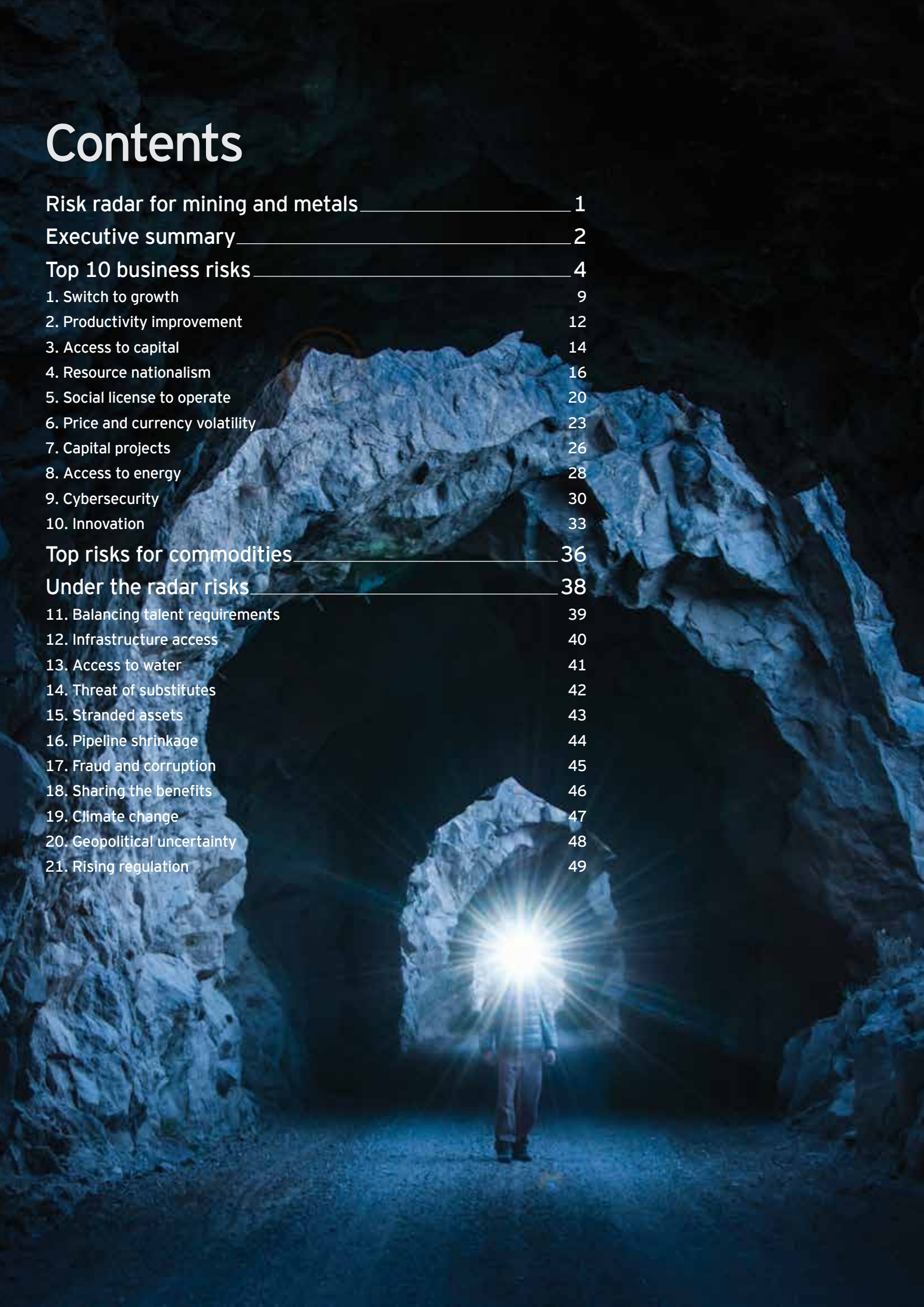
Business risks facing mining and metals 2015–2016

Moving from the back seat to the driver's seat

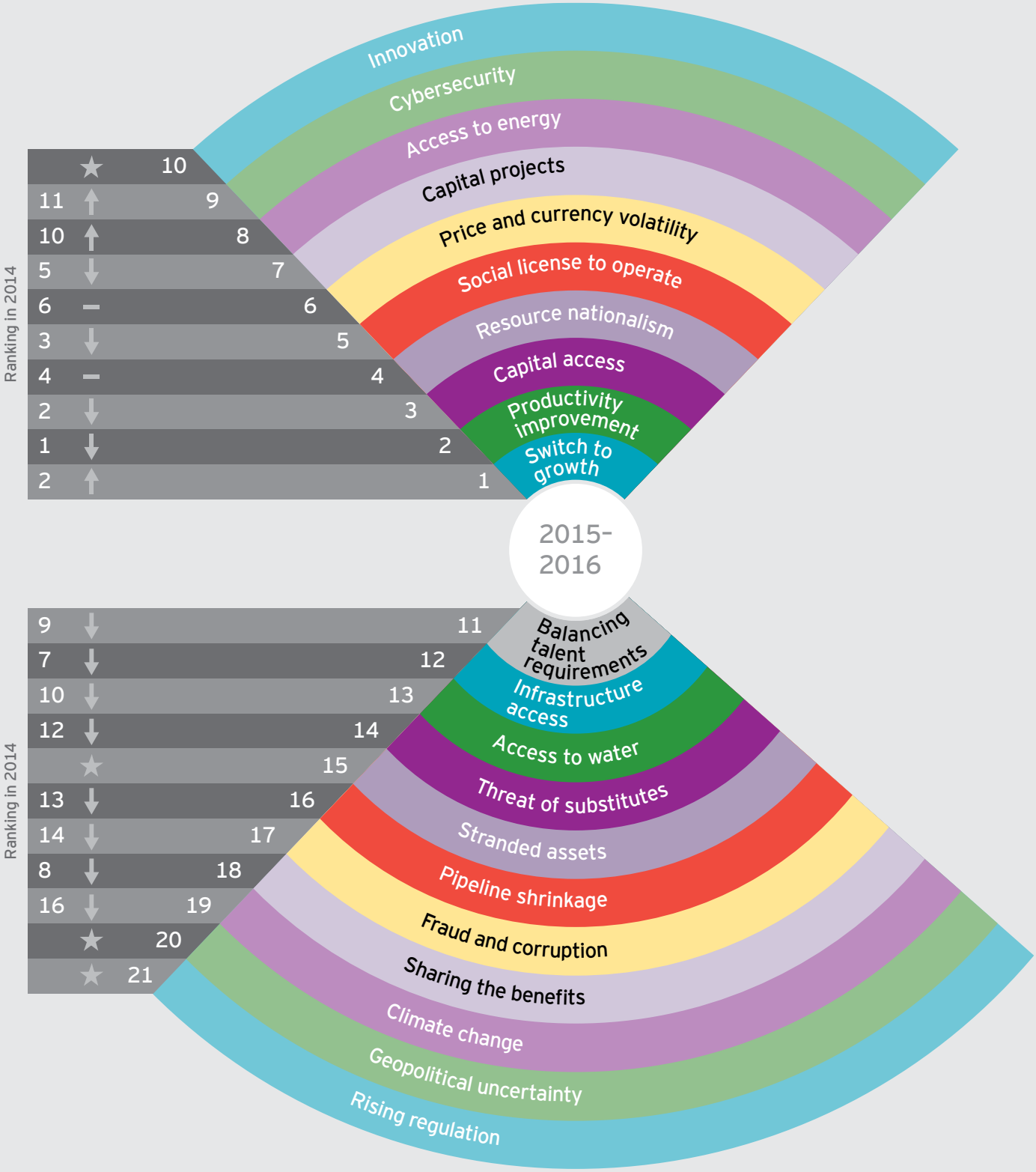
EY
Building a better working world

Contents



Risk radar for mining and metals

Top 10 business risks



Under the radar business risks

Up from 2014 | Down from 2014 | Same as 2014 | New to the radar

Executive summary

"Mining and metals companies are grappling with unprecedented global supply restructuring in the wake of the super-cycle. Those that best manage the ever-evolving business risks will be best positioned to survive and thrive in the next cyclical upswing."

Future growth, productivity and capital access top business risks for miners

The global mining and metals sector is in the midst of the "super correction" to the super-cycle, with an extended period of lower and volatile commodity prices, resulting in unprecedented impacts on earnings, balance sheets and investor perceptions of the sector. As a result, mining and metals companies remain focused on margin, cash flow and capital returns.

The seeds of recovery have been planted in the past few years, with major capex reductions and mine closures. As a result, we are now seeing early constraints on supply in a number of commodities, and the inevitable upturn in the cycle is expected in the next few years. However, the upturn will be different for each commodity.

With highly risk-averse capital markets, most mining and metals companies remain focused on the short-term – cost-cutting and maximizing current returns to shareholders – and risk limiting future growth prospects.

Adding to the threat, new competition is emerging in the form of private capital investors and commodity traders, who may be in stronger strategic and financial positions to make long-term countercyclical investments without the resistance of risk-averse public shareholders.

The switch to growth is looming and assets are now still relatively cheap and ripe for opportunistic acquisition. Given the long lead time to develop new supply, decisions to invest for future growth have to be made now or long-term returns will be lowered.

It is the paradox that long-term reinvestment and growth is essential for the sustainability of the sector and yet public capital markets are still demanding the opposite. This has pushed "switch to growth" to the top of the rankings in this year's *Business risks in mining and metals 2015–2016* report.

Productivity and access to capital both maintained their top three positions in this year's rankings. While most miners have commenced actions to regain the productivity lost during the "production at any cost" boom years, the need for sustainable and enduring productivity improvements remains vital for survival and prosperity. Cementing productivity improvement measures is a two-to-three year transformation and, as such, it

remains high on the risk list for the sector because even though some work has been done on it, there is still sizeable scope for improvement. While number two in our ranking, productivity will remain the number one operational focus of CEOs throughout 2015-2016.

Access to capital remains a survival issue for most juniors and many mid-tier companies, coming in at number three on the risk list. For smaller, higher-cost producers in some parts of the industry, there is little prospect of near-term turnaround. While for those that can access capital, the risk of accessing capital is around the increasing complexity of the financing models.

Evolving risks: resource nationalism and social license to operate

"Resource nationalism" and "social license to operate" (SLTO) round out the top five risks. While many countries are now actively seeking to attract mining and metals investment, mandated beneficiation and tax transparency measures around the world mean resource nationalism continues to be an ever-changing risk to businesses.

Similarly, while social license to operate can be considered a routine part of doing business for mining and metals companies, the nature of the threat continues to increase and evolve. Projects continue to be delayed or shelved completely because of conflicting community interests, with governments increasingly backing these communities.

Undiminished: price and currency volatility, capital projects

Price and currency volatility remains at number six. It has not diminished in the past 12 months, and continues to wreak havoc with many mining and metals businesses. It has been the large currency fluctuations and the focus on either price or currency volatility, instead of both, that has kept this risk high up on the agenda.

Capital projects also held its spot in the top 10 business risks for mining and metals organizations. Despite significantly less capital being allocated to projects, development continues because of the long lead times for projects approved during the super-cycle. EY research shows that, apart from fierce competition for capital within mining and metals companies, massive budget overruns continue to plague the completion of these complex multibillion dollar projects. With the productivity of invested capital being a key issue for CEOs, there is an imperative to address the cost blowouts and overruns.

Increasing threats: access to energy, cybersecurity, innovation

While falling oil prices have brought some relief to mining and metals companies, the energy-intensive nature of the sector makes access to energy a key long-term issue. Securing sustainable, cost-effective and reliable energy supply from project conception will become even more imperative as companies expand operations to remote areas with underdeveloped energy infrastructure and reducing emissions and energy footprint becomes an imperative in developed countries. The increasing affluence of the population in these countries also means there is increasing competition for energy between the mining and metals companies and this community.

"Cybersecurity" and "innovation" both move into the top 10 for the first time this year.

Cyber-hacking in the mining and metals sector has become more widespread and sophisticated – in our *Global Information Security Survey 2014*, 65% of mining and metals companies said that they had experienced an increase in cyber threats over the past 12 months, and this is likely understated as many incidences go unreported. The integration of IT and operations technology (OT) could make organizations more vulnerable to cyber-hacking but applying the greater levels of security and control around IT to OT will eventually enhance the integrated technology environment.

Being a victim of any form of cyber-attack can cost a company millions of dollars in lost production, threaten worker safety or cause massive reputational damage, by leaking of confidential or stakeholder-sensitive information.

The focus on regaining lost productivity has also brought the lack of innovation in the sector to the fore, pushing it onto the risk rankings this year. Innovation will be vital to protecting and sustaining margins in the long term, and will be the key to maximizing revenues in the future.

Top 10 risks

2015

01	Switch to growth
02	Productivity improvement
03	Access to capital
04	Resource nationalism
05	Social license to operate
06	Price and currency volatility
07	Capital projects
08	Access to energy
09	Cybersecurity
10	Innovation

Over 8 years

2008 (peak of supercycle)

01	Skills shortage
02	Industry consolidation
03	Infrastructure access
04	Social license to operate
05	Climate change
06	Rising costs
07	Pipeline shrinkage
08	Resource nationalism
09	Access to energy
10	Increased regulation

The top 10 business risks

01 Switch to growth – the decision to invest for future growth is now

In the mining and metals sector, value diminishes with every tonne or ounce produced. Pro-cyclical, short-term behavior currently prevails, with the collective industry mindset focused on consolidation and capital returns in a low-growth environment. But standing still is not an option: we believe now is the time to prepare for a switch to growth.

A clear understanding of growth options available to companies – whether to build or buy – is essential. This requires ongoing awareness of the market (capital markets, global supply and demand, geopolitical developments and customer behavior) and the competition. Exploiting a unique value proposition, consolidating market share or identifying opportunities to improve project economics are ways in which companies can enhance or consolidate their competitive advantage. But management should also consider means of acquiring competitive advantage – for example, through a change of commodity, product or geographic focus; entry into joint ventures with strategic partners; and acquisition of technologies, businesses and capabilities that can transform the value chain. Whichever strategy is pursued, preparation and execution are critical.

02 Productivity improvement – vital for survival and prosperity

The need for sustainable and enduring productivity improvements remains vital for survival and prosperity and, even though some work has been done on it, there is still sizeable scope for improvement. Productivity improvement has been a source of competitive advantage for those that have been early adopters. Those that have been successful in improving their productivity levels have addressed productivity as a whole of business issue and with an end-to-end focus. They have also actively engaged workers who have operated in a cost-constrained environment. These companies are also open to innovation and are addressing cultural change to foster a productivity focus. They are effectively managing data to understand what good productivity looks like, and are measuring and monitoring performance accordingly. Critically, they are focusing on productivity for the long-haul.

Mining and metals companies need to ensure that their investment in productivity isn't deprioritized once commodity prices improve, and the sector's focus turns once again to production growth. This is especially true as the levels of improvement have not managed to recapture what has been lost over the past decade. To see real productivity gains requires real innovation. Those companies which choose to seriously innovate will drive superior performance for the next mining and metals cycle.

03 Access to capital – a survival issue

The cyclical downturn has created challenging fundraising conditions for the mining and metals industry. While producers are largely focused on restoring balance sheets and improving profitability through asset sales and capex reductions, mid-tier and junior companies are grappling with the challenge of risk-averse equity markets and highly selective lenders. These market conditions have facilitated the rise of alternative sources of finance, but such sources often bring increased complexity, costs and risks.

Companies are faced with limited choice, which can lead to short-term responses: accept the options available, which may result in higher capital costs, loss of control and diluted future

for mining and metals

earnings potential; or risk project stagnation or even loss of ownership. As such, it is critical that companies maintain a focus on the longer-term strategic aims of project fundraising in order to meet both short- and long-term needs as the project progresses through its various stages. This can be achieved through effective preparation, knowledge, risk mitigation and market awareness.

04 Resource nationalism – increased taxes and advancing transparency

Resource nationalism activity continues in the form of mandated beneficiation and increased taxes, albeit at a slower rate. This activity is being driven by the perception that mining and metals companies are still not paying their "fair share" to host nations. It is this sentiment and a drive to combat corruption that has resulted in new transparency laws being enacted that will require companies to start reporting taxes and other government payments.

Mining and metals companies will need to ensure they are ready for these new reporting requirements. Changes will need to be made to reporting systems to ensure all data is collected and companies are happy with the story it tells. Organizations should take advantage of these changes to fully demonstrate the value they are adding back into communities, thereby creating a better understanding and slowing future resource nationalism activity.

05 Social license to operate – increasing government-backed communities

Maintaining a SLTO is an increasingly multi-faceted and multi-stakeholder risk with a complex array of relationships to negotiate. In recent years, this risk has broadened in the face of tougher global economic conditions. As miners consider closing projects, they must balance the potential reputational damage of withdrawing from a community and the impact on local economies that it may have. Illegal mining activities can also threaten a company's SLTO, with poor conditions, dangerous practices and environmentally hazardous activities, continuing to threaten the health and safety of employees and local economies, potentially leading to mine closure. Community challenges to broader political and economic decisions have given rise to protest and unrest at the mine site, delaying or even stopping projects. Activists with broad-ranging agendas are becoming more litigious, organized and social media savvy, widely spreading anti-mining sentiment. Some governments are now giving greater powers to communities to make the final decision on approving mining and metals activities in their area.

With billions of dollars in project investment at stake, ongoing engagement, collaboration and effective communication with all of these stakeholders is crucial and mutually-beneficial solutions are increasingly expected.

06 Price and currency volatility – a balanced focus required

A clear legacy of the super-cycle for mining and metals is a "super correction," with markets ultimately self-correcting via the price mechanism – the greater price stimulus both in scale and duration, the greater the correction and the greater the volatility as markets seek to correct. However, not all markets, for all commodities, will correct at the same rate and duration. The source of currency volatility has come due to the end of quantitative easing in the US which has generally seen a correction in producer currencies against a stronger US dollar. The Canadian and Australian dollars, the South African rand, the Chilean peso, the Brazilian real and Peruvian sol have all depreciated, providing a price stabilizer in local currency terms. The sudden correction in the US dollar, which occurred over a short period of just six weeks in early 2015, added to the volatility for producers.

Since the link between currency and price has been restored during 2014–15, it is essential that any hedging program considers both parts of volatility. Also, the value of flexible in mining and metals operations in times of high price volatility is important. With the growing convergence of the producer/trader and trader/producer models, we are witnessing more flexibility across portfolios of mining and metals companies.

07 Capital projects execution risk – addressing the massive overruns

The productivity of invested capital is a key issue for CEOs across the global mining and metals sector as falling commodity prices and rising supply surplus have ushered in a period of restraint in capital project investment. Scarce capital is driving a strong focus on capital productivity or "value for money," and with that numerous high-profile projects have been scrapped, shelved or sent back for re-planning.

Despite many mining and metals companies enhancing the process maturity of engineering design, projects continue to experience significant project cost and schedule overruns. EY's study of recent global capital projects revealed, despite increasingly mature delivery skill-sets, 69% of megaprojects were facing cost overruns, with an average overrun of 62% for those projects with available data. These overruns are directly impacting the capital productivity and commercial performance of mining and metals companies across the globe, and new perspectives are essential to turn this trend and deliver to boards and investors the gains in capital productivity and strategic outcomes they require. A focus on three critical areas can help significantly improve project delivery:

- Implementing governance and reporting frameworks with lead indicators that reliably flag emerging risks while they can still be efficiently mitigated
- Allocating adequate cost and time contingencies to account for risks across a project's lifecycle
- Enhancing the value of contingency planning by aligning contingency plans to scenario plans

08 Access to energy – key is sustainable, cost-effective and uninterrupted

Rising energy prices in an environment of declining commodity prices and the resultant margin squeeze has kept this risk in the top 10. While falling oil prices have brought some relief to mining and metals companies, the current slump in oil prices is the result of oversupply and the imbalance could be reversed through supplier discipline. This becomes even more critical as mining and metals companies expand operations to remote areas with under-developed energy infrastructure, while reducing their emissions and energy footprint becomes an imperative in developed countries. Increasing affluence of the local population in developing markets has also increased demand for residential energy and created competition for energy between the community and the miners.

Ensuring energy security in a sustainable, cost-effective and uninterrupted manner requires an integrated approach, right from the project conception and planning stage. Companies can explore a number of alternatives to ensure access to affordable energy, including: hedging energy costs while they are low; self-supply; divestment of energy inefficient operations and synergistic acquisition of energy companies; innovation to de-intensify energy usage in mining operations; and most importantly increasing the use of renewable energy sources.

09 Cybersecurity – underestimated and underprepared

Cyber-hacking has become more widespread and sophisticated, with cyber-attacks being a common issue across the mining and metals sector regardless of size or scale. Of course, not all cyber-attacks are for financial gain – hackers can be groups seeking to serve their own purpose. Being a victim of any form of attack can cost a mining and metals company millions of dollars in lost production, create health and safety issues on site, or cause massive reputational damage by leak of confidential/stakeholder unfriendly information.

Key threats to the mining and metals sector include: the convergence of IT and operational technology (OT) creating more gateways for cyber attack; historic under-investment and current budget trends which retains a lower security budget without consideration for the increased risk; and an understanding of whether the organization has been breached as this is often undetected or detected late. It should also be noted that IT and OT convergence is an opportunity to enhance cybersecurity around OT because of the increase in formal measures around OT and the inheritance of the IT security protocols.

Information and operational security needs to be a board level priority and managed from the top down. Cybersecurity needs to feature on the corporate level risk register and to be integrated in the ERP. It's not just about systems – an approach is needed that includes threat and risk-based implementation of people, processes and technology capabilities to develop a resilient cybersecurity environment.

10 Innovation (new) – key to growth, lagging most

The burning platform for innovation is clear – the sector is currently operating in a low-price environment. Therefore, many mining and metals companies may need to innovate to survive, while others may look to maximize revenues and gain first-mover advantage when the market returns to growth. Unfortunately, it is clear that compared with most other sectors, there is a deficit of transformational innovation in the sector. The first automated truck was seen 20 years ago and yet there is still not a complete fleet in existence at a mine. On a ratio of revenue basis comparison, the mining and metals sector spends 90% less on technology and innovation than the petroleum sector. And yet there is plenty of opportunity for innovation to add value to the mining and metals sector.

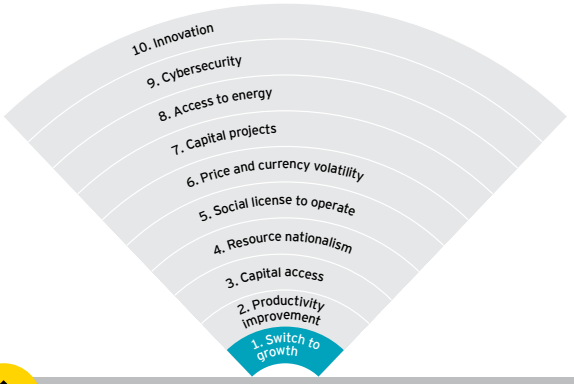
The benefits of innovation are clear: those businesses that encourage innovation can improve their position on the cost curve relative to their peers. Most cost savings (e.g., a lower oil price) affect most mines similarly and the cost curve drops for all – so the margin is the same. However, innovation can help reduce production costs, improve productivity, extend the life of a mine and reduce and/or eliminate the impact of impurities, and make uneconomic resources economic – thus, allowing movement along the cost curve to capture savings as increased margin. Innovation is here for the long haul and those businesses that innovate will in the long term see increased productivity across the supply chain, experience improved market valuations, and face an increase in capital project efficiency.

The top 10 business risks

01

Switch to growth

(2 in 2014)



Key thought

To be in a position to take advantage of the next cyclical upswing, the decision to invest for future growth is now.

Following an extended period of commodity price weakness, the mining and metals sector remains primarily occupied with the prevailing switch from growth to consolidation and capital returns. The seeds of cyclical recovery have been planted in the form of capex reductions, mine closures, cost savings and productivity improvements, but at what point should the sector begin to refocus minds on growth, and how must growth be achieved differently this time around? And more importantly, when the time for growth is upon us, who will be in the positon to enjoy first-mover advantage?

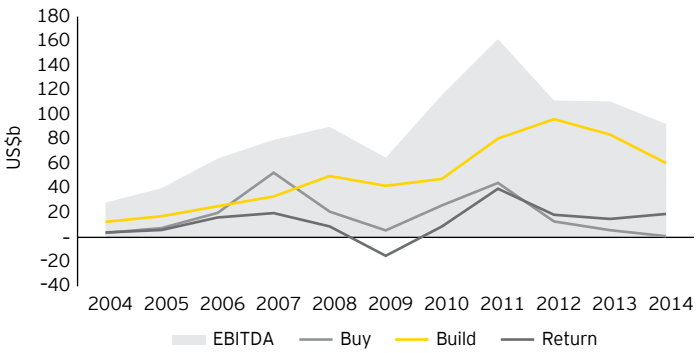
The age of capital austerity

Weakened margins, reduced earnings and rising debt levels have forced the sector to retrench for longer than was perhaps expected at the start of last year, with prices of many commodities remaining weak in the face of slower demand and an even slower supply correction. The response has been, and continues to be, further capex reductions and asset sales at a time when equity valuations must be nearing their cyclical lows.

Investment by the sector has historically been pro-cyclical. The super-cycle made higher profits from higher prices, making capital spending both possible and desirable to shareholders. The chart below illustrates the scale of investment that went into organic and inorganic growth at the peak of the last cycle by the industry's top companies – investment that inevitably perpetuated higher equipment and labor costs, that embodied a culture of volume growth at any cost, and that was made at a time of high-to-peak equity valuations.

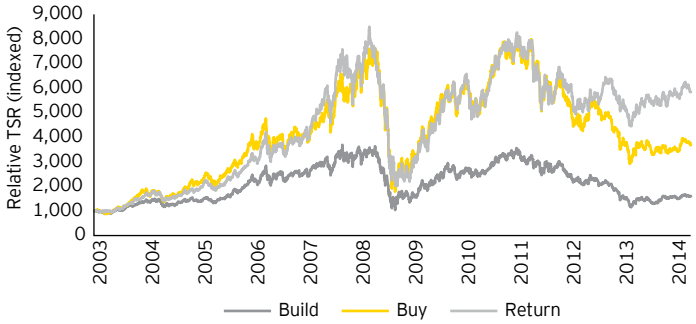
The subsequent impact on value creation as the cycle turned is evident in total shareholder returns and is the cause of one of the major obstacles to the industry's ability to break this pattern today: investors' demands for healthier near-term returns, and the intense scrutiny public companies now face over their investment decisions.

Capital allocation strategies over 2004–14



Source: EY, S&P Capital IQ

Relative total shareholder returns by strategy over last decade



Source: EY, S&P Capital IQ, Thomson Datastream

Following are some of the potential consequences of the pro-cyclical, short-term behavior that continues to prevail now as we hover at the bottom of the cycle are already looming ominously on the horizon:

- **Pipeline shrinkage:** A drastic reduction in exploration spending across the industry in 2013 and 2014 sets the scene for a future supply crunch and serves to perpetuate the familiar cycle of boom and bust. (See risk the pipeline shrinkage risk later in the report.)
- **Declining volume growth:** Production profiles of the major producers are forecast to decline from 2016 onward as mines' age and grades fall, raising a question over the majors' ability to deliver top-line growth over the medium/long term if further capex reductions and asset sales are used to fund cash returns to shareholders.[1]
- **New competition:** New buyers are set to stake their positions in the sector. These buyers — such as private capital investors and commodity traders — may be in a stronger position strategically and financially to make long-term countercyclical investments today without the scrutiny and resistance of public shareholders. They may also possess sufficient financial strength and industry expertise to become significant mining companies or owners of strategically important assets.
- **Opportunity cost:** Many companies are focused on the optionality residing in diminishing pool of existing assets, but this risks missing the benefit of acquiring an undervalued, near-production asset in the market at a rock-bottom price.

It is not difficult to see that the industry is setting itself up for a supply crunch further down the line, which will exacerbate price volatility, disrupt progress made on efficiency and diminish value-creation potential.

Breaking the "pro-cycle"

Companies today face a difficult choice about how to allocate capital and create value: in its simplest form, this choice can be articulated as "buy, build or return" within the context of the need to balance short-term priorities with longer-term value creation. Complicating this choice is the reluctance of shareholders and capital providers to support or fund major investment in growth in an industry that must invest years in advance of production, and in which so many factors are outside the control of management.

But standing still is not an option; growth is essential in an industry that diminishes with every tonne or ounce it produces, where value is ultimately destroyed if the pipeline is not replenished. While risk appetites may vary over the commodity price cycle, the investment horizon of mining and metals is still long-term, and pro-cyclical behavior will lower long-term returns.

The year 2015 has brought a subtle shift in growth rhetoric among the major producers, with acquisitions now at least getting a mention, where they were notable by their absence a year ago. But deals remain the outlying option for most, with companies remaining committed to a path of capital restraint, brownfield organic growth and balance sheet discipline, and acknowledging that there is "still much to do" in terms of productivity and operational improvements. In the words of BHP Billiton's Andrew Mackenzie, "Should an opportunity arise, we are prepared to move, but it has tough competition to beat further investment in our own portfolio … it has to be one hell of a deal."[2]

Growth today is fraught with risk and tension. In an era of slower and lower global economic growth, it is likely that company-specific catalysts rather than commodity prices will drive upside share price performance. Companies must work much harder for growth this time around, no longer able to rely on rapid and extreme demand-driven price rises.

It is, therefore, critical that if companies are to successfully refocus their minds on growth, they must demonstrate that they have their houses in order; ensure that their operations and strategy are resilient and flexible enough to adapt swiftly to market changes and perform throughout cycles; and have their stakeholders on board for the journey.

Switch to growth: evaluating the options

With solid foundations in place, a clear understanding and evaluation of the growth options available (whether buy or build), and their potential impact on the overall business and its strategic direction, need to be established. This requires ongoing awareness of the market (capital markets, global supply and demand, geopolitical developments, and customer behaviors) and the competition. Emerging supply gaps in different commodities could transform the future "winners" landscape, with potential for significant variation in valuation between those that positioned themselves at the "right" time, in the "right" commodities, and those that did not. Following the pack generally did not serve companies well in the last growth cycle.

1. **Consolidating competitive advantage**
   Playing to existing strengths is the one clear strategy dominating the industry at the moment, as the major iron ore producers exploit their competitive cost positions through volume increases to push higher cost supply out of the market. The debate rages as to how sustainable and successful this strategy will prove to be; but understanding,

1. "European metals & mining," *JP Morgan Cazenove*, 23 January 2015, via ThomsonONE.

2. "BHP Billiton CEO Andrew Mackenzie won't rule out new oil acquisitions," *Financial Review*, 7 May 2015.

exploiting and effectively executing on unique capabilities or opportunities can help to expedite a risk-managed growth journey with commensurate returns for shareholders. Possibilities include:

- Exploiting a unique value proposition to create or unlock value in an acquisition that the current owners are unable to — for example, through the addition of unique synergies, technological capability or management expertise
- Consolidating market share through lower-risk, noncompetitive acquisitions in safe jurisdictions or locations in proximity to existing projects, in order to lower costs, enhance volume growth and improve access to capital
- Identifying opportunities to improve project economics and reduce execution risks — for example, through adoption of productivity solutions such as Reliability Technology at the commissioning stage to identify system constraints earlier; improved planning and contingencies at the outset of capital project development, when the ability to influence project outcomes and mitigate risks is the greatest; making the most of available tax refunds and incentives; or enhancing project design to stagger capital outlay and optimize timing and scale of output and cash flows

2. **Acquiring competitive advantage**
Regular portfolio review is essential for understanding the current strengths and gaps in relation to the company's growth strategy. Divestments are likely to remain a prominent feature of the sector's M&A landscape for the next year or two, as companies determine which assets are no longer strategic fits. However, management should also start to think longer term about how to drive performance and growth through the acquisition of assets and capabilities that don't already exist in the portfolio. Examples could include:

- **Change of commodity, product or geographic focus** to diversify or minimize risk exposure; exploit variations in cyclical peaks in different commodities; get closer to end consumers; or seek first mover advantage in new markets
- **Joint ventures with strategic partners** that bring something extra to the table, such as unique synergies, technological capabilities, marketing relationships, infrastructure access and capital
- **Access to capital** — partnerships with long-term investors that have a mutual interest in achieving the company's objectives, offer a relatively stable source of capital, and can bring additional value such as industry expertise, government relationships or advice on issues surrounding social license to operate
- **Acquisition of value-add downstream capabilities**, or collaboration with consumer sectors, to optimize products and gain competitive advantage through evolution and provision of supply to emerging technologies
- **Acquisition of new businesses that transform the business model or supply chain** — for example, integration of trading capabilities
- **Acquisition of technologies** to improve project economics and productivity, or open up access to previously impenetrable geographies or geologies
- **Low-risk, cost-minimized investing in prospective greenfield projects** today, so that investment decisions are possible by 2016 and beyond, when demand/supply dynamics may be more nascent, and investment decisions more palatable for shareholders. This could be achieved by holding on to growth options in the existing portfolio, or via earn-ins or equity stakes in exploration companies

Whichever strategy is pursued, we believe that execution is far more critical than the underlying strategy itself. Management won't succeed by choosing between inorganic or organic growth: they will succeed by choosing the right acquisition or the right development option.

Switch to growth: determining the opportune timing

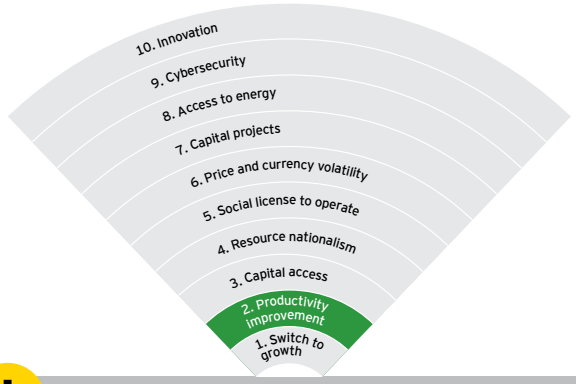
It is clear that (a) preparation is critical and (b) timing is a game of pure chance or guesswork without that preparation in place. Without solid foundations, market awareness and shareholder support, companies will be unable to successfully capitalize on unique market opportunities as they present themselves. Companies are also exposing themselves to the risk that better-prepared or better-positioned competitors will seize the initiative at a time when the market is arguably flush with quality, "cheap" investment opportunities as a result of widespread asset sales.

Beyond the well-known maxim "buy low, sell high," no one can determine the exact right time to invest, and hindsight has rendered many well-considered investment decisions seemingly reckless. But EY's view is that now is the time to begin that growth journey — to prepare the organization, its operations and its stakeholders, to reset minds on long-term growth, and to build a business that is more sustainable, resilient and profitable throughout economic cycles.

02

Productivity improvement

(1 in 2014)



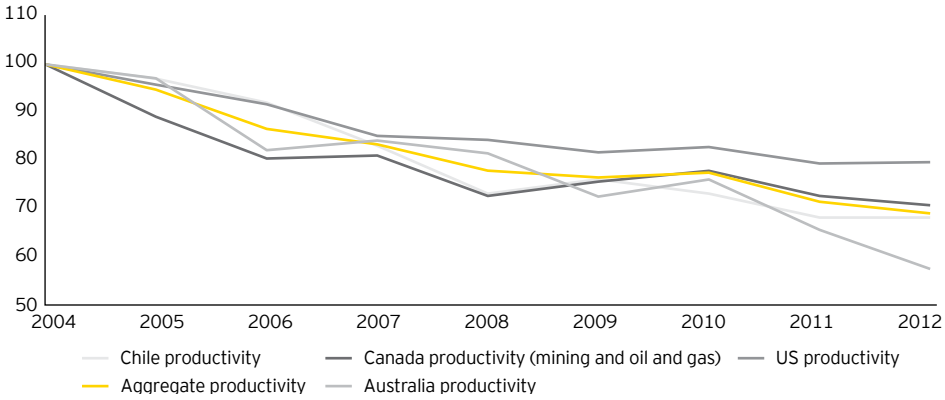
Key thought

To achieve real productivity gains, the entire leadership team will need to be engaged and behind transformational change.

During the commodity super-cycle, productivity fell to its lowest rate in more than 30 years, with the sector focusing on production at any cost during an unprecedented boom in commodity prices.

> "It now takes 40% more inputs to generate a single unit of mineral product."
>
> Mark Cutifani,
> CEO, Anglo American[1]

Mining labor productivity 2004–2012 (2004=100)



Source: Country statistical data, EY

In late 2014, EY undertook a survey with over 60 global mining executives through which four major areas were established as leading to the decline in productivity:

1. **Labor** – during the boom, miners accelerated recruitment in a time of severe skills shortages. This meant that they were recruiting inexperienced staff and managers leading to a steady decline in labor productivity.
2. **Capital productivity** – EY research has identified average cost overruns of 62%, with 50% of projects facing delays caused by project management factors, stakeholder conflicts, resource constraints, regulatory and policy-related challenges and an unfavorable external environment.
3. **Materials** – depleting reserves and falling grades are also a contributing factor.
4. **Economies of scale** – many miners have observed a decline in productivity levels as they have expanded operations, primarily due to the challenge of managing the complexity of much bigger operations.

Boards and CEOs have quickly recognized that regaining lost productivity and accessing the improvements to productivity made by other sectors, over the last decade, is critical for long-term return on capital employed. From our work with leading global miners, we believe that a narrow focus on point solutions or continuous improvement will not close the productivity gap sufficiently, and may even be counterproductive. We believe that real productivity gains will only come from end-to-end transformation.

1. "A CRITICAL IMPERATIVE – INNOVATION AND A SUSTAINABLE FUTURE WORLD MINING CONGRESS, MONTREAL CANADA, MARK CUTIFANI," Anglo American, accessed 18 June 2015.

Source: Company reports, EY analysis

Having reached a ceiling on cost reduction, mining companies have since made substantial progress with their productivity initiatives and working capital solutions as seen in the diagram above.

But there is a recognition that more needs to be done to ensure that each element in the business, from the resource in the ground to the product being delivered to clients is optimized – not on its own, but as part of a business system. Our observations are that those mining companies that have been successful in improving their productivity levels have the following traits:

- They address the productivity issue as a "whole of business" or end-to-end focus.
- They have learnt from history and actively engaged workers who have operated under a cost-constrained environment.
- They are open to innovation, and are beginning to invest in it.
- They are addressing the cultural change required to foster a productivity focus.
- They are effectively managing data from their IT/OT systems, to enable them to know what good productivity looks like, and are measuring and monitoring performance accordingly.
- They are focusing on productivity for the long-haul.

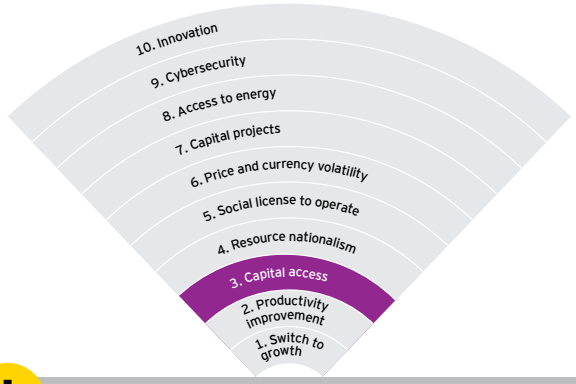
The current focus on productivity is bottom-line driven to maximize revenue and minimize cost in a low-price environment. Mining companies need to ensure that their investment in productivity isn't deprioritized once commodity prices improve, and the sector's focus turns once again to production growth. By taking a longer-term focus, sustained productivity levels can help to optimize capital. As mining companies continue to optimize their portfolios, and make acquisitions or divestments, it is critical that they consider productivity as a part of synergies. This is a particular challenge for private capital and for the majors where permission to grow will come sooner than for the rest of the sector.

Cost reduction has become expected as everyone has done it and so there is little competitive advantage. Productivity improvement has been a source of competitive advantage for those that have been early adopters, but the levels of improvement have not even recaptured what has been lost over the past decade. To take advantage of where the sector could be in productivity performance requires real innovation. Those mining and metals companies which choose to seriously innovate will drive superior performance for the next mining and metals cycle.

03

Access to capital

(2 in 2014)



Key thought

Capital access is a matter of survival for most junior and mid-tier companies.

The mining and metals industry has entered a historic period of correction to adjust oversupply, as a result of the cyclical downturn. This is having an impact on earnings, balance sheets and investor perceptions.

Producers are focused on restoring stretched balance sheets and improving profitability through asset sales and capex reductions; distressed mid-tier companies are restructuring debt; and juniors are struggling to access the equity needed to sustain their activities. Retail investors are all-but-absent from the sector; institutional investors are largely risk averse and highly selective, seeking opportunities only in those that meet the most demanding of investment criteria; and yield-hungry funds are increasingly on the lookout for desperation equity or distressed debt opportunities.

Risks currently associated with accessing capital are thus increasing in complexity, requiring careful consideration of both immediate and future financing needs.

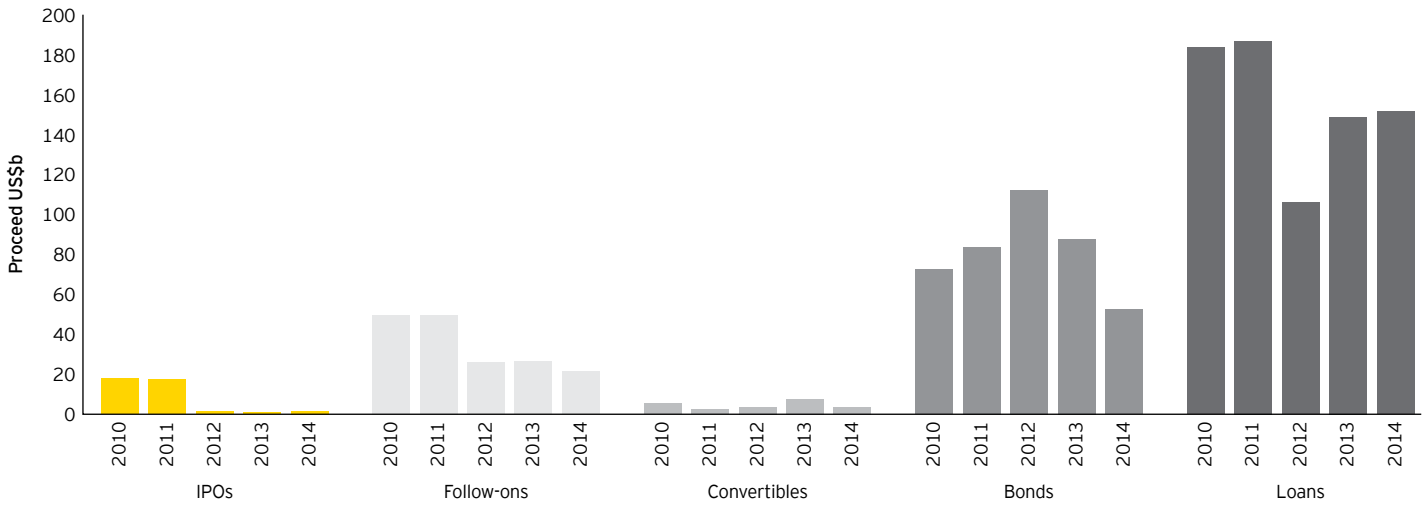
Nervous markets

Capital raised by the industry dropped 15% y-o-y in 2014, which is partly a reflection of lower appetite for spending by producers and partly of the challenging market conditions. Equity raised by the global junior mining and metals sector has fallen year-on-year since 2012, with over half of equity issues by junior companies in 2014 raising less than US$1m. Around a third of those companies returned to the market at least once more within 12 months to raise additional funds – some as many as six to eight times. Favorable windows have opened in the equity markets, for example, for Toronto-listed gold companies in early 2015 following a brief uplift in the gold price. But such windows are typically open only for short periods of time in the current volatile environment. Companies need to be "documentation ready" to take advantage of these window openings.

Of the US$152b of bank debt raised by the sector, just US$22b (15%) was specifically used for project finance. Nearly US$75b of refinancing by larger producers accounted for 49% of loan proceeds, pointing to continued demand and liquidity for strong names, but lenders' tolerance of risk has its limits in this environment. Fortescue Metals Group, for example, abandoned a US$2.5b refinancing attempt in March 2015 (subsequently launching a US$2.3b offering in April 2015, underlining the fickle nature of the markets), reportedly due to challenging conditions in the debt markets.[1]

1. "Fortescue withdraws senior secured note offering," *Fortescue Metals Group*, 18 March 2015.

Capital raised – five-year trend by asset class (2010–14)



Source: EY analysis, ThomsonONE.

Access to capital is increasing in complexity

The market conditions have facilitated the rise of alternative sources of finance, such as streams, royalties, high-yield bonds, pre-finance offtake and equity-linked instruments — at once, both a boon for companies in need and source of increased risks. Companies are faced with limited choices: accept the options on the table or risk project stagnation, loss of competitive positioning and, at worst, loss of ownership under "use it or lose it" rules.

As a result, they are often accepting terms that may be expensive to arrange and maintain (potentially beyond their means in a deteriorating market), and may dilute future earnings, present loss of control and damage future financing prospects. Private capital investors have pointed toward stream agreements, for example, as an impediment to their willingness to invest, due to the loss of upside potential, the dilutive effect and the complexity involved in unwinding such structures. Furthermore, with capital providers being reluctant to "spend big," companies can often find themselves needing to approach multiple providers to secure sufficient funds, thereby increasing the complexity and costs of arranging finance.

While survival is a strong motivation for many juniors in their choice of new capital, this can create excessive short-term action that may cumber the value of the asset or project indefinitely. Directors have a responsibility to ensure their companies can meet their debts as and when they fall due; but, they also have a fiduciary responsibility to shareholders to protect and grow the value of companies' assets.

Leverage also remains a key concern, particularly in the iron ore and coal sectors, with little prospect of near-term turnaround for smaller, higher-cost producers, and a cumulative US$14b of debt maturing in the next three years in the relatively small US high yield sector alone.[2] Investors are pricing risk at a premium in 2015; coal and iron ore issuers CONSOL Energy, Peabody Energy and Cliffs Natural Resources paid a weighted-average coupon of 8.8% in Q1 2015, compared with a sector average of 7.5% in 2014.[3] Conditions are arguably ripe in certain sectors of the industry for distressed debt hedge funds looking to exploit "buy-to-own" opportunities; a number of US coal companies are said to be the targets of such interest.

As the markets are "risk-off," there is little capital for higher risk producing projects (e.g., those that face higher technical or country risks), let alone for developing projects or exploration and evaluation. Given the gap, private capital firms are increasingly seeing good investment opportunities but are more likely to prioritize producing assets. While there are exceptions, private capital is unlikely to be a major source of finance for junior explorers.

Time for a strategic approach

Successful navigation of these challenges requires a strategic and agile approach to fundraising:

- **Preparation, knowledge and planning**: Companies should maintain a focus on the longer-term strategic aims of project fundraising in order to meet both short- and long-term needs as the project progresses through its various stages. This requires a thorough understanding of the short- and long-term implications of different funding structures, and the means with which to mitigate risk, such as building inter-creditor principles and debt headroom into contracts, and minimizing future earnings dilution. Understanding and mitigation of default risks are also critical in such an uncertain environment, requiring a conservative approach to the economic assumptions used in feasibility studies and a proactive approach to refinancing. An understanding of the pros and cons of different funding structures from a valuation, risk and tax perspective should also be considered.
- **Market awareness**: With documentation and strategic aims in place, companies should have a keen eye on the market in order to successfully capitalize on windows of investor confidence and secure or "extend and amend" finance on attractive terms.
- **Investor perception**: While yield continues to be a short-term driver of demand in capital markets, mining companies are long-term investments, requiring long-term financing partners. Attracting the "right" kind of investor requires clear and realistic articulation of how inherent risks will be managed and mitigated throughout the life of the proposed investment.
- **Successful divesting**: To maximize value and speed of execution, a strategic approach to divestments is also key. Regular portfolio review, rigorous preparation, a story targeted to individual buyers, and effective separation planning are just some of the means by which companies can avoid missing the boat and leaving value on the table.[4]

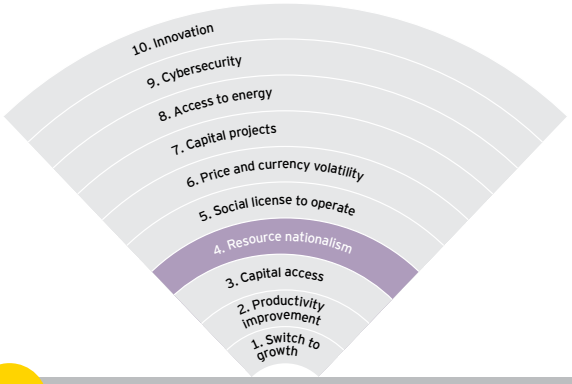
2. "Fitch U.S. high yield default insight," *Fitch Ratings*, 21 April 2015.
3. Weighted by duration. Source: EY, ThomsonONE.

4. Further guidance around successful divesting can be found in EY's *Global Corporate Divestment Study*, http://www.ey.com/GL/en/Services/Transactions/EY-global-corporate-divestment-study accessed 18 June 2015.

04

Resource nationalism

(4 in 2014)



Key thought

The new age of transparency means increased reporting requirements have left a number of sector participants scrambling to comply.

Retreating resource nationalism

Resource nationalism continues apace, but not with the vigor of previous years. Taxes and royalties are still being increased around the world, and are either being implemented or proposed in countries such as India, Guatemala and the Democratic Republic of the Congo. Mandated beneficiation is gaining political popularity with the perceived value adds to economies. Outside of ongoing negotiations with Indonesia around its mandated beneficiation requirements for nickel, bauxite and copper, many other countries are reviewing its introduction. In Zimbabwe, mining and metals companies are seeking clarity over proposed mandated beneficiation for platinum, while countries such as South Africa and Ghana have discussed its possible introduction. Most recently, Namibia is looking at mandated beneficiation with the establishment of a Value Addition Committee and calls from the Deputy Minister of Mines and Energy for investors to prioritize value addition to the mining process.

A positive trend we see continuing from 2014 is that many countries are changing their laws to encourage capital flows into the sector by improving the investment environment. These countries include Peru, Mongolia and Ecuador. In more extreme cases where divestment was a threat, countries have reversed their position on resource nationalism action, which is a sign that a turning point has been reached. For example, Australia repealed its Minerals Resource Rent Tax on coal and iron ore in 2014. Zambia returned to a 9% royalty rate and then lowered it further to 6% for underground and open-pit operations (from 20% and 8%, respectively). This was after the increase was met with threats of mine closures and job losses. The Zambian Government did so in order to regain the confidence of the sector, and maintain and encourage investor confidence in what is perceived as a high-risk location and difficult market conditions.[1]

Advancing transparency

Despite these changes, there is still the perception that the big miners are taking advantage of countries and not paying their "fair share." In addition, there is increasing political pressure to expand the disclosure of payments by extractive industries to governments as a means of reducing corruption by shining a light on these payments. This belief has seen the increasing emergence of calls for transparency in reporting of taxes and other government payments. Changes mean that companies will need to start disclosing annually their government payments on country-by-country and project-by-project bases. These rules are also often referred to as the "publish what you pay" rules which are focused solely on the payments that oil, gas, mining and logging companies make to governments.

The disclosure by extractive industry companies of payments made to governments is not new as the concept began with the Extractive Industries Transparency Initiative (EITI) in 2002. The EITI goal is to enhance good governance of natural resource development through improving transparency and accountability in the extractive industries. Under EITI, companies publish (disclose) what they pay to a specific jurisdiction and the government publishes what it receives in a process that is overseen by a multi-stakeholder group of governments, companies and civil society.

In an effort to demonstrate support for EITI, the US included a provision in the Dodd-Frank Act in 2010 to require extractive industry companies subject to US securities laws to report payments made to the US and foreign governments. Although the initial rule issued by the US Securities Exchange Commission (SEC) was vacated by the courts in litigation, a final rule implementing the law may be issued sometime in 2016 that is in compliance with the court ruling. Accordingly, it is anticipated that extractive industries companies (oil, gas and minerals producers) subject to SEC rules will be reporting these payments in the near future.

1. "Zambia sets mining royalties at 9% – presidency source," *Reuters News*, 14 April 2015; "Zambia Said to Revert to 30% Profit Tax for Mining Companies," *Bloomberg.com*, 14 April 2015; "Zambia seeks to appease mining sector with royalty revision but caution likely to remain until 2016 election," *IHS Global Insight Daily Analysis*, 22 April 2015.

The European Parliament enacted new Accounting and Transparency Directives in 2013 that included requirements for companies engaged in the extraction of oil, gas, minerals and logging activities to publish payments they make to governments. The Member States of the European Union are required to enact conforming laws by November 2015 to implement these directives. To date, the United Kingdom and France have passed conforming rules so companies who are registered entities in those jurisdictions or are publicly traded on their exchanges must comply for 2015 and publicly disclose payments made to governments in 2015 in reports filed in 2016.

Finally, and most recently, Canada passed the Extractive Sector Transparency Measures Act which requires Canadian entities engaged in the extraction of oil, gas minerals and logging to publicly disclose payments made to governments. The new law entered into force on 1 June 2105 and applies to payments made in financial years beginning after that date. Accordingly, companies with a calendar year end will be required to disclose payments to governments made in 2016 in reports filed by May 2017.

An opportunity exists to demonstrate your contributions to local economies and help build positive government, investor and public relationships.

The Organization for Economic Cooperation and Development (OECD) has initiated a project to develop rules to counter perceived abuses by multination companies to erode their tax base through profit shifting (Base Erosion and Profit Shifting – BEPS). This initiative will impact all multination companies and is focused on fifteen actions to provide governments with tools to prevent multination companies from paying little or no income taxes. A cornerstone of the BEPS project is Action 13: *Guidance on the Implementation of Transfer Pricing Documentation and Country-by-Country Reporting* which deals with the reporting of key financial and operating data of an organization on a country-by-country basis. The country-by-country report will be filed by a multinational parent company with its home country which will share the report with other relevant governments under information exchange agreements.

The OECD Action 13 Guidance recommends that the first country-by-country report be required to be filed for, and contain information with respect to, a multination company group's first fiscal year beginning on or after 1 January 2016. For multinational company groups with fiscal years ending on 31 December, the first report would be required to be filed by 31 December 2017.

There is an important distinction between these rules:

1. The OECD country-by-country reporting is a BEPS initiative that impacts all companies and relates to the disclosure of headcount, property and other income allocation methodologies to ensure tax authorities have sufficient information to determine the accurate allocation of corporate income between jurisdictions.
2. The reporting of government payments is the disclosure by extractive industry companies of all tax and other payments on a project and country basis to enable all stakeholders to better understand the total taxes and fees received from extractive projects and how the amounts are being spent, as well as to reduce the possibility of corruption.

As noted above, rules requiring the disclosure of payments to governments have been enacted in the UK, France and Canada, with other countries moving toward similar enactments, with some of these rules being effective for payments made in 2015 and first reporting due in mid-2016. The OECD Action 13 reporting will commence for calendar year commencing on 1 January 2016 with reports due in 2017. Consequently, if they have not already begun, impacted companies should be working to understand how these rules will impact them and how they will comply. Mining and metals companies should consider these two sets of reporting and disclosure requirements in tandem in order to develop systems and processes that will allow them to comply in an efficient manner.

In a global poll undertaken in June 2015 by EY on transparency in the sector, nearly 50% of the 725 mining and metals sector respondents felt that increased transparency requirements would be a financial and reporting burden, and 70% felt they were either unprepared for increased reporting requirements or have a lot of work to do to sufficiently comply.

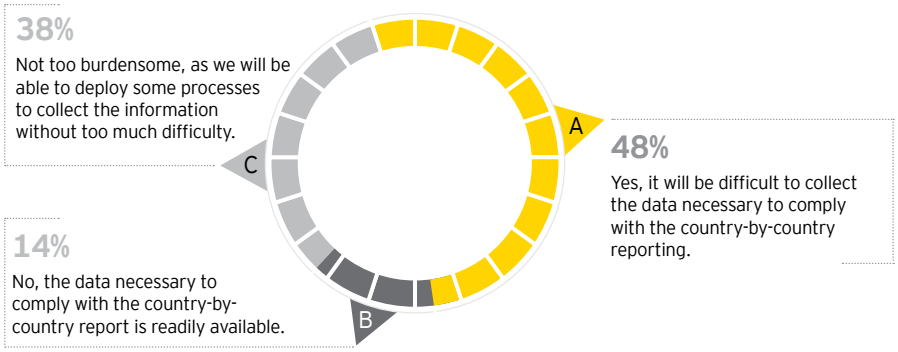
Companies will need to keep in mind some of the implications of these new reporting requirements and consider the following:

- Have they reviewed their systems to ensure they capture all the detail they will need, remembering that it will include details outside of tax?
- Do they have access to the data that will be required to be disclosed?
- If the data is available, will it be reliable?
- Can they create a standardized profile of payment information to disclose even though the rules are still under development and countries may have unique requirements?
- Once summarized, will the information tell the story they believe it will tell?
- Have they reviewed the type of data they will be generating and are you happy for the data to be publically shared?

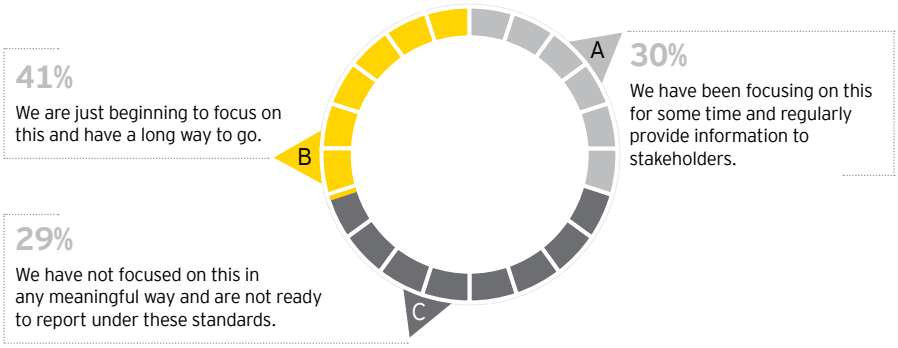
While the reporting of government payments will clearly be a significant challenge for many mining and metals companies, it should also create an opportunity to better communicate the contributions that are being made to the countries in which these companies operate.

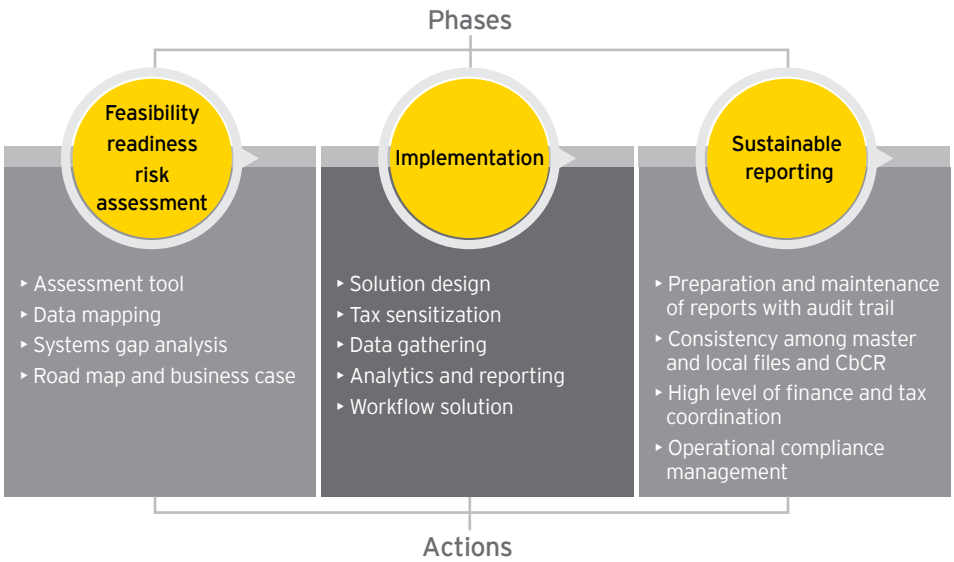
Global poll results — government payments

Do you think the compliance associated with the OECD BEPS Action 13 will be burdensome to your organization?



How prepared is your company for the increased reporting requirements around government payments?

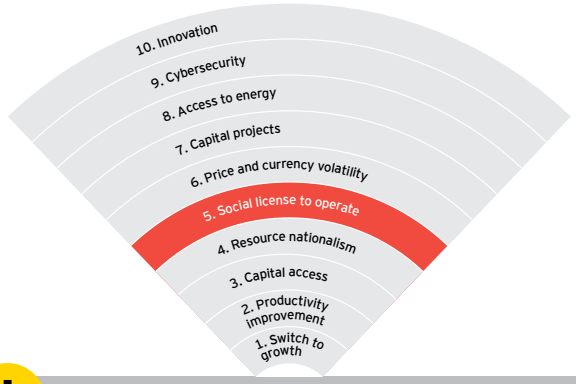




05

Social license to operate

(3 in 2014)



Key thought

This risk has become even more political, with many projects being abandoned or postponed due to an inability to obtain a social license to operate.

Social license to operate (SLTO) is a complex, multifaceted issue. This issue has a wide impact on all communities — from governments to locals and activists as well as the mining and metals organizations. It is the way these groups interact with each other on projects, which results in whether a miner receives the SLTO. And, when billions of dollars in investment are at stake, it is critical that this juggling act between project viability and SLTO is not seen as a trade-off, but rather as a mutual collaboration. These are the issues most at stake that impact the SLTO.

Impact to the mine, impact to the community

Mining and metals operations and the community are inseparable. Operators more than ever recognize that they need to bring host communities along with them on their road to prosperity, if they are to successfully operate in the area of the community. However, this means that communities share the risks during challenging times too.

This has never been more evident that in the present operating environment. Lower commodity prices have meant that many operators are cutting their exploration and investment budgets. This is having an impact especially on the economies of developing regions that are increasingly relying on foreign investment to support communities.

Similarly, non-economic threats may affect the viability of a project but the potential damage to the community in ceasing operation could be devastating. For instance, the Ebola crisis had a disastrous effect on Sierra Leone's economy in 2014 as organizations abruptly suspended, and considered closing operations, in the mineral-rich nation.

Despite the tough economic times for operators and explorers, it is "false savings" to cut back on community engagements just because exploration spending has slowed. Time and time again, it has been proven that early and consistent community engagement and investment is far more valuable to a potential project than a massive increase in spending post-feasibility.

Any reduced spending on local projects, and loss of local employment when mines close, creates negative sentiment towards the operator, and the sector generally, as it damages the relationships they have developed and creates distrust. This is exacerbated by the indirect economic impact on the community, such as loss of business for local suppliers, employment in affiliate industries, population decline and discontinuity of services.

In a capital-constrained environment, there is also the very real temptation to cut costs where possible, yet if too many cuts are made in important areas, such as safety, employee and community health and environmental impacts, the potential longer-term consequences could be far more damaging than the costs saved.

Informal mining and conflicting rights

Illegal "guerrilla" mining increasingly impacts the legitimate miner's SLTO. Unlike artisanal and small-scale subsistence miners, these miners undertake activities without the permission or knowledge of formal or informal landowners, trespassing on mineral-rich mining properties and stealing ore-bearing material. Often this accompanies criminal activities, including forced labor, affiliation with drug cartels, organized gangs/terrorist activities, extortion and black market trading. Generally, illegal mining involves poor conditions, dangerous practices and environmentally hazardous activities, which pollute water supplies and threaten the life of workers. Developing countries with a long history of informal and small-scale mining activities, such as those in Latin America, are increasingly impacted by illegal mining activities; there are ongoing actions by governments in these regions to tackle the problem.[1]

1. "Minecraft: Illegal mining in Latin America," *The Economist*, 16 September 2014.

For legitimate miners, illegal mining threatens the health and safety of the employees, community and environment surrounding mine site. The threat may be so bad as to warrant closing mines and freezing development plans. This, in turn, also means that community economic benefits, such as employment opportunities and development programs, are withdrawn, and hence damages their social license to operate. Harmony Gold, for example, closed its Kusasalethu mine in South Africa in October 2014 for two weeks in response to fires reportedly caused by illegal mining activity.[2] Subsequently, legal mining operations find it harder to gain the buy-in of surrounding communities.

The influence of government and regulators

Governments in some developing regions are being challenged on mining decisions that affect communities, leading to heightened local backlash. While governments recognize the opportunity-cost in encouraging investment to develop their economies, for miners the reputational risk of operating in social conflict-prone regions may outweigh the potential reward. For example, the Peruvian Government is under criticism for approving the Southern Copper's US$1.4b Tia Maria project against the wishes of a significant portion of the community. This has erupted into ongoing and violent protests, despite concessions to alleviate environmental concerns by the company.[3] On the flip side, the Eldorado gold project in Greece has seen the left-wing Government attempting to close the mine on financial and environmental grounds, but local supporters and miners have protested against the move because closure would threaten jobs.

Deregulation in past decades has also elicited negative public criticism in recent years for its potential impact on communities. Inadequate regulation and policy in the Canadian mining and metals sector, for example, in addition to staffing cutbacks and poor design processes at the Mount Polley mine, have been criticized for the tailings pond disasters.[4] Mining and metals operators will increasingly face re-regulation as a result of these types of accidents, and additional community scrutiny as the public awareness of these incidences becomes widespread.

Macro agendas, micro actions

While the genuine concerns of the host community should not be underestimated, we are seeing cases where politically-motivated activists with global agendas latch on to local concerns to attempt to stop or delay projects. Some NGOs are increasingly litigious in their anti-mining activities, which can result in lengthy and expensive legal battles and can cause reputational damage within the wider community.

Wider stakeholders opposed to invasive mining operation are also starting to gain leverage by combining forces, increasing their visibility and the ability to influence public sentiment. "Lock the Gate," a coalition of Australian farmers, traditional landowners, conservationists and local residents is a good example. In such cases, discontent is often multifaceted and deeper than that which is vocalized by stakeholders at the picket line.

Social media is being used as an effective weapon by anti-mining and special interests groups to exploit local community fears over mining to unite often disparate objectives of various stakeholder groups and to publicize these issues to the wider community. The sector has traditionally been less sophisticated in understanding what information is disseminated via the social media and has not taken full advantage of using social media to combat misinformation. Instead, social media can and should be seen as an effective tool to promote the real value of a project to its host community.

2. "Harmony Gold closes biggest mine as 105 illegal miners arrested," *Bloomberg*, 1 November 2014.

3. "Peru mining protests leave one dead, more hurt," *Wall Street Journal*, 23 April 2015.

4. "Mount Polley tailings pond breach: Weak foundation was like a "Understaffing, deregulation to blame for Imperial Metals' Mount Polley tailings pond disaster: critics," *Vancouver Observer*, 5 August 2014.

Increased awareness of impacts and rights

Improving awareness around both cultural and economic value of the land means that negotiations for fair compensations can be a long and expensive process. Communities seek a benefit or reimbursement for the potential and actual impacts to them. Las Bambas took six years of consultation and required the relocation and construction of a new village complete with power, running water, sewerage treatment, schools and sporting facilities in order to achieve community acceptance.[5] Previously, traditional communities may not have understood the full impacts of a project and were consequently placed in a vulnerable position at the negotiating table. Now, in an increasingly global and connected world, communities have improved understanding of the ways a mine can affect their lifestyles and can be more proactive about working with miners.

Some governments are now acknowledging the free prior and informed consent as part of official approvals processes. Vedanta was forced to abandon a US$2b project to mine a mountain sacred to the Dongria Kondh tribe's after the Indian courts resolved that the community had the final right to decide.[6] The Bougainville Mining Act 2015 was recently passed to ensure that local landowners have the power to stop exploration or licensing grants and ensure access to small-scale and artisanal miners.[7] Also, the Mongolian Government created a text messaging referendum in February 2015, which enabled constituents to vote on the expansion of the Oyu Tolgoi mine or continue with its current austerity measure.[8] The community voted in favor of the expansion and reached a successful agreement in April 2015 as a result.

How to approach this risk productively

These risks highlight the crucial importance of ongoing, regular and in-depth communication and engagement that exceeds basic regulatory requirements, and cannot be underestimated. Many mining and metals organizations now recognize the value in participating in global initiatives to take responsibility for cultural and environmental sustainability and to demonstrate their social value. However, more can always be done to ensure that this is less about public relations and more about genuinely sharing the benefits and minimizing the impact of operations on communities.

A distrust of governments places even greater importance on quality information and ongoing communication from operating organizations and how crucial it is to demonstrate the value they bring. Miners cannot rely exclusively on groups representing a community to ascertain impacts. They should engage in their own complete and independent consultation, ongoing engagement and collaboration programs to ensure that the needs of the community are fully understood.

Engagement from the prefeasibility phase is essential as is integration into the entire planning process to ensure that all stakeholders are aware of all impacts. For the miners, there is benefit in understanding the financial contributions necessary to meet community expectations upfront, but they must also remain flexible as these needs can and will change over a project's lifecycle.

Organizations need to remain abreast of local and regional rules and embed regular reviews of systems into their audit processes to accommodate the constantly changing regulatory environment. As communities and advocates become more and more litigious, early consultation and negotiation is crucial to avoid expensive and potentially damaging legal battles. Organizations also need to be aware that community attitudes often run ahead of the legal and regulatory framework.

Finally, examining options for shared ventures with local industries is a potentially invaluable win-win for both operators and community. This includes developing new strategies, new ways of thinking and metrics to not only support the community, but also help them thrive. In exploring partnerships in infrastructure development, schools and businesses, for example, companies can leverage shared costs, stimulate local economies and, in turn, provide genuine opportunities to create sustainable communities.

5. "Miners offer bull rings, clinics as protests ice $25billion," *Bloomberg Business*, 17 March 2015.

6. "India rejects plan to mine bauxite in Niyamgiri Hills," *Wall Street Journal*, 12 January 2014; "India's rejection of Vedanta's bauxite mine is a victory for tribal rights," *The Guardian*, 15 January 2014.

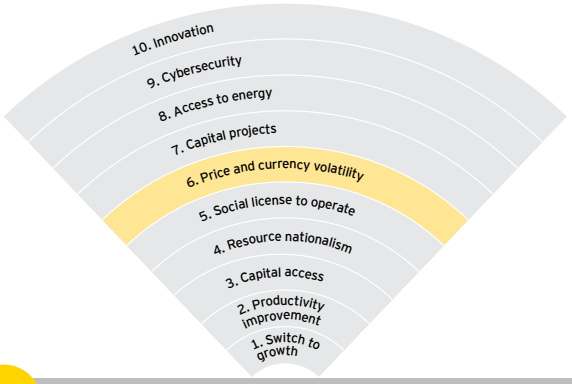
7. "New mining law now in force in Bougainville," *Mining News Premium*, 2 April 2015.

8. "Mongolian 'text referendum' backs Oyu Tolgoi copper mine expansion," *Reuters*, 3 February 2015.

06

Price and currency volatility

(6 in 2014)



Key thought

Hedging one side of price and currency volatility is like only addressing one half of the story. You need to hedge both the commodity prices and producer nation currencies to flatten out volatility.

Source of price volatility

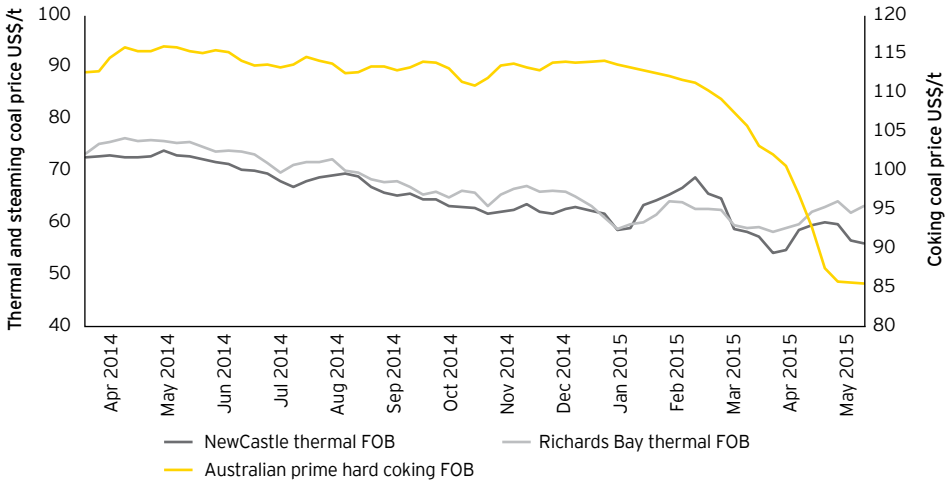
A clear legacy of the super-cycle for mining and metals is a "super correction." The price stimulus for a decade of supply-chasing demand growth was slow to build momentum due to the long lead times to bring on new supply. Similarly, the price signals to restrict new supply and to start in high-cost supply as surpluses started to emerge were blunt due to the same time lags.

In effect, capital approvals in 2011 and 2012 are contributing to the supply excess despite most prices only adjusting in 2013 or later.

Markets are ultimately self-correcting via the price mechanism – the greater price stimulus both in scale and duration, the greater the correction and the greater the volatility as markets seek to correct. However, not all markets, for all commodities, will correct at the same rate and duration. The presence of dominant producers and nonmarket participants can have a significant impact on volatility.

In case of met coal, the existence of a very large low-cost producer, which was able to increase low-cost production, caused the met coal price to fall quicker than it may otherwise have done, thereby accelerating the rational closure of high-cost mines. This increased the volatility, but decreased the duration.

Met coal volatility – short and sharp



Source: Datastream, McCloskey, EY analysis

In case of iron ore, the existence of high-cost, state-owned producers willing to subsidize loss-making mines, while large low-cost producers increase supply, has led to a more rapid lowering of the price, forcing the closure of mid-cost producers – a lose-lose-lose situation for high-, mid- and low-cost producers. This has also increased volatility.

Source of currency volatility

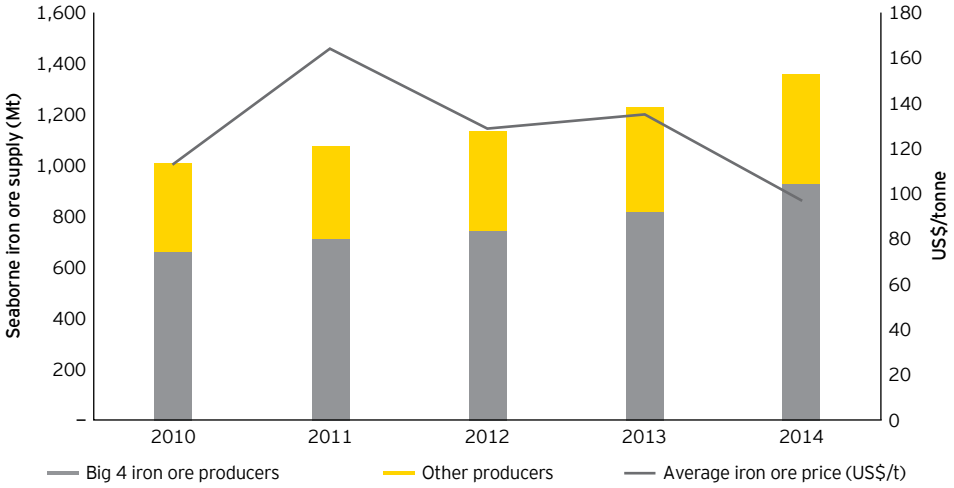
In 2014 and prior, the sector was most concerned about price volatility, as the normal hedge with producer currencies being surprisingly absent. This was primarily due to the relative weakness of the US dollar and not because of trade flows with producer nations. The end of quantitative easing has generally seen a correction in producer currencies against a stronger US dollar. As such, the Canadian and Australian dollars, the South African rand, the Chilean peso, the Brazilian real and Peruvian sol have all depreciated, providing a price stabilizer in local currency terms.

The sudden correction in the US dollar, which occurred over a short period of just six weeks, added to the volatility for producers.

Interplay of currency and price

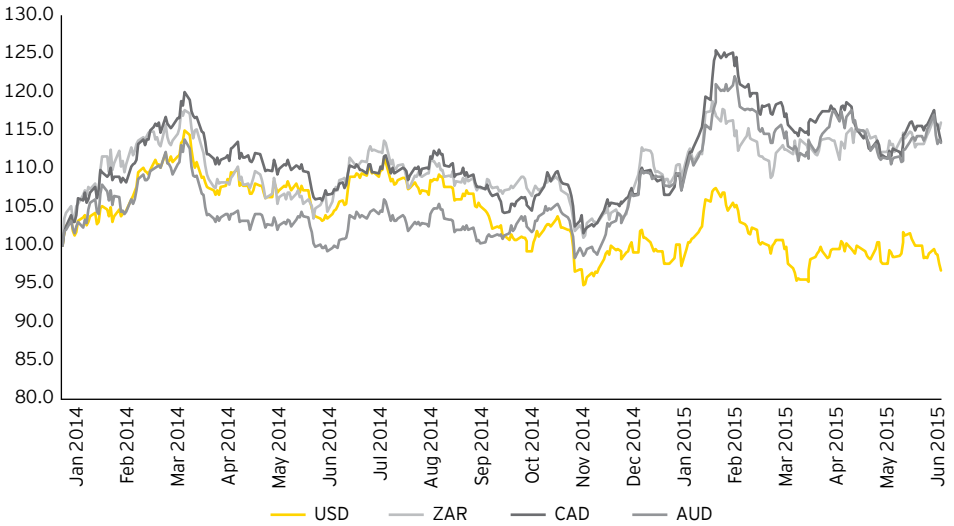
As currencies reset, the relative positioning of producers also change on the cost curve. For example, depreciation of the Canadian dollar lowered the local costs of a Canadian gold miner, when compared to either a US or Chinese gold producer. The marginal costs of the sub-sector may become lower, thereby further lowering prices, and new high-cost producers may emerge and have to face the threat of mine closure.

Iron ore prices drop as wall of supply hits the market



Source: Company annual reports, UBS, EY analysis.

Gold prices (Jan 2014=100) stabilized by producer nation currency fluctuations



Source: World Gold Council

Industry response

The rational reaction of producers was to lower costs to improve their relative position on the cost curve. Largely, this has been ineffective as most producers have adopted the same rational individual strategies, achieving roughly the same cost reduction, maintaining the same position relatively on the cost curve, lowering the marginal cost of production, and thereby lowering prices even further.

However, few have fully repaired the loss of productivity over the super-cycle. Those producers that have increased productivity have also improved their relative cost curve performance.

Some have undertaken hedging to mitigate volatility risk, either voluntarily or as part of financing arrangements. However, since the link between currency and price has been restored during 2014–15, it is essential that any hedging program considers both parts of volatility. The folly in hedging only one side has been discovered by a number of producers in recent times.

Rising value of flexibility

In our report of prior years, we pointed out the value of flexible mining and metals operations in times of high price volatility. By that we meant a flexible operation was one that could vary the level of production without significant cost penalty. To achieve this, a producer would need to increasingly substitute variable costs for fixed costs.

Nobody understands the option value of flexibility better than a trader. With the growing convergence of the producer/trader and trader/producer models, we are witnessing more flexibility, not just in individual mines but also across portfolios of mining and metals companies.

A great example is the flexibility displayed by Glencore in the three-week Christmas closure of its Australian coal operations: work roster changes, revisions to product portfolio and campaign mining in open pits, etc. The combined impact of these changes was a reduction in production by 15mt–20mt, without any mine being placed into care and maintenance or without any permanent mine closure.[1]

Outlook

We expect price and currency volatility to continue into 2017. The prolonged period is impacted by:

- The size of the correction required
- Increased regulation, especially with regard to mandated beneficiation
- Further monetary policy weakening in Europe and Japan, and increased geopolitical risk in the Middle East, North Africa and Eastern Europe
- State-owned mining and metals companies subsidizing loss-making operations
- Continued unwinding of financing deals secured by physical metal holdings

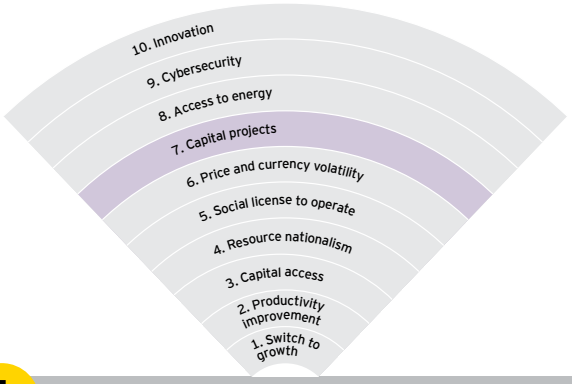
The less known factor that may impact price and currency volatility is the future outlook for demand. If real Chinese metal demand growth were to slow or even decline, this could further compound an already volatile market. Current evidence is contradictory and not clear-cut. Whatever the outcome, the uncertainty created will also increase volatility.

1. "Glencore to close for Christmas," *miningaustralia.com.au*, 14 November 2014, http://www.miningaustralia.com.au/news/glencore-to-close-for-christmas, accessed 11 June 2015.

07

Capital projects

(5 in 2014)



Key thought

The enormity of overruns on capital projects is an issue that is further exacerbated by the current low-cash environment.

The productivity of invested capital is a key issue for CEOs across the global mining and metals sector as falling commodity prices and a rising supply surplus are ushering in a period of restraint in capital project investment. Decisions focusing purely on volume growth, and thus resulting in productivity trade-offs, may have been commercially viable during the boom period, but are often no longer acceptable to investors in the current post-boom era.

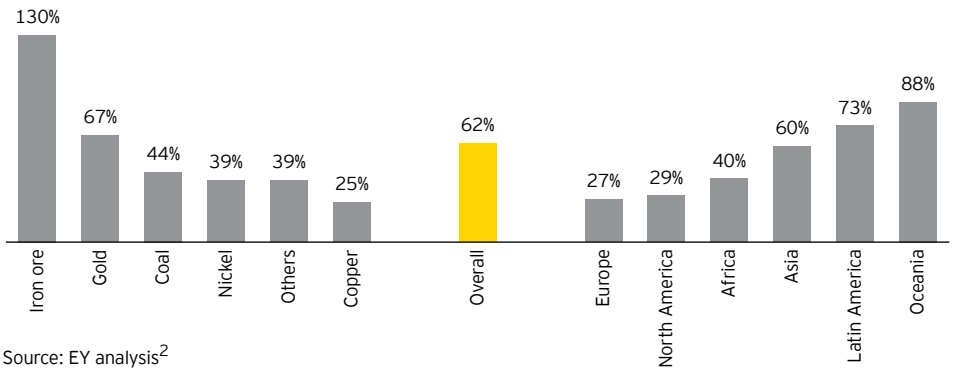
Scarce capital is driving a strong focus on capital productivity or "value for money," and with that numerous high-profile projects have been scrapped, shelved or sent back for re-planning, with a recent study identifying aggregate cuts in capital expenditure of more than US$27b in the period since January 2012. Following a robust peak in growth of 27% in 2012, mining capital spending declined by 10% in 2013 and was expected to have dropped by a further 15% in 2014.[1] Competition for a smaller pot of capital project funding within organizations is now fiercer than ever and has led to an even greater emphasis on ensuring that there is enhanced rigor in determining which projects will deliver the gains in capital productivity and strategic outcomes that are desired and required by boards and investors.

EY's study of recent global capital projects revealed, despite increasingly mature delivery skill-sets, 69% of megaprojects were facing cost overruns, with an average overrun of 62% for those projects with available data.

Iron ore represented the highest proportion of projects experiencing cost overruns at 73%, with the average cost overrun being 130%. As iron ore is a bulk commodity being mined in large volumes compared to other commodities, the projects are vast in scale and cost. In addition, these projects are often constructed in remote locations, necessitating simultaneous development of large-scale infrastructure to support the project. This adds to the complexity and cost of the project, with an increased number of variables that can cause cost blowouts.

Oceania and Latin America reported the highest average budget overruns due to the large amount of investment in projects in these regions occurring concurrently during the boom. This caused an increase in competition for raw materials and

Average cost overruns by commodity and region



Source: EY analysis[2]

Despite an estimated US$20b–US$55b* being spent globally in up-front engineering and design, average budget overruns were 62% and 50% of projects were reporting delays.

*Projected up-front engineering and design spend in the typical range of 5%-15%

1. "Riding The Rising Tide of Global Growth," Deutsche Bank Research, 19 February 2014, via Thomson One.
2. Note: Data came from an EY study of projects in the mining and metals sector (October 2014) surveyed 108 projects at various stages across the investment and project delivery life cycle.

personnel, which pushed up the cost of both. These higher costs are also seen in active projects today.

These overruns are directly impacting the capital productivity and commercial performance of mining and metals companies across the globe, and new perspectives are essential to turn this trend and deliver to boards and investors the gains in capital productivity and strategic outcomes they require.

Long lead times and the need to prepare for the next cyclical upswing makes capital project execution a critical skill to leading mining and metals companies. There are two key levers for companies to enhance their capital productivity performance:

1. Minimized and predictable "input" through controlled project delivery
2. Maximized and sustainable "output" through earlier asset operationalization (e.g., schedule acceleration) or operational efficiency (e.g., improved equipment availability and utilization processes and skills)

Successful capital mining and metals projects drive enhanced capital productivity outcomes by addressing both these levers — "inputs" are controlled and "output" efficiency is designed simultaneously. In contrast, at-risk capital projects commonly face challenges of both "input" inflation (such as cost and schedule variance) and compromised "output" performance (such as operational impacts of poor design). Capital productivity is a two-part relationship that can work to a project's advantage or detriment.

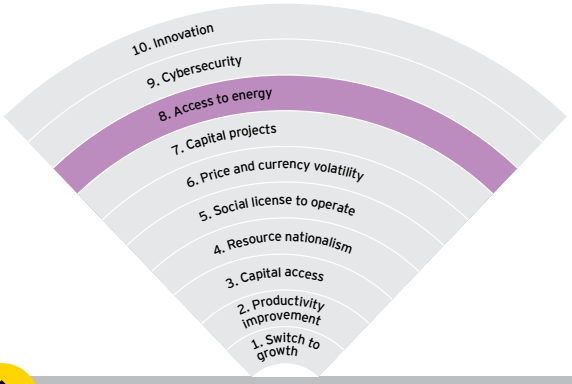
Despite many mining companies enhancing the process maturity of engineering design, projects continue to experience significant project cost and schedule overruns. While the oil and gas sector is not perfect in capital project execution, it is far more mature than the mining and metals sector and there are many lessons the sector could take from oil and gas. From our global experience working with clients on large and complex capital programs, we have observed a consistent theme of underinvestment and lack of focus in three, often overlooked, but critical areas:

- **Implementing governance and reporting frameworks with lead indicators that reliably flag emerging risks while they can still be efficiently mitigated**
  Having a well-structured and defined governance framework with clear roles and responsibilities is necessary to ensure that decisions are being made by the right people and in a timely manner. Embedding leading indicators into reporting dashboards is an effective approach to flagging these risks as they begin to emerge during delivery. This ensures that management is empowered with timely information to make quick and effective mitigation decisions, meaning more risks are caught early and addressed before they drive budget and schedule slippage.
- **Allocating adequate cost and time contingencies to account for risks across a project's lifecycle**
  Mature risk management processes will ensure that the negative impacts on costs and schedule are considered equally, with the upside through cost and time savings initiatives. The most successful of these processes encourage teams to think innovatively in order to not only protect budgets and schedules, but to drive true productivity across the project life cycle.
- **Enhancing the value of contingency planning by aligning contingency plans to scenario plans**
  A missing link in many capital planning processes is the closely integrated connection between the complementary disciplines of contingency allocation and scenario planning. By understanding the scenarios that could occur, and having an informed view of different scenario impacts, management can be significantly more agile and able to adapt to emerging future. Given the importance of timely and decisive action to address emerging risks, this increased level of decision-making confidence can make the difference between achieving capital productivity outperformance and falling victim to the capital productivity statistics.

08

Access to energy

(10 in 2014)



Key thought

Securing sustainable, cost-effective and reliable energy is key as costs sky-rocket and governments back community interests.

Mining is an energy intensive activity with the cost of energy representing up to 40% of a company's total cost base, making it a keenly managed component of any operation. Unsurprisingly, rising energy prices in an environment of declining commodity prices and the resulting margin compression had been one of the foremost issues that mining and metals companies have been struggling with over recent years. Falling oil prices have brought some relief to mining and metals companies, making a significant dent in one of their major input costs. It has also lessened the transportation cost differential especially in transport of bulk commodities, where proximity from consumer markets ceased to be a benefit as more commodities could be transported farther for cheaper. However, the current slump in oil prices is the result of oversupply, with demand remaining more or less unchanged, signifying that the balance could be reversed through supplier discipline. Volatility, escalating prices and the finite nature of the most widely used sources of energy, oil and natural gas, pose a great risk to mining and metal companies.

Longer term, ensuring energy security in a sustainable, cost-effective and uninterrupted manner requires an integrated approach, right from the project conception and planning stage. This becomes even more critical as mining and metals companies expand operations to remote areas with under-developed energy infrastructure, while reducing their emissions and energy footprint becomes an imperative in developed countries. Cheaper power can also help maximize output from a mine by making "uneconomic reserves" economically extractable. Underinvestment in electricity generation and rising domestic demand for energy has given rise to power shortages in many countries such as South Africa, Ghana, Congo, Indonesia, Zimbabwe, India, Namibia, Madagascar, Rwanda, Botswana and Brazil. While some of these countries have only cyclical shortages, such as drought conditions, many have structural problems. The problem becomes magnified as many of these countries are stepping up resource nationalism efforts by mandating beneficiation domestically to garner increased value of the resources within the country.

In addition, the increasing affluence in developing markets has translated into greater demand for residential energy. This has created competition for energy between the community and the miners. Given the constrained infrastructure conditions, the battle is often lost by industry as the community is backed by government.

There are a number of options to ensure access to affordable energy:

1. **Hedging oil and gas prices**

From a near-term perspective, mining and metals companies should hedge and forward cover their demand given the strong cost advantage at current low prices. Although this may not be as effective for remote mining sites, which are more sensitive to the cost of getting energy to the site than the cost of fuel itself, and hence are less leveraged to a fall in oil prices.

2. **Self-supply**

The current self-supply model adopted by mining and metals companies has reduced power uncertainty and price fluctuations. However, this has also been costly for companies and has not benefited the local community. For instance, since 2000, mines in Africa have spent around US$15.3b on electricity and operating costs to install 1,590 megawatts of generating capacity, none of which has made it into a national grid.

3. **Government supply**

In countries with favorable policy environment, the mining and metals industry can potentially become the "anchor customer" and help unlock energy resources for the sustainable development of the power sector and in turn be rewarded with a social license to operate.[1]

1. "The Power of the Mine," World Bank Group, https://openknowledge.worldbank.org/bitstream/handle/10986/21402/9781464802928.pdf?sequence=3, accessed on 10 April 2015.

4. **Acquisitions and divestments**

Small synergistic acquisitions of energy companies can help to achieve energy self-sufficiency. For instance, in the last few years, the aluminium industry in China has witnessed many small acquisitions of power and utility companies to counter erratic power supply and power rationing during peak season. In 2014, Jiaozuo Wanfang Aluminium Manufacturing acquired Wanji Energy Technology for US$273m to improve its energy security.[2] At the same time, it is advisable to sell energy intensive operations while the environment of low oil/energy costs makes the economics look better.

5. **Innovation**

Innovation can help to de-intensify energy use in mining and metals processes, reducing both energy requirements and emissions, thereby reducing costs. Analyzing data on energy consumption in mining and metals processes can deliver significant energy savings. For instance, integration of energy management with manufacturing execution systems can help to efficiently forecast and control energy usage in mining and metals processes to reduce energy wastage. A recent study found that by using integrated energy management systems, coal and metals industries in the US can potentially reduce their energy use by 17% and 21%, respectively, while minerals have the potential to reduce it by 27%.[3] Automation can also reduce wastage and delivering energy efficiency in mining operations.

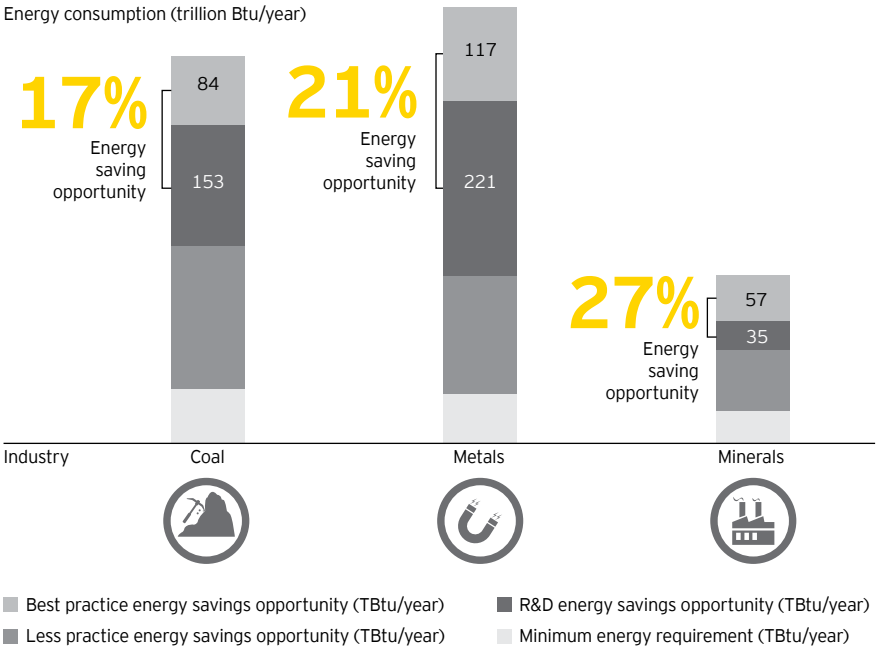
6. **Flexibility in mine plan**

Usually there is a constant trade-off between increasing the blast to reduce particle size or increasing the amount of crushing required. If operations can source their electricity from the grid or gas, it may push the scales in favor of more energy in blasting that can help maximize cost savings.

7. **Renewable energy sources**

While the current energy price environment may have dis-incentivized the development of renewable energy sources, investment in renewable energy can help companies ensure energy safety and also hedge against energy price fluctuations. On-site renewable energy generation, efficiency technologies and micro-grids are already helping mining and metals companies create a significant cost savings and operational optimization, thus reserving their place as the sustainable energy solutions of the future.

US mining industry energy bandwidth for coal, metal and mineral mining



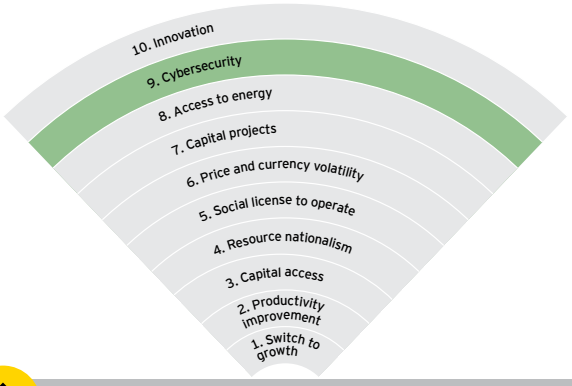
Source: Schneider Electric[4]

2. EY analysis and Thomson Datastream
3. "Identifying opportunities to reduce the consumption of energy across mining and processing plants," Schneider-Electric, http://www.schneider-electric.nl/documents/white-papers/Identifying_opportunities_to_reduce_the_consumption_of_energy_across_mining_and_processing_plants.pdf, accessed on 13 April 2015.
4. Ibid.

09

Cybersecurity

(11 in 2014)



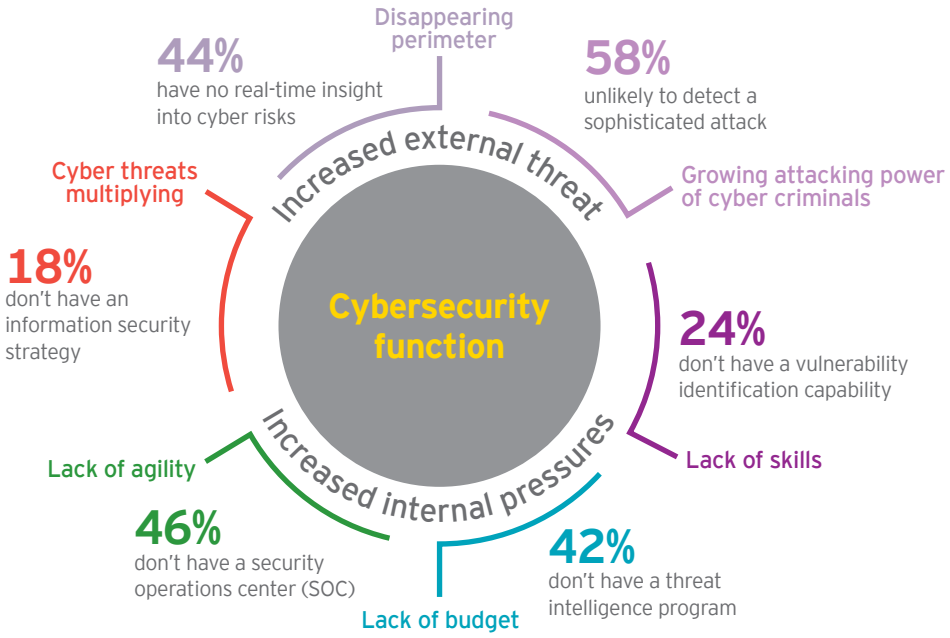
Key thought

Cyber-attacks are largely unreported or unknown, so the extent of the threat, or breaches, is under-estimated. This leads to an under-investment by organizations protecting themselves against such threats.

Cyber-hacking has become more widespread and sophisticated. In our *Global Information Security Survey 2014*, 65% of mining and metals companies said that they had experienced an increase in cyber threats over the past 12 months. In today's cybersecurity landscape, it is no longer possible to prevent attacks or breaches. In addition to technology, today's attackers have significant funding, are patient and sophisticated and attack vulnerabilities in people and processes. Despite the increase in threat, our survey results showed that only 47% of our respondents planned to increase their organization's total information security budget in the next 12 months, showing an apparent lack of urgency around the issue.

Cyber-attacks are a common issue across the mining and metals sector regardless of size or scale. High profile attacks on large, well-known companies in banking, government and many other sectors highlight that bigger organizations are equally as vulnerable as smaller organizations. Of course, not all cyber-attacks are for financial gain – hackers can be groups seeking to serve their own purpose. Being a victim of any form of attack can cost a mining and metals company millions of dollars in lost production or cause massive reputational damage, by leak of confidential/stakeholder unfriendly information.

The rapidly expanding cyber threat landscape



Key threats

We believe there are number of key threats to the mining and metals sector as follows:

- **Convergence of operational technology:** One of the vulnerabilities that the mining and metals sector faces is derived from the convergence of IT and operational technology (OT) and the increased cyber risk that it creates. Mining and metals operational functions have not traditionally been connected to the network and so, in the past, IT security risk has not been an issue. However, many mining and metals companies have been investing heavily in new technology to manage and run their networks centrally, in a bid to improve production, maintenance and data flow. Advancements in big data, mobile computing and the "internet of things" have enabled exciting opportunities in OT to improve safety, sustainability and productivity. However, at the same time, they have exposed mining and metals businesses of all sizes to increased threats of cyber hacking. By merging their IT and OT systems onto one platform, they have made the hackers job significantly easier. OT is a domain that

has historically focused on functional design (operational) and health, safety, environment and community (HSEC) controls rather than IT security. It has generally been managed by Control Engineering practitioners who are not as well versed and/or experienced as Corporate IT security practitioners. As a result, we are seeing web enabled OT across all aspects of mining and metals operations, but much of it is not being designed and operated with the same degree of risk management and security controls as traditional IT functions. Mining and metals companies are increasingly dependent on remote operations controlled by Operational which are seen as an opportunity for cyber theft, or terrorism, and securing these control systems is critical. Any breach of an OT system can be a safety risk. A recent example occurred in Germany where cyber attackers took control of a steel mill remotely, causing massive damage to the mill through an unscheduled shutdown.[1] However, IT and OT convergence can also be seen as an opportunity to enhance cybersecurity around OT because of the increase in formal measures around OT and the inheritance of the IT security protocols which would blanket the OT functionality.

- **Historic underinvestment and current budget trends**: Mining and metals organizations have historically under-invested in security, and security budgets are often static, despite increasing cyber threats. With total budgets remaining flat in recent years, competing priorities and budget constraints mean mining and metals companies are addressing only the top one or two priority areas each year. This places huge importance on how spend is prioritized and means that these companies have a limited ability to keep pace with cyber threats evolving outside their priority areas. An EY survey showed that the majority of current spend is being allocated simply to maintain existing security capabilities. This is not to suggest that maintaining fundamental security capabilities, such as patching, antivirus updates, and user identity and access management, is not important. It is, but it does not advance a company's security capability. If you are not advancing, then you are standing still, which — in the context of an evolving cyber-threat landscape — means that your cybersecurity vulnerability is increasing. Many organizations have not historically seen their cybersecurity improve as spend has increased. Security departments often still focus on purchasing the latest security tools instead of investigating and evaluating the underlying business behavior and/or root cause of the security challenges they face, in order to better prioritize finite budgets. In the mining and metals sector, budget constraints are often further compounded by a separation of roles and responsibilities for OT security and cybersecurity. OT security often falls outside of the remit of a chief information security officer or chief information officer and this can lead to duplication of security spend, resource effort and misalignment of priorities as well as gaps in the overall cybersecurity environment.
- **An understanding of whether the organization has been breached**: There is a growing body of evidence suggesting the majority of large organizations have been breached and either have threat actors operating undetected within their environments or have failed to identify the breach when it occurred. In some cases, where a breach has been discovered, forensic investigation has revealed that the breach occurred much earlier and that the threat actors had likely traversed the environment targeting specific information or assets. It is often only at the point when data is being removed from the environment that an organization identifies the malicious activity and is then able to respond.

Several high-profile reports in the media over the past few years relate to state-sponsored activity within critical national infrastructure.

Securing key data

There are three key areas that mining and metals companies should focus:

- **Marketing systems**: As mining and metals companies begin to operate their own trading systems, they face risk of strategic manipulation of trading models which can result in missed trading opportunities, and so securing these systems is key.
- **Reserve data**: Access to reserve data can result in loss of trading advantage, as cyber hackers could use the data to drive prices up or down. This can also have a broader market impact on commodity markets if leaked.
- **M&A data**: This can result in counter-trading positions and allegations of insider dealing leading to regulatory investigation.

As mining and metals companies continue to digitize their operations, they need to focus on reducing and controlling the number of internet gateways to reduce the risk of cyber-attack. And the more dependent businesses become on big data, then the more reliant they become on the veracity of that data and, in turn more vulnerable to increased security risk. The high value of transactions in the mining and metals sector, even for smaller operators, makes the sector a greater target for cyber criminals. The key for companies is to treat cybersecurity as they would IT security and other business risks — understand and assess the risks, have a comprehensive operational technology security strategy, and either accept or mitigate the risks. We see a lot of new technologies and applications deployed without an appropriate risk assessment and controls up front. "Security by design" is a fundamental principle that needs to be embedded across new initiatives.

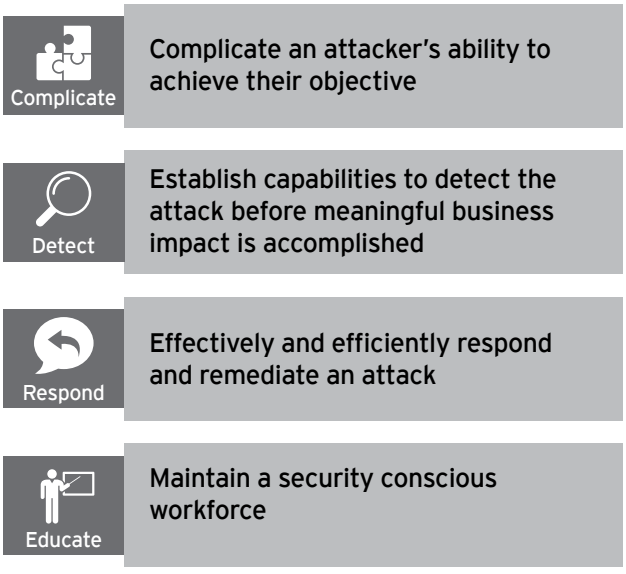
1. "Hack attack causes 'massive damage' at steel works," *bbc.com*, 22 December 2014, http://www.bbc.com/news/technology-30575104, accessed 15 June 2015.

Companies need to understand the risks, have a structured strategy in place to assess vulnerabilities and risks, and accept or manage the risks. Investment in technology should be deferred until the associated risks are assessed and understood. Investment in people, processes and culture are increasingly as important as the investment in the technology. From a people and culture perspective there are a number of challenges to consider:

- Mining and metals companies need to ensure that their teams can bridge the gaps between IT/OT bearing in mind that they may need to re-skill their existing SCADA teams to the heightened risk, and that there are limited IT security practitioners with exposure/experience with OT platforms.
- While connectivity from remote mine sites to corporate office is key to keeping in contact with the remote workforce, many of these mobile devices are not governed by the companies' security policy and hence offer another gateway for cyber-attack.
- The easier you make it for employees to access IT, the easier it is for hackers – don't lose sight of the potential of "moles" in the organization – i.e., people who have been placed in the organization with an intent to access data.
- Additionally, the risks from third parties have increased because of greater connectedness with contractors and the supply chain. Businesses need to look at who they are working with upstream and downstream and consider the vulnerabilities of those businesses as well if the risks are not being appropriately managed. Also, when contractors/companies leave, there is a need to ensure that there has been 100% termination of access to systems.

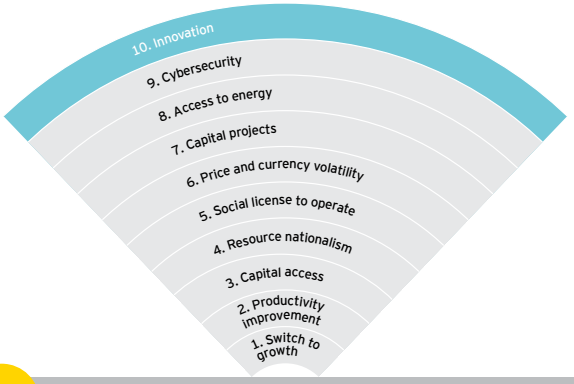
EY's survey found that 42% of the mining and metals organizations do not have a threat intelligence program in place and a further 35% only have an informal program in place. This leaves over three quarters of our survey respondents unprepared to identify a security threat. This also limits their ability to proactively identify and manage cyber risks that threaten the availability and confidentiality of corporate, operational, personnel and customer information. A robust cyber-threat intelligence program will enable the organization to collect intelligence information that is relevant to the business in order to assess the threat level and drive appropriate strategic and tactical countermeasures. The approach to cybersecurity should be driven from the top down, and companies must focus their efforts to ***complicate*** attacks, ***detect*** malicious activity, ***respond*** to threats and ***educate*** the organization to keep operations in sync with business imperatives.

Information and operational security needs to be a board level priority and has to be managed from the top down. Cybersecurity needs to feature on the corporate level risk register and to be integrated in the ERP. It's not just about systems – an approach is needed that includes threat and risk-based implementation of people, processes and technology capabilities to develop a resilient cybersecurity environment:



10 Innovation

(New)



Key thought

Innovation is a large issue that looms larger in the long term as the sector lags most others.

"Our industry is damned by the fact that our spending on innovation, research and development is one-tenth that of the petroleum industry. If we don't start to bring innovation back … the major diversifieds will be subsidiaries of General Electric or some other conglomerate that has still got innovation in their vocabulary."[1]

Mark Cutifani,
CEO, Anglo American

"… new reef-boring technology is 'a game changer', if we do nothing, the gold industry is in terminal decline."[2]

Srinivasan Venkatakrishnan,
CEO, Anglogold Ashanti

1. "Anglo chief warns on pace of innovation," *Reed Mining events*, 28 January 2014, http://www.reedminingevents.com.au/index.php/2014/01/28/anglo-chief-warns-on-pace-of-innovation-ft-com/, accessed 9 June 2015.
2. "AngloGold Starts Reef Boring to Avert 'Terminal Decline,'" *Bloomberg.com*, 6 November 2014.

In dealing with the sector's productivity challenge, there is a clear recognition that significant productivity gains can be made possible by rethinking how work is being done, and by being prepared to innovate. The burning platform for innovation is clear – the sector is currently operating in a low-price environment. Therefore, many miners may need to innovate to survive while others may look to maximize revenues and gain first-mover advantage when the market returns to growth.

As Steve Jobs said, "Innovation distinguishes between a leader and a follower." Unfortunately, primarily due to risk aversion (of cost and technology) there is an old adage in the mining sector that "miners like to be first to be second." It is clear that compared to most other industries, there is a deficit of transformational innovation in the mining and metals sector. The first automated truck was seen 20 years ago and yet there is still not a complete fleet in existence at a mine. On a ratio of revenue basis comparison, the mining and metals sector spends 90% less on technology and innovation than the petroleum sector. The oil and gas sector recognizes innovation as the single most important driver of productivity improvement, having experienced significant change via recent innovations in shale and coal seam gas, and floating LNG platforms, all of which have enabled reserves of oil and gas to last much longer than the predictions of "peak oil."

Innovation is rarely going to happen at the peak of a cycle as the need is just not there. Hence, a super-cycle provided an extended period of low innovation to the mining and metals sector. Just as "necessity is the mother of invention," so is super-correction the catalyst for fresh innovation in the sector, as some seek to survive with low grades, high labor or energy costs, low productivity and greater community demands, among other issues. Therefore, the largest drivers for innovation are counter-cyclical. In 2015/16, these cyclical influences are likely to provide greater stimulus for innovation.

That is not to say no innovation has been taking place in the sector. Advances have been made in this direction. Examples include Rio Tinto's Mine of the Future™ and Anglo American's FutureSmart.™ However, the mining and metals sector is lagging other sectors and there is plenty of opportunity for innovation to add value.

In a recent survey undertaken by VCI, most of the 200+ global mining executives interviewed agreed that innovation could bring a much-needed step change to address a number of key structural issues in the mining sector, namely:

1. Declining ore grades
2. Increased mining in remote and difficult locations
3. Access and cost of energy and infrastructure
4. Increasing operational complexity

The same executives felt that innovation would have the greatest impact over the next 15 years in the following areas:

- **Automation** – leading to the removal of people, and enhanced safety and lower cost
- **Reducing energy consumption**
- **Resource extraction** – by reducing distribution and improving recoveries
- **Data and analytics** – for process optimization and enhanced decision-making
- **Processing** – reducing material movements, and increasing process efficiency and recoveries

The benefits are clear: whoever gets this right can improve their position on the cost curve relative to their peers. Most cost savings (e.g., oil) affect most mines similarly and the cost curve drops for all – so margin is the same. Innovation, on the other hand, can help reduce production costs, improve productivity, extend life of mine and reduce and/or eliminate the impact of impurities and make uneconomic resources economic – thus, allowing movement along the cost curve to capture savings as increased margin.

To achieve success in innovation, the most important precondition that needs to be in place is to ensure that a company is one that fosters innovation. Successful companies :

1. **Align their innovation program to strategy**: Success requires ownership and tone from the CEO downwards. A clear vision and road map needs to be developed and communicated across the organization. For innovation to succeed, companies need to reward value creation (not just cost-cutting). Thus, they need to have the right incentives and metrics in place as well as a clearly-defined budget for innovation.
2. **Have the right structure, systems and processes in place**: Innovation tends to be hampered not by a lack of ideas, but by poor execution. Companies need to implement a process to facilitate and empower innovation whereby successes and early failures are celebrated. To get the structure right may mean a structural change to enable much-needed cross-functional collaboration (which we discovered was lacking in our recent report *Productivity in mining: now comes the hard part*).
3. **Undertake comprehensive change management**: Innovation is a people issue. A report by the Harvard Business Review[3] found that technology adoption alone, without the accompanying changes in work practices, has little or even a negative impact on productivity. An innovation culture requires collaboration, common language and common understanding across the organization. Too often innovation implementation fails due to an ineffective change management program.

Collaboration is key to success

From other sectors, it has been proven that increasing collaboration will catalyze innovation; it also brings the benefit of cost-sharing and de-risking. There have been some successful examples of the mining and metals sector collaboration with other industries and with academia but, on the whole, mining and metals organizations have often left innovation to the mining equipment, technology and services (METS) sector. R&D is not seen as a core competency of mining, but short-term problem solving is. However, organizations are reluctant to give small METS companies an opportunity until innovation is proven. Procurement processes also block innovation small suppliers from access via pre-qualification.

While this point of the cycle is conducive to innovation, significant barriers remain:

- Low risk appetite leading to a poor tolerance for failure
- Small market size requiring greater risk sharing and collaboration
- An aging workforce which is likely to be more resistant to change
- An alpha male culture that doesn't accept failure or value collaborators
- Long-lived assets which have technology/process locked in for life of mine – hard to change without zero-based mine planning
- Heavy regulation which reinforces the status quo, increases the cost of being the first mover and disincentives certifying equipment from other sectors
- Engineers focus on the technology, not the people change

Innovation is for the long haul

In preparation for the return to growth, companies need to move away from using innovation as the sole driver for improving their short-term bottom line and instead consider the longer-term horizons to maximize return from increased innovation:

- To aid productivity across the supply chain
- To improve valuations – the innovation premium can add 50% or more to market value
- To improve capital project efficiency

Companies that successfully integrate innovation as part of their everyday "modus operandi" have seen long-term benefits:

- Procter & Gamble has managed 58 years of consecutive dividend increases[4]
- John Deere's net sales and revenue per employee have grown at an average of 6% year-on-year over the last 30 years[5]
- Apple is one of the world's most valuable company by market capitalization[6]

3. "Collaboration Will Drive the Next Wave of Productivity Gains," *Harvard Business Review*, 2 May 2012.

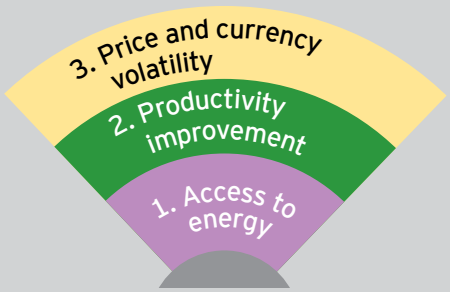
4. "P&G Declares Quarterly Dividend," *Procter & Gamble*, 13 January 2015.

5. "John Deere Committed to Those Linked to the Land," Investor Presentation, *Deere & Company*, March/April 2014.

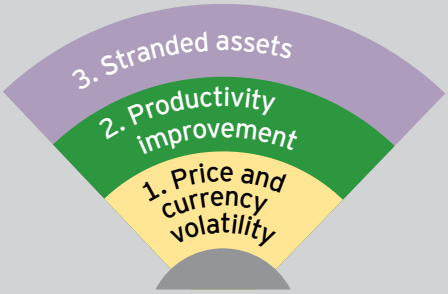
6. "List of public corporations by market capitalization," *wikipedia.com*, 2015, http://en.wikipedia.org/wiki/List_of_public_corporations_by_market_capitalization, accessed 9 June 2015.

Top risks for commodities

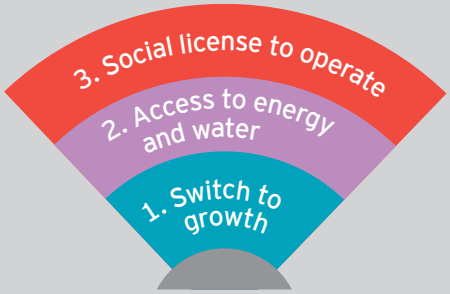
Aluminium



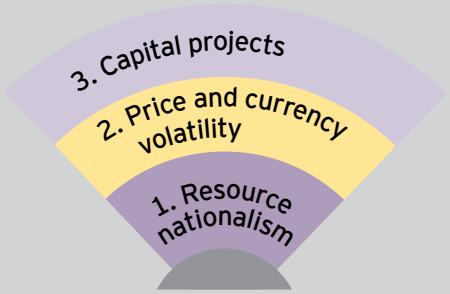
Coal



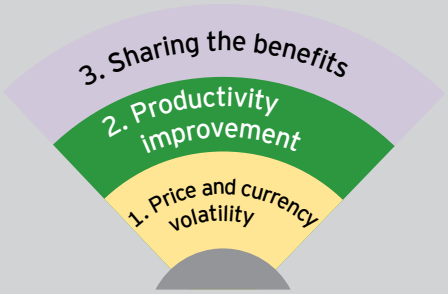
Copper



Nickel



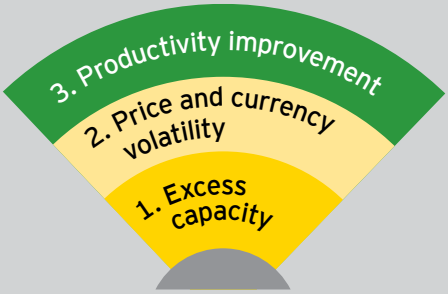
PGM



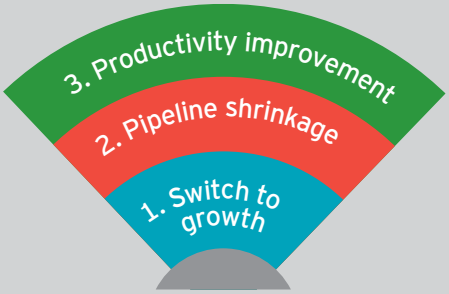
Potash

Gold

Iron ore

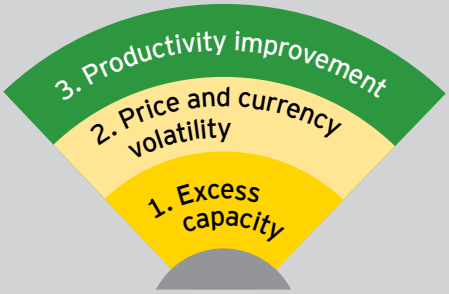


Lead/zinc

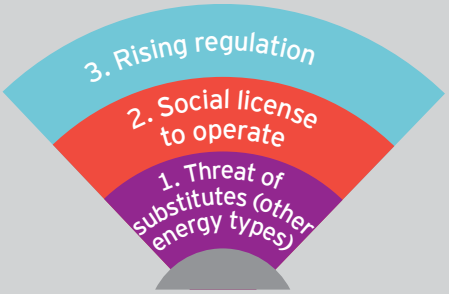


Silver

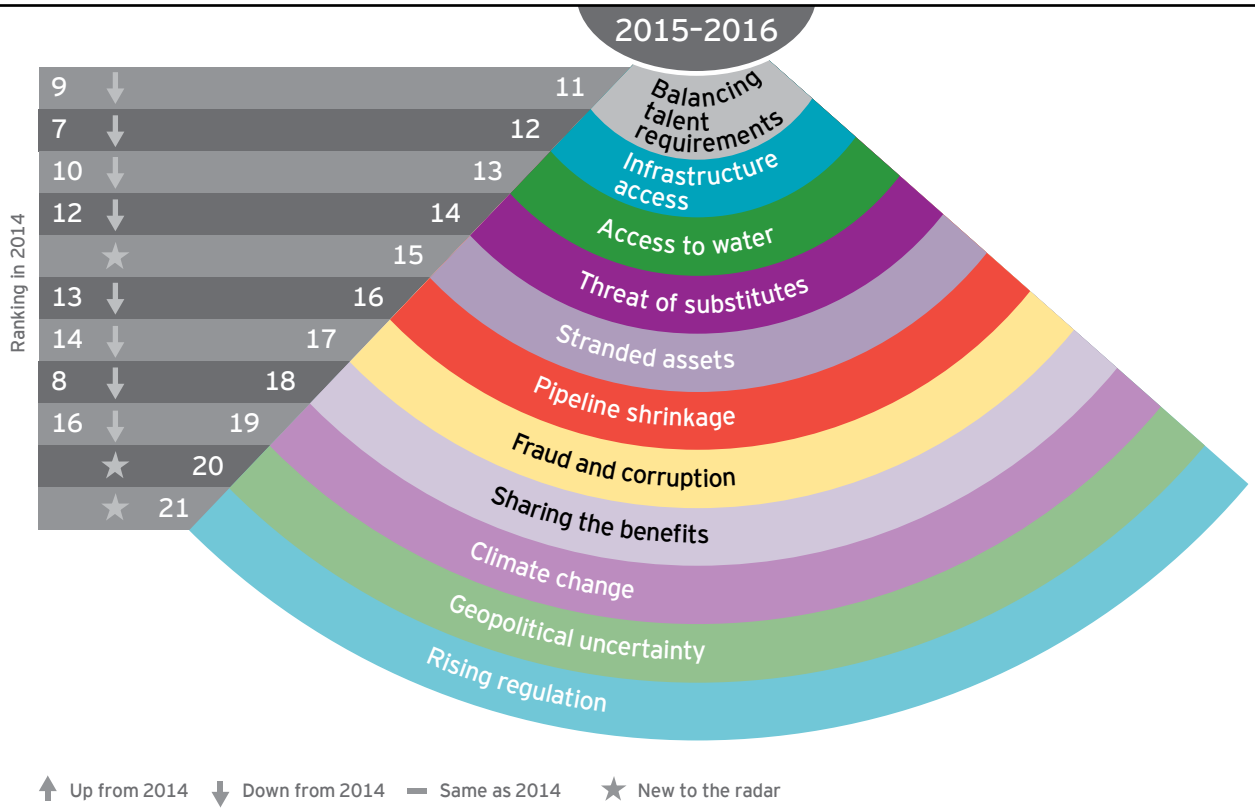
Steel



Uranium



Under the radar risks



11 Balancing talent requirements

(9 in 2014)

Key thought

While a softening market has eased the skills shortage, the evolution of the market has made this problem more complex and in need of a more strategic approach.

A structural skills shortage was exposed in the recent super-cycle as mining and metals companies rapidly expanded supply. The end of the mining super-cycle has forced the miners to implement a series of cost-cutting exercises and attempts to arrest a decade-long decline in productivity. The cost-cutting measures often involved workforce reductions.[1] On the surface, the risk of a skills shortage appears to be softening when, in fact, it has transformed into a more complex risk, and loss of talent may lead to two significant structural changes to the sector:

1. Shortages of sufficient skills and experience
2. Possibility of permanent exit of skills from the sector and reversal of new talent development worsens the shortages

Retaining the wise and experienced talent

While new talent will be critical to the sector, companies would find it hard to replace the deep expertise of senior professionals who have experienced the mining and metals sector before the boom. This experienced talent pool has seen cycles of boom and bust and are best placed to deliver the changes needed to achieve better productivity in a cash-strapped environment.

Currently, there is a clear differentiation between the continued shortage of senior and experienced talent and the abatement of shortages concerning unskilled workers,[2] which may be replaced in the future by automation.[3] Priority should be towards investing directly in the senior, experienced talent and upskilling new talent as the productivity challenges of today are only set to intensify.

The threat to talent

Trends that are set to impact the supply of talent include:

1. **Ageing workforce** — A sizeable number of the senior technical experts (e.g., mining engineers and geologists) and seasoned tradespeople are fast approaching retirement in many markets, which are threatening the supply of key skills asset. In Canada, an estimated 40% of the workforce in resource extraction sector is at least 50 years old, and around 33% of those are expected to retire by 2022.[4] These retirements impact operational continuity and lead to a great loss of organizational know-how and operational experience for mining companies.
2. **Globalization adds complexity** — Globalization means access to a wider global talent pool but it also results in increased competition for talent on a global stage
3. **Disruptive technologies changing talent map** — Disruptive technology has changed the talent requirements, e.g., driverless trucks changed the skills profile from heavy license drivers to controllers, schedulers and employees, with data processing and technical planning capability.

Mining and metals companies need to look beyond the talent procurement and retrenchment pattern that mirrors the commodity price cycle. As these companies look to reduce headcount in the post-boom period, it may result in shortage of critical skills to meet the future demand upturns.

What can be done

EY believes that mining and metal organizations can have clear strategies to ensure survival during the down cycle while building capability to support the inevitable upswing. They can achieve this by:

1. **Retaining the right people** by rigorously mapping talent as it exists internally and externally.
2. **Developing and growing talent** by having senior and experienced people mentor newer staff in order to capitalize during the upcycle.
3. **Creating a retention strategy** that may include moving employees from one product/commodity group to another where complementary skill sets are used to reduce talent leakage.

A practical approach

Labor should be seen as an important asset to mining and metals companies rather than a cost. Talent management is a rigorous, metric-driven approach to sourcing, attracting, developing, deploying and retaining the best talent, optimizing productivity and maximizing performance. It bases human resources decisions on bottom-line outcomes by measuring an employee's return on people investment, allowing organizations to build best-practice sourcing and deployment strategies. Taking an analytical approach to such strategies allows organizations to create a competitive advantage by ensuring that any investment in people will support and help to deliver on corporate objectives.

1. "Labour Market Research and Analysis Branch," *Australian Department of Employment*, August 2014.
2. "Geographic Labour Mobility: Submission on the Productivity Commission's Issues Paper," *Minerals Council of Australia*, August 2013.
3. "Exploring the social dimensions of autonomous and remote operation mining: Final Cluster Research Report," *Centre for Social Responsibility in Mining, University of Queensland,* February 2013.
4. "Mining skills shortage in B.C. in 2014 and beyond," *The Vancouver Sun,* January 2014.

12 Infrastructure access

(7 in 2014)

Key thought

As an increasing cost of a mining and metals operation, financing of infrastructure has become creative and often involves multiple stakeholders.

The rapid rise in demand during the super-cycle challenged the supply to be brought on quickly. The lack of available infrastructure biased mine development to those projects that did not require infrastructure. As such, the more infrastructure-dependent projects have been left to be the new sources of supply for the next cyclical upturn. To be ready for that time, the difficult work of planning, approving, financing and even constructing the infrastructure needs to be done now. However, in an environment of softening commodity prices, stretched balance sheets and increased scrutiny by stakeholders, projects that need high levels of infrastructure investment will struggle to gain approval.

The issue is made complex by the large number of stakeholders in infrastructure and the expected benefits for each, as well as the question of by whom, and how, the infrastructure is financed.

Financing models

Mining and infrastructure projects typically involve multi-billion dollar investments. These have traditionally been financed by miners, governments, commercial banks and project financiers. However, alternative sources of finance have emerged in the form of export credit agencies, sovereign wealth funds, private equity firms, and patient investors such as pension funds.

The projects can include equity as well as debt financing, and are financed through one of the following models or a combination thereof:

1. **Public sector investment:** Governments have budgetary constraints, and may not be the most reliable mode of finance.
2. **Mining and metals organization as sole developer and user:** This may provide control, but these companies have stretched balance sheets and are being judged on ROCE, which does not favor low-return infrastructure investment.
3. **Special purpose vehicle (SPV):** These are a form of off-balance-sheet financing, where a miner contributes equity but with limited recourse to its balance sheet.
4. **Public-private partnership (PPP):** Also a form of SPV, these include public investment.
5. **Third-party operator:** In this model, a group of miners invest, but infrastructure is operated by a third party.

Stakeholder	Expected return/agenda
Mining and metals organizations	Control of the infrastructure and preference to develop brownfield expansions rather than the more risky greenfield projects
Financiers	Stable financial returns
Governments	An advisory role to maintain control of the infrastructure, in some cases, the need for a free-carry shareholding;[2] also, "shared access" model of infrastructure development as new infrastructure is seen to support regional socioeconomic development
Communities	Socioeconomic development, jobs opportunities and environmental sustainability
Customers	Supply certainty

Take-or-pay contracts mitigate risk for infrastructure financiers

One of the more successful ways in which infrastructure has typically been financed is through the use of long-term take-or-pay contracts. These contracts require mining and metals companies to pay for infrastructure usage, irrespective of whether they use it or not. Some of the contracts also have penalty provisions if agreed capacity is left unutilized.

Take-or-pay contracts effectively transfer the downside volume risk from the pricing formulas in the financing models to the miner, and have helped secure financing for projects by allowing the securitizing of the future cash flows of miners with a strong credit rating. With lower commodity prices, some miners have been required to pay for unused infrastructure capacity and, in some instances, to keep open loss-making mines to avoid incurring "take or pay" payments. This has tended to give "take-or-pay" infrastructure a poor reputation, but it is better than outright asset purchase and financing.

Despite the concerns of operators and the market, the contracts have performed. The contracts have ensured regular payments to the infrastructure provider, and proved that they are largely invulnerable to commodity price risk.

Stakeholder agenda

Development of large mining and infrastructure projects requires coordination among a number of stakeholders, who often lack consensus on how to develop the project because of divergent priorities and varying agendas.[1] Different stakeholders have different tolerances to the various risks of infrastructure. The innovative structures value (price) these risks to enable the transfer between stakeholders. Having a common way of pricing these risks is critical to success.

The approach to infrastructure

Due to the large number of stakeholders and the multiple agendas, the risk profile of an infrastructure project has increased, notwithstanding an uncertain economic and commodity market outlook. A more collaborative approach among stakeholders and regular communication around project benefits and timelines can lower the risk-return ratios.

1. *Business risks facing mining and metals 2014-2015,* EY, http://www.ey.com/Publication/vwLUAssets/EY-Business-risks-facing-mining-and-metals-2014%E2%80%932015/$FILE/EY-Business-risks-facing-mining-and-metals-2014%E2%80%932015.pdf, accessed 18 June 2015.

2. "Chinese firm wins 600 mln USD port construction contract in Ghana," *Africa Xinhanet,* 9 April 2015, http://news.xinhuanet.com/english/2015-04/09/c_134134765.htm, accessed 11 May 2015.

13 Access to, and sustainable use of, water

(10 in 2014)

Key thought

Water is a shared resource and transparency around its use to the community and shareholders should be embedded in a secure water allocation plan.

Water is a finite resource. Availability, accessibility, quality and active management of this resource have become differentiating factors for operational success of mining and metals companies, even more so, as they expand into remote and more arid areas in search of new reserves, with almost 70% of the operations of the five largest mining and metals companies[1] located in regions with high water stress.[2] The cost of managing water stress in countries that do not have a strong water management policy or infrastructure in place can be unpredictable and can cause costly overruns.

Sharing a critical resource

Access to water is a basic human right as well as necessary for almost all economic activities, and conflict among stakeholders can arise over alternate uses of water. Further, mining activities, unless properly planned and managed, can gravely threaten the quality of water, making it unfit for other critical community uses. Additionally, any ad hoc approach during the establishment of a new mining and metals project, especially in developing countries, often sparks community unrest, and can lead to irreparable loss of trust and cancellation of SLTO for mining and metals companies.

While most operators are aware of the issue, there have been sufficient examples of a lack of long-term water policy and proactive management resulting in multimillion dollar losses and operational difficulties. With growing community interests has come the growing intervention by local governments. Understanding community interests and concerns, addressing them early and managing them continually are essential to gaining and maintaining access to water.

During the project approval and development stage, insufficient community engagement, not taking preventative action and an over-reliance on government to approve based on precedent can lead mining and metals companies to poor project outcomes. Some projects, such as the Tia Maris project in Peru, have been indefinitely suspended, whereas a more expensive but accommodating water solution may have allowed that project to progress.

Planning throughout the life cycle

Access to water is not only an essential component of establishing feasibility of mining and metals operations, but also needs to continue right through the life cycle from exploration and the commencement of mine construction, to operation, closure and post closure. Operators also need to undertake appropriate scenario analysis throughout the life of the mine to ensure sufficient water supply for normal operating conditions as well as extreme conditions, and make appropriate contingency plans.

Decreasing your water footprint

While increasing wealth from mining resources benefits the community, it also leads to increasing expectations on water utilization. In response, organizations are starting to respond by decreasing their water footprint and making more water available to local communities. This is increasingly becoming a part of organizations' sustainability initiatives. For example, in its Serra Sul S11D project, Vale plans to introduce innovative techniques such as utilization of natural humidity for ore processing, which will result in a 93% reduction in water usage compared to a conventional operation.[3]

Managing stakeholders

Mining and metals organizations need to manage an increasing range of stakeholders (communities, local governments, NGOs) to ensure access to water for economic activity. Having a robust water management plan and water accounting framework is as critical as ensuring its clear communication to stakeholders to ensure smooth commencement and operations while achieving a social license to operate. Many of the major mining and metals organizations have been reporting their "water balance" and communicating their sustainability priorities via their annual reports or through presentations to stakeholders. However, this heightened level of transparency around water usage and policy needs to be embedded in the overall strategy of the organization and should no longer be seen as optional or regulatory issues, irrespective of the region of operation. Transparency will increase stakeholder trust to participate in water allocation plans that can achieve secure water access entitlements and can promotote reliable water markets and trading.

1. BHP Billiton, Rio Tinto, Anglo American, Vale and Glencore.

2. "Leveraging Mining Investments in Water Infrastructure for Broad Economic Development: Models, Opportunities and Challenges," *Columbia Center on Sustainable Investment Policy Paper,* http://ccsi.columbia.edu/files/2014/05/CCSI-Policy-Paper-Leveraging-Mining-Related-Water-Infrastructure-for-Development-March-2014.pdf, March 2014, accessed 9 April 2015.

3. "Carajás S11D Iron Project," *Vale website,* http://www.vale.com/canada/EN/initiatives/innovation/s11d/Pages/default.aspx, accessed 4 June 2015.

14 Threat of substitutes

(12 in 2014)

Key thought

Commodity substitution is a larger risk in high-cost or single commodity operations.

The interplay between commodity prices, technological innovation and changes to regulatory and environmental legislation often leads to substitution among commodities as follows:

Price volatility across a number of commodities has led to commodity substitutions, including:

- **Aluminum and copper:** The significant rise in copper prices in prior years has led to substitution by aluminuim whose pricing has remained weak in applications like roofing, plumbing tubes, refrigeration and air conditioning. A stronger outlook for copper is aiding this trend.
- **Rare earths substitutions:** Volatility in the prices and availability of rare earth elements has led to its substitution by alternative materials across various applications. For example, permanent magnets are being based on ferrite and manganese/aluminium alloys, and transition metal ions such as Mn^{2+} are being used in energy-efficient lighting systems.

New technology is a disruptive risk which may spare the demand of some minerals over others. Innovation has created a host of substitution opportunities and challenges for the sector:

- **Thermal coal, pulverized coal injection and met coal:** Innovative technologies and methods of producing steel have led to substitution of metallurgical coal. Adoption of new steelmaking technologies such as Corex, Finex and ITmk3 will further reduce dependence on met coal and encourage a switch to thermal coal.
- **Shale gas and coal:** Energy coal continues to face stiff competition from natural gas for electricity generation worldwide, particularly in the US.[1] The EIA estimates that in 2015 lower natural gas prices will lead to a 6% y-o-y decline in coal consumption in the US electric power sector.[2]
- Going ahead, it will be interesting to observe the effects of emerging technologies on the sector. Will 3D printing and manufacturing lower the demand for certain metals while increasing the demand for others? Will automotive and battery storage trends increase the value of mining certain metals, such as lithium and magnesium, while decreasing that of others such as lead?

Changes to regulatory and environmental legislation:

- **Environmental legislations** that require automakers to manufacture light-weight cars have resulted in aluminum being substituting for steel across several applications in the automotive sector, e.g., in Ford's F-150 and Toyota's Camry. The substitution risk has led steel companies to innovate the "commodity" steel that they have been producing traditionally. They are now producing light-weight, yet high-strength and durable steel for use in the automotive sector.
- **E-waste:** An increasing focus on the recycling of e-waste is expected to lead to substitution of primary metals, with e-waste recycling being made compulsory in some regions. For example, the European Union enacted e-waste recycling rules in 2012 that require member states to recycle 65%-85% of their e-waste by 2019.[3]

Responding to substitution

Commodity substitution will impact the global supply chains of the affected commodities. Companies will need to rebalance portfolios to tap into new resources, reduce exposure of substituted commodities, and keep abreast of emerging trends across commodities for timely intervention.

Organizations in which one commodity dominates the product mix or profit share will be the most at risk. Mining and metals companies have to consider a diversification strategy, and should not aim to invest for a very long term without taking equivalent risk mitigation measures. It is imperative that players strive to be in the low quartile of costs, so that even if the market changes, they would have business continuity to respond.

1. "Coal to gas switching in 2015," Hydrocarbon Engineering, 4 March 2015.
2. "Short-Term Energy Outlook," US EIA, 12 May 2015.
3. "EU revamps e-waste rules with demanding new recovery targets," *The Guardian*, 14 August 2012.

15 Stranded assets

(new)

Key thought

Stranding of assets is a long-term trend and is being driven by changes in technology, consumer choice, political influence, community support and environmental factors.

History behind the "stranded assets" debate

The concept of environmentally stranded assets originated in NGO campaigns against the major fossil fuel companies that sought to demonstrate that there are more proven thermal coal reserves on the balance sheets of the world's fossil fuel majors than could possibly be monetized if the world were to avoid catastrophic climate change. Given that most of the governments share a stated intention to avoid catastrophic climate change, the hypothesis was that a large number of thermal coal, and oil and gas assets must eventually be stranded through political intervention. These campaigns called for greater disclosures from the fossil fuel industry to attempt to force it to either acknowledge the existence of environmentally stranded assets, or the nonexistence of an effective climate change strategy.

Stranded assets are "the assets that have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities."[1] In the mining and metals sector, the stranding of assets is being driven by changes in technology, consumer choice, political influence, community support and environmental factors. A few examples of the stranding of assets are as follows:

- Assets stranded by infrastructure, for example, in Western Australia, small and medium-size iron ore miners have relied on trucking for transport while prices were high, and cannot afford the infrastructure now when prices have dropped dramatically[2]
- Higher-cost assets, such as steel mills, which are being pushed out of the market by lower-cost facilities in China and India
- Water-intensive operations which are at risk of being stranded by domestic water prioritization or water stress
- Assets in locations where community support has been lost and projects can no longer be developed, for example, World Heritage areas
- Mandated beneficiation, where the cost of investing in beneficiation of the commodity in the country of origin is too high or where it is risky to maintain operations, for example, lower-grade nickel deposits in Indonesia
- Assets stranded by government policy, for example, ban on uranium mining
- Assets stranded due to delays in securing mining approvals; this can cause windows of opportunity to close. For example, many governments are treating lithium as a strategic asset, but battery technology may be evolving faster than government policy, and sodium-ion and magnesium-ion batteries may replace lithium-ion batteries because of perceived shortages of lithium

Currently, the assets at the highest risk are those related to fossil fuels (oil, gas and coal), due to internationally agreed climate change targets. In order to stay within the global target range temperature of no more than a 2 degree increase, 60%–80% of oil, gas and coal reserves are unlikely to be used before 2050.[3]

Fossil fuel demand, namely coal, may be declining in the OECD markets; but, the greater reality is that while coal will make up a decreasing share of electricity demand, its absolute demand in emerging economies is growing.

The key factors that could change the use of coal are:

- Political interventions that support alternative energy or suppress coal use
- Disruptive technologies, which are either those that will drive stranded assets, i.e., technologies to dramatically lower the cost or scale of renewables; or those which would support coal use with less emissions, e.g., carbon capture and storage (CCS) or much more efficient power generation

The other key consideration is that not all coal is created equal. If restrictions on emissions increase, higher quality coal will start to play an increasingly important role in the market, and this is where the stranded asset risk will come into play. Thus, companies with lower-quality-coal mines and projects need to take greater heed to this risk. They need to consider the viability of their low-quality coal in a changed market, and view upgrading options possible to improve the quality of their coal.

1. "What are stranded assets?" *smithschool.ox.ac.uk,* no date, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/background.php, accessed 13 April 2015.
2. "Iron ore: stranded assets," myresources.com.au, http://www.myresources.com.au/news, accessed 13 April 2015.
3. "Sustainable and Responsible," *Morgan Stanley,* 14 October 2014. "Unburnable Carbon 2013: Wasted capital and stranded assets," *Carbon Tracker Initiative 2013,* http://carbontracker.live.kiln.it/Unburnable-Carbon-2-Web-Version.pdf, accessed 30 May 2015.

16 Pipeline shrinkage

(13 in 2014)

Key thought

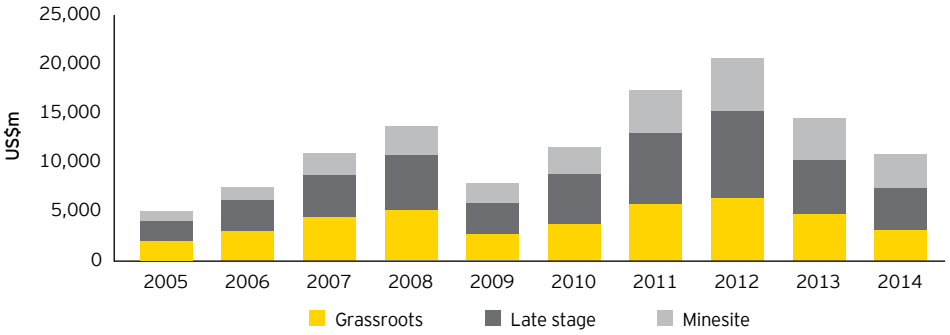
The lack of pipeline investment now will feed the next supercycle.

Falling commodity prices and the short-term focus of many investors have taken their toll on mineral exploration. Investors are largely focusing their attention on near-term returns and the avoidance of excessive risk. Therefore, junior exploration companies, who historically undertake most of the industry's exploration activity, have been unable to secure the risk capital needed via the public equity markets to further their exploration activities.

Exploration budgets in decline

SNL's 2014 *Corporate Exploration Strategies* study points to a second year of decline for non-ferrous exploration budgets, down 26% y-o-y in 2014, following a 30% decline in 2013.

Worldwide exploration budgets by stage of development, 2005–14



Source: "Corporate exploration strategies 2014 – exploration budgets by stage of development, 2014," SNL Financial.

Juniors' share of exploration activity continues to decline, and perhaps of more concern, the share of budgets directed to grassroots exploration has fallen to an all-time low at 30%, behind minesite exploration at 31%.[1]

This apparently dire situation raises the prospect of a shrinking pipeline of supply to feed the longer-term economic, industrial and strategic demand for minerals. Similar circumstances arose in the 1990s and helped to feed the intensity of the subsequent super-cycle. In the long-term, the challenges associated with exploration – not least falling discovery rates, lower conversion rates, and increasing lag times – suggest the industry will not be sufficiently prepared or able to meet future demand. This will serve to perpetuate the familiar boom-and-bust pattern that has such severe implications for global price stability, supply of strategic minerals, retention of and investment in skilled labor, economic stability in mineral-dependent countries, and investment in sustainability and innovation.

Boom-and-bust cycle continues

According to Richard Schodde of MinEx Consulting, exploration spending cannot afford to revert to the historic mean, but must be maintained at peak spending levels, if future supply needs are to be met.[2] For this to be achieved, urgent advances and innovation are needed in exploration funding, technology and regulation, within the context of an industry and its shareholders that are better prepared for and more focused on a longer-term, through-cycle, disciplined growth agenda (see our discussion in *Switch to growth*).

Call to action: funding evolution

The funding landscape has already evolved significantly in recent years in the absence of public equity markets, with alternative financing mechanisms coming to the fore as investors seek high yield opportunities in a low-yielding environment. Nevertheless, the focus for that investment has largely been on advanced and near-production assets, with minimal appetite for pure exploration companies. Standby-equity facilities have risen in prominence and provided some level of support to explorers, but bring inherent risks. For many, the capital raised has been "life support" funding and has done little to advance the exploration success of the company.

With market values depleted (sometimes to below-cash levels), continued equity dilution is both implausible and unsustainable. As such, we see a greater role for:

- **Joint ventures:** Arrangements between explorers and majors would build growth options into their respective portfolios.
- **Venture funds:** Seed funding by major producers to exploration funds to leverage private capital funding, thereby getting a multiplier effect of spend, and earning the right of first refusal on properties.
- **Government incentivization:** This is prevalent especially in countries whose economies depend on local mineral exploration or imports of strategic minerals where supply risks may be prominent.
- **Cross-border capital flows:** These capital flows are improving access to domestically important international investment opportunities for local investors. For example, the Santiago Stock Exchange Venture Market (SSEVM) was established in 2015 in collaboration with the TSX Venture (TSX-V) exchange to facilitate investment by Chilean investors in mining stocks and improve access to capital for TSX-V-compliant exploration companies.

1. "Corporate exploration strategies 2014: overview of exploration trends, 2014," *SNL Metals & Mining,* 2014.

2. "Long term outlook for the global exploration industry – gloom or boom?" Richard Schodde, *MinEx Consulting,* July 2013; "Recent trends in mineral exploration: are we finding enough?" Richard Schodde, MinEx Consulting, November 2011.

17 Fraud and corruption

(14 in 2014)

Key thought

The controls around fraud and corruption are becoming more stringent as more measures are legislated and transparency becomes increasingly important.

Rapid growth markets offer a range of opportunities for mining and metals companies. If companies are to realize these opportunities, it is critical that they understand what constitutes fraud and corruption, and conduct themselves responsibly, following leading principles of governance. The recent warehousing scam at Qingdao Port International in China clearly demonstrates the risk of not being aware of or not understanding local laws. In this case, many of the global firms involved in the metals warehouse industry in China outsourced to local firms to cut overheads and to avoid dealing with complex local regulations. This has given way to many grey deals where it appears that the same cargo of metals was pledged multiple times for loans at different banks.[1]

The controls around fraud and corruption are becoming more stringent as transparency becomes increasingly important. As corruption is seen as a drain on economic energy, and anti-corruption has become a politically powerful movement, several governments are introducing stricter legislation to address the issue. There is such an international groundswell of anti-corruption activity that most companies will soon be obliged to align with multiple jurisdictions or risk compromising their ability to do business cross-border.

- The UK Bribery Act makes overseas companies who do business (including fund-raising) at any level in the UK liable if they fail to prevent bribery and corruption, including the actions of associated third parties.
- The US Federal Government is bringing significantly more Foreign Corrupt Practices Act charges against overseas companies, with increased penalties.
- European countries are responding positively to the OECD's call for bribery and corruption legislation and enforcement.
- The Chinese Government has introduced an anti-corruption campaign and is enhancing transparency.

Mitigating risk from fraud and corruption

Companies are under pressure by boards and shareholders to demonstrate that they are taking the fight against fraud and corruption seriously. While it is impossible to eliminate all bribery and corruption, a comprehensive, robust and contemporary risk management framework will go a long way towards protecting your organization against future threats and minimizing damage if an event does occur. It may also help with the defense case: in the UK and US, if it is proved that adequate anti-corruption procedures were in place when an offense occurred, it could assist in mitigating penalties. Investigations by the US Department of Justice under the Foreign Corrupt Practices Act against BHP Billiton illustrates that just having the framework is not enough if it is treated as a "check-the-box" exercise as is alleged. The framework must be active and effective.[2]

The highest priority task is, therefore, to identify and analyze any risks inherent in the business, while simultaneously taking into account the relationships that the company has with government entities, agents and intermediaries, and also factoring in the complexity of operations and the regulatory environment in which the company operates.

It is critical that mining and metals companies:

- Undertake detailed due diligence on all new agents, suppliers, contractors, employees, subsidiaries and other entities with which the company is dealing.
- Establish compliance strategies that encompasses employee (direct, subsidiary, agent and contractor) training, highlighting the steps they ought to take to comply with anti-corruption policies, guidance on red flags, whistle blowing and regular monitoring.
- Undertake detailed due diligence investigation into the operations of an M&A target. The due diligence process, supported by indemnities and warranties, can unearth potential risks and liabilities that may help reduce buyer risks.

Companies can also utilize forensic data analytics (FDA) and other modern analytical techniques to uncover possible fraud and corruption. In our survey, *Global Forensic Data Analytics Survey 2014,* we found that 63% of senior executives (surveyed around the world) agree that they need to improve the use of FDA to detect fraud and corruption. Companies can combine multiple data sources and using FDA tools can gain new and important insights from their business data. The companies can leverage statistical tools that incorporate predictive modelling, anomaly detection and risk-scoring algorithms to detect potential fraudulent transactions in real- or near-real time.

1. "After port fraud, China's vast warehouse sector under scrutiny," *Reuters,* 22 June 2014, http://www.reuters.com/article/2014/06/22/us-china-qingdao-warehouses-idUSKBN0EX15P20140622, accessed 4 June 2015.

2. "BHP Billiton announces the end of US investigations," BHP Billiton website, 20 May 2015, http://www.bhpbilliton.com/home/investors/news/Pages/Articles/BHP-Billiton-Announces-End-of-US-Investigations.aspx, accessed 4 June 2015.

18 Sharing the benefits

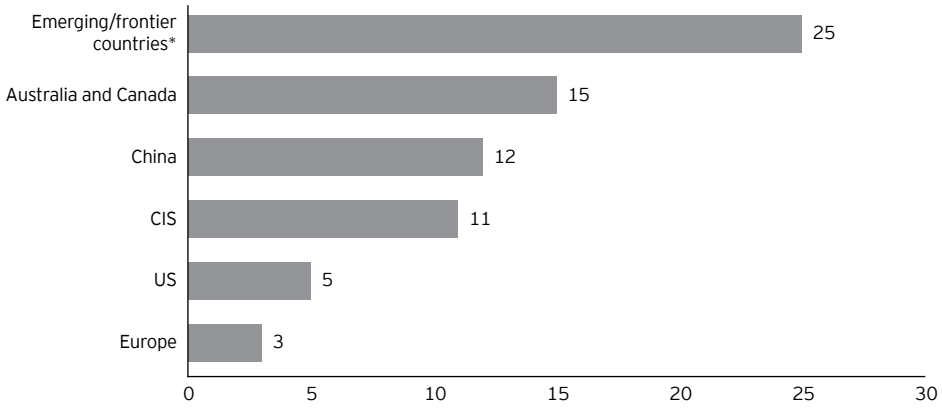
(8 in 2014)

Key thought

Sharing the benefits across the stakeholders can lag the cycle and thereby increase strain on an already strained sector. Managing stakeholder expectations is a large component of success.

The success of labor-intensive mine production has been highly dependent on its productivity relative to its cost. Even today, many mines and mining and metals regions around the world attain their primary competitive advantage through access to large pools of relatively low-cost labor. As part of mine planning and optimization, these mines are designed to leverage that advantage: mines can save on up-front capital and can operate with lower productivity if labor is cheap. Although the mining and metals industry has looked to adopt automation, it still remains largely a labor-intensive industry in the emerging and frontier countries. And organizations have developed mines in these low-labor-cost countries for the availability of large deposits that can be extracted economically. As a result, share of mining has greatly altered during the latter half of the last century and continues to shift towards emerging and frontier markets in the 21st century. The share of world mining for some of the emerging and frontier countries (including Chile, Brazil, Peru, South Africa, Zambia and DR Congo) had risen to around 25% by 2009.

Share of world mining (2009, %)



Source: ICMM.[1]

* Emerging/frontier countries: Chile, Brazil, Peru, South Africa, Zambia and DR Congo.

Managing stakeholder expectations during down cycle

Mining and metals operations in emerging and frontier countries employ large labor pools, which also carry votes for the local political establishments. This translates into government policies that often seek to preserve employment and improve wages. These policies create regulations that may reduce productivity while also providing for real wage increases. During the recent mining boom, profits for mining and metals companies soared and resulted in mine workers demanding higher wages (which in many cases were correcting prior disadvantage). However, with mining and metals companies grappling with reduced profits and soaring costs, expectations of increases in real wages can lead to scaling back, suspension or closure of projects. Some governments look to safeguard employment but offset the impact of such measures by lowering economic rent by lowering taxes or royalties. For example, the Chinese Government has reduced the resource tax on iron ore by 60% in order to safeguard the domestic iron mining industry in the wake of falling global iron ore prices.[2]

The mining boom of the last decade, greater democratization and political participation of unions has increased the pressure on governments to ensure that the broader group of stakeholders receive their fair share of benefits from mining and metals projects. Although, in the current business climate, most governments and policymakers have become more pragmatic in the expectation of economic rents to either attract or preserve investment, it is imperative that the expectations continue to be carefully managed.

Political establishments are further involved when labor unions stage a collective protest, such as the tool-down strike called by South African labor unions that affected operations at Anglo American Platinum, Impala Platinum and Lonmin in 2013–14.[3] Disagreements over wage settlements between unions and miners have resulted in production stoppages, which in turn have led to economic losses. Despite the commodity price downturn and falling labor productivity, workers and organized labor in many mines are still seeking increases in real wages and using strike and stoppages as tools to pressure for this. Mines with higher labor intensity are most exposed.

Outlook

During the down cycle, it is all the more important for industry participants to embrace a multi-stakeholder model to manage competing stakeholder expectations and undertake structural reform. Employee, community and government engagement has to be balanced with shareholder expectations ensuring adequate returns for their risk.

1. "Trends in the mining and metals industry," *ICMM,* https://www.icmm.com/document/4441, accessed 8 April 2015.

2. "Iron mining taxes to be reduced by 60 percent," *Chinadaily.com,* accessed 10 April 2015.

3 "South African miners agree wage deal to end strike," *BBC,* 24 June 2014.

19

Climate change

(16 in 2014)

Key thought

Climate change targets are inevitable and companies are increasingly accountable for their role in addressing this issue.

Global action against climate change is regaining momentum and mining and metals organizations need to be more proactive in addressing the business risk as this directly affects their likely cost of doing business and SLTO. At the same time, we are seeing a public- and investor-based push to make companies more accountable for contributions to climate change. Environmental groups are targeting miners involved in extracting fossil fuels through protests and legal action. Ethical investing is also on the rise, with many religious and educational institutions withdrawing funding for fossil fuels miners, while institutional investors are under increased pressure from environmental advocates to withdraw their support of businesses in carbon-intensive sectors.

Global initiatives

Newer, more refined and broader-reaching global initiatives on climate change are beginning to appear, affecting most of the major mining regions around the world, such as the China–US climate change agreement signed in November 2014. This contained unilateral measures to set greenhouse gas (GHG) emission targets of 26%–28% reduction by 2015 and de-carbonize industries with at least 20% of power generation coming from non-fossil fuel sources.[1] In December 2015, 196 countries will meet and sign a climate change agreement in Paris to commence in 2020. The aim is to reach a universal and legally binding agreement that will help the world tackle climate change and provide a structured transition towards a low-carbon global society. Ambitious targets will be set requiring immediate, ongoing and long-term action by signatories at the national level to limit global warming to less than 2°C. It will also provide a simpler framework for companies in different countries to achieve global carbon reduction goals, taking into account the capacity of each individual country to contribute to the targets.[2]

Tougher targets and increased costs

As an energy-intensive industry, emitters of fugitive emissions and producers of hydrocarbons, this will come at a cost for mining and metals organizations, as almost 40 countries and 20 cities or states have implemented carbon pricing mechanisms in the form of a carbon tax or an emissions trading scheme.[3] The estimated cost of compliance with the recently heightened environmental standards for Chinese steel makers is approximately US$26/tonne, which puts greater pressure on margins in an already depressed market.[4] These costs include taxes, emissions rights, new technologies, compliance and litigation from breaches of emission targets. Also, reporting on the volume of emission is imminent, with some already listing GHG emissions intensity as one of their annual reporting KPIs. There is inevitability that carbon-intensive mining operations will be exposed to greater financial costs.

Climate change adaptation

The most significant impacts on the mining and metals industry are expected to be:

- Public pressure to change the energy mix
- Increased water stress in many producing areas
- Increased frequency and intensity of storm events requiring changes to mine design and increased operational disruption
- More extremes in operating temperatures requiring more protection for employees and equipment
- Greater risk of disruption or loss from wildfires
- Supply chain disruption
- Greater variation in customer demand
- Increased post-closure liabilities
- Workforce exposure to new diseases

In responding to these increased risks, the mining and metals sector is only now developing strategies to eliminate or avoid risks, to mitigate or protect against these risks or to plan to remedy the impacts.

1. *Let's talk: sustainability. Special edition on stranded assets,* EY, March 2015; "U.S. and China reach climate accord after months of talks," *New York Times,* 11 November 2014.

2. "COP21 Main Issues," *Paris 2015: Conference of the Parties to the United Nations Framework Convention on Climate Change* website, http://www.cop21.gouv.fr/en, accessed 8 May 2015.

3. "Pricing Carbon," *The World Bank website,* http://www.worldbank.org/en/programs/pricing-carbon, accessed 8 May 2015.

4. "Tougher environment law pressures China steel mills," *Reuters,* 4 February 2015.

20 Geopolitical uncertainty

(new)

Key thought

Increased geopolitical instability and introduction of sanctions as a tool of choice is increasing the exposure of global businesses and supply chains to physical and economic disruptions.

Geopolitical uncertainty is a risk that lies outside the control of a company, but can have a major effect on its growth plans. It can also threaten the safety of life and property, disrupt operations and destroy shareholder equity.

While this risk cannot be completely controlled, it can be contained, as mining and metals companies can establish procedures to trigger an early response through contingency planning, geographic diversification, insurance and emergency response measures to ensure the safety of their employees and operations.

The impact of geopolitical instability can extend further down the value chain and cause a collapse in consumer demand, an increase in currency volatility and disrupt critical infrastructure and transportation networks. For example, the recent violence in Ukraine resulted in steel production dropping 29% y-o-y to 3.46mt in the first two months of 2015 as major Ukrainian steel mills were suspended or reduced operations,[1] and coal output dropped 22% in 2014 to 65mt, which led to shortages at power plants.[2] The long-term effects can be more damaging, subsequently leading to possible shift in the political, social or regulatory environments. Some of the impacts are explained below.

- **Social impact:** Possible loss of life and property are some of the most devastating impacts of a geopolitical risk, causing a disruption to business activities and triggering unemployment. The recent outbreak of Ebola virus caused 9,700 fatalities in Sierra Leone, Guinea and Liberia. Many mining companies in Western Africa were forced to temporarily suspend operations or put their expansions on hold. For instance, Rio Tinto temporarily stalled progress on its US$20b Simandou iron ore mine in Guinea.[3] Major miners including Vedanta Resources evacuated their entire expatriate staff from the affected regions.
- **Supply/demand mismatch:** Collapse in demand or restriction in supply availability are major consequences of geopolitical instability in a region. As a result, companies may experience a drop in productivity, an increase in costs and decreased profitability.
- **Economic and financial impact:** Subdued industrial activity in a conflict-ridden region and regulatory/control action by the government are very likely to impact the economic growth and trade in the affected region as well as in the regions with which it trades. It also poses a threat to financial stability, as major companies face constrained liquidity in the market and asset devaluation. For instance, the escalating crisis in Yemen is expected to have a destabilizing impact on the region, given the country's strategic importance of being located at the entrance to the Red Sea and thus the Suez Canal, and its proximity to the Gulf States.
- **Increased volatility:** Geopolitical issues exacerbate volatility in commodity prices, currencies and equities, directly impacting a company's earnings. For instance, the US and EU sanctions against Russia over the Ukraine crisis have impacted major companies, as they may face difficulty in raising finance for projects in Russia and will be unable to roll over debt unless financed in Russia.

What organizations can do about this risk

Mining and metals companies need to efficiently manage the risk in order to build competitive advantage and ensure business continuity. Thus, it is vital that companies develop adequate risk analysis capability to identify, assess and develop strategies to mitigate the risk while continuously monitoring the environment for possible changes. Organizations can efficiently manage the risk by adopting the following measures:

- **Diversification:** Organizations should focus on diversifying their geographic portfolio and reducing their dependence on a single source of risk.
- **Identification and assessment:** Companies must have a strong early warning system for the identification of possible instability/changes to the operating environment and have requisite systems in place to identify the possible disruptions to its workforce, supply chain and infrastructure.
- **Business disruption planning/continuity planning:** Risk mitigation through contingency planning is vital. An organization needs to focus on getting the right insurance coverage for operations and also have emergency procedures and evacuation strategies in place. There should also be a strategy in place to ensure continuity of operations.

1. "Ukraine steel output down 29 pct so far in 2015," *Reuters,* 5 March 2015.
2. "UPDATE 7-Thirty-three miners dead after pit blast in east Ukraine," *Reuters,* 4 March 2015.
3. "Rio's $20 Billion Iron Project Advances as Ebola Wanes," *Bloomberg,* 6 February 2015.

21 Rising regulation

(new)

Key thought

The cost of regulation to business is one which is easy to underestimate, both in compliance and breach.

Mining and metals companies have never faced so much regulation as today in multiple jurisdictions. The factors driving this increased regulation are:

- **Social license to operate** – increasing formalization of the social license to operate (SLTO) by governments responding to community demands to increase the accountability of mining and metals companies.
- **Greater democratization and use of government to protect community and other stakeholder interests** – the political process has an impact on all aspects of the regulatory environment, that is, the legislators, the judiciary, the executive and the civil servants
- **Anti-corruption initiatives** – the rise of more impactful anti-bribery legislation and disclosure standards, such as Dodd-Frank Act in the US, the UK, the EU and Canada has increased the compliance and reporting load.
- **Conflict mineral reporting** – the Dodd-Frank Act in the US and voluntary codes, such as the World Gold Council Conflict Minerals Standard
- **The rise of resource nationalism** – more complex taxes and royalties have led to more extensive and intrusive reporting. Even where direct reporting to revenue authorities may be lower, there is a greater emphasis on tax transparency reporting to demonstrate a fair amount of taxes have been paid in each impacted jurisdiction.
- **Compliance with increasingly complex international sanctions** – the use of economic and financial sanctions as a tool of geopolitical consequence management have significant impacts on mining and metals companies that operate globally and have global supply chains
- **New regulation of commodities trading** – commodities trading has largely been an unregulated activity for many centuries. However, the convergence of the physical markets with derivative markets has led many governments and regulators to extend increased regulation to commodities trading since the global financial crisis. Examples include MiFID2/MIFIR/MAD/REMIT/MAD2/MAR in Europe.
- **Access to energy, water and infrastructure** – as greater competition for the use of these resources emerges, the means of access, monitoring and dispute resolution increases the amount of the publically administered process.

The increased volume and scope of regulation is increasing the cost of compliance, the risks of noncompliance and delays while interacting with the regulators. While there is a broad global anti-corruption agenda, this rise of regulation not only slows the pace of business and increases the cost, but may also increase the potential for corrupt officials to use regulation to attempt to extract financial benefit.

About this report

EY's *Business risks in mining and metals 2015-2016* report is based on EY discussions with leading global mining and metals companies, and analysis of the operating environment for companies in the sector. It is EY's eighth annual report analyzing and ranking the top strategic business risks for companies in the sector. Underlying business risks for mining and metals companies do not vary significantly from year to year, but the acuteness of the issues and their priority can change. While the report does not provide an exhaustive list of the risks facing companies in the sector, it does provide a snapshot of the most significant challenges during 2015-2016. Mining and metals companies that best understand the risk scenarios and potential impacts on their business are better positioned to manage these risks and seize strategic opportunities.

How EY's Global Mining & Metals Network can help your business

With a volatile outlook for mining and metals, the global mining and metals sector is focused on margin and productivity improvements, while poised for value-based growth opportunities as they arise. The sector also faces the increased challenges of maintaining its social license to operate, balancing its talent requirements, effectively managing its capital projects and engaging with government around revenue expectations.

EY's Global Mining & Metals Network is where people and ideas come together to help mining and metals companies meet the issues of today and anticipate those of tomorrow by developing solutions to meet these challenges. It brings together a worldwide team of professionals to help you succeed – a team with deep technical experience in providing assurance, tax, transactions and advisory services to the mining and metals sector. Ultimately it enables us to help you meet your goals and compete more effectively.

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