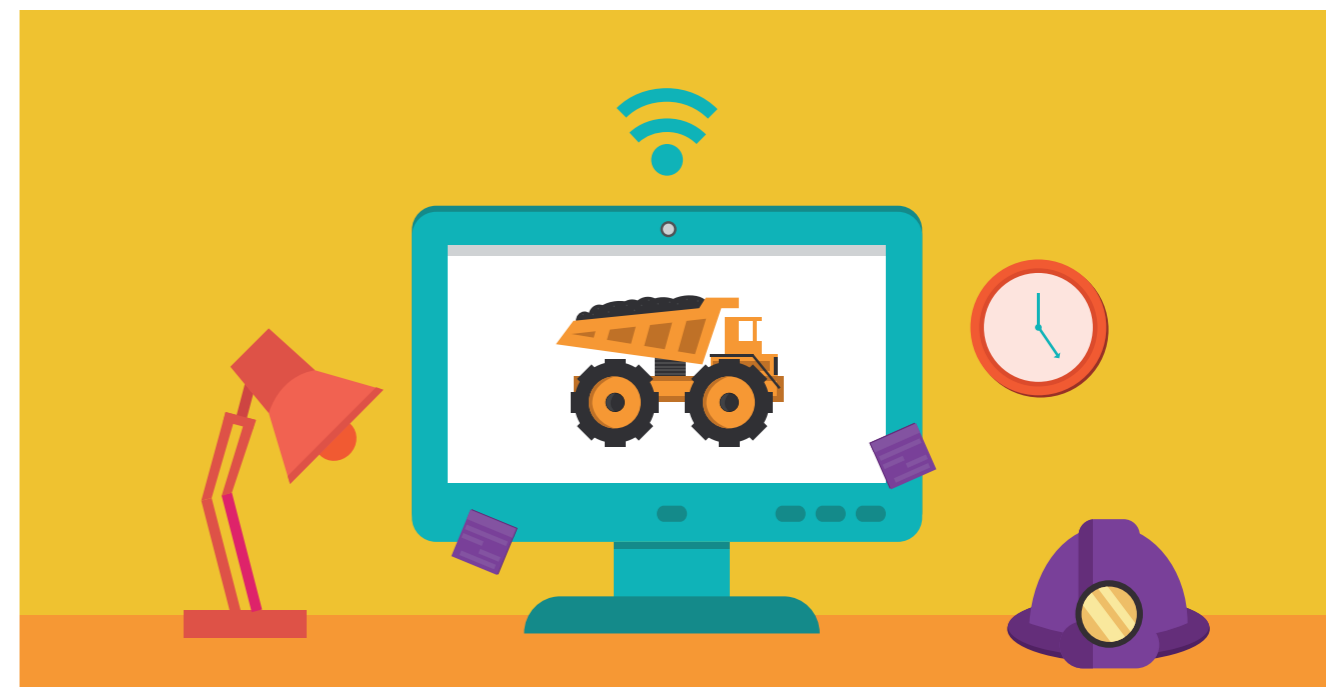
sites within the same organisation. Opportunities for value creation through better utilization of technology in mining exist across the value chain, and there is a growing focus of miners on investments that can deliver rapid improvements in productivity and efficiency such as equipment optimisation, process automation, and control optimisation at specific points in operational processes — ultimately working towards creating the ability for operational transparency across operations in real time. However, the reality is that very often a number of more basic steps relating to corporate systems, operational data collection and storage, connectivity and data accuracy are required before the value of these bigger transformation investments can be realised. Additionally, with the end of the commodity price boom fewer miners are seeking big transformational approaches, and more are interested in applying various point solutions that can individually deliver value by improving efficiency and costs at specific points in the process.

Rio Tinto was the first of the large miners to identify the untapped potential of technology in mining and start to create competitive advantage by focusing on approaches that would deliver far greater operational efficiency. Rio's Mine of the Future programme was initiated in 2008, the programme includes a number of components, the most recent being the ability to precisely identify the size, location, and quality of ore in real time by retrieving data from automated trucks and drills operating in the mine. This is through the technology investments that Rio has already made and the RTVis 3D software that creates 3D images of mine pit activities and allows Rio Tinto to more accurately identify ore boundaries, undertake more accurate drill blasting, reduce explosives that are required and enhance dig rates. These capabilities alone contribute to reducing operational costs.

### Rio's Mine of the Future programme includes the following major components that have been developed since 2008:

**Mine automation system (MAS):** The MAS is a critically important part of the Mine of the Future programme. It is the central data processing engine that is fed vast quantities of operational data from across Rio's mine site operations and generates visualisation in real time of each of those visualisation environments. The scale of the data analytics is enormous, the mine equipment is highly implemented, and each unmanned truck produces 5TB of data per day. The philosophy behind the MAS is to create the ability to synthesise data in such a way that operators can "sense, think, act" and to help Rio improve safety, meet production targets more consistently, and increase efficiency.

**Equipment automation:** As part of the Mine of the Future programme Rio has 53 driverless trucks, as well as automated drills, automated concentrators and trains (Automated Haulage System or AHS). The trucks and equipment are monitored and controlled from the command and control centre based in Perth. Command and control: Rio has implemented a command and control centre. The centre



enables automated equipment to be remotely controlled from more than 1800km away in Perth. This includes 14 mines mostly located in the Pilbara region of Western Australia, but also a number of mines in other locations globally.

**Processing Excellence Centre (PEC):** The PEC, located in Brisbane, Australia, was announced in March 2014. The PEC enhances monitoring and operational performance by examining real-time processing data from seven Rio Tinto mine sites around the globe. Experts in the PEC support teams in mine sites in Mongolia, the U.S.A., and Australia to maximise productivity and improve performance. Rio Tinto is by far the most progressed among all the global miners in their programmes to drive data insights, automation, and control across mine site operations. There are a number of other prime examples that provide insights into approaches that miners can take. MMG has implemented broad-based asset performance management optimisation, in which the miner has instrumented every asset and undertaken bottleneck analysis to drive the efficiency and productivity across their mines. Anglo American is another prime example of a global diversified miner that is taking big steps in placing technology innovation centrally within plans to drive mine site efficiency and productivity. However, it is not just the large miners that are driving productivity and efficiency through optimisation and innovative approaches. Dundee Precious Metals, a Canadian miner operating a number of mines in Bulgaria and Armenia. With forward-looking leadership, this small miner has doubled production, halved costs, improved equipment utilisation and availability over the course of three years, without investing in any new mine equipment in its major mine in Bulgaria. The strategy has been to go after the low-hanging fruit, dealing with the basic waste in the system of the mine first. CEO Rich Howes believes that the process of optimisation in their case is just the beginning and the opportunities to continue to drive productivity improvements through clever deployment of technology will be a continuing journey.

Rio Tinto's heavy focus within its iron ore business on efficiency and cost savings best practice, including technology innovation and other initiatives associated with efficiency and cost management are paying off. In June 2014, CEO Sam Walsh spoke about the cash costs within Australian Rio Tinto iron ore business of around US\$20/ton. With iron ore prices currently at around US\$70/ton, this is good news for Rio Tinto, especially given that many players in the market are operating close to or at a loss. It is not likely that the Mine of the Future initiative and Rio's other IT investments are the only driver behind these results, the companies cost and efficiency related invested are much broader than that, but technology investments that the company has made are a contributing factor to achieving such strong results. For most miners that do not have the scale of Rio Tinto, the scale of potential technology investments is also more limited, but well-made technology investments can provide process insights that can be used to improve efficiencies, higher productivity for mine staff, and a safer operating environment. Dundee Precious Metals is an example of how well considered technology investments can dramatically improve the performance of a smaller miner. Dundee Precious Metals, a Canadian miner operating in Bulgaria, made investments through utilising mobility and a short interval task approach to mine planning to create operational visibility and responsiveness across the whole mine in real time. These investments enabled Dundee Precious Metals to double production, halve costs and improve equipment utilisation and availability. In 2014 PricewaterhouseCoopers (PWC) undertook a study of operational productivity within mining companies. This study found that the best performing mining companies have a clear mine strategy, a clear data management strategy and a clear people strategy. Mining companies that gather, analyse and use their data on a daily basis account for 92% if top-quartile equipment performance. The use of data is a distinguishing feature of mines that achieve outstanding equipment performance.

## Technology Investment Growth Areas

As miners look forward to building their technology roadmaps across the corporate and operational business units, the move to 3rd Platform technologies — cloud, social business, big data/analytics, and mobile — will be key in driving change across the industry. IT and operational technology strategies that can shift efficiency and productivity are typically a combination of these technologies. Figure 2 shows IDC's 3rd platform.

IT investment roadmaps that miners have in place are heavily focused on third platform technologies, CIOs are seeking to increase efficiencies but also to support improvements in operational KPIs such as success against health and safety metrics, compliance against regulatory and environmental requirements and to maximise production given the available resources.

**Miners have placed a great deal of focus on mobility over the last few years – from networking connectivity and services to field force mobility and applications. Investments have been centred on seeking to improve workforce productivity through enabling access and interaction with corporate and operational applications and through the ability to monitor equipment, people and things in real time. Mobility will continue to be a game changer for miners as they change their approach to operations – through the further implementation of mobile capabilities. As automation and remote control investments mature, miners will be able to access their mines sites, modify or fix issues while off site and have a greater ability to analyse data from their machines.**

With the resetting of company incomes as commodity prices fall, miners' IT strategies have shifted to utilising cloud capabilities much more aggressively. Miners have in the past very often put a great deal of importance on owning the infrastructure components of their IT, or building their capabilities themselves, but requirements to drive efficiency and cost savings are changing IT strategies for many miners. The first workloads that we have seen move across to the cloud are personal workspace and testing and development environments and this will continue, but the workloads in the cloud will rapidly expand. Analytics and compute power are two areas, as the data processing requirements of automation and remote monitoring of miners



vast data sets drive requirements for these capabilities, along with storage. For example, Rio Tinto announced in December 2014 that it had formed an agreement with Active Navigation for big data and cloud services. As we have seen in other industries, miners will also start to put their ERP systems in the cloud.

As miners move to understand their operations, based on available operational and corporate data, analytics investments will be a fundamental and critical part of how they go about doing that. Miners currently have vast quantities of data in the form of sensor data from equipment, seismic data, geothermal data, real time environmental data, corporate data and financial data for example – the quantities are immense, so if organisations are to use all of this information to create insights that they can respond to, analytics capabilities will be a critical part of the solutions that enable the organisation to understand and respond. In many cases, first though, there is work required in data management and analysis – to understand the available data sets, how accurate they are, and how they can be used to create insights about the operations of the business.

Table 1 shows the combination of technologies to deliver improvement to a specific process area.

	Cloud	Social Business	Big Data / Analytics	Mobile
Maintenance Excellence	Predictive maintenance — with cloud based analytics. Work orders automatically transmitted to maintenance teams' mobile devices; social business approach to sharing information relating to the equipment. Visual Overall Equipment Effectiveness reporting			
Remote Operations and Control	Autonomous vehicles — telematics, analytics on vehicle diagnostics Data integration and analytics Real-time control Virtualisation and 3D simulation			
Supply Chain		Collaboration with partners across the supply chain	Analysis of inventory turns	
Workforce Management		Greater connectivity with workforce		Underground Wi-Fi and equipment monitoring

## Challenges/Opportunities

The move to optimisation, far greater process automation, creating real-time control and insight, and embedding data within approaches to day-to-day operations of the mine site are very significant developments for most miners. While the technology implementations are challenging, a far greater challenge is the internal change that these kinds of approaches mean. Success will require extremely strong leadership and a willingness to tackle change within the organisation. The management of cultural change is a critically important part of ensuring that automation investments within mining deliver the organisational value they are designed to do. Rio Tinto has spoken about the importance of demonstrating the value of technology investments in smaller portions at periodic intervals and to ensure that corporate and operational teams across the business benefit from the implementations that are undertaken.

For many miners the most critical first steps to driving productivity and efficiency through optimising process and utilising new approaches are getting the basics in place first. Even at mine sites in developed countries, basic communications — fixed and mobile — and core systems such as ERP, financing, and human resources for example are still required before data-led optimisation and operational insights as we have discussed are possible. In developing countries, getting these basics right is even more important.

Technology innovations that are being implemented by large miners such as Rio Tinto and Anglo American demand good quality telecommunications networks, and operational transparency can only be achieved where operational and corporate data sets are integrated and aligned. This is by no means a trivial task, and even for miners that have progressed considerably along this path, real value is generated through full data integration and utilisation of data for decision making across the business. Even those that have progressed most have not yet fully reached this stage. The journey of optimisation towards cost management and efficiency will be a challenging one for most miners. Additionally, the current environment is one where miners are less inclined to stomach risk and are therefore interested in offerings that will deliver rapid improvements in their productivity and efficiency once investments have been made. Vendors need to make sure that rapid improvements are possible. The opportunity for IT vendors looking to engage with the mining sector is to look at the mid- and longer-term roadmaps with their customers, and to break the roadmap into chunks so that more rapid improvements can be made in individual areas like predictive maintenance, equipment optimisation, implementation of command, and control or automation of key operations processes and the components of work that make up undertaking those implementations, for example.



Although much of the analysis presented is relevant to larger miners, an opportunity equally exists for mid-tier players, and it is among these players that point solutions are an even more important approach. Customised approaches will be too expensive and rapid returns on investment even more important, but in this segment of the market the economic pressure is even more critical than for the large diversified global miners. The experience of Dundee Precious Metals is an excellent example of what the possibilities are where the required leadership is in place.

## Conclusion

The mining sector is challenged, and in this environment miners need to consider even more the approaches that can support excellence in cost management and efficiency gains by doing things differently. Getting the basics right is important, for example standardising software applications across mine sites, building out ERP implementations and ensuring appropriate quality communications networks are available. Many of the early approaches are already being undertaken across the industry, miners need to look to those examples and use cases from other industries. There are several key things that miners should be thinking about their technology investments.

Look for quick wins. There are opportunities across the entire value chain of most mining organisations. Miners need to look at their processes and determine where there are opportunities to make quick wins that can demonstrate the value of technology and data based approaches.

Think the roadmap. While it is important to consider the points where gains can be made, miners need to consider those within a broader roadmap through which the organisation can work towards achieving a step change in operational excellence and to ensure that investments fit within an overall planned objective.

Work with vendor partners and providers to realise the value to your organisation. Across the sector it is the large miners that are taking steps to extend their field force mobility, data analytics, automation, command and control and process optimisation investments. As demonstrated by the example of Dundee Precious Metals, these capabilities can be equally applied to smaller mining operations, for those willing to take up the challenge. Take the low hanging fruit, do the simple things first and build out an integrated solution from there. Look at offerings that are affordable and have a rapid return on investment.



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