ICMM
International Council on Mining & Metals

Role of mining in national economies

third edition

Contents

Executive summary

Past editions of the Role of Mining in National Economies (Romine) have drawn attention to the significant contribution of mining and metals to the global economy and to the economies of an increasing number of low- and middle-income countries. This third edition, produced at a time of considerable turbulence in international commodity markets, shows that despite the metals prices downturn a great many low and middle-income economies remain dependent on the mineral sector. A dependence jolted only slightly by the commodity markets downturn.

This reinforces the need for the contribution of mining and metals to national economies to be thought about more strategically as a catalyst for sustainable development: a position contrary to much of the conventional commentary about the industry. The magnitude of its value to the economies of many lower-income countries gives it and its stakeholders a clear responsibility to be ever more conscious of how mining and metals might contribute to sustainable development. The potential for mining to contribute to the Sustainable Development Goals is the subject of a guest contribution from the United Nations Development Programme (UNDP) to this publication (see page 60).

Findings

This edition of Romine introduces an updated Mining Contribution Index (MCI) that synthesises into a single number the significance of the mining and metals sector's contribution to over 180 national economies. It also adds a new indicator – mineral rents as a percentage of GDP – to those previously used to construct the MCI. Mineral rents are defined as production values minus 'normal costs' so they loosely approximate to the aggregation of tax and profit above 'normal' profits from mining. The indicators are each given equal weight in the index.

The MCI scores and rankings provide an indication of the relative importance of mining in the economic life of each of the 183 countries covered. However, whether or not a relatively high position on this Index ultimately translates into broader-based economic and social benefits for a country is a separate yet critically important question.

Overall, the MCI shows that the biggest mineral-producing countries (a list topped by China, Australia, Russia and the United States) are not necessarily those most economically dependent on mineral production. Of the 20 biggest mineral-producing countries, only Australia, the Democratic Republic of the Congo (DRC), Mozambique and Ukraine appear in the top 20 of the MCI.

Position	Change[1]	Country
1	+2	Congo, Dem Republic
2	-1	Mauritania
3	+5	Burkina Faso
4	+34	Madagascar
5	+5	Botswana
6	-4	Guyana
7	+12	Uzbekistan
8	+6	Liberia
9	+14	Kyrgyz Republic
10	+57	Tajikistan

'It is predominantly in low-and-middle- income countries that national economic life depends most heavily on mining'

It is predominantly in low- and middle-income countries that national economic life depends most heavily on mining. And this dependence has been increasing over the last two decades. The MCI confirms that many of the most mineral dependent countries continued to become even more dependent on the economic contribution of mining between 2011 and 2014, despite the fall in commodity prices. In light of this, getting the framework that governs mineral resources right will be increasingly important if governments are to insulate their economies from vulnerability to the commodity cycle.

The revised MCI – as a composite of four main quantitative indicators – is a useful starting point for understanding the extent of mining's contributions to a country's economy.

1. The third edition of the MCI incorporates a new indicator: mineral rents as a percentage of GDP. The previous MCI has been recalculated to include this indicator for purposes of showing the change in ranking.

However, it remains a compromise between what we would ideally like to measure and include and what can in practice be measured across all countries. In particular it does not yet capture some other highly significant contributions and factors that influence how effectively mining contributes to broader development. To begin to bridge this gap we have sought to supplement the MCI data with further analysis on the potential contribution of the mining and metals industry to government revenues and employment, and to reflect on the importance of governance.

Mining's contribution to government revenues

The responsible stewardship of tax revenues is key to translating mining and metals contributions into long-term development. Available data suggests that mining's contribution to government revenues in low- and middle-income countries can be significant, but is also highly variable between different economies (contributing anywhere between 2 and 20 per cent of total revenues, with some outliers), and is also often volatile. In the recent past, lower commodity prices have already led to fiscal problems in some national economies, creating the need for several countries to cut spending or increase borrowing.

Mining's ability to generate jobs

Currently no reliable or comparable data is produced for all countries but what data exists suggests that mining typically contributes only around 1–2 per cent of total employment in a country – but when indirect and induced employment is included, this can jump to 3–15 per cent. The multiplier effect of the industry means that each loss of a mining job caused by the commodity price slump could have the knock-on effect of causing several more workers to lose their jobs.

The quality of governance

A well-governed country is more likely to maximise the contribution of mining by negotiating good terms with mining companies; collecting, managing and spending revenues wisely; and creating an enabling environment to enhance employment. Some indicators of governance exist, although as yet are insufficiently comprehensive to incorporate into the MCI. Evidence from both the World Bank (World Governance Indicators) and the Natural Resources Governance Institute (Natural Resources Governance Index) suggests that of the top 50 MCI-ranked countries, approximately 75 per cent are governed at levels below those considered satisfactory for good governance of natural resources. However, many do relatively well on measures of having in place appropriate institutional and legal settings, safeguards and quality controls. This creates a base on which to build.

Looking towards the future

As more comprehensive data become available, future editions of Romine and the MCI will work towards building a more nuanced understanding of the extent to which countries rely on mining – and how well they leverage mining for broader development. This will improve the value of the MCI and ensure that it provides a regular and useful basis for assessing mining's role in the global economy and in individual mining economies.'

'...getting the framework that governs mineral resources right will be increasingly important if governments are to insulate their economies from vulnerability to the commodity cycle'

Introduction

1.1

Mining's contribution and sustainable development

The past few years since the publication of the second edition of the Role of Mining in National Economies (Romine) have been highly eventful for the mining industry. Price uncertainties have persisted leading to the cancellation or delay of major projects; several countries that host mining projects have faced painful fiscal and other adjustments; and many of the major mining companies have seen changes to their management teams, to their financial structures and to their operational plans.

This is the third edition of Romine. The first edition (published in 2012) covered the period from 2000 to 2010, when metals and minerals prices were generally strong and on the increase. The second edition (published in 2014) extended the analysis to 2012: a period during which prices for many metals peaked but later declined. This edition extends coverage through the period to 2014/15 during which prices generally further declined but by the end of which limited signs of turnaround had become evident at least for some metals.

The first two editions of the Role of Mining in National Economies documented the very substantial roles of the mining and metals industry in the global economy. They also drew attention to the industry's growing significance to the economic performance of an increasing number of low- and middle-income economies, as mineral production shifted from its traditional centres in Europe and North America to exploit large and often remote resources in Latin America, Asia and Africa.

Since the last edition, the UN General Assembly has adopted the Sustainable Development Goals (the successor agenda to 2000's Millennium Development Goals), covering the period from 2015 to 2030.[2] Mining is not generally thought about in the context of the agenda for sustainable development and its component targets, such as global poverty reduction.

However, the magnitude of mining in many lower-income countries gives the industry and its stakeholders a clear responsibility to be ever more conscious of the role mining can and should play in broader economic and social development. The potential for mining to contribute to the Sustainable Development Goals is the subject of a guest contribution from the United Nations Development Programme (UNDP) to this publication (see page 60).

International Council on Mining and Metals (ICMM) members recognise that large mines, especially in lower-income countries, need to be designed and operated to make a genuine contribution to the sustainable development of their host societies. This goes beyond the obligation to make a fair and reasonable fiscal contribution to the budgets of host-country governments although that is a crucial component. It also involves large-scale mining's undoubted ability – if well managed, and supported by appropriate host-

'the magnitude of mining in many lower-income countries gives the industry and its stakeholders a clear responsibility to be ever more conscious of the role mining can and should play in broader economic and social development'

2. The full title of the agenda is *Transforming our world: the 2030 Agenda for Sustainable Development*. The agenda comprises 17 goals with 169 targets covering a broad range of sustainable development issues including ending poverty and hunger, improving health and education, more sustainable cities, combating climate change, and protecting oceans and forests.

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country policies – to catalyse broader economic development.

The industry recognises also that a finite and depletable resource cannot, on its own, deliver sustainable long-term development. But the exploitation of that resource over several decades can provide various beneficial stimuli to processes that can deliver such development. These include new productive activities stimulated by mining company procurement; higher incomes for local populations, leading to new local demand from non-mining sources; new, multi-user infrastructure; the introduction of new technologies, both hard and soft (eg management techniques), with related improvements in local corporate capacity; new skills stimulated by training programmes linked to mining; and higher levels of government social and economic spending, supported by mining companies' tax and royalty payments.

In short, the mining and metals sector – if properly managed, regulated and supported – can be a powerful way of helping a lower-income country transition to higher and more sustainable levels of income and long-term development.[3] There is no guarantee, however, that the transition described will be achieved easily or in all countries. And the positive story about the transition was certainly easier to tell when commodity prices were rising after 2003, driven in large part by the growth in metals demand from China. During those years, three decades of economic literature drawing attention to a 'curse of natural resources' became less prevalent in political debates.

Today, despite five years of lower commodity prices, the fundamental idea of the extractives sector acting as a bridging activity to sustainable long-term development remains fundamentally valid, and the framework for understanding this role has been articulated clearly in a number of studies.[4]

The case for mining-led economic and social progress still needs to be supported by more evidence, more documentation of successful cases, more critical assessments of existing policy interventions and more practical support from all those charged with policy-making for the sector, both in companies and in governments.

This third edition of Romine seeks to contribute to that agenda. It does this by presenting a revised and updated version of the Mining Contribution Index (MCI), which was introduced in the first edition of Romine in 2012.

The MCI provides an indication of the relative importance of mining in the economic life of each of the 183 countries for which comparable data exist. However, whether or not a relatively high position on this index ultimately translates into broader-based economic and social benefits for a country is a separate question that can only really be answered by recourse to more detailed country case studies of the type that ICMM has supported through its Mining: Partnerships for Development (MPD) programme.

'The case for mining-led economic and social progress still needs to be supported by more evidence'

3. This idea, including a strong recommendation for host countries to pursue economic diversification as the focal point of their stance towards extractives, has been set out in detail in a recent study published by Chatham House. See Stevens, P, Lahn, G and Kooroshy, J (2015), *The resource curse revisited*, London: Chatham House, August 2015.

4. Examples include Gibson, R, Hassan, S, Holtz, S, Tansey, J and Whitelaw, G (2005), *Sustainability assessment – criteria and processes*, London: Earthscan; and Hodge, A (2011), Mining and sustainability, Chapter 16.2 in Peter Darling (ed), *SME mining engineering handbook*, third edition, Englewood, Colorado: Society for Mining, Metallurgy and Exploration.


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Introduction continued

1.2 Overview

Section 2 describes the current global context for mining. It first documents the main headline story of the past few years, significant drop in the prices of the major metals and minerals, and assesses both near-term and longer-term prospects. It then examines the longer-term global levels and geographical patterns of metals consumption and how these continue to drive the levels of production and prices in international markets.

Next it considers the main ways in which the major international mining companies – in both the Organisation for Economic Co-operation and Development (OECD) and the BRIC countries (Brazil, Russia, India and China) – have been impacted by the decline in metal prices, and the various adjustment mechanisms that companies have employed to protect their positions in the face of these difficulties.

Section 3 presents a revised and updated version of the MCI, which was introduced in the first edition of Romine in 2012 as 'a basis for discussion and a first step towards providing a long overdue and continuously updated set of data on mining's overall economic contribution'.[5] Section 3 also updates the analysis of the second edition of Romine by showing how the role of low- and middle-income countries in mineral production has further increased.

It was recognised in the two previous editions that the numerous components of 'contribution' that can be assessed in detailed country case studies[6] could only be captured in part by using data that was readily available and consistently produced for all mining economies. In the first two editions of Romine, the MCI used just three equally weighted main variables. However, it was always the intention to incorporate additional indicators of contribution as and when appropriate data became available.

The process of producing this third edition of the MCI was preceded by an in-depth examination of a range of indicators that might be considered for inclusion, either in this edition or in later years.[7] However, this process showed that there are still only a very limited number of indicators that meet the condition of being readily available for all or most countries on a timely, consistent and comparative basis. Just one new indicator has been added this year – mineral rents as a percentage of gross domestic product (GDP) – and given the same weight as the other three indicators. The role of this new indicator is further explained in Section 3. Notes on the methodology and the weightings used to construct the MCI were set out in previous editions, and are not repeated here. Further structural analysis about the role of each individual indicator in the MCI is presented in the supplement to this third edition of Romine– the Mining Contribution Index.

Section 4 elaborates three issues that are not yet formally captured in the MCI, but which are highly influential in determining the overall size and nature of mining's contribution in all mining countries: taxation, employment and various dimensions of the governance of the sector in host countries. Section 4.1 addresses the contribution that mining makes to government revenues, and Section 4.2 covers its contributions to employment. Both sections outline why these contributions are important, discuss evidence about how much the sector contributes, and consider emerging evidence about the impacts of the commodity price drop on these contributions. Section 4.3 assesses governance in the countries ranked in the top 50 of the MCI and outlines how governance is likely to impact on the contributions of mining to government revenues and employment.

5. It was noted at the time that there was no source that systematically captures the important role of the extraction and production of mining, minerals and metals in the economies of each country in the world. Hence there was an obvious gap to be filled and the MCI was designed to do just that.

6. Including the eight in-depth country cases undertaken by ICMM itself under the umbrella of its MPD programme.

7. This process was led by a well-qualified specialist who was independent of ICMM and who also examined some of the other weaknesses of the MCI and how these might be addressed.

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Global context of mining's contribution

Global context of mining's contribution

2.1 Introduction

The headline stories about mining over the past 24–36 months have mainly been about the prolonged downturn in most metal prices; the substantial adjustments to activity levels and future plans that this has caused; the demergers and sell-offs that it has provoked among the major corporates; and the fiscal and other difficulties arising in many of the lower- and middle-income host economies leading to further expressions of resource nationalism. However, these prominent and challenging short-term issues have obscured a more positive longer-term story about the ongoing and growing significance of the mining and metals industry in the global economy.

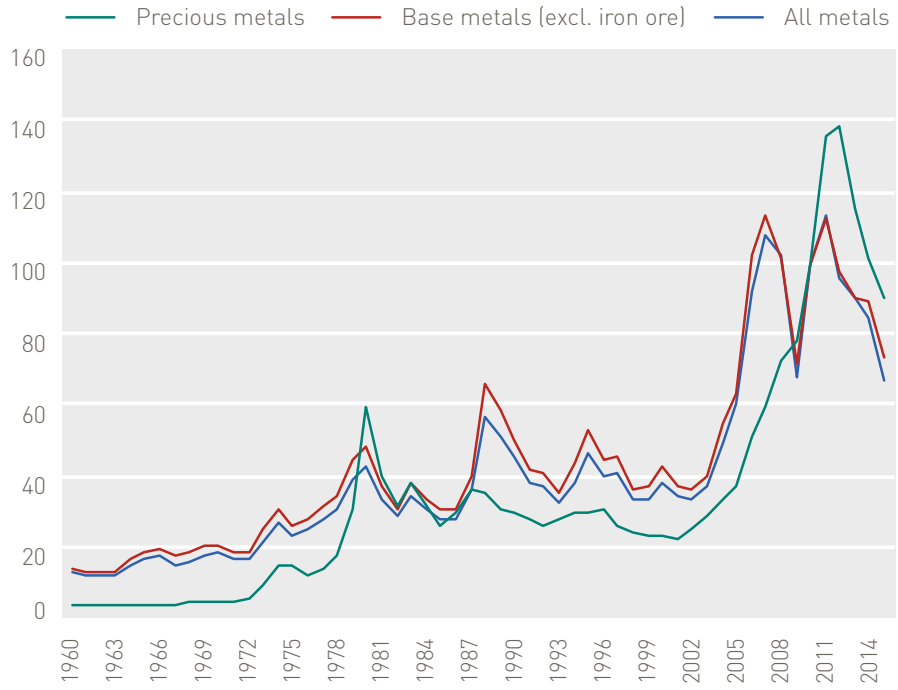
2.2 Metals prices

Despite the significant dip in prices after the global financial crisis in 2008, and the more sustained downturn after 2011,[8] most metal prices by 2015 were still significantly higher (in nominal terms) than they had been in the 1980s and 1990s, as shown in Figure 1.

Even in constant (2005 dollar) prices, base metals prices show a slight long-term rising tendency from the early 1990s, and precious metals show a dramatic long-term rising trend.

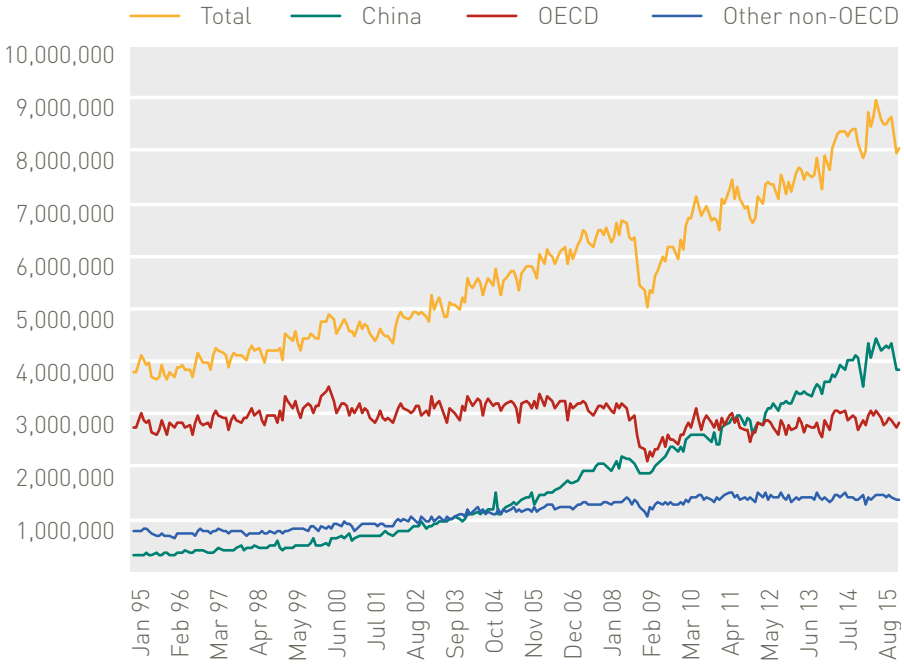
An assessment of the most recent available data suggests that prices for many metals have once again begun a small upward movement – mirroring the partial recovery in the price of crude oil. For example, World Bank data for June 2016 shows

Figure 1: Indices of metal prices 1960 to 2015 (nominal; 2010 = 100)



Source: World Bank, Commodities Price Data (the Pink Sheet) July 2016

Figure 2: World refined metals consumption – monthly data 1995–2015 (metric tonnes)



Source: World Bank, *Commodity markets outlook*, April 2016, data supplement

8. As was shown in the 2014 edition of Romine, after the peak in 2011, prices fell very sharply for many metals through the second quarter of 2014 – circa 10 per cent for copper and aluminium, circa 20 per cent for iron ore and gold and almost 40 per cent for silver. Over the same period tin, zinc and lead prices all rose (see ICMM (2014), Figure 4).

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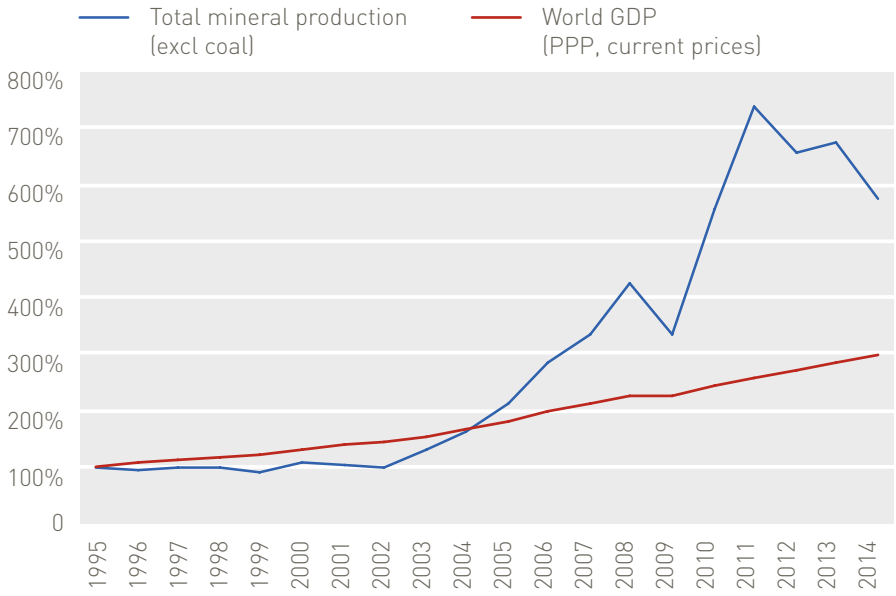
price increases relative to those for October–December 2015 of 6.4 per cent for aluminium, 10.6 per cent for iron ore, 1.6 per cent for lead, 12.5 per cent for tin, 15.3 per cent for gold and 16.9 per cent for silver.[9] But these movements are neither firmly established nor consistent across all metals; there is still some differentiation across metals and ongoing volatility. So, for example, in that same period, there have been further price declines for both copper (5.2 per cent) and nickel (5.5 per cent).

2.3 Demand and supply

The long-term price tendencies shown in Figure 1 have been driven by what seems to be a well-established long-term trend for increased metals consumption in emerging lower- and middle-income countries around the world. Although demand from the OECD countries has been pretty much flat over the 20 years since 1995 (at around 3 million metric tonnes per annum),[10] rising demand from the emerging economies – especially China – has ensured a very significant increase in total global metals consumption, as evidenced in Figure 2.

Relative to the growth of global incomes (as measured by GDP) over the same period, this increase in metals consumption as shown in Figure 2 has been dramatic. Total world GDP in current prices rose by about 140 per cent from 1995 through 2015 in nominal dollar terms, by just under 200 per cent using the purchasing power parity (PPP) measure of GDP but by only 78 per cent in constant price (2010 $) terms.

Figure 3: World GDP and total mineral production – 1995 to 2014 (1995 = 100)



Sources: SNL database and World Bank

By contrast, the value of metallic minerals produced (which includes the impact that rising demand has had on the prices of metals) rose much faster, by no less than 470 per cent between 1995 and 2014 – as seen in Figure 3.

The downturns both in 2008 and after 2011 are clearly visible in Figure 3 – but despite this volatility, the total global demand for metals has held up strongly in the longer-term perspective. Specifically, the long-term growth in the physical (real) growth of metals consumption (1995 through 2015) as shown in Figure 2 was 106 per cent whereas the corresponding real (constant price) change in GDP over the same period was 78 per cent. This suggests that the long-term elasticity of metals demand with respect to GDP has been circa 1.36 in this period (ie 106/78).

The underlying reason for an elasticity greater than one, as noted in previous ICMM reports, is that the specific properties of minerals in general, and metals in particular, continue to give them a central role in everyday life and economic development.[11] This fundamental reality has driven both the long-term upward movement of prices and the long-term movement of total production.

It is a reasonable proposition that the strong growth in demand has been driving the supply of the main metals and minerals in the recent past. But there have also been significant supply side forces that have been exerting an effect on the global markets for particular minerals and their prices. In recent years, for example, huge investments have been made in Latin America, Africa and parts of Asia, driven by factors including the

9. Overall, data from the World Bank suggests that the decline in prices was halted in 2014Q3, with the World Bank metals price index rising 2.6 per cent (quarter on quarter).

10. Consumption in this section refers to world refined metal consumption as defined by the World Bureau of Metal Statistics.

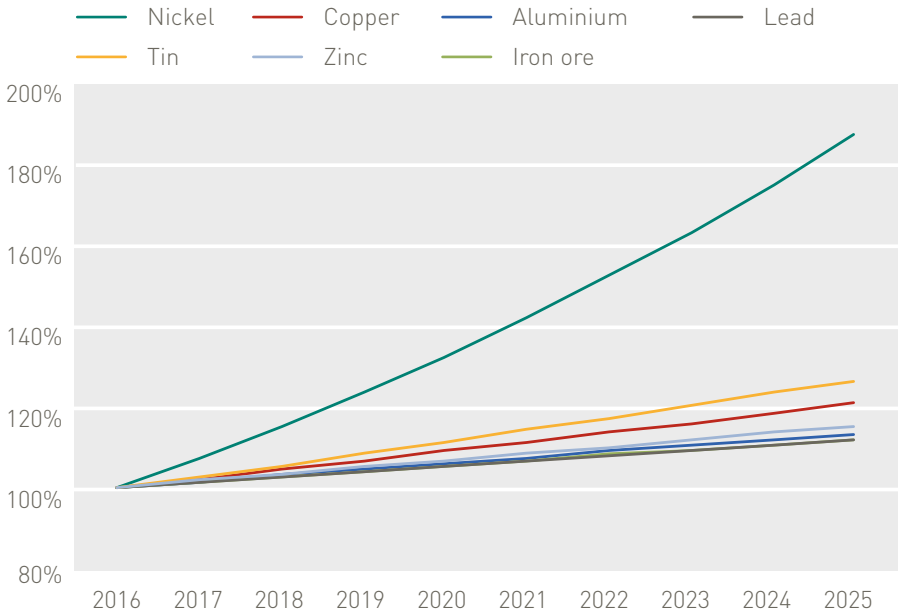
11. These characteristics include strength, durability, capacity to conduct heat and electricity, aesthetic appeal and – to date – their reasonable cost.

Global context of mining's contribution continued

depletion of easily accessible mineral deposits in Europe and the US.

In addition, technological advances have made feasible the mining of previously inaccessible deposits in remote less-developed regions, and the development of huge ocean-going vessels facilitating trade in bulk minerals has made their transportation around the globe increasingly feasible and lower cost. These trends are expected to continue. Strategic factors have also played a part with China in particular putting security of supply high on its own political agenda. This has led that country to spend increasing amounts on exploring for minerals inside China and also to reach out ever more to participate in the mining and metals industry in other countries. Supply factors have also influenced demand because of the ongoing technological developments that have made it possible to mine ores of declining grades and more complex mineralogy. By lowering costs this has opened up feasible new uses for some metals.

Figure 4: Selective metal price forecasts – 2016 to 2025 (2016 = 100)



Source: World Bank, Commodities Price Forecast (constant US dollars) – 19 April 2016 release

2.4 Implications

How the pattern of global demand revealed by Figures 2 and 3 will evolve in future years is critical to an assessment of how metal prices are most likely to evolve. With flat demand from OECD countries, overall growth has become ever more dependent on lower- and middle-income countries and particularly China. As noted by ICMM (2012):[12]

Studies have now consistently demonstrated that when per capita incomes reach US$5,000–10,000 per year, metal demand increases particularly quickly. When populous countries such as China and India go through this development phase, the effects on metal demand are dramatic … From this perspective alone, only a prolonged global economic recession or a global environmental or social disaster would stop the overall growth in demand for minerals and metals in the foreseeable future. This is so even when there are swings in the global economy that result in peaks and troughs in demand.

Although China's slower growth has recently caused market commentators much anxiety, the economy is expected to grow by around 6–7 per cent per annum – and from a much higher base than in the recent past, with its total GDP having quadrupled since 2000. So a still high growth rate is being applied to a much bigger total economic base. While slower infrastructure growth could cause difficulties for iron ore and coal, the rebalancing of Chinese aggregate demand towards a greater role for private consumption will likely boost demand growth for base metals such as copper and nickel as well as zinc. Additionally, any slackening of demand growth from China could possibly be taken up by more rapid growth of demand from India and other Asian and African economies approaching the critical $5,000–$10,000 per capita income level. Metals usage remains very low for a large share of the world's total population. So it is reasonable to assume that continued high rates of growth for at least a subset of the world's poorer countries could be an ongoing stimulus to sustain the significant growth in metals demand for many more years to come.

Certainly it seems likely that the broad pattern of demand growth revealed by Figures 2 and 3 will be sustained, albeit with further occasional perturbations. This implies that metals prices are likely to rebound

12. ICMM (2012). *InBrief. Trends in the mining and metals industry.* Mining's contribution to sustainable development. October 2012. London: ICMM, p 3.

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further from the downturns of recent years. In confirmation of this, some major forecasters are expecting a sustained upturn in the prices of most metals (dramatic in the case of nickel), as shown by examples from World Bank forecasts in Figure 4.

2.5 Implications for mining companies

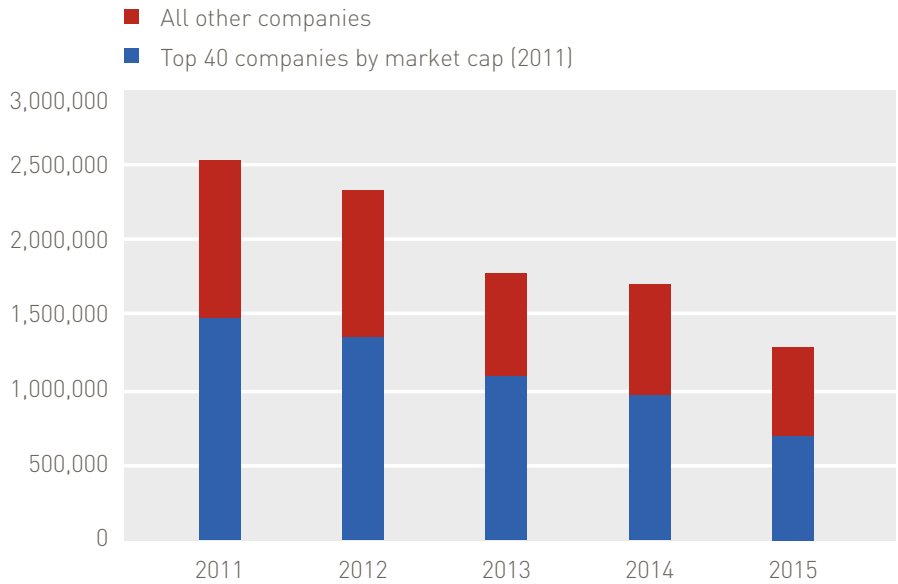
2.5.1 Market capitalisation

The past few years have been problematic for most mining companies, as manifest in the stock market capitalisation of the Top 40 companies. A 2015 report by PricewaterhouseCoopers (PwC) put their total capitalisation at $791 billion at the end of 2014 – no higher than in 2004, despite huge investments in the intervening decade, and 50 per cent lower than at the peak of the super cycle in 2010.[13]

However, the pain was not equally spread. In 2014 the OECD-domiciled companies in the Top 40 lost 21 per cent of their value (a massive $137 billion) versus only 7 per cent ($19 billion) in BRIC-domiciled companies. More than half the BRIC companies actually saw improvements in value, with three Chinese companies – two predominantly coal miners – seeing impressive gains of more than 30 per cent.[14] South African miners disappeared completely from the Top 40 list, having occupied five places in 2004.

The stock markets' view of mining companies has not been helped by a number of one-off problems, notably the tailing dam failure at BHP Billiton and Vale's Samarco operation in Brazil. The overall decline in market capitalisation continued through 2015, not only for the 40 largest in 2011,[15] but also for another 2,590 companies in the SNL mining database, as shown in Figure 5.

Figure 5: Market capitalisation – 2011 to 2015 ($ million)



Source: SNL Mine Economics database

2.5.2 Cash management and production costs

The more difficult operating conditions of the past three to four years have elicited various corporate reactions, often involving a scramble for tighter operational management – especially cash flows. More than half of the Top 40 felt the need to change their chief executive officers. They have generally reduced investing activities, especially in greenfield projects; looked for new ways to cut costs, to achieve lower levels of debt; cut dividend payouts; and been less enthusiastic about merger and acquisition activities. The 2015 PwC report indicates that 2014 saw a 23 per cent reduction in capital expenditures by the OECD companies – significantly higher than in the BRIC-based companies, whose markets were growing more rapidly.

The PwC data shows that more than half the Top 40 companies saw a decline in their gross revenues between 2013 and 2014, with a total fall of $38 billion (5 per cent of the 2013 total of $728 billion). However, those companies also reduced their operating costs by circa $26 billion overall through a variety of measures helped in part by various extraneous forces, notably the significantly lower costs of energy inputs such as oil, and by their own efforts to boost productivity.

Previous editions of Romine discussed factors that had tended to increase production costs, as miners sought to take advantage of historically high metals prices (see Section 2.4 in the second edition). However, the evidence metal-by-metal through the period of declining prices since 2011/12 tells a somewhat different story. For example, from 2012 to 2015 the

13. PwC defines the Top 40 companies by reference to their market capitalisation – in this case in 2014.

14. PwC (2015), *Mine 2015: the gloves are off*, review of global trends in the mining industry.

15. On this 2011 basis, the 10 largest companies were BHP Billiton, Vale, Rio Tinto, Polyus Gold, China Shenhua, Coal India, Anglo American, Barrick, Mitsubishi Materials and Glencore.

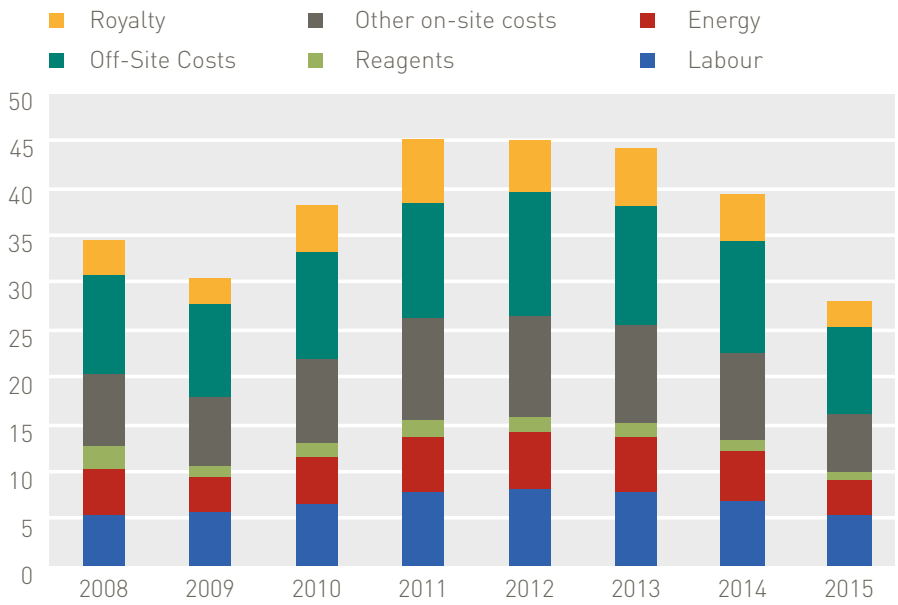
Global context of mining's contribution continued

weighted average total costs (including royalties) of iron ore declined substantially, from about $45 per dmt (dry metric tonne) to $28 – a decline of 38 per cent. This followed a 31 per cent increase in the boom period from 2008 ($34.4 per dmt) to 2012. Several factors contributed to this decline, as shown in Figure 6: labour costs (reduction of $2.7 per dmt); energy costs (down by $2.4); other on-site and off-site costs (each down by over $4); and lower royalty payments, as the taxable base for these payments declined (down by $2.6).[16] These decreases in royalty payments have implications for governments, as discussed in Section 4.1.

The evolution of weighted average costs in copper production has been similar, with a substantial rise through the boom years to 2012 followed by significant reductions thereafter. Total cash costs declined from $4,066/ton in 2012 to $3,512 /ton in 2015, a reduction of 14 per cent – smaller than for iron ore, but nonetheless significant. This contrasts with an increase of over 37 per cent between 2008 and 2012. As shown in Figure 7, the main sources of cost savings in copper production since 2012 have been labour costs (almost $173/ton) and energy (over $100/ton). There was also a $135/ton saving in royalty payments, which had the effect of passing some part of the adjustment on to host governments.

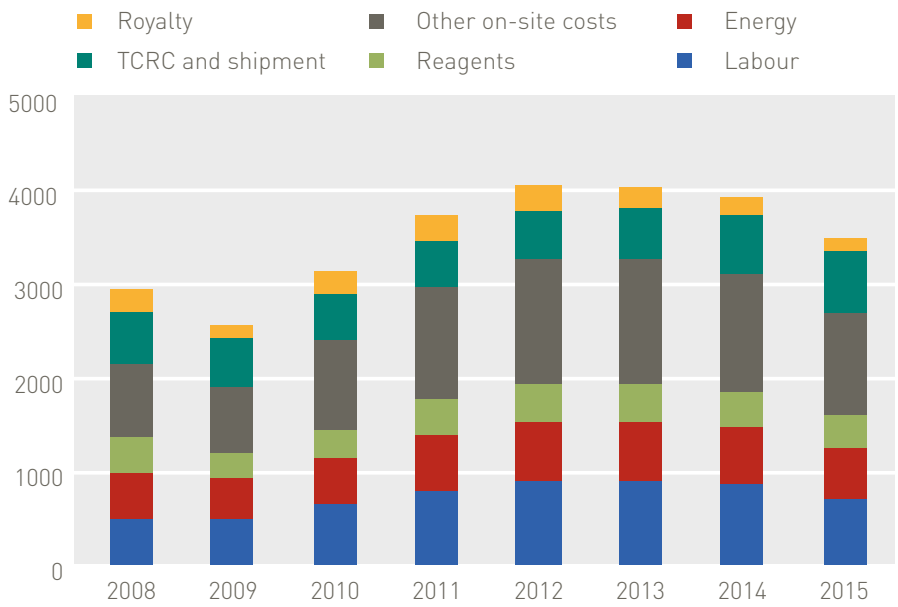
Finally, although its price fall has been more modest, the cost trends in gold mining have followed a similar path to those seen in copper and iron ore. Since 2012 total cash costs[17] have fallen by $82 per oz, a fall of 11 per cent – although following an extremely large increase of over 60 per cent

Figure 6: Production and royalty costs for iron ore – 2008 to 2015 ($ per dmt), free on board



Source: SNL Mine Economics database

Figure 7: Production and royalty costs for copper – 2008 to 2015 ($/tonne)



Source: SNL Mine Economics database

16. Most of the major resource exporting countries such as Australia, Brazil and Canada saw their exchange rates appreciate during the price boom period and subsequently fall as prices came down, and this has also helped companies to reduce costs expressed in $US terms.

17. Many of the top gold producers now generally report costs on an all-in sustaining costs as opposed to cash costs basis. However, the SNL data on cash costs is preferred here since it enables us to split production costs into its energy, labour etc components.

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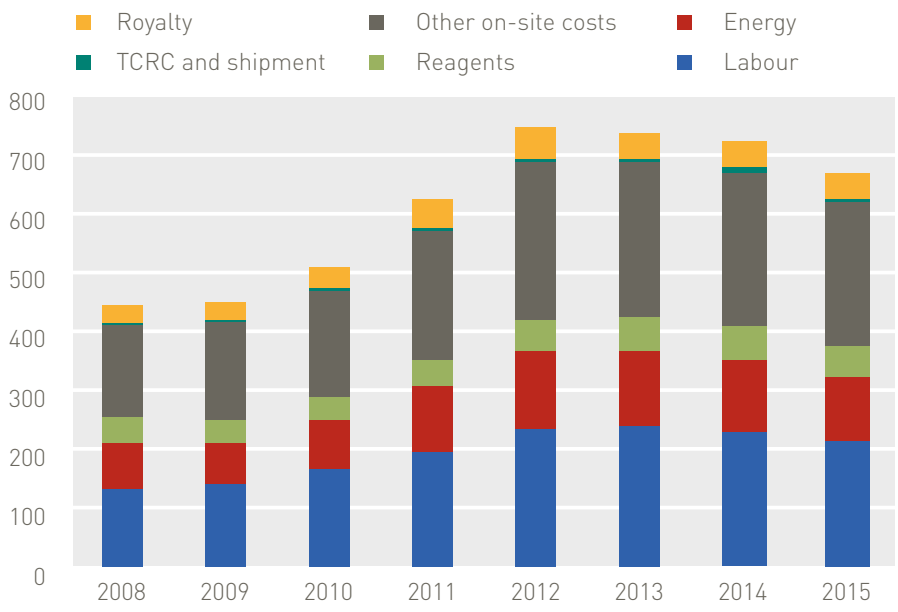
between 2008 and 2012. As shown in Figure 8, the sources of the cost savings since 2012 are similar to those in iron ore and copper: a $24/oz saving in labour costs, $20/oz in energy costs and almost $14/oz in royalty payments.

Significantly, the detailed mine-by-mine data provided by SNL Mine Economics continues to show large variations in costs across the world's many gold mines. For example, while the average total cost in 2015 was $670/oz, around a quarter of the world's 'paid gold'[18] was produced at a total cost of under $500/oz, and a quarter at over $750/oz. Ten per cent of gold production cost well over $1000/oz to produce. At the peak of total costs, in 2012, a significant number of mines (in Australia, Canada, South Africa, West Africa and Papua New Guinea) produced at a total cost in excess of $1,500/oz, but by 2015 only a handful of South African mines were still producing at that level.

2.5.3 Exploration spend

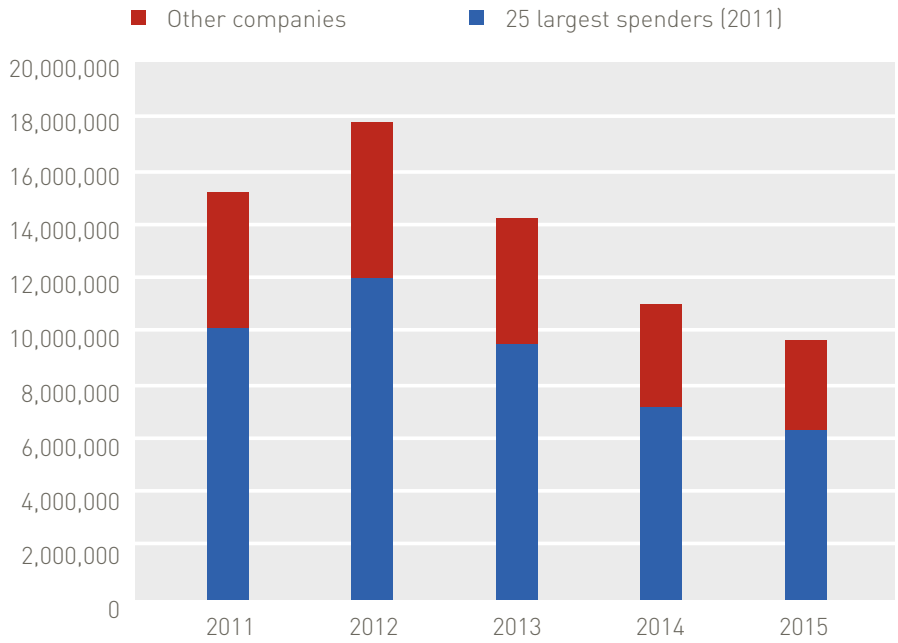
The scramble for increased free cash has also resulted in significantly decreased exploration activity, which is likely to impact future levels of production. Figure 9 shows data for the 25 companies that were the largest spenders on exploration (including research and development)[19] in 2011, and for 1,247 other companies making data available. Exploration spend was slow to react to declining metal prices in 2011, and continued to increase in 2012. But since then there has been a major decline, with the spending of the top 25 almost halving between 2012 and 2015.

Figure 8: Production and royalty costs for gold – 2008 to 2015 ($/oz)



Source: SNL Mine Economics database

Figure 9: Spending on exploration, research and development 2011–15 ($ '000)



Source: SNL Mine Economics database

18. In the statistics the concept of 'paid gold' or 'payability' reflects the actual arm's-length contract between the miner and the smelter/refiner eliminating the adjustment of any unpaid metal units (or losses).

19. On this 2011 basis, the 10 largest spenders on exploration and research and development were, in order: Vale, Rio Tinto, BHP Billiton, Newmont, Nippon Steel and Metals, Posco, Areva, Metallurgical Corporation of China, Barrick and ArcelorMittal.

3

A revised Mining Contribution Index (MCI)

A revised Mining Contribution Index (MCI)

3.1 Introduction

As was noted in the introduction, the MCI aims to synthesise important aspects of mining's contribution in individual countries into a single number and an associated ranking. This is a complex task, and it is accepted that the data does not yet exist to do this in a wholly satisfactory manner for all countries. So parallel work is needed and indeed is being carried out by ICMM and others on more in-depth case studies of individual countries. The results of such studies are always more detailed and so more directly helpful for policy purposes, but they do not lend themselves to easy comparability across multiple countries. Hence a construct such as the MCI has value. Nonetheless, the MCI is inevitably a compromise between what should be included in principle and what can be measured in practice. ICMM is committed to improving and widening the scope of the MCI as data availability allows.

For the moment, the MCI as presented here provides an indication of the relative importance of mining in the economic life of a given country. However, as was noted in the introduction, whether or not this can be interpreted as also indicating something about the broader-based economic and social benefits for a country is a separate but profoundly important question. Arguably, some of the countries that rank highest in the MCI – such as DRC and Mauritania – occupy these high positions by virtue of the limited extent to which they have successfully diversified their economies into areas that are independent of metals and minerals. Other countries such as Chile and Brazil that are further down the rankings have moved further along the transition path to incorporate their still important mining activities into broader-based economic development. So the relative position of a country on the MCI is not necessarily an indication of the extent to which it has benefited from mining to date: instead, it signals the current significance of mining in the economic life of that country and the importance of taking steps to better understand and then strengthen the contribution of mining and metals to sustainable development.

In the first two editions, the MCI was derived based on the total contribution of mining to export earnings (2012), the change in export earnings in the preceding five years (which gives a sense of whether mining is growing or diminishing in importance over time) and the value of mineral production expressed as a percentage of GDP. For this edition, one new indicator has been incorporated – mineral rents as a percentage of GDP. This makes four indicators in total, with each given one-quarter weight in the index. Mineral rents are defined as production values minus 'normal costs', including an appropriate rate of return on investment. So they loosely approximate to the aggregation of potential tax and profit flows from mining.[20] Therefore the new indicator may have a relatively small numerical value but may also be quite volatile to changing circumstances such as downswings in mineral prices like those seen since 2011.

As a result, the latest MCI results may show a greater degree of short-term instability relative to that shown by the previous index. The new variable's inclusion in the index helps to capture some sense of the margins associated with mining once all normal costs and normal profits have been taken into account. To achieve comparability with the index values from the first two editions of Romine, the MCI has also been calculated with the inclusion of that new indicator for the previous years. The remainder of this section summarises the main numerical results, starting with Table 1 that presents the ranking of countries according to the revised MCI for 2016.[21] Full country-by-country detail for 183[22] countries can be found at www.icmm.com/romine/index

20. The World Bank publishes estimates of natural resource rents as a percentage of GDP for minerals and coal separately. It defines these rents as the production values of a range of minerals less their 'normal' costs of production including an appropriate rate of return on investment. Mineral rents do not equate precisely with any national account statistic. Their addition to the MCI does add new information relative to the existing 'production value' indicator.

21. The rankings use data for 2014, the last year for which all the necessary data is available at the time of publication. The previous two versions of the index had the same two-year lag in data.

22. The first two editions of Romine covered 214 countries. Of this original list, two or less data points are available for 31 countries which have been omitted from the main data table and rankings. However, available information for these countries is included at the end of the MCI supplement.

A revised Mining Contribution Index (MCI) continued

Table 1: An updated and revised Mining Contribution Index – top 25 countries in 2016

1	2	3	4	5	6	7
2016 MCI rank	Country	2016 MCI score	2014 rank with mineral rents	Difference in ranks between 2016 and 2014 (col 4 – col 1)	2014 rank without mineral rents	Difference in ranks between 2016 and 2014 without mineral rents (col 6 – col 1)
1	Congo, Dem. Rep.	96.2	3	+2	4	+3
2	Mauritania	95.6	1	-1	1	-1
3	Burkina Faso	94.0	8	+5	8	+5
4	Madagascar	91.7	38	+34	37	+33
5	Botswana	90.7	10	+5	9	+4
6	Guyana	90.8	2	-4	3	-3
7	Uzbekistan	89.8	19	+12	25	+18
8	Liberia	89.0	14	+6	11	+3
9	Kyrgyz Republic	88.8	23	+14	33	+24
10	Tajikistan	87.0	67	+57	81	+71
11	Australia	84.5	12	+1	13	+2
12	Mozambique	84.0	35	+23	17	+5
13	Jamaica	83.7	73	+60	87	+74
14	Ghana	83.4	51	+37	62	+48
15	Sierra Leone	83.2	58	+43	52	+37
16	Dominican Republic	81.9	54	+38	53	+37
17	Senegal	82.0	24	+7	30	+13
18	Ukraine	80.6	29	+11	39	+21
19	Rwanda	79.4	77	+58	77	+58
20	Mongolia	78.0	11	-9	14	-6
21	Armenia	77.6	16	-5	19	-2
22	Sudan	77.2	37	+15	42	+20
23	Nicaragua	76.7	27	+4	32	+9
24	Chile	75.8	42	+18	50	+26
25	Myanmar	75.1	28	+3	16	-9

Source: various sources for indicators that make up MCI (available online at www.icmm.com/romine/index)

3

3.2 Results

The results for the top 25 ranked countries are summarised in Table 1. There has been a significant change at the top of the rankings in 2016 with just over half (13) of these countries changing since 2014. Most of the top 25 are classified as lower- or lower-middle income countries, with the exception of the higher-income economies of Australia and Chile. The top-ranked countries are the Democratic Republic of the Congo (DRC), Mauritania, Burkina Faso, Madagascar and Botswana.

Three of these changes to the top 25 are the result of the exclusion of countries for which data was available for only two of the four components that make up the index. The countries excluded are Eritrea, Democratic Republic of Korea and the North Mariana Islands. However, a number of countries have made significant gains to feature in the top 25 rankings, including Madagascar, Tajikistan, Jamaica, Ghana, Sierra Leone, Dominican Republic and Rwanda. Tajikistan, Jamaica and Rwanda have made the greatest gains (see fourth column).

As in the previous version of the index, these larger gains are mainly associated with the most dynamic variable among the four, namely the change in mineral export contribution measured from a base year of 2009. In the case of Jamaica, for example, that change was positive in the current index (13 per cent) whereas in the previous index it had been strongly negative (-23 per cent). Increases in production value (as a percentage of GDP) was also significant in some instances. Between the 2014 MCI and this third edition it had more than doubled in Tajikistan and increased threefold in the Dominican Republic.

The component indicators among the highest-ranked countries differ significantly. For example, DRC had a very high export contribution of 78.3 per cent; a change in that contribution, relative to 2009, of 5.6 percentage points; a production value relative to GDP of 27.5 per cent; and a high mineral rent level relative to GDP of 20.1 per cent. By contrast, fifth-placed Botswana had a higher export contribution of 92.1 per cent, a larger change in that contribution of 18.3 percentage points, even after many years of seeking to diversify away from diamonds, but a production value lower than that in DRC of 6.5 per cent and a lower mineral rents ratio of 1.8 per cent. Tajikistan, now ranked 10th (compared with 81th in 2014), increased its export contributions from 29.0 to 48.5 per cent from 2009 to 2014, whereas for the 2014 MCI its export contributions reduced by 11.2 percentage points from 2007 to 2012, which helps to explain its significant gain in the rankings.

The final column of Table 1 shows that the inclusion of the new indicator on mineral rents has made a difference to the rankings, but not a huge one. Most of the top 25 ranked countries in 2014 and 2012 move by only a few places in the rankings when the index is recalculated on the previous three-variable basis. This is partly because the new indicator shows some degree of correlation with the production value indicator. However, there are a limited number of exceptions to this.

3.3 Mining's location and dependency levels

Previous editions of Romine have shown that countries that are the major producers of minerals do not necessarily have a high degree of economic dependence on mineral export activity, whereas an increasing number of smaller but generally poorer countries do show high levels of dependency. Mineral production is still dominated by a few higher-income economies (notably Australia, the US, Chile and Canada), the four BRIC economies, South Africa and a few higher middle-income countries such as Mexico and Indonesia. Table 2 shows the rankings of countries in terms of production value for 2010, 2012 and 2014, together with the 2014 levels of production (with and without coal).

The major fallers in the rankings since 2010 include Brazil (from 3rd to 9th) and Zambia (from 16th to 23rd). New entrants to the top 20 in 2014 include Colombia, Germany and Poland, along with DRC and Mozambique – the only two low-income countries to feature, and the only new entries that remain in the top 20 when coal is excluded.

However, low- and middle-income countries continue to show the highest levels of dependence. Table 3, for example, ranks countries in terms of the first of the four indicators of the MCI – exports of metals and minerals (excluding coal)

A revised Mining Contribution Index (MCI) continued

Table 2: Top 20 countries in terms of production values

2014 ranking	Country	2014 production value ($ bn)	2014 production value excl coal ($ bn)	2014 ranking excl coal	2014 production value (% of world total)	2012 ranking	2010 ranking
1	China	159.0	83.4	2	17.4%	1	1
2	Australia	112.9	90.4	1	12.3%	2	2
3	Russia	88.0	69.9	3	9.6%	4	4
4	US	81.5	36.0	6	8.9%	6	8
5	South Africa	48.9	40.0	5	5.3%	7	7
6	Chile	47.1	46.9	4	5.1%	5	5
7	India	44.0	14.9	11	4.8%	9	6
8	Canada	39.9	35.9	7	4.4%	8	9
9	Brazil	35.8	35.8	8	3.9%	3	3
10	Indonesia	27.3	9.5	13	3.0%	12	11
11	Peru	23.1	23.1	9	2.5%	10	10
12	Mexico	16.7	16.3	10	1.8%	11	13
13	Kazakhstan	13.5	9.5	12	1.5%	13	14
14	Ukraine	11.7	9.0	14	1.3%	14	12
15	Poland	11.3	5.1	22	1.2%	na	na
16	Germany	9.2	1.2	50	1.0%	na	na
17	Congo, Dem Rep	9.0	9.0	15	1.0%	na	na
18	Philippines	8.1	7.7	16	0.9%	19	18
19	Colombia	6.6	2.9	33	0.7%	na	na
20	Mozambique	6.5	6.1	17	0.7%	na	na
	Total – top 20	800.1	552.6		87.5%		
	Total – all countries	914.4	666.5		12.5		

Source: SNL Mine Economics database 2016

relative to total commodity exports in 2014, with comparison figures for 1996 and 2012.

In 2014, 41 countries had a mineral export dependence ratio of greater than 25 per cent. A further 13 (not shown) had a ratio between 15 per cent and 25 per cent.[23] Eight of these 54 countries were classified as high income (Australia, Aruba Bahrain, Chile, French Polynesia, Iceland New Caledonia and Switzerland) – the other 46 were either low- or middle-income countries.

Table 3 also shows a very clear tendency for these dependency ratios to have increased since 1996. Only 9 of the 41 most dependent countries shown in Table 3 decreased their levels of dependence between 1996 and 2014, with many of the others showing large increases: for example, Rwanda (42.4 percentage points (pp) increase), Burkina Faso (41.4 pp), Mali (38.7 pp) and Mozambique (35.4 pp). The average magnitude of this increase across all the 41 countries was 12.8 percentage points. This rising level of mineral dependency is partly explained by the super cycle of price rises through

23. These other 13 countries are Suriname, Niger, Ghana, Cuba, Dominican Republic, Myanmar, Zimbabwe, Togo, Djibouti, Senegal, Bhutan, Brazil and Korea Dem Rep.

3

Table 3: Export contribution (metallic and industrial minerals, excluding coal) 1996, 2012 and 2014 as percentage of total exports

	Income classification	Country	1996	2012	2014	Change (% points)	
						1996–2012	1996–2014
1	Middle income (upper)	Botswana	80.90%	91.60%	91.92%	10.70%	11.02%
2	Low income	Congo, Dem Rep	72.40%	81.50%	78.26%	9.10%	5.86%
3	High income	French Polynesia	71.00%	64.00%	72.90%	–7.00%	1.90%
4	Middle income (lower)	Zambia	76.10%	69.20%	69.05%	–6.90%	–7.05%
5	Middle income (upper)	Mongolia	57.50%	74.60%	64.23%	17.10%	6.73%
6	Middle income (lower)	Mauritania	35.90%	62.90%	58.82%	27.00%	22.92%
7	High income	Chile	47.70%	61.60%	56.92%	13.90%	9.22%
8	Middle income (upper)	Peru	48.30%	60.10%	53.71%	11.80%	5.41%
9	Low income	Guinea	76.30%	60.10%	53.15%	–16.20%	–23.15%
10	Middle income (lower)	Guyana	37.40%	58.50%	51.52%	21.10%	14.12%
11	Low income	Burkina Faso	8.20%	46.30%	49.65%	38.10%	41.45%
12	Middle income (lower)	Tajikistan	30.20%	58.50%	48.51%	28.30%	18.31%
13	Middle income (upper)	Jamaica	49.70%	39.10%	48.14%	–10.60%	–1.56%
14	Middle income (lower)	Armenia	24.60%	44.50%	47.30%	19.90%	22.70%
15	Low income	Mali	8.40%	42.30%	47.12%	33.90%	38.72%
16	Low income	Sierra Leone	27.80%	50.60%	45.91%	22.80%	18.11%
17	Low income	Rwanda	2.80%	39.10%	45.18%	36.30%	42.38%
18	Low income	Central African Republic	56.00%	44.60%	44.75%	–11.40%	–11.25%
19	Low income	Liberia	49.30%	24.00%	43.43%	–25.30%	–5.87%
20	High income	Australia	24.50%	57.30%	42.33%	32.80%	17.83%
21	Low income	Mozambique	6.10%	35.90%	41.55%	29.80%	35.45%
22	High income	Iceland	10.60%	37.70%	39.02%	27.10%	28.42%
23	Middle income (lower)	Papua New Guinea	24.50%	51.30%	38.71%	26.80%	14.21%
24	Middle income (lower)	Lesotho	3.50%	44.50%	37.83%	41.00%	34.33%
25	High income	Aruba	0.30%	1.20%	37.82%	0.90%	37.52%
26	Middle income (upper)	Namibia	38.00%	53.40%	37.65%	15.40%	–0.35%
27	High income	New Caledonia	42.20%	37.80%	35.70%	–4.40%	–6.50%
28	Low income	Eritrea	62.50%	60.50%	35.68%	–2.00%	–26.82%
29	Middle income (lower)	Uzbekistan	9.90%	18.60%	35.49%	8.70%	25.59%
30	Low income	Madagascar	8.00%	17.80%	33.58%	9.80%	25.58%
31	Low income	Tanzania	4.00%	35.20%	32.91%	31.20%	28.91%
32	Middle income (upper)	South Africa	29.60%	33.00%	32.50%	3.40%	2.90%
33	Middle income (upper)	Montenegro	na	na	32.11%		
34	High income	Israel	31.90%	29.40%	31.21%	–2.50%	–0.69%
35	Middle income (lower)	Lao PDR	1.30%	39.10%	29.64%	37.80%	28.34%
36	Middle income (lower)	Bolivia	30.10%	29.80%	27.22%	–0.30%	–2.88%
37	High income	Switzerland	5.10%	5.80%	26.98%	0.70%	21.88%
38	Middle income (upper)	Lebanon	10.60%	32.50%	26.15%	21.90%	15.55%
39	Middle income (lower)	Kyrgyz Republic	6.70%	17.20%	25.62%	10.50%	18.92%
40	High income	Bahrain	42.70%	29.50%	25.37%	–13.20%	–17.33%
41	Low income	Sudan	4.20%	45.80%	25.21%	41.60%	21.01%
	Average					13.24%	12.80%

Source: Data used to construct the MCI based on UNCTAD trade database

A revised Mining Contribution Index (MCI) continued

2011, and partly by the increased volume of minerals produced in lower-income environments. As was noted in Section 2, in recent years huge investments have been made in Latin America, Africa and parts of Asia, driven by factors including the depletion of easily accessible mineral deposits in Europe and the US and technological advances that have made feasible the mining of previously inaccessible deposits in remote less-developed regions.

Although there has been some inevitable arithmetic effect on export dependency ratios caused by the more recent decline in mineral prices, this has not reversed the longer-term tendencies shown by Table 3. This is evident from the final two columns of Table 3. Although the increases in dependency levels for the 41 mineral exporting countries were generally a bit larger in the period of rising prices (1996 through 2012), these increases still remained large in the longer period (1996 through 2014), by which time prices had trended downwards.

This reinforces the results from a recent paper that examined the dependence of low- and middle-income countries on both mineral and oil and gas exports. That paper showed that the commodity price collapse did indeed disrupt the previously strong upward tendencies. However, that disruption has not been general across all countries and many of the most extractives-dependent low- and middle-income countries saw their levels of dependence actually increase further between 2011 and 2014.[24]

Successive editions of Romine had emphasised the fact of high and increasing dependence of many low- and middle-income countries on the mining sector. This fact alone should be sufficient reason for the policies towards such countries – whether of host governments, donor agencies or non-governmental organisations (NGOs) – to devote more attention to interventions that can potentially enhance the beneficial impacts that well-run mining operations can undoubtedly bring in their train.

There are by now a whole host of positive examples of regulatory arrangements and partnerships between key players in the sector that demonstrate how this general point can and indeed has become manifest in many real-world situations. The point is further strengthened by the fact that many of the more dependent countries also have large oil and gas resources, which pose similar management challenges to those of mining.

There was a brief discussion of these matters in previous editions of Romine (especially Section 5 of the second edition)[25] that also recognised the different economic, political and environmental contexts of different countries and how these contexts shape the extent to which the impulse from mining might be captured (or not) in the local economy.

3.4 Deconstructing the MCI

Finally, Table 4 illustrates how the top 25 countries rank in relation to the four individual components of the MCI. As outlined in the MCI supplement, Mauritania has the highest score of the 183 countries on the new mineral rents indicator. Botswana ranks highest on the sector's contribution to exports, Liberia ranks highest on the change in that variable since 2009 and Sierra Leone leads on production value as a percentage of GDP. Table 4 demonstrates that:

There is a moderate connection between the size of a country's existing export contribution and the change in that contribution since 2009. Nine countries rank in the top 25 for these components of the MCI. This helps to explain why the overall index shows shifts between countries over time.

- There is a slightly higher overlap between export contribution and production value as a percentage of GDP, with 11 countries ranked in the top 25 for both components of the MCI.
- There is only a limited degree of overlap between export contribution and the new indicator on mineral rents – with just 8 countries ranked in the top 25 for these components of the MCI. This illustrates why the overall index is likely to be modified by the introduction of this new indicator.

24. Roe, A and Dodd, S (2016). The statistical tendencies. Paper for UNU-WIDER Conference on Extractive Industries and Development. Helsinki, April 2016.

25. That section examined the various routes through which mining can be and has been a catalyst for broader economic and social development in some countries, and offered some specific examples.

3

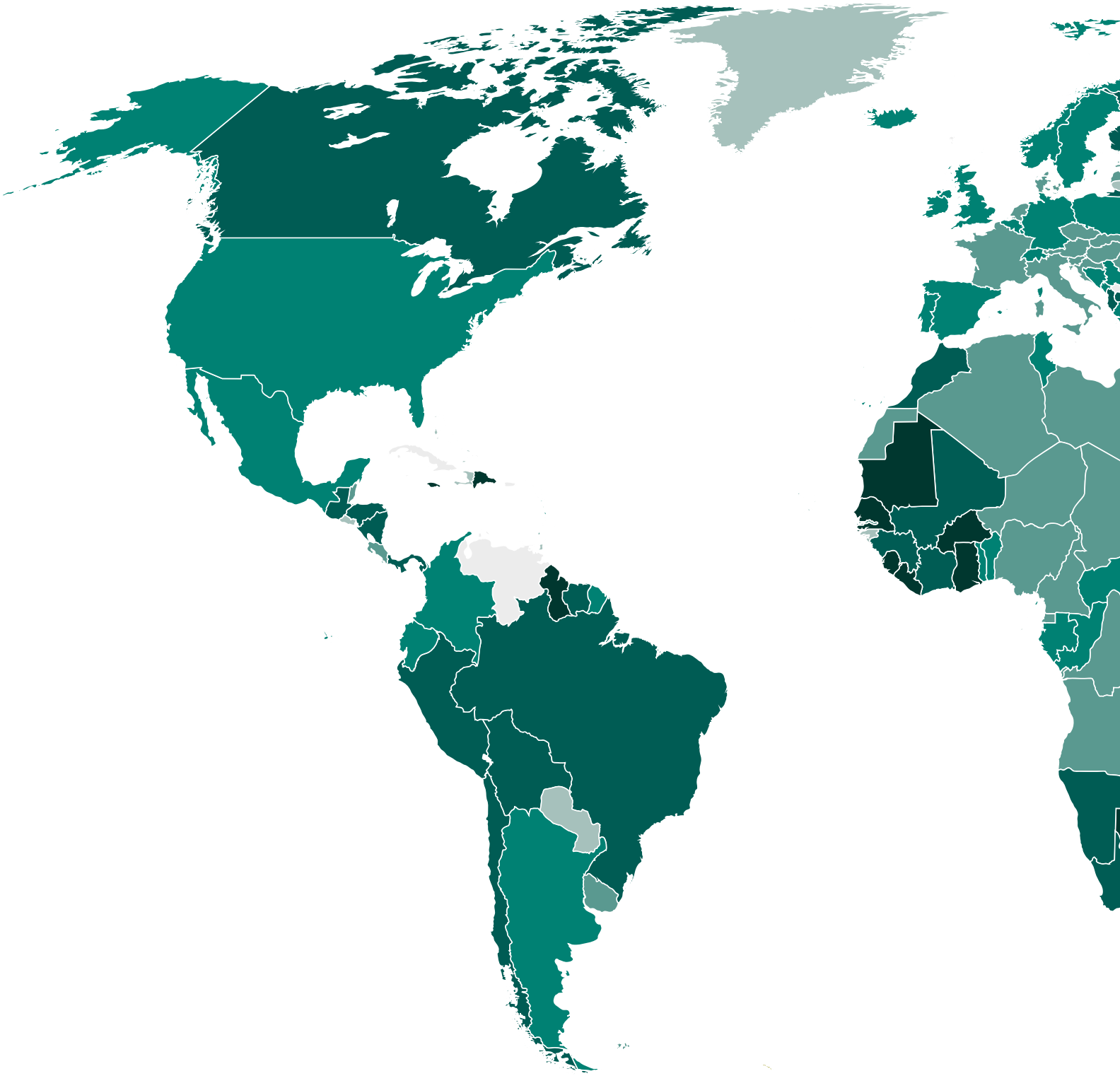
Table 4: Level of overlap/correlation between component parts of the MCI

	Country	Ranked in the top 25 for these index components			
		Export value	Change in export value	Production value	Mineral rents
1	Congo, Dem Rep	Yes	Yes	Yes	Yes
2	Mauritania	Yes	Yes	Yes	Yes
3	Burkina Faso	Yes	Yes	Yes	Yes
4	Madagascar		Yes	Yes	Yes
5	Botswana	Yes	Yes	Yes	
6	Guyana	Yes		Yes	Yes
7	Uzbekistan		Yes		Yes
8	Liberia	Yes	Yes	Yes	
9	Kyrgyz Republic		Yes	Yes	Yes
10	Tajikistan	Yes	Yes		
11	Australia	Yes		Yes	Yes
12	Mozambique	Yes	Yes	Yes	
13	Jamaica	Yes	Yes		
14	Ghana			Yes	Yes
15	Sierra Leone	Yes		Yes	
16	Dominican Republic		Yes		
17	Senegal		Yes		
18	Ukraine			Yes	Yes
19	Rwanda	Yes	Yes		
20	Mongolia	Yes		Yes	Yes
21	Armenia	Yes			Yes
22	Sudan				
23	Nicaragua				
24	Chile	Yes		Yes	Yes
25	Myanmar		Yes		

Each component indicator of the MCI constitutes a (different) pointer to the significance of mining activities in a country, and it can be useful to consider them separately as well as weighted together.

As the opening paragraphs of this section highlighted, while the MCI provides insight into the importance of mining in the economic life of a given country, it does not indicate whether this ultimately translates into broader-based economic and social benefits. In the final section of the report (Section 4), we consider three further dimensions of 'contribution' that we cannot for the moment measure consistently across all mining economies but which nonetheless have a significant bearing on the extent to which mining supports broader-based economic and social progress. These three further dimensions are mineral taxation, employment and governance.

A revised Mining Contribution Index (MCI) continued



Two or less data points available

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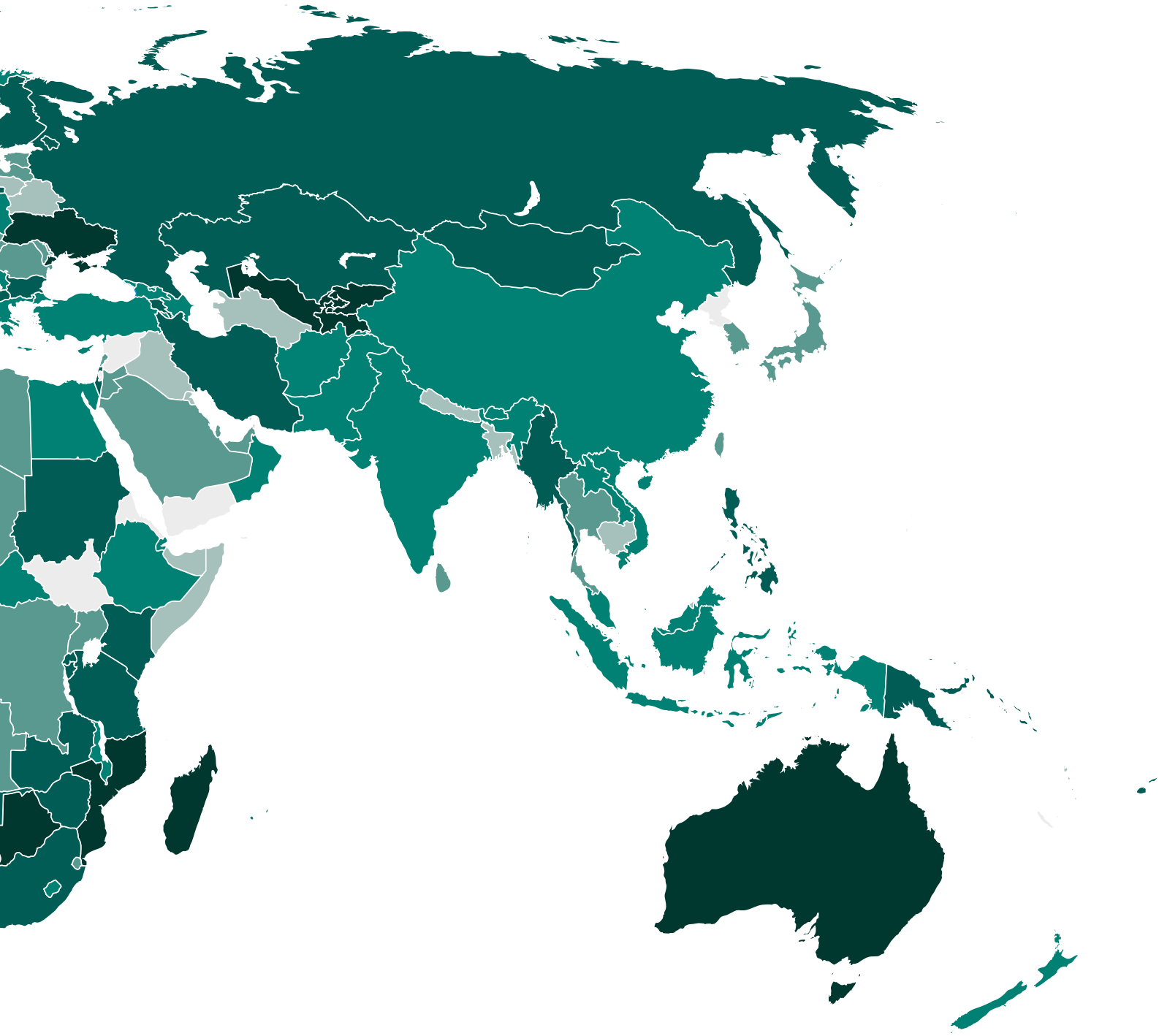


80+ Above 80

60+ Above 60, less than 80

40+ Above 40, less than 60

20+ Above 20, less than 40

0+ Zero to 20

4

Selected topics that significantly influence mining's contribution

Selected topics that significantly influence mining's contribution

While the MCI is a useful starting point for understanding the mining sector's contributions to a country's economy, it does not capture some other highly significant contributions – notably to government revenue and to employment. It is also unable to capture some of the more qualitative aspects of mining sector contributions, such as the nature and quality of jobs the sector generates or the governance of the sector, which influences the size and nature of its contributions.

This section attempts to fill these gaps, expanding on the earlier analysis of global context in Section 2 and the findings of the MCI to outline the available evidence from various countries on the contributions that mining makes to government revenue, employment and the quality of governance. Box 1 recaps organising frameworks outlined in previous ICMM publications, providing an overview of the how, what, when and how much of mining sector contributions. Section 4.1 discusses the evidence on mining's contributions to government revenues, Section 4.2 outlines contributions to employment and Section 4.3 discusses how governance influences both.

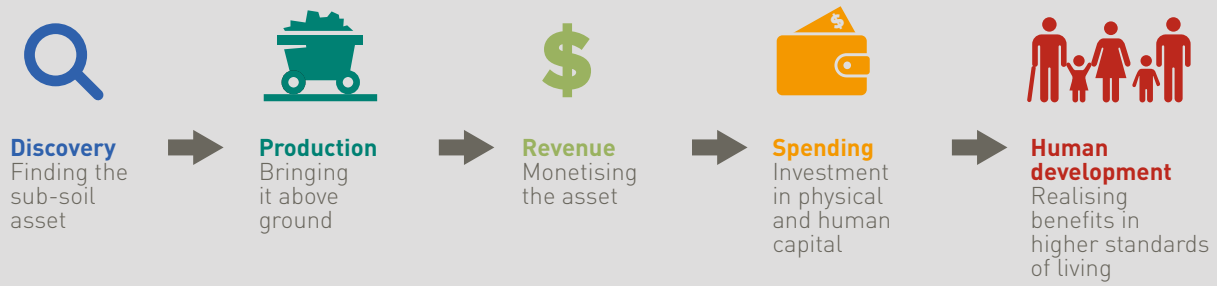
Box 1: Organising frameworks – how, what, when and how much?

How – from natural resources to socioeconomic development

Metals or mineral deposits are a national asset – something of value that belongs to the entire nation. How can these deposits be transformed into outcomes that nations value (such as higher living standards, human development and economic growth)? Figure 10 provides a simplified schematic.

Subsoil assets (metals or minerals in the ground such as copper or gold) need to be discovered, brought above the ground and monetised, that is, turned into economic value. The portion of the resulting revenue that accrues to government can be used to finance public spending on, for example, physical capital (infrastructure such as roads or bridges), human capital (through education, cash transfers or public health investments) or intangible capital (such as institutional development), which can lead to future socioeconomic development and growth (Dietsche et al, 2013).

Figure 10: Asset transformation – from subsoil assets to development



4

What – allocation of revenue shares

When minerals or metals are monetised, the revenue is shared between four main stakeholders: suppliers (who are paid for their inputs), employees (who are paid their wages), government (which receives its share through royalties and taxes and sometimes profit share) and investors (who receive profits – typically a residual after the other payments have been made).

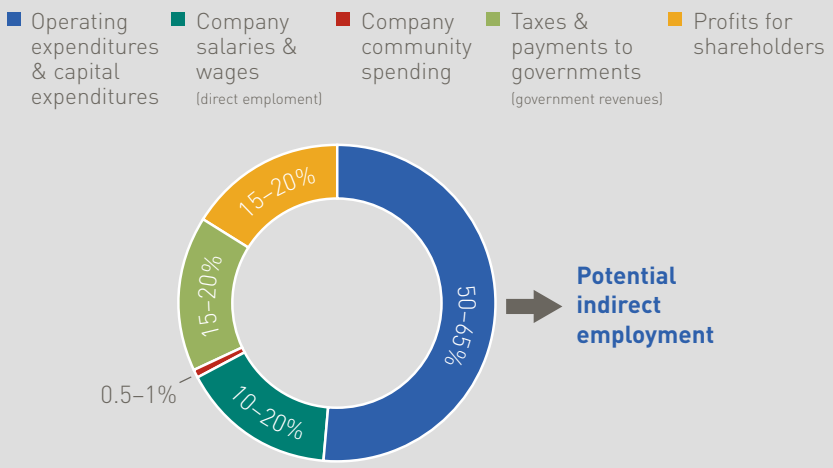
Figure 11 indicates the typical shares received by each group. Most of the revenue a project generates (50–65 per cent) typically goes towards operating and capital expenditures (simplified here as suppliers), 10–20 per cent goes to employees, 15–20 per cent goes to government and 15–20 per cent goes to investors.

In terms of socioeconomic development, the shares received by government, employees and suppliers are the most important. The share allocated to government represents the contribution mining makes to total government revenue, discussed in Section 4.1. The employees' share represents direct employment generated by a mining project, while the suppliers' share represents potential indirect employment, depending on how much of the supplies (both goods and services) come from local firms. Together these represent the contribution of mining to employment in an economy, discussed in Section 4.2.[26]

How large each of these shares are and how much they are able to contribute to socioeconomic development over the long term are determined in part by the quality of governance in a country. This is discussed in Section 4.3.

'In terms of socioeconomic development, the shares received by government, employees and suppliers are the most important'

Figure 11: Revenue allocation to different stakeholders for a typical mine



26. There is, in addition, a third contribution to employment – namely the jobs created in local businesses as the employees of both the mining activity and their suppliers spend their wages and salaries.

Selected topics that significantly influence mining's contribution continued

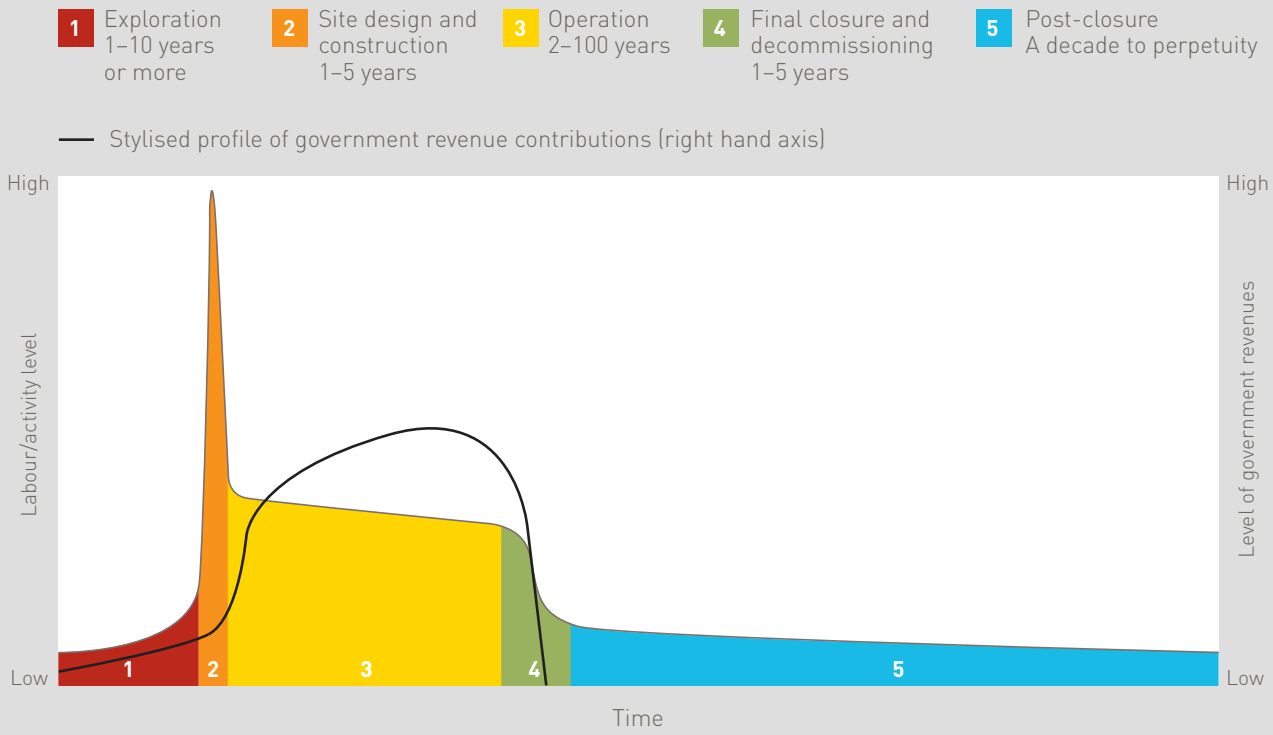
When – the mining life cycle

Figure 12 provides a simplified representation of the life cycle of a mine. It shows five phases, with typical timelines: exploration (1–10 years), site design and construction (1–5 years), operation (2–100 years), final closure and decommissioning (1–5 years) and post-closure (10 years to perpetuity). It also shows how the size of government revenue and employment contributions vary over the course of a project.

In terms of government revenues (shown by the black line in the figure), a mining project typically generates only a small amount of revenue during the first two phases of the life cycle (exploration and construction) and during the initial part of the operations phase. Revenues then rise sharply around seven to eight years into the phase of full operation, when projects become profitable and profit-based taxes kick in. Depending on the amount of resources available, revenues typically peak 10–20 years after this and then start to decline as both production and profitability fall.[27]

In terms of direct employment (shown by the coloured area) the contributions are typically largest during the short-lived site design and construction phase (phase 2) and then level off to a smaller total during the longer-lasting operations phase, although ongoing sustaining investments can keep this higher for longer. However, this does not include potential indirect employment, which is likely to increase over time as supplier capacity is built in a country.

Figure 12: Mining life cycle – revenue and employment contributions



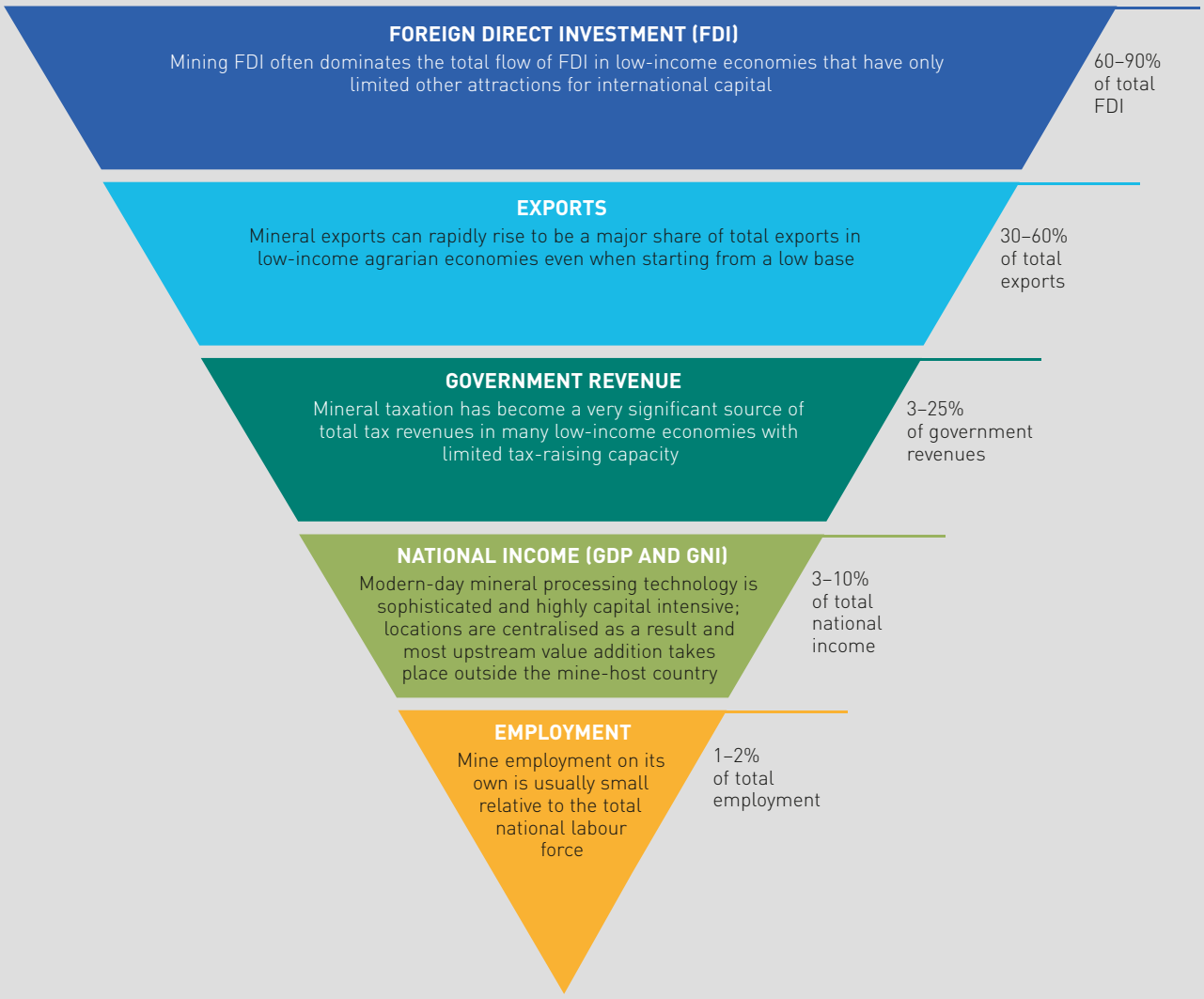
27. This assumes a mine life of some 20–30 years. But in some operations the lifespan can be much longer than this and the period of profitability can also be extended.

4

How much – the inverted pyramid of macroeconomic contributions from mining

Past research carried out by ICMM based on a series of in-depth country case studies has found that the macroeconomic contributions made by the mining sector form an inverted pyramid, as illustrated in Figure 13: in low- and middle-income countries, mining often makes up the majority of foreign direct investment (FDI) and progressively decreasing proportions of exports, government revenue, national income and employment.

Figure 13: Macro-level contributions in low- and middle-income countries



Source: ICMM (2014)

Selected topics that significantly influence mining's contribution continued

4.1 Mineral taxation – what contribution does mining make to government revenue?

4.1.1 Why is this an important contribution?

As outlined in Figure 10 in Box 1, a key part of transforming minerals and metals into socioeconomic development involves using the revenues generated from the sector for public spending and investment. Revenues from mining can be particularly important in low-income countries that have minimal other formal economic activity and, hence, limited capacity to raise taxes. While this revenue can be spent on urgent current needs, it can also enable governments to invest in physical and human capital. If managed appropriately, these investments can generate future revenues and contribute significantly to sustained economic growth.[28]

The contribution of mining to government expenditures is typically far larger than the direct government revenue that mining generates through corporate taxes and royalties levied on mining companies, although it is this that commands most public attention. Governments will also receive indirect taxation revenues from economic activity stimulated by the sector, including additional corporate and income tax revenues from new jobs created in the supply chain and induced through employee spending (see Section 4.2).

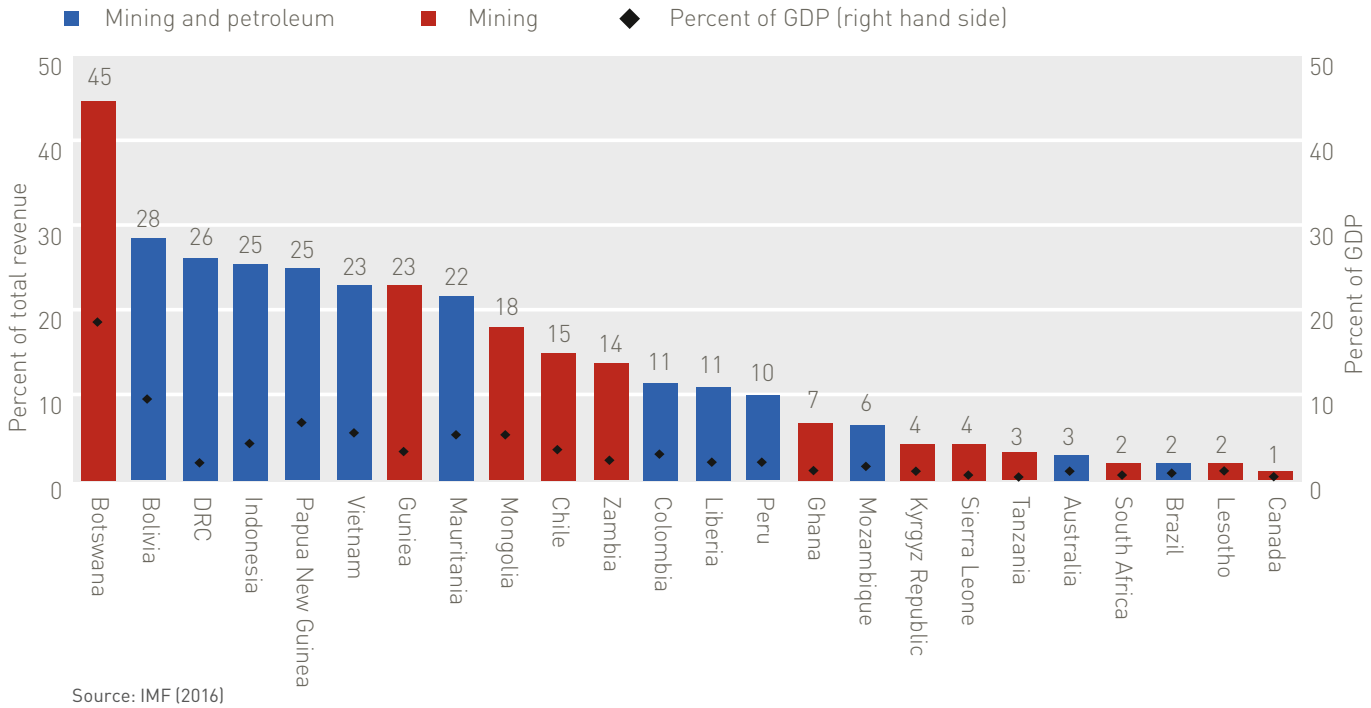
4.1.2 How much does mining contribute to government revenues?

Case studies carried out through the application of the Mining: Partnerships for Development (MPD) Toolkit have found that the contribution of mining varies significantly, from 3 to 25 per cent of total government revenues.

A number of factors influence the size of the contribution that any mining project makes to government revenues in any given year, including the size of the project, the size of the economy, the stage of the mining life cycle and the commodity price. Fluctuations in metal and mineral prices influence the profitability of the sector and the level of production, both of which influence the level of revenue paid to government.

It is still the case that, as noted in the previous Romine edition, there is no standardised database available to help assess the size of the mining sector's tax contributions for most of the countries included in the MCI. The International Monetary Fund (IMF) has recently started to put together figures for a subset of countries;

Figure 14: Government receipts from natural resources (averages 2000–2013[29])



Source: IMF (2016)

28. See also https://www.icmm.com/en-gb/society-and-the-economy/economic-development/revenue-management.

29. Selected countries, in percent of total revenue excluding grants.

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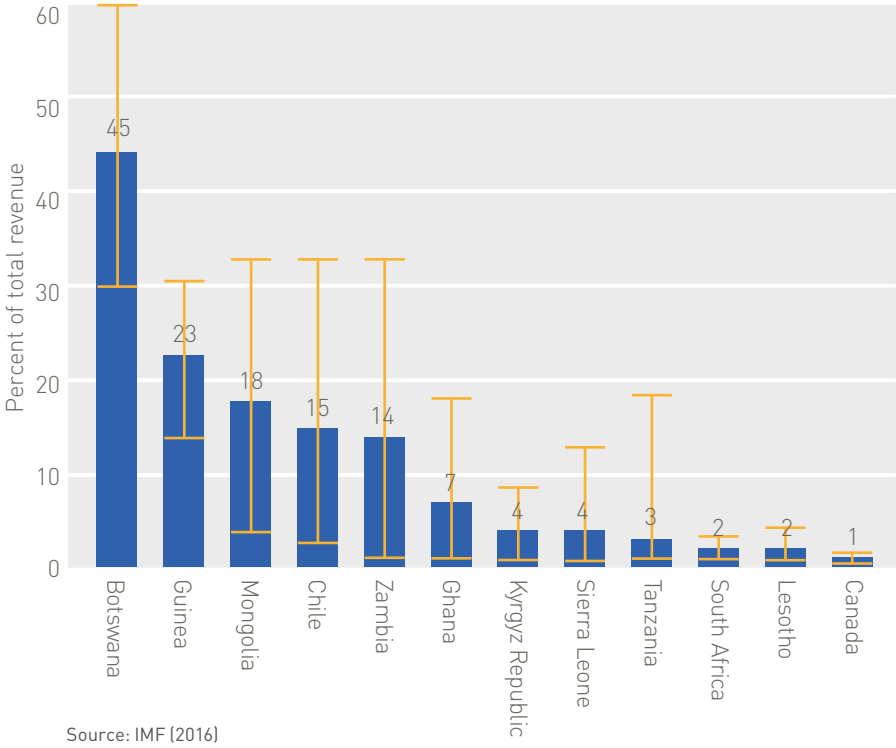
unfortunately, where a country has both mining and petroleum resources, taxation contributions to government have been combined into one figure. This results in revenue figures being available for just 12 mining-only countries,[30] with a combined figure for a further 12 countries[31] that have both mining and petroleum resources. Figure 14 shows the average contributions between 2000 and 2013 as a percentage of total government revenues and (the black diamonds, calibrated against the right axis) as a percentage of GDP.

Botswana has by far the highest contribution among the mining countries, accounting for 45 per cent of government revenue – more even than the 12 countries with both mining and petroleum resources. The other mining countries cluster between 1 and 7 per cent (Ghana, Kyrgyz Republic, Sierra Leone, Tanzania, South Africa, Lesotho and Canada) or between 14 and 23 per cent (Guinea, Mongolia, Chile and Zambia).

These averages do not show year-on-year variations (which can be wide), related to the maturity of the industry and commodity prices.

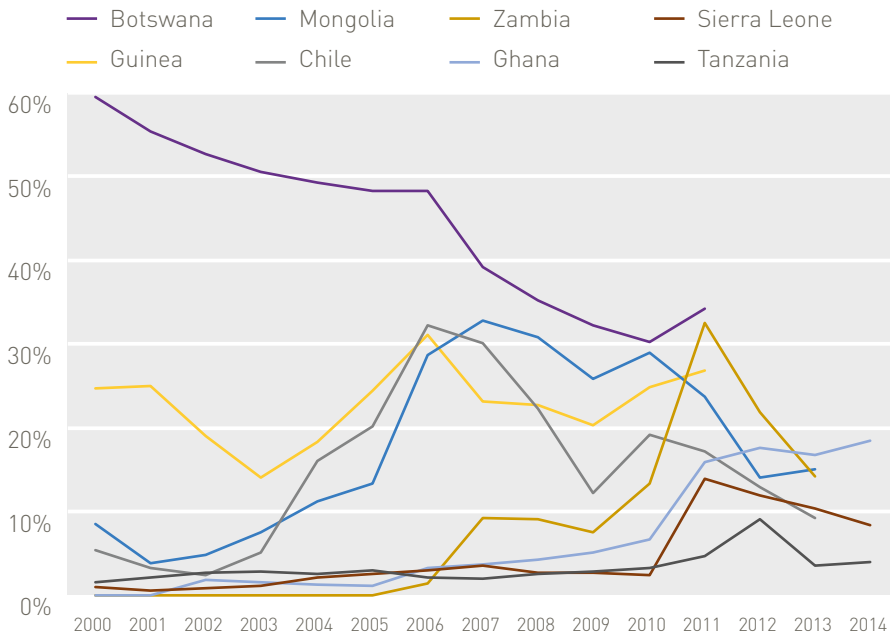
Figure 15, which focuses on the mining-only countries, shows that – for example – in Mongolia, Chile and Zambia, mining contributions constituted only around 2–4 per cent of total government revenues in some years, but over 30 per cent in other years. In Botswana, the contribution has varied between around 30 per cent and up to 60 per cent – that is, in some years mining contributed a majority of Botswana's government revenue. This inherent year-to-year instability in revenues naturally constitutes a major fiscal

Figure 15: Government receipts from mining (average, min and max 2000–2013)



Source: IMF (2016)

Figure 16: Government receipts from mining (2000–2014)



Source: IMF (2016)

30. Bolivia, Papua New Guinea, Vietnam, Mauritania, Indonesia, Colombia, Peru, DRC, Liberia, Mozambique, Australia and Brazil.

31. Botswana, Mongolia, Chile, Guinea, Zambia, Kyrgyz Republic, Lesotho, Ghana, South Africa, Sierra Leone, Tanzania and Canada.

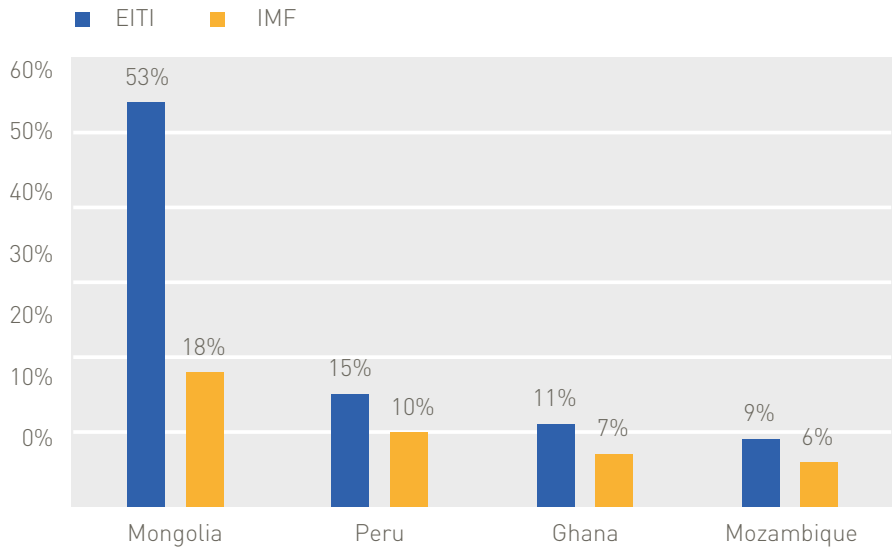
Selected topics that significantly influence mining's contribution continued

management challenge for the countries concerned.

Figure 16 shows the differing trends over time in eight of these countries. For example, Botswana experienced a sustained reduction, with the sector's contribution steadily halving over 10 years – from around 60 per cent in 2000 to 30 per cent in 2010. By contrast, Ghana has seen a steady and sustained increase, from 2 per cent in 2000 to 18 per cent in 2014. Some countries have seen a large amount of volatility: in Zambia, mining contributed just 1.4 per cent of government revenues in 2006, rising to 32.5 per cent in 2011, and back down to around 14 per cent in 2013. Other countries also experienced peaks either just before the financial crisis (Chile and Mongolia peaking around 2006–7) or before the recent fall in prices (Sierra Leone and Tanzania mirroring Zambia's peak in 2011).

Other, partial information is available from various sources on the contribution that mining makes to government revenues. While this is not collected on a consistent or comparable basis, it seems to confirm the findings from the IMF database. The reports on past MPD Toolkit applications in countries not on the IMF list have found mining sector contributions of 12 per cent of government revenues in Lao PDR, 5 per cent in Peru and 2 per cent in Brazil, at varying dates. The Extractive Industries Transparency Initiative (EITI) has found average revenue contributions over 2008–13 of around 15 per cent for Peru, 12 per cent for Burkina Faso, 11 per cent for Cote d'Ivoire and 5 per cent for Togo. Interestingly, EITI's figures are consistently higher than the IMF's for the four countries included in both datasets (see Figure 17). It is possible that the IMF figures underestimate the total contribution that the mining sector makes to government revenue by missing some additional taxes paid at the local level or through employee income tax.

Figure 17: EITI and IMF figures for average mineral sector contributions to government revenue (2008–13)



Sources: IMF (2016) and EITI reports

An expanded dataset from the IMF, preferably separating mining from petroleum contributions, will in time provide for a more precise assessment of the direct contributions that the mining sector makes to government revenues in more of the countries included in the MCI.

For now, based on only partial information, three points are clear:

- There is a large degree of variation in revenue contributions across countries.
- There is a large degree of variation within countries over time, which seems to be a function of both the life cycle stage of some large projects in the smaller economies and commodity price movements.
- With some outliers, contributions to government revenues in low- and middle-income countries tend to sit in the region of 2 per cent to 20 per cent. For context, governments tend to spend around 10 per cent of their expenditure on health – so, in many countries, contributions from the mining sector will roughly cover the entire health budget.

These figures consider only the direct contribution made by the mining sector to government revenues, primarily through royalties and corporate taxes. They do not capture additional contributions in the form of income taxes paid by mine employees, or income or corporate

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Box 2: MCI rankings and government revenue contributions

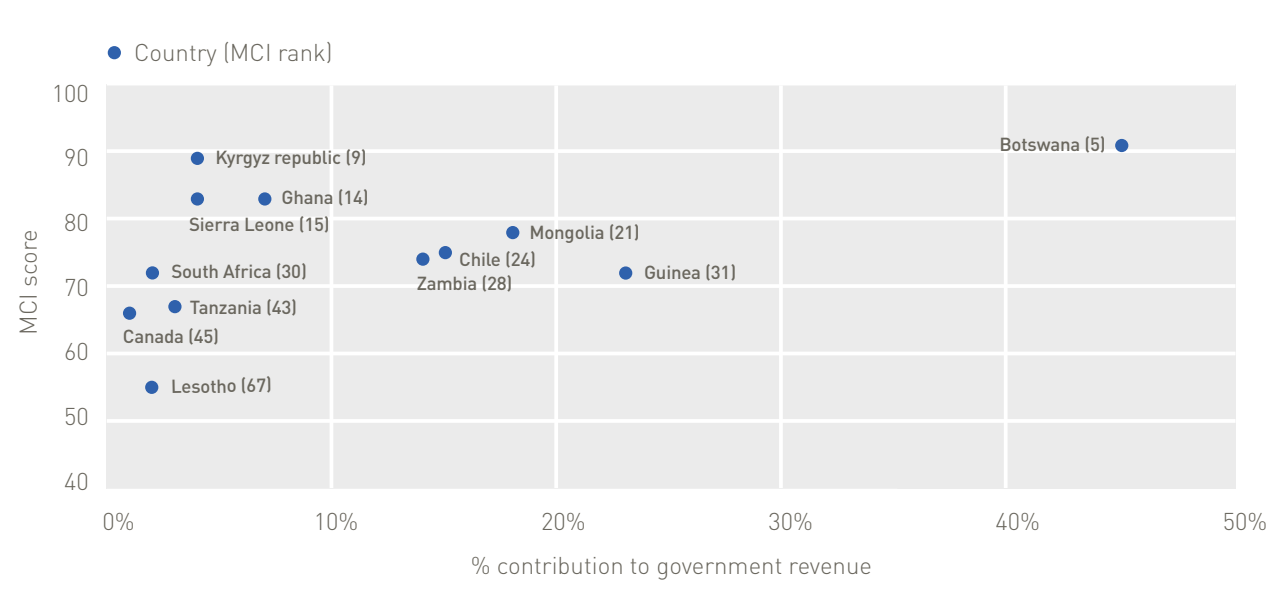
Figure 18 compares MCI data from Section 3 to the fiscal contributions from the mining sector. As with the previous Romine publication, there is some correlation between the MCI score and the total contribution to government revenue but this is fairly low.

For example, South Africa (72, ranking 30th) and Guinea (72, ranking 31st) have the same MCI scores but have dramatically different levels of mining sector contributions to government revenue: 2 per cent on average for the period 2000–2013 in South Africa, and over 23 per cent for Guinea. Chile, ranking 24th in the MCI, receives a higher percentage of revenue contributions from mining (15 per cent) than several countries ranked above it (eg Kyrgyz Republic and Ghana, ranked 9th and 14th respectively).

The relationship between the MCI and fiscal contributions from the sector is not straightforward. As outlined in Section 4.2.1, government revenue contributions within a country vary dramatically across years. By contrast, changes in exports and production experience smaller year-on-year fluctuations. The life cycle phase of mining has an important impact on government revenue contributions. If a large mining project is relatively new, several of the underlying components of the MCI (the production and export figures) may be large while government revenue contributions are still low. Both of these factors reduce correlation between MCI scores and government revenue contributions.

If and when this important contribution is included in the MCI, the scores and rankings may change for several countries – but this will not be possible until additional data is available for more countries on a consistent and comparable basis.

Figure 18: Comparison of MCI rank, MCI score and mining sector contribution to government revenue



taxes generated through supply chains or induced employment (see Section 4.2), which could be at least as important. For example, 20 per cent of all of Rio Tinto's tax payments[32] in 2014 were in the form of employee income tax – a substantial amount of $1.8 billion (Rio Tinto, 2014).

32. Total tax paid globally by Rio Tinto in 2014 was just under $9 billion. Employee income tax made up $1.8 billion of this.

Selected topics that significantly influence mining's contribution continued

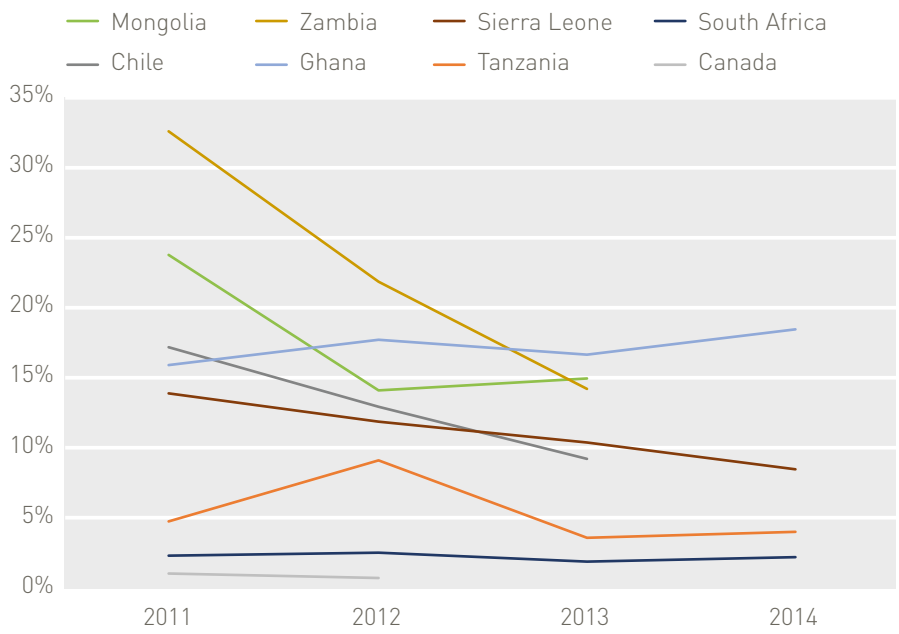
4.1.3 Emerging evidence of fiscal problems

As outlined in Section 2, the downward trend in commodity prices began in 2011 and was well established by 2012.

Figure 19 shows IMF data for fiscal contributions from the mining sector for 2011–14 for countries where this is available (Ghana, Mongolia, Chile, Zambia, Sierra Leone, Tanzania, South Africa and Canada). With the exception of Ghana, all these countries show a downward trend that is clear and sometimes sharp: in Zambia, from 32 per cent in 2011 to 14 per cent in 2013; in Mongolia, from 24 per cent to 15 per cent; in Chile, from 17 per cent to 9 per cent; and in Sierra Leone from 14 per cent to 8 per cent.

While the data is limited, it clearly indicates that the drop in commodity prices is already having a serious negative impact on a number of governments that have historically relied on the mining sector for a significant share of their revenue. Some countries are to some extent insulated from these drops in revenue as a result of having established sound macroeconomic management practices and institutional mechanisms to allow for the smoothing of revenue over time. Many low- and middle-income countries, however, are not. Even for high-income countries, the impacts can be significant.[33] This is already leading to painful fiscal adjustments through some combination of reduced government spending, increased taxation, increased debt financing or (as with Ghana) recourse to new IMF programmes (NRGI, 2015).

Figure 19: Fiscal contributions since the commodity price crash



Source: IMF (2016)

The impacts are likely to prove deeper than these figures suggest, as the commodity price decline continued after 2013–14 – the last years for which data is available – and it is likely to lead to a reduction in production, as new mining developments are delayed or cancelled and existing, higher-cost operations are shut down. If a government has already committed to spending anticipated revenues that do not now materialise, then necessary fiscal adjustments (such as increased debt financing) are likely to further reduce the budget available for future spending. The experience of the recent metal price collapse has brought into renewed focus the instabilities associated with mining's contribution to government revenue, and the need for governments to be well organised to manage their way through such periods.

4.1.4 Implications of government revenue contribution findings

Mining clearly contributes a significant share of government revenue in low- and middle-income countries. The direct contributions alone are large – typically ranging anywhere from 2 to 20 per cent of total government revenue. Additional indirect contributions further increase the total contributions of the sector. However, these contributions fluctuate dramatically across years. This presents a serious revenue management challenge for governments. Given the size of total revenue contributions, periods of sustained reductions in commodity prices – such as that currently being experienced – have serious consequences for low- and middle-income countries. Low commodity prices have already

33. In the case of Australia, for example, mining revenues grew from around A$5 billion in 2000/01 to A$25 billion in 2008/9 before falling to around A$15 billion in 2009/10.

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reduced government revenue in a number of countries. Sustained low prices could have serious long-term consequences – reduced spending, increased debt financing and increased taxation of other sectors of the economy.

4.2 Employment – how much employment does mining create?

4.2.1 Why is this an important contribution?

The mining sector's ability to generate jobs receives as much attention as its contributions to government revenue. Employment is a priority for communities living close to mine sites, particularly in remote areas where alternative opportunities are limited. Employment is also a priority for national governments: it reduces poverty, boosts living standards, raises productivity and allows individuals to invest in themselves and their families – improving health, education and future economic prospects. Expanding formal economy jobs is particularly important in low- and middle-income countries where unemployment is high and most work opportunities are in the insecure informal economy.

The mining sector generates employment directly by hiring people to work on mining projects (including long-term contractors) and indirectly through the supply chain (see Box 3). With today's highly capital-intensive mining technologies, the number of direct jobs is often limited. However, the employment contributions of the sector extend well beyond these two areas. Additional employment is generated through the spending of incomes received by individuals who are directly or indirectly employed by the sector. The overall employment effect, even over the short and medium term, is typically much larger than the direct employment figures suggest.

As with government revenue, there is also a qualitative component and a longer-term dynamic to the employment contributions made by the sector. In the short term, the jobs generated are typically much better paid than alternatives in the same geographical area. Over the longer term, local suppliers build increased capacity to service the industry (sometimes directly supported by mining companies) and mining companies train employees. These contributions not only expand indirect employment, they also build skills that are transferable to other industries, supporting future growth and employment. And, as more employment is generated, so too is additional government revenue through income and corporate taxes.

4.2.2 How much does mining contribute to employment?[34]

Earlier research carried out by ICMM has found that the employment contributions of the industry are smaller than other macroeconomic contributions (see inverted pyramid in Figure 13). The mining sector typically contributes only around 1 to 2 per cent of total employment in a country. This is typical of capital-intensive industries. However, these figures take into account only direct employment. The contributions of indirect employment, and particularly induced employment (see Box 3 for an explanation of these terms), are generally many times larger.

Box 3: Direct, indirect and induced employment

Direct employment – individuals employed by the company that owns and operates the extraction site. This sometimes includes contractors' staff if their regular workplace is on-site. An example would be an engineer employed on a mine site.

Indirect employment – individuals employed by companies that supply goods or services to the mining company or that use its services, that is, employment through the supply chain. It can also include employment generated through social investment activities such as local business development. An example would be a mechanic supplying services to a mine as a contractor.

Induced employment – additional employment generated as a result of the spending activities of those employed directly or indirectly by the industry. This includes things such as employees spending their wages in shops or on accommodation or transport. An example would include someone who has opened a shop in a mining region to sell groceries.

Source: Cordes et al (2016)

34. Note that this only includes large-scale mining. Artisanal and small-scale mining (ASM) is not included in the analysis as reliable estimates for employment in ASM do not exist. ASM contributes to many more jobs but the benefits are hampered by low wages, dangerous work conditions and environmental hazards.

Selected topics that significantly influence mining's contribution continued

Many factors influence the contribution that mining can make to employment in a particular country (see Box 4 for details). These include general industry characteristics (eg the life cycle phase of a mine, prevailing commodity prices), national characteristics (eg the enabling environment for businesses generally, and skills levels in a country), mine-specific factors (the type and grade of a mineral deposit) and any efforts made by mines – sometimes working in collaboration with other stakeholders – to enhance indirect employment (eg through local sourcing and supplier development programmes). Despite these variations, some consistent patterns can be seen in employment contributions from the sector.

Box 4: Factors influencing job creation potential in the mining industry

- **Type of mine ownership** – publicly owned mining companies generate more direct and less indirect employment; private companies generate less direct employment but more indirect employment.
- **Size and life of a mine** – larger mines with longer operating periods generate more employment.
- **Life cycle phase** – construction phases generate more direct employment and more unskilled employment; operational phases generate less direct employment and less unskilled employment but increasing indirect employment over time.
- **Type of mining operation** – underground mines generate more employment than open pit mines, relative to production value and volume. Underground staff tend to have higher skills and therefore higher wages, which increases induced impacts.
- **Type of commodity** – different commodities generate varying levels of employment. Uranium mines tend to have the largest employment impacts, and gold and potash mines the smallest.
- **Mineral grade** – in general the lower the mineral grade, the higher the employment impact.
- **Level of existing infrastructure** – if infrastructure needs to be developed in a region, more employment will be generated through its construction. This may generate further employment benefits if the new infrastructure allows for additional trading opportunities for the local population.
- **Skills levels in local and national economy** – the higher the skills levels and more relevant the skills in the local economy, the higher the employment impact.
- **Level of development and diversification** of local and national economy – the more diversified an economy is, the higher the employment effects.
- **Enabling business environment** – an enabling business environment generates higher indirect employment over the long term.
- **Technical assistance programmes** – implementation of supplier development or technical assistance programmes can speed up capacity building of local suppliers and increase indirect employment.

Source: Cordes et al (2016) and McMahon and Moreira (2014)

Direct employment

Generating national figures on mining sector employment that are comparable across many countries is currently very difficult. It is particularly difficult to accurately measure the total amount of induced employment that the industry generates – but even measuring direct and indirect contributions can be difficult given the available data. National statistics can provide an estimate of total employment in the mining sector. However, the sector classification of workers ('mining and quarrying') is problematic. In many countries the national statistics include quarry workers who are not employed in the mining sector, and excludes workers who are employed in the mining sector but are captured in other categories (eg construction or services). The figures may also include artisanal and small-scale mining in some countries and not in others. So these figures need to be treated only as a very rough estimate.

In terms of direct employment, the best information currently available is that produced by the International Labour Organization (ILO) through its database. The database includes data collected through labour force surveys by national statistics agencies in individual countries, albeit with the aforementioned limitations. Also, data is available only for some countries and for some years: Ilostat (ILO's central statistics database) figures for mining employment and total employment are available for 23 of the 50 highest-ranking countries on the MCI (see Table 5).

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Table 5: ILO data on mining employment and total employment

Country	Year	Mining employment	Total Employment	Mining employment as % of total employment
Peru	2013	198,000	4,598,800	4.3%
Mongolia	2014	40,900	1,110,700	3.7%
Kazakhstan	2013	249,300	8,570,600	2.9%
South Africa	2014	428,000	15,317,000	2.8%
Ukraine	2015	399,100	16,443,200	2.4%
Namibia	2013	13,600	685,700	2.0%
Bolivia	2014	100,300	5,082,000	2.0%
Zambia	2012	90,000	5,386,100	1.7%
Liberia	2010	17,000	1,091,000	1.6%
Zimbabwe	2014	92,300	6,265,900	1.5%
Madagascar	2012	126,800	10,441,900	1.2%
Ghana	2010	112,700	10,243,500	1.1%
Senegal	2011	41,200	3,777,900	1.1%
Guinea	2012	53,300	4,982,500	1.1%
Bulgaria	2015	25,700	3,031,900	0.8%
Iran	2014	159,500	21,304,300	0.7%
Armenia	2015	8,000	1,072,600	0.7%
Philippines	2015	234,500	38,740,800	0.6%
Turkey	2015	118,800	26,618,500	0.4%
Rwanda	2012	18,200	4,152,700	0.4%
Kyrgyzstan	2014	9,200	2,302,700	0.4%
Guatemala	2015	8,600	6,325,800	0.1%
Suriname	2013	6,500	37,917,000	0.0%

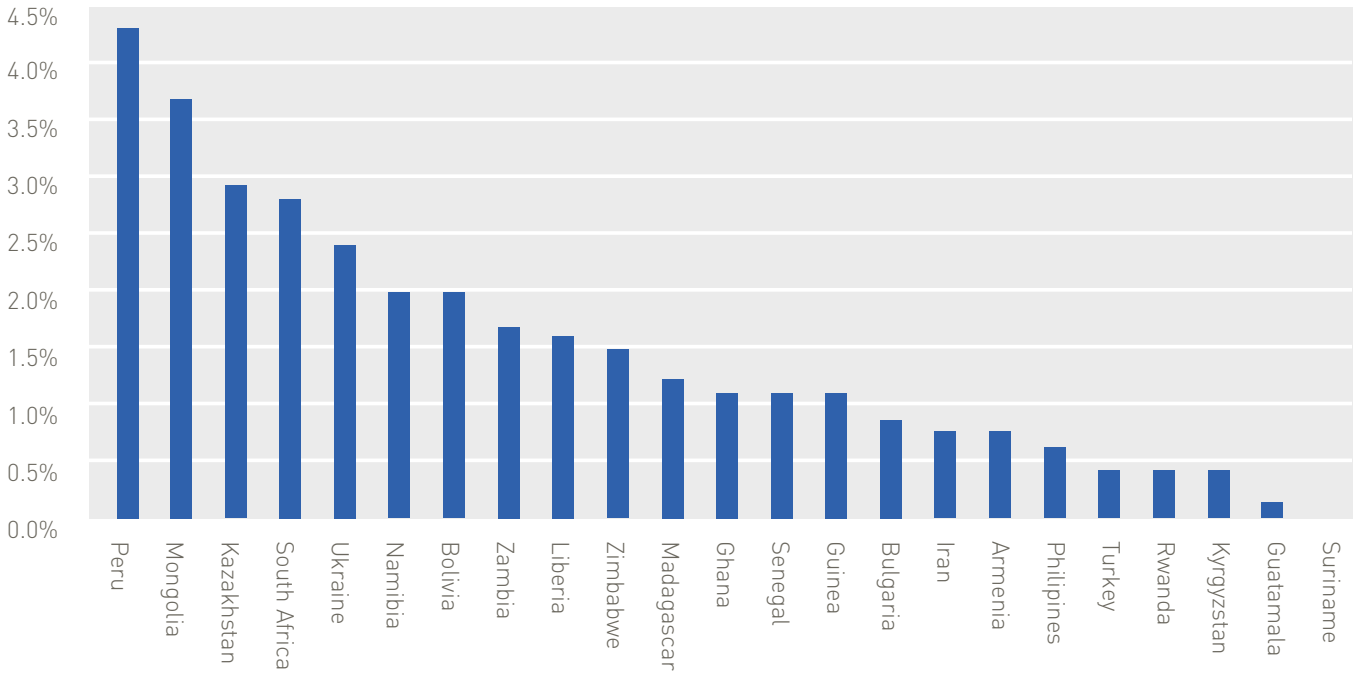
Source: Ilostat

Figure 20 illustrates the percentage contribution that mining makes to total employment. This ranges from 4.3 per cent in Peru to a negligible amount in Suriname; most countries sit between 0.5 and 3 per cent with slightly higher mining sector contributions to employment in Peru (4.3 per cent) and Mongolia (3.7 per cent).

Alternative sources for estimating mining sector contributions to employment include information directly collected from mines. While these figures are more accurate, they too suffer from problems with consistency and comparability across mines and countries. Direct and indirect employees are classified differently by different companies. Even if two mines generate exactly the same amount of direct and indirect employment in total, one mine may look as if it generates much higher levels of employment and smaller multiplier effects, while another may look as if its direct employment impact is small and multipliers are large. Any comparisons made across studies carried out where employment data has been directly collected from mines needs to be sensitive to these differences.

Selected topics that significantly influence mining's contribution continued

Figure 20: Mining sector direct employment as a percentage of total employment



Source: Ilostat

ICMM has collected a large amount of case study data on employment through the MPD Toolkit applications. These case studies have found that the sector's direct employment contributions are generally in the region of 1–2 per cent of total national employment, which conforms to the Ilostat findings. The most recent case studies have found direct employment in the mining sector contributing just under 1 per cent to total employment in Brazil (2009), 1 per cent in Lao PDR (2009), 1.7 per cent in Zambia (2012) and 1.1 per cent in Ghana (2013). Importantly, the findings also indicate that the jobs generated directly by the sector tend to be better paid than alternative jobs available in these countries. For example, an MPD Toolkit application in Chile found that average incomes in mining were double that of other economic activities (ICMM, 2007). The majority of these jobs go to national employees rather than expatriates.

Indirect and induced employment – evidence on multipliers

While these figures are useful in order to understand the magnitude of mining's direct employment contributions, they do not provide any indication of indirect and induced employment impacts (or the 'multiplier effects'), which in many cases are much larger. Figure 11 illustrates why this is true for indirect employment: the share of total project revenue paid to employees ranges from 10–20 per cent, whereas the proportion typically paid to suppliers is around 50–65 per cent. This will generate indirect employment if the goods and services supplied are provided locally, which depends on the local economy's level of development and diversification – although even in very underdeveloped economies, many services will be locally procured. An MPD case study demonstrated this in Zambia: though most manufactured goods were imported, almost 100 per cent of services were locally procured. Public–private partnerships can expand indirect employment contributions by enhancing the capacity of local suppliers (see Box 5).

Evidence suggests that induced employment (as defined in Box 3) is likely to be larger than both direct and indirect employment combined. This component is the most difficult

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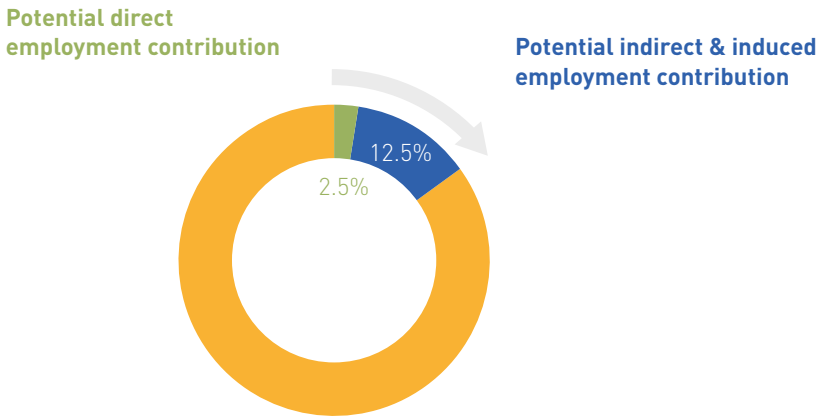
Box 5: Enhancing indirect employment contributions through supplier development programmes in Chile

Chile has successfully built supplier capacity and maximised the employment contributions of mining in Antofagasta (Region II) through a series of public–private programmes that began in the early 1990s and continue today. Mining companies (including two ICMM member companies – BHP Billiton and Codelco) and governments have worked together on initiatives to support the growth of small and medium enterprises: financing, training, support in gaining ISO certification, and promoting suppliers associations. In the early 1990s most goods and services for Chile's mining sector were imported. Now Chilean companies supply goods and services not only in Chile but also to the rest of the region, and the Ministry of Mining aims to establish local firms as world-class suppliers.

Sources: ICMM (2007) and McMahon and Moreira (2014)

Figure 21: Potential direct, indirect and induced employment contributions to total employment



to measure, since it arises as the result of many diffused spending decisions by many different people – some in the informal economy – and so it can be difficult to identify and link to mining. However, it can make a significant contribution to local incomes and create a potential base for diversified development.

Various studies[35] have attempted to estimate the multiplier effects of mining sector employment – the total number of additional indirect and induced jobs generated for every direct job created. These multipliers are highly context specific and reliant on the assumptions used in models that estimate them.[36] They vary dramatically across industries, within industries across countries, and even within an industry in one country; they can vary depending on the region being assessed, the type of mining activity and individual firms' characteristics. Multipliers can even change for a specific case study if the base year used for estimates is changed (IFC, 2013). They therefore need to be treated with caution and seen as indicative rather than precise. Nevertheless, they can still be an informative reference point for estimating total employment effects.

Most studies find that multipliers are spread over a range between two and five.[37] Depending on the context, the mining sector therefore contributes anywhere from two to five additional jobs for every direct job created. If mining typically contributes 1–2.5 per cent of an economy's total jobs through direct employment, this means that its total contribution could range from 3 to 15 per cent (see Figure 21).

35. For examples see studies listed in IFC (2013), World Bank and IFC (2002) and McMahon and Moreira (2014).

36. Multipliers are generally estimated using econometric techniques – input-output or computable general equilibrium models.

37. Much larger multipliers have been found in Ghana (around 20 indirect and induced jobs per direct job). This report focuses on the more conservative estimates found in other countries.

Selected topics that significantly influence mining's contribution continued

Box 6: Comparison of MCI rank, MCI score and mining sector contribution to employment

Figure 22 compares the MCI data to the employment contributions from the mining sector. Consistent with the findings from the previous Romine publication and the findings on mineral fiscal contribution, the degree of correlation is low. For example, South Africa is ranked only 30th on the MCI but mining contributes 2.8 per cent of total employment; by contrast, Madagascar is ranked as far more mineral dependent, 4th on the MCI, but mining contributes only around 1.2 per cent of total employment.

The relationship between the MCI and employment contributions is complicated. As outlined in Box 4, many factors influence the job creation potential of mining. These factors differ across countries and therefore influence employment contributions. However, the underlying surveys informing Ilostat figures use different methodologies and do not necessarily produce comparable figures. It is unsurprising that the degree of correlation between MCI figures and employment contributions are low. Low correlation is partly due to genuine differences in employment contributions, but a larger part is due to methodological differences. This complicates any analysis of employment contributions and MCI scores.

Figure 22: Comparison of MCI rank, MCI score and contribution to direct employment

Country	MCI rank	MCI score	% contribution to employment
Mongolia	20	78	3.7%
South Africa	30	72	2.8%
Ukraine	18	81	2.4%
Bolivia	33	71	2.0%
Zambia	27	74	1.7%
Liberia	8	89	1.6%
Madagascar	4	92	1.2%
Ghana	14	83	1.1%
Senegal	17	82	1.1%
Guinea	29	72	1.1%
Armenia	21	78	0.7%
Rwanda	19	79	0.4%
Kyrgyz Republic	9	89	0.4%

4.2.3 Emerging evidence of employment impacts of commodity price drop

During periods of sustained low commodity prices, such as that between 2011 and 2015, producers respond by seeking to reduce costs (see Section 2), including through workforce reductions. Job losses or wage cuts affect not only those directly employed, but also those in induced employment, whose incomes rely on the spending of mining sector workers. Consequently, employment impacts can be far larger than the figures for direct employment losses might suggest.

Unfortunately, as Ilostat relies on infrequently administered labour force survey data, it provides little information on the time trends in mining sector employment and offers only limited insights into the employment effects of recent commodity price falls. However, some data is available for changes over time in Peru, Mongolia and the Philippines.

In Peru, total employment in 'mining and quarrying' declined from around 205,000 jobs in 2012 to 198,000 in 2013; in Mongolia, mining employment declined from 45,000–46,000 in 2011–12 to 40,900 in 2014; in the Philippines, it fell from 250,000 in 2012 to 234,500 in 2015.

A recent World Bank study also found that mining employment growth in Mali, which steadily increased to a peak of 3,862 direct jobs in 2012, decreased to 3,568 direct jobs in 2013 (Sanoh and Coulibaly, 2015). The National Australia Bank recently estimated that the mining sector created around 169,000 jobs in Australia from the start of the mining construction boom in 2005 to its peak in 2013 but that 46,000 of these

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had now gone with another 50,000 expected to be lost in the next two and a half years.[38]

Although these figures are limited and preliminary, they nevertheless indicate that the commodity price slump is having an impact on mining sector employment. The thousands of direct job losses being experienced in some countries could translate into tens of thousands of job losses when the knock-on effects on indirect and induced employment are included.

4.2.4 Implications of employment contribution findings

Employment contributions from mining are difficult to measure. Currently no reliable, comparable data is produced to allow for cross-country comparisons. MPD Toolkit applications and Ilostat data do, however, provide some initial evidence of employment contributions. MPD Toolkit applications have found that direct employment contributions typically range from 1 to 2 per cent of total national employment. The Ilostat database suggests that the range is slightly wider: around 0.5–3 per cent. Although the Ilostat figures are less reliable, they confirm the MPD findings that direct employment from mining is likely to constitute only a few percentage points of national employment. For each of these direct jobs, an additional two to five jobs are generated through indirect and induced employment. Once this is factored in, the total employment contribution could be as large as 15 per cent of total employment. Low commodity prices have already led to a reduction of thousands of jobs in some countries. This could result in tens of thousands of job losses through indirect and induced employment. This has serious consequences for these tens of thousands of individuals (and their dependants) if they are unable to find alternative employment.

4.3 Governance – how does governance influence mining contributions?

4.3.1 The importance of governance in determining economic and social outcomes

The quality of governance in a country has a dramatic impact on both the nature and the magnitude of the economic and social contributions of the mining sector. As a general principle, better governance improves how well a country does overall – it has been linked in various studies with higher levels of per capita GDP and higher rates of GDP growth (Han et al, 2014) and better social indicators such as infant mortality rates (Kaufmann et al, 2000).

Governance influences mining's contributions to government revenue (see Section 4.1) and employment (see Section 4.2) at all stages of its life cycle, from a government's ability to attract initial investment[39] and secure a good deal during initial contract negotiations, to its ability to manage the contribution over time to facilitate development in the rest of the economy. A country that is well governed is more likely to negotiate good terms with mining companies; to collect, manage and spend revenues effectively to generate broad-based growth and development; to create the enabling environment needed to enhance employment; and to succeed in using mining to catalyse longer-term economic diversification.

4.3.2 Definitions and measures of governance

'Governance' has many definitions, encompassing the processes of making and implementing decisions. The widely used Worldwide Governance Indicators (WGI) identify three main components of the concept: the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them (Kaufmann et al, 2000). 'Good governance' generally implies that the rule of law is respected, corruption is kept in check, political institutions are stable, government is effective and citizens are able to hold government to account.

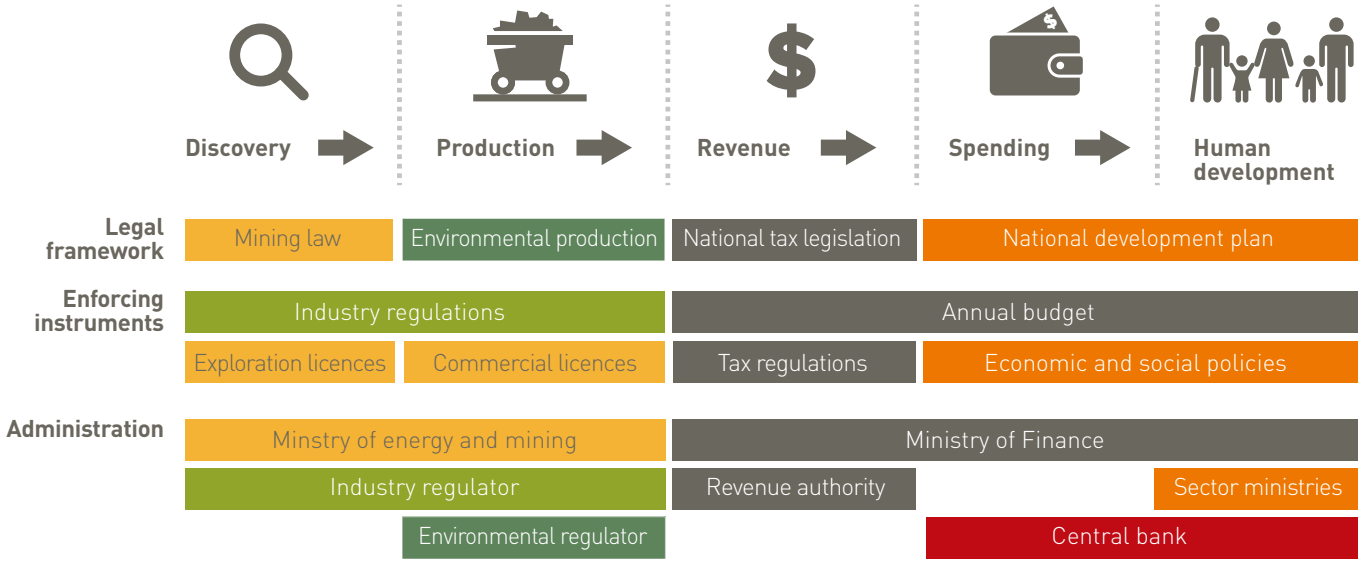
Good governance requires a broader political environment that encourages accountability – for example, by allowing a free press and an active civil society. In relation to governing mineral resources, a key component of accountability is transparency – including transparency in contracts, beneficial ownership and revenue payments. Good governance also requires a government to have capacity to translate mining activities into social and economic development – ranging from mineral-sector-specific capabilities (eg the ability to administer a mining cadastre) to general public administration skills (eg procurement) to complex technical skills (eg capacity for sound macroeconomic management).

38. ABC News Friday 10 June 2016.

39. The Fraser Institute produces an Investment Attractiveness Index detailing how attractive investments are in various countries as a result of mineral policies. Investment Attractiveness Index scores are positively correlated with the RGI composite score and the WGI scores for government effectiveness and regulatory quality.

Selected topics that significantly influence mining's contribution continued

Figure 23: The value chain and governance



Source: Adapted from Dietsche et al, 2013

Government comprises a complex set of institutions that operates at various levels and interacts in various ways. Good governance at one level does not automatically translate into good governance at other levels. For example, a national government may have better capacity to manage revenues from the mineral sector than a local government; if revenue is transferred to the local government to invest in infrastructure, this may reduce mining's contribution to broad-based growth.

Getting the policies right for mineral sector policy and administration is complex and requires coordination across many agencies, something that is difficult to achieve even in highly effective governments.

Figure 23 shows a simplified outline of the numerous agencies, policies and levels of government that intersect across the 'value chain' involved in converting natural resources into growth and development.

Its broad scope makes 'governance' difficult not only to define but also to measure, although numerous indicators have been developed to measure various aspects of governance. Two are particularly relevant to the mineral sector.

The first is the Worldwide Governance Indicators (WGI), created by the World Bank. These include six indicators that act as proxies for the overall quality of governance within a country (see Box 7 for more information). As they are not aggregated into an overall score for governance, we have focused on the two indicators that seem most relevant for determining how large a contribution mining is able to make to a country – government effectiveness and regulatory quality.

The second index focuses more specifically on governance of the natural resource sector. The Resource Governance Index (RGI) was created by the Natural Resource Governance Institute (NRGI). It is made up of four main components (see Box 8 for more details) that are aggregated to provide a composite score for each country it assesses.

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Box 7: The Worldwide Governance Indicators (WGI)

The Worldwide Governance Indicators were created by the World Bank. They cover 215 countries and have been produced since 1996. The most recent figures are for 2014. Six indicators assess governance from three perspectives:

- the process by which governments are selected, monitored and replaced: **voice and accountability** and **political stability**
- the capacity of government to effectively formulate and implement sound policies: **government effectiveness** and **regulatory quality**
- respect of citizens and the state for the institutions that govern economic and social interactions among them: **rule of law** and **control of corruption**.

The indicators are informed by a large number of existing data sources and include views from the public and private sector as well as NGOs. Data sources include household and firm surveys (eg Afrobarometer surveys), NGOs (eg Global Integrity), commercial business information providers (eg Economist Intelligence Unit) and public sector organisations (eg CPIA assessments of World Bank).

The six indicators are not aggregated to provide an overall assessment of governance per country. Instead each indicator stands alone for each of the 215 countries, enabling comparisons over time and across countries. Scores are assumed to have a normal distribution and lie on a range from –2.5 to 2.5, with higher numbers indicating better governance. Countries are also ranked according to percentiles, with 0 indicating the lowest rank and 100 the highest.

Source: Worldwide Governance Index

Box 8: The Resource Governance Index (RGI)

The Resource Governance Index, a recent initiative by the Natural Resource Governance Institute, covered 58 countries in 2013 and will be updated in early 2017. It evaluates four components of the quality of governance in the extractives sector:

- **Institutional and legal setting** – the degree to which the laws, regulations and institutional arrangements facilitate transparency, accountability and open/fair competition.
- **Reporting practices** – the actual disclosure of information by government agencies. Because de facto disclosures are the best indicator of transparency, this component receives a greater weight.
- **Safeguards and quality controls** – the presence and quality of checks and oversight mechanisms that encourage integrity and guard against conflicts of interest.
- **Enabling environment** – the broader governance environment, based on more than 30 external measures of accountability, government effectiveness, rule of law, corruption and democracy.

The first three components are informed by a 173-item questionnaire. Responses are clustered into 45 indicators, which are then mapped onto the components. The final component uses data from 30 external sources, including the WGI. These components are then weighted (40 per cent for 'reporting practices', 20 per cent for the others) to provide a composite score for each country assessed, ranging from 0 to 100.

Source: Natural Resource Governance Institute

Selected topics that significantly influence mining's contribution continued

4.3.3 Governance indicators for top 50 countries on the MCI

Figure 24 provides an indication of government effectiveness (using the WGI indicator) and Figure 25 of regulatory quality for the countries ranked in the top 50 on the MCI. Countries are colour coded according to the percentile in which they rank in terms of government effectiveness and regulatory quality.

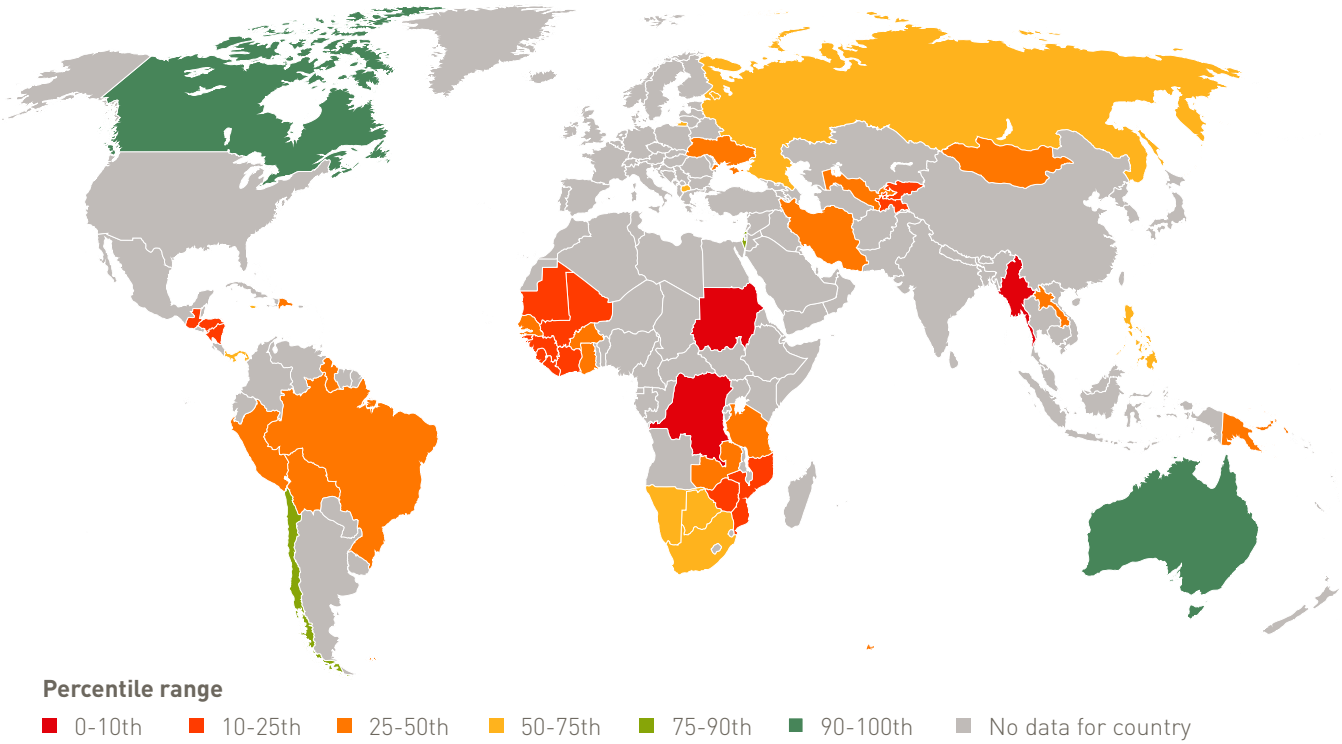
Overall, most of the top 50 MCI countries do poorly on both of these important measures of governance. Around a quarter of the countries (13 of 50 for government effectiveness and 17 of 50 for regulatory quality) rank in the top half, and only four (Australia, Canada, Chile and Israel) in the top quarter.

The majority of countries (around three-quarters) lie in the bottom half of the government effectiveness rankings.

Of the 37 countries in the bottom half of government effectiveness, 18 rank in the lowest quartile and 5 in the bottom decile. Of the 33 countries in the bottom half of regulatory quality, 13 rank in the lowest quartile and 6 in the bottom decile.

The NRGI assessed 23 of the top 50 MCI countries.[40] Their composite scores are shown in Figure 26 and mapped in Figure 27. Five are rated as 'satisfactory', eight as 'partial', five as 'weak' and five as 'failing'.

Figure 24: Government effectiveness (WGI) in 2014 of the countries ranked in the top 50 of the MCI[41]



40. Australia, Bolivia, Botswana, Brazil, Canada, Chile, DRC, Ghana, Guinea, Iran, Liberia, Mongolia, Mozambique, Myanmar, Papua New Guinea, Peru, Philippines, Russia, Sierra Leone, South Africa, Tanzania, Zambia, Zimbabwe.

41. Source – Worldwide Governance Indicators website.

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Figure 25: Regulatory quality (WGI) in 2014 of the countries ranked in the top 50 of the MCI

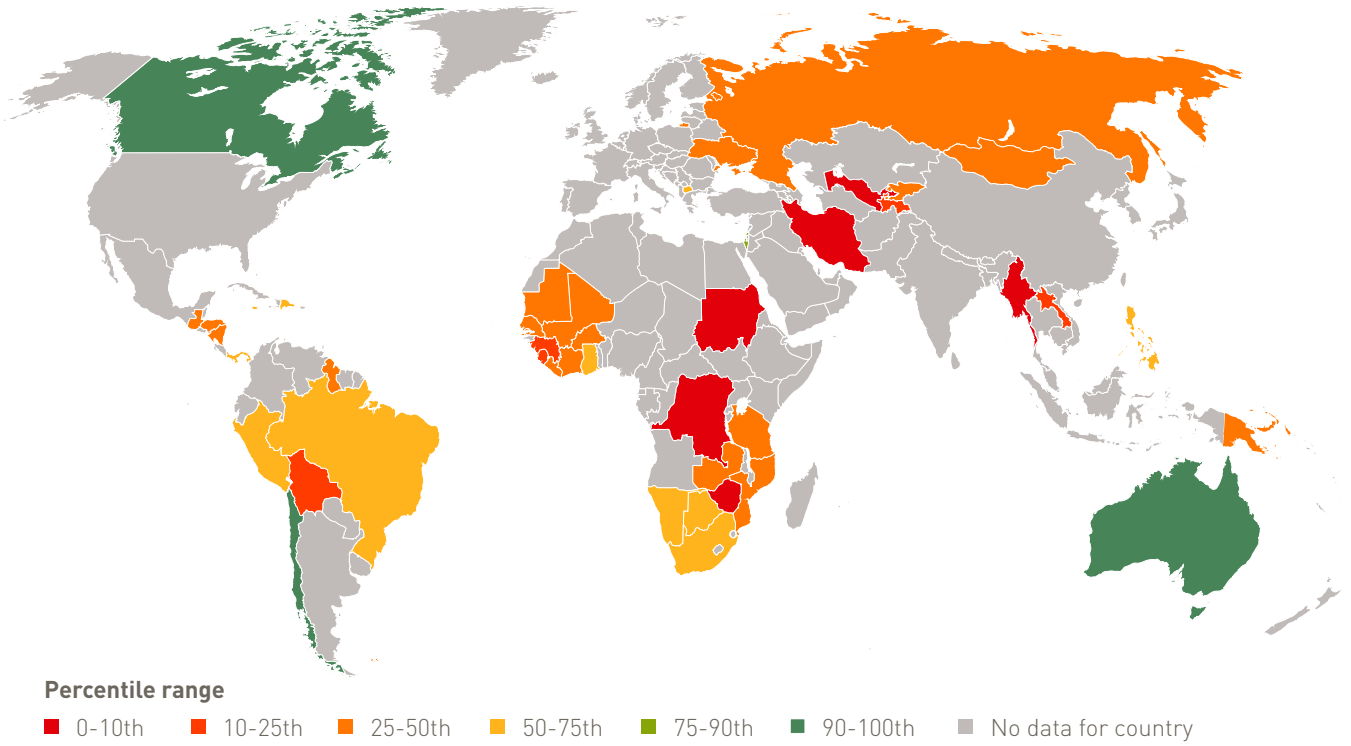
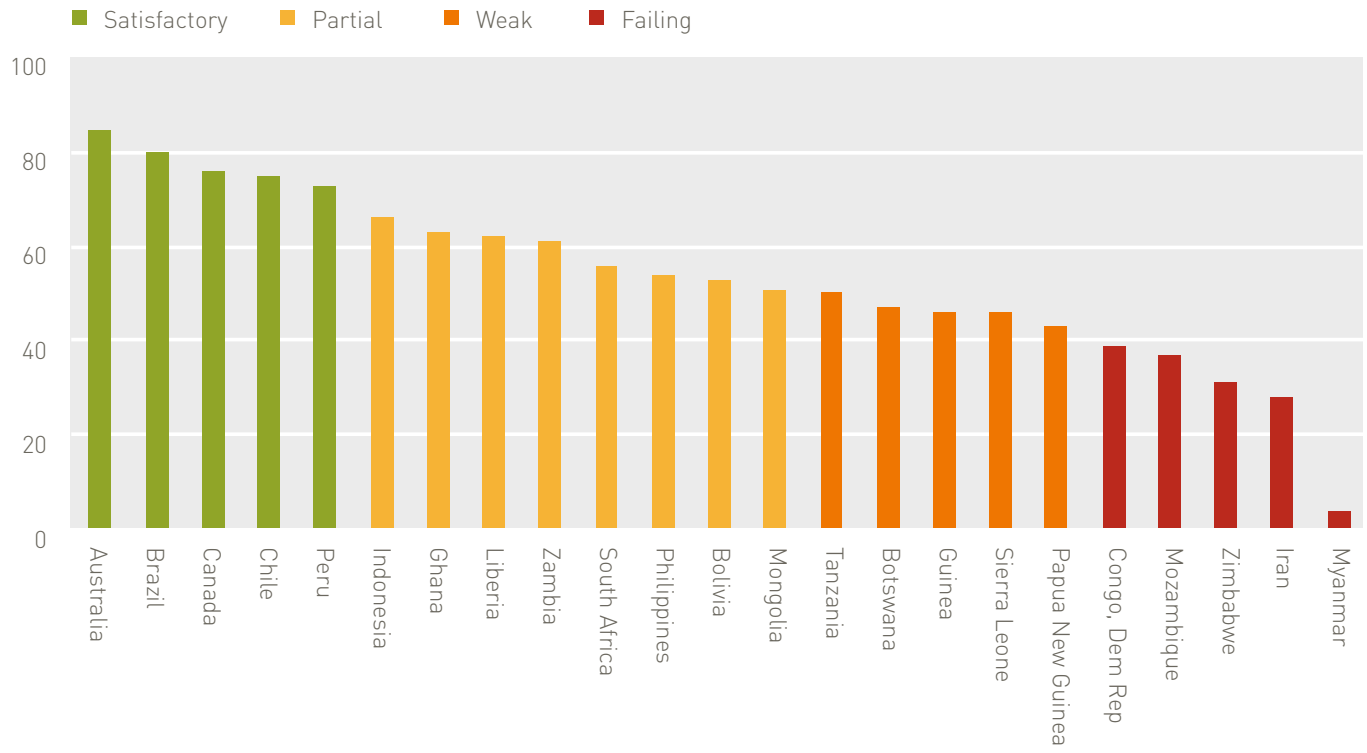


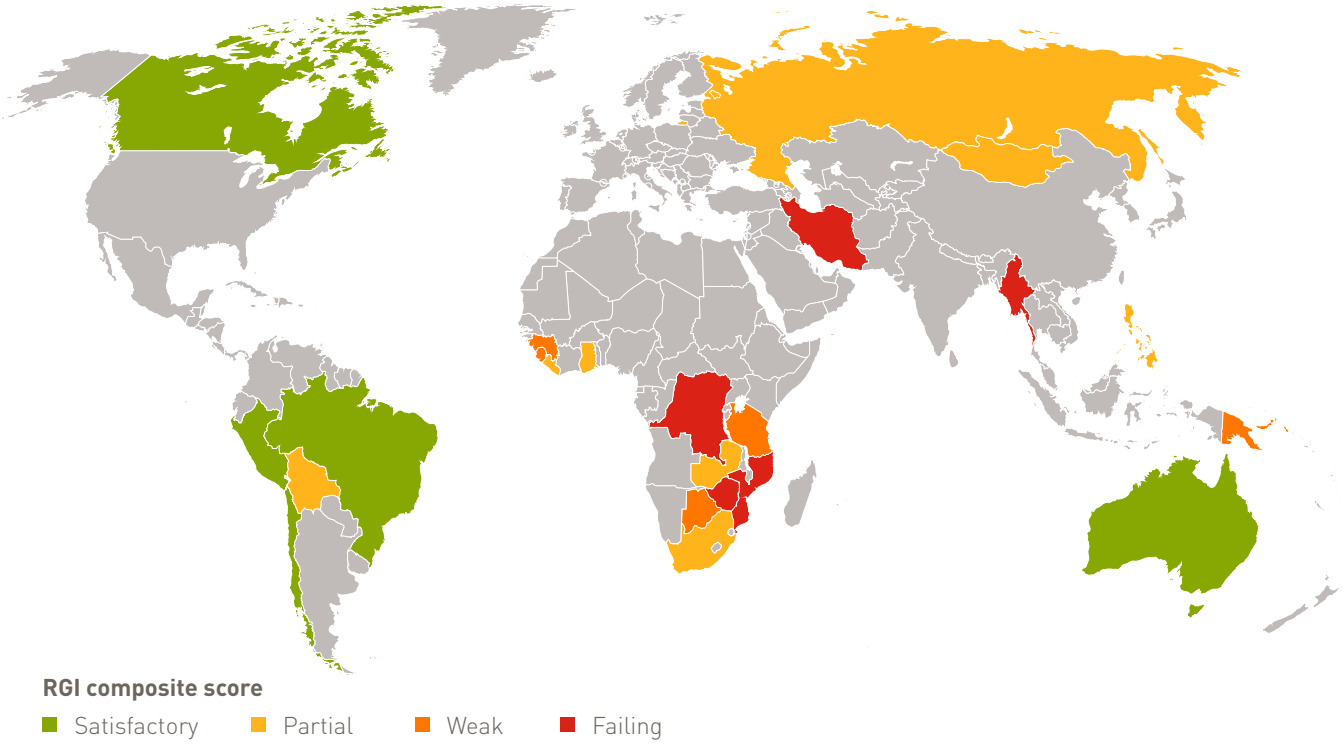
Figure 26: Resource Governance Index composite scores for 23 of the top 50 MCI countries



Source: NRGI

Selected topics that significantly influence mining's contribution continued

Figure 27: Map of Resource Governance Index composite scores for 24 of the top 50 MCI countries



Source: NRGI Resource Governance Index 2013

Table 6 breaks down how the 23 countries score on the four components that inform the NRGI composite score, with their WGI government effectiveness and regulatory quality scores added in the final two columns for reference and colour coded according to the same criteria.

It shows that there is variation in how well countries score in the underlying components, even if their composite scores are similar. For example, South Africa and Bolivia have similar composite scores (56 and 53), but South Africa does better on 'enabling environment' and 'safeguards and quality controls' while Bolivia does better on 'institutional and legal setting' and 'reporting practices'.

Some patterns emerge. In general, the 'enabling environment' is fairly poor for the 23 of the top 50 MCI countries assessed by NRGI, even for those countries scoring relatively well on the composite score. However, relative to their composite scores, many countries seem to perform relatively well on 'institutional and legal setting' and 'safeguards and quality controls'.

For example, Guinea scores as 'weak' on the composite index but scores very high on 'institutional and legal setting'. This highlights that even if the formal legislation is good, governance in reality can still be very poor. But it also offers encouragement, in the sense that even in countries where government capacity is currently limited and regulatory capacity is poor, some

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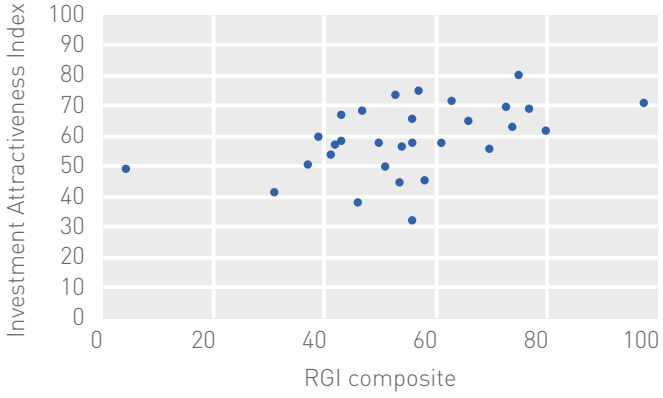
Table 6: RGI composite and disaggregated scores and WGI government effectiveness score

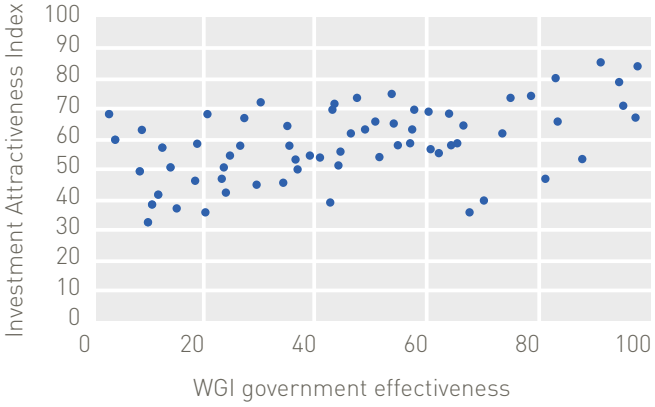
Country	RGI					WGI	
	Composite	Institutional and legal setting	Reporting practices	Safeguards and quality controls	Enabling Environment	Government effectiveness	Regulatory quality
Australia	85	88	87	65	96	92	98
Brazil	80	81	78	96	66	47	50
Canada (Alberta)	76	67	72	74	96	95	98
Chile	75	77	74	65	87	84	92
Peru	73	88	83	56	55	44	69
Ghana	63	79	51	73	59	44	51
Liberia	62	83	62	71	31	8	23
Zambia	61	71	62	72	37	36	32
South Africa	56	69	31	75	72	65	64
Russia	56	57	60	62	39	51	37
Philippines	54	63	54	51	46	62	52
Bolivia	53	80	47	63	32	30	20
Mongolia	51	80	39	49	48	38	46
Tanzania	50	44	48	68	42	27	41
Botswana	47	55	28	53	69	65	72
Guinea	46	86	45	43	11	11	13
Sierra Leone	46	52	47	59	24	11	24
Papua New Guinea	43	59	34	50	38	28	42
Congo, Dem Rep	39	56	45	42	6	4	11
Mozambique	37	58	26	37	37	24	38
Zimbabwe	31	48	23	56	6	12	2
Iran	28	26	33	26	23	38	49
Myanmar	4	8	5	2	2	9	6

Sources: NRGI and WGI

Selected topics that significantly influence mining's contribution continued

Figure 28: Investment Attractiveness Index compared to RGI composite and WGI government effectiveness scores





of the key components for effective governance of the resources sector can (and have) been put in place – such as an appropriate institutional and legal setting, and effective safeguards and quality controls.

Governance matters not just for current investments but also for future potential investments. The Fraser Institute produces an Investment Attractiveness Index that combines country ratings of geologic attractiveness and the effects of government policy on attitudes towards exploration investment. Figure 28 shows a positive correlation between this index and two measures of governance – the RGI composite score and the WGI government effectiveness score. Poor governance is therefore likely to constrain the amount of investment that a country receives.

4.3.4 What does this mean for the mining sector's actual and potential contributions?

In summary, the evidence shows that good governance is lacking in many of the top 50 MCI countries: 74 per cent rank in the bottom half of the WGI government effectiveness score, 66 per cent rank in the bottom half of the WGI regulatory quality score and 78 per cent of those covered by the RGI are rated at levels below that considered satisfactory for good governance of natural resources.

Poor governance is likely to constrain investment. Even when investments are made, poor governance constrains some of the benefits that mining could otherwise bring to countries. It can reduce the amount of revenue that governments receive as a result of poorly negotiated contracts or ineffective collection of taxes; lead to poor management of revenues through corruption or lack of capacity to smooth fluctuations or invest well; and prevent governments from effectively formulating and implementing policies to enhance indirect and induced employment over the long run. These challenges are particularly concerning given the current global context of deflated prices and reduced investments, as outlined in Section 2.
Good governance is needed for effective management of the effects of the downturn.

However, there are some positive signs. Many countries have strengths to build on, such as relatively strong scores on 'institutional and legal setting' and 'safeguards and quality controls'. They therefore have some of the key foundations

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Table 7 EITI status of top 50 MCI countries

Country	MCI rank	Implementing EITI	Country	MCI rank	Implementing EITI
Congo, Dem. Rep.	1	Yes	Philippines	26	Yes
Mauritania	2	Yes	Zambia	27	Yes
Burkina Faso	3	Yes	Brazil	28	No
Madagascar	4	Yes	Guinea	29	Yes
Botswana	5	No	South Africa	30	No
Guyana	6	No	Papua New Guinea	31	Yes
Uzbekistan	7	No	Mali	32	Yes
Liberia	8	Yes	Bolivia	33	No
Kyrgyz Republic	9	Yes	Peru	34	Yes
Tajikistan	10	Yes	Cote d'Ivoire	35	Yes
Australia	11	No	Israel	36	No
Mozambique	12	Yes	Russian Federation	37	No
Jamaica	13	No	Zimbabwe	38	No
Ghana	14	Yes	Solomon Islands	39	Yes
Sierra Leone	15	Yes	Guatemala	40	Yes
Dominican Republic	16	Yes	Macedonia, FYR	41	No
Senegal	17	Yes	Namibia	42	No
Ukraine	18	Yes	Lao PDR	43	No
Rwanda	19	No	Tanzania	44	Yes
Mongolia	20	Yes	Suriname	45	No
Armenia	21	No	Fiji	46	No
Sudan	22	No	Iran, Islamic Rep.	47	No
Nicaragua	23	No	Panama	48	No
Chile	24	No	Honduras	49	Yes
Myanmar	25	Yes	Bulgaria	50	No

in place to build upon for improved governance in other areas. Initiatives such as EITI are helping to improve other important components of governance in 51 countries that are implementing the EITI standard. Currently, 26 of the top 50 MCI countries are implementing EITI (see Table 7). Companies can also play their part by recognising limited government capacity in countries where they operate and do their part to enhance governance, for example, by agreeing to contract disclosure as a means to enhance transparency and accountability in government revenues (something already done by a number of ICMM member companies), or by taking steps to build capacity in local governments (see Box 9 for an example). These efforts enhance both revenue and employment contributions from the sector over the long term.

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Box 9: Local government capacity building by mining companies – Vale Foundation in Brazil

Vale is the dominant mining company in the state of Southeast Pará in Brazil. Public services in Brazil are decentralised, and municipalities have significant responsibilities for providing public services but lack capacity for managing revenues and planning projects. Vale recognised the limited capacity of municipal government in Pará state and responded by setting up several structures to help build capacity within local municipalities. Through its public–private social partnership framework, it provides technical support to build municipalities' capacity to apply for federal funds and use them to implement projects. Vale has helped improve local government's capacity to map demand, supply technical information for project design and develop monitoring tools to manage funds. All of this has supported improved revenue management at the subnational level in Pará state.

Vale has also supported public education and technical training provision in the state. Through its Ação Educação (Education Action) programme, it supports municipal government (through an NGO) to implement and monitor education programmes from the federal and state levels. Technical assistance for federal fund applications is provided, and training is given to education department officials and school administrators. Through its supplier development programme Inove, Vale partners with national education institutions (Senai and Sesi) to develop technical training to build capacity among local suppliers. These initiatives have increased the employment contributions from the sector in Pará state (see ICMM Brazil case study for details).

Source: ICMM (2013)

4.3.5 Implications of governance findings

Governance is complex. It is difficult to define and to measure. But it is also an important determinant of the economic and social contributions that mining makes to a country. The Worldwide Governance Indicators (WGI) and the Resource Governance Index (RGI) show that overall levels of governance in countries ranked in the top 50 on the MCI are low. Three-quarters rank in the bottom half of countries for government effectiveness and two-thirds for regulatory quality on the WGI. Almost 80 per cent rank below satisfactory levels of governance on the RGI, although more than half were satisfactory or partially satisfactory. However, there are promising signs. Despite poor levels of overall governance, many countries have put in place the key foundations for improved governance in the form of appropriate institutional and legal settings, and safeguards and quality controls, and transparency initiatives such as EITI are working to improve other important aspects of governance. Over time these improvements should allow the already fairly substantial government revenue and employment contributions from mining to have a larger and more sustained positive impact on economic and social outcomes in the top 50 MCI countries.

5

Conclusions

Conclusions

This third edition of Romine has been produced at a time of considerable turbulence in the international markets for metals and minerals with significant ramifications for all major participants in the industry as documented in Section 2. In such a period the need to verify and update the broad structural dimensions of minerals and metals as a significant global activity remains as important as ever.

The initial idea from the first edition in 2012 was to provide a long overdue and regularly updated set of data on mining's overall contribution in the global economy both in its totality and in individual mining economies. That basic mission statement remains relevant. The introduction of a single number for each country – its score and relative ranking on the MCI – was and remains an important part of the picture that Romine sets out to portray.

This edition has shown that notwithstanding the turbulence in the past seven to eight years, there are certain facts about the industry that have persisted as longer-term characteristics through 2016. These include the ongoing increase in demand for the series of products that we include under the label of mining and metals; the clear dependence of this increase on the rising demands that we still see in major middle-income countries; an ongoing shift in the production of major minerals to tap previously inaccessible deposits in remote less-developed regions; some stability of the positioning of most countries according to the MCI; and above all the still high level of dependence of many low- and middle-income economies on the mineral sector, a dependence jolted only slightly by the commodity price downturn.

Solid evidence on these and other aspects of the industry's role is helpful in advancing the proposition that mining needs to be thought about more centrally as a crucial contributor to a host country's economic and social development, a position contrary to much of the conventional commentary about the industry. That proposition can be defended by reference to the high and rising levels of dependence of so many low- and middle-income countries on the sector: for example, the numerical fact that those countries make up almost all of the top 25 countries in the MCI in the years for which it has been produced.

However, the authors of this report acknowledge the limitations of the MCI. It is inevitably a compromise between what one would ideally like to measure and include and what can in practice be measured using the data currently available for most of the 183 countries that it seeks to cover. These limitations underlie the ongoing commitment to make the MCI more complete as a numerical representation of mining's 'contribution' as more and better data becomes available. MCI-ranked countries, over 75 per cent are governed at levels below those considered satisfactory for good governance of natural resources.

Looking to the future, the Romine work will continue to explore ways to improve the scope and content of the MCI to ensure that it provides a regular and useful basis for

'Solid evidence on these and other aspects of the industry's role is helpful in advancing the proposition that mining needs to be thought about more centrally as a crucial contributor to a host country's economic and social development'

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Qualitative analysis

In this edition of Romine, quantitative analysis has been supplemented by a qualitative assessment of selected components of mining's 'contribution', which do not lend themselves to systematic quantification.

There is no standardised database available to assess mineral taxation across countries; what limited comparative data there is shows very wide variations in the significance of tax and royalty payments in the total budgets of host countries. Closer examination of the data suggests that such variations often arise from the different states of maturity of the industry in different countries (ie its position along the life cycle) but also, more recently, from the turbulence of price movements that have affected some metals more than others.

This edition of Romine also found that while no reliable data is available to make possible cross-country numerical comparisons on employment, what limited evidence there is confirms two important points. These are that direct employment created by most modern mining activities (excluding artisanal mining) represents only a small proportion of total employment in most host countries but that indirect employment creation can often be very substantial. Available multiplier evidence suggests that while total direct mining employment may only equate to some 2.5 per cent of a country's total employment, total indirect or influenced employment can exceed 10 per cent.

Lastly, the effects of 'governance' on the sector's contribution can be significant. Available evidence confirms an all too familiar conclusion that – in spite of many initiatives (national and international) and undoubted improvements in some areas – weak governance can prevent the mining sector from delivering on its full economic and social development potential. More specifically, evidence from both the World Bank (World Governance Indicators) and the natural Resource Governance Institute (Natural Resource Governance Index) suggests that of the top 50 MCI-ranked countries, over 75 per cent are governed at levels below those considered satisfactory for good governance of natural resources.

assessing mining's role in the global economy and in individual mining economies. The selected topics as discussed in this edition will be expanded in future editions to examine other important dimensions of the industry's contribution including, probably next time, an analysis of the methodologies for managing and evaluating community contributions; and a synthesis of the impacts of the major international climate change initiatives on the industry.

'the Romine initiative will continue to explore ways to improve the scope and content of the MCI to ensure that it provides a regular and useful basis for assessing mining's role in the global economy and in individual mining economies'

Guest contribution The Sustainable Development Goals: An Opportunity to Re-Imagine Mining's Role in Development

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Agenda 2030 with its 17 Sustainable Development Goals (SDGs) was adopted by all United Nations member states in September 2015.[42] It is a highly ambitious agenda to overcome poverty while protecting the planet, two challenges not easily compatible.

While globalisation has contributed to significant economic growth and poverty reduction in the past 15 years, gains have come at a high cost in terms of environmental damage and climate change coupled with sharply rising inequalities of income and a rise in conflict.

The SDGs emphasise that economic growth has to come alongside social fairness and environmental sustainability.

Especially noteworthy is the role expected of the private sector and private capital in contributing to SDG achievement. This ambition goes far beyond philanthropy and CSR to look at how growing private investment flows can be aligned with the SDGs. In 1990, total FDI was $21 billion, less than half of Official Development Assistance (ODA) at $53 billion. By 2014 FDI was $735 billion, more than five times larger than ODA at $135bn.[43]

What is the role of mining in contributing to the SDGs?

As this ICMM report illustrates, mining plays an important role in the economies of many countries. But mining's role in sustainable development goes beyond economic contributions.

'This involves enhancing positive contributions and avoiding or minimizing the negative impacts often associated with mining'

A recent report by UNDP, the World Economic Forum, Columbia Center on Sustainable Investment and the Sustainable Development Solutions Network,[44] highlights the many direct contributions mining companies can make to all SDGs through their investments and business operations as well as through social investments and partnerships. This involves enhancing positive contributions and avoiding or minimizing the negative impacts often associated with mining.

The resources mining companies invest to extract minerals are significant and often outweigh the amounts paid to governments. How these resources are spent is essential in ensuring mining's contribution to the SDGs.

A recent World Gold Council study showed that the biggest single element in benefit distribution for

42. Transforming our world: the 2030 Agenda for Sustainable Development

43. See: World Bank Group and IMF, 2015, 'Global Monitoring Report 2015/2016: Development Goals in an Era of Demographic Change'; and Kose and Ozturk, 2014, 'A World of Change: Taking Stock of the Past Half Century', Finance and Development, IMF

44. Mapping Mining to the SDGs: An Atlas (UNDP, WEF, CCSI, SDSN, 2016)

communities and government comes from procurement by gold mines, not from taxes and royalties.[45] Out of a total of $55bn annual spending in 2012 by the fifteen Gold Council member companies participating in the study, some $35bn were payments to other businesses, mostly subcontracting and procurement. Less than $10bn were royalty and tax payments to governments. So if even a small additional share of these expenditures can be captured by domestic enterprises and workers in developing countries, it can have significant impact on local economic development and job creation, contributing to SDGs 8 and 9.

As companies invest in mining-related infrastructure required to operate a mine, there is ample opportunity for leveraging such infrastructure for local development. For example, in Peru, Compañía Minera Antamina constructed a 304 km pipeline to transport copper and zinc concentrate slurry from mine to port. The company also built a fiber optic cable next to the pipeline to monitor it for leaks or disturbances. The cable enabled the national telecommunications utility to better serve the area with mobile and internet coverage at a much lower cost than if the mining company's cable had not been used.[46]

Or consider what mining, as a major water user, can do to contribute to SDG 6 on increasing water use efficiency. At Vale's Sossego metallurgical plant in Para, Brazil, 99.99% of the water used is recycled from the tailings pond and re-circulated through the processing circuit. The procedure saves 900,000 cubic meters of freshwater annually that had previously been pumped from a nearby river. This is enough water to supply a town of 25,000 people for six months.[47]

How can mining's contribution be scaled up?

A relatively limited number of leading companies pursue such opportunities in a systematic way. To enhance mining's contribution to the SDGs there is a need to scale up these kinds of efforts. A number of drivers can help make this happen.

1. There is a need to further articulate the specific business cases for companies to take action on the SDGs and demonstrate how to operationalise the SDGs in mining. Broadly, it is clear that doing so can lead to greater efficiencies, cost savings, enhanced competitiveness and improved license to operate.

Take SDG 7 on sustainable energy and the target on increasing the share of renewable energy in the global energy mix for example. Mining is extremely energy intensive and normally consumes between 10 per cent to 40 per cent of operational costs for a mine.[48] Investing in renewable energy can help reduce this cost significantly. The Mining and SDG Atlas highlights cases where mines in remote areas are saving tens of millions USD in energy costs by replacing traditional fuels with renewables such as wind or geothermal power.

Significant cost savings over time can also be made by taking action in other SDG areas, such as increasing local procurement or investing in conflict prevention. On the latter, a 2014 study[49] showed that the cost to a world-class mining project ($3-5bn investment) of lost production due to a shutdown caused by conflicts with communities is estimated at $20 million per week.

2. Another central driver for mainstreaming the SDGs into mining is governance. As countries start to implement the SDGs, it is expected that national policies and regulations, including those governing mining, will increasingly incorporate or be informed by the SDGs.

One concern often expressed about stringent environmental and social regulations is the trade-off with competitiveness, ie the more stringent regulations a country has in place the less competitive it will be in attracting mining investments. However, recent research[50] dispels this concern and shows that a lack of timeliness, flexibility and predictability in implementing regulations rather

45. World Gold Council - Responsible gold mining and value distribution: A global assessment of the economic value created and distributed by members of the World Gold Council, 2013

46. CCSI, 2014. Leveraging Mining Demand for Internet and Telecommunications Infrastructure for Broad Economic Development: Models, Opportunities, and Challenges. http://ccsi.columbia.edu/files/2014/05/CCI-Policy-Paper-Leveraging-Mining-Related-ICT-Infrastructure-for-Development-June-20141.pdf

47. ibid

48. World Mining Congress, 2013. Production Energy Optimization in Mining.

49. Harvard Kennedy School, Shift, and Univ. of Queensland, 2014. Costs of Company-Community Conflict in the Extractive Sector. http://www.hks.harvard.edu/m-rcbg/CSRI/research/Costs%20of%20Conflict_Davis%20%20Franks.pdf

50. Environmental regulation and mining sector competitiveness: Söderholm, Söderholm, Petterson, Svahn, Viklund, Helenius, 2014

than the stringency of regulations are actually the greatest threats to competitiveness.

This points to the importance of two key governance aspects to maximise mining's contribution to the SDGs: i) effective, capable and accountable government institutions and ii) the quality and design of regulations and policies.

SDG 16 recognises the central role of good governance to achieve sustainable development. Prioritising and making progress on this Goal will be central to scale up and maximize mining's contributions to (all) other SDGs.

3. Investors and providers of finance for mining projects increasingly require adherence to sustainability principles. The IFC already applies its Performance Standards on Environmental and Social Sustainability to all its project financing. The Equator Principles, based on the IFC Performance Standards, have been adopted by nearly 80 banks and financial institutions. The Norwegian Pension Fund includes sound sustainability performance as a key criterion for investment decisions. In Peru, the financial sector regulator is incentivising better management of social conflict by extractive companies through requirements of due diligence by banks, insurers and pension funds.[51]

The SDGs will further accelerate this move towards factoring in environmental, social and governance issues into credit risks and rewarding projects that demonstrate strong contributions to sustainable development.

4. The trend towards increased transparency in the sector will continue and will move beyond revenues and financial flows spearheaded by initiatives such as EITI. Disclosure of environmental, social and economic impacts will increasingly be required, whether by regulators, financiers or the public and will be fuelled by enhanced digital connectivity and access to information. This will further incentivise mining stakeholders to take action in support of sustainable development.

Moving forward – partnerships and data

The 2030 Agenda is ambitious and multidimensional. Maximizing mining's contributions to it will require new forms of partnership between all stakeholders.

Global development institutions like UNDP are working closely with governments of developing economies to integrate the SDGs into national development plans and to support SDG implementation. In mineral-rich countries, the mining sector must become engaged and define its role in these efforts.

Making such engagement effective will require collaborative governance mechanisms that allow for structured and continuous multi-stakeholder dialogue, priority setting, coordination and partnerships focused on mining's contributions. UNDP works to support such approaches.

To ensure continuous progress in enhancing mining's contributions will also require improvements in tracking and measuring results. More and better quality data will be needed that can be aggregated and feed into wider national and international SDG monitoring. As mineral rich countries define their specific SDG priorities and indicators to measure progress, the mining sector should be engaged in these discussions.

Contributing to the SDGs is not only a call to action to the mining industry. Other industry sectors ought to take similar steps. But mining is unique: mineral resources are finite and are owned by the people. A fundamental objective of mining is therefore to ensure that the extraction of this natural capital is transformed into human capital and broader sustainable development.

51. See SHIFT: Advising the Peruvian Financial Regulator on Improved Corporate Management of Social Conflict

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Abbreviations and glossary

ASM	artisanal and small-scale mining
BRIC	Brazil, Russia, India and China
dmt	dry metric tonne
DRC	the Democratic Republic of the Congo
EITI	Extractive Industries Transparency Initiative
FDI	foreign direct investment
GDP	gross domestic product
ICMM	International Council on Mining and Metals
IFC	International Finance Corporation
ILO	International Labour Organization
Ilostat	ILO's central statistics database
IMF	International Monetary Fund
MCI	Mining Contribution Index
MPD	Mining: Partnerships for Development
NGO	non-governmental organisation
NRGI	Natural Resource Governance Institute
OECD	Organisation for Economic Co-operation and Development
pp	percentage points
PPP	purchasing power parity
PwC	PricewaterhouseCoopers
RGI	Resource Governance Index
Romine	Role of Mining in National Economies
SME	small and medium enterprise
UNCTAD	United Nations Conference on Trade and Development
WGI	Worldwide Governance Indicators

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ICMM is an international organisation dedicated to a safe, fair and sustainable mining industry. Bringing together 23 mining and metals companies and 34 regional and commodities associations we strengthen environmental and social performance.

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