

DRAFT

TOWARDS MINING VISION 2030

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Introduction

In 2012, the South African government adopted the National Development Plan (NDP) with its overarching vision for 2030, which sets out the macrosocial targets for a more equitable society. The major outcomes contained in the plan include the elimination of extreme income poverty (R419 per person per month) from 39 percent, reduction of unemployment to 6 percent from around 25 percent, reduction of income inequality as measured by the Gini co-efficient from 0.69 to 0.6, more than doubling of the per capita income to R120 000, increasing “the share of national income of the bottom 40% from 6% to 10”, and ensuring “household food and nutrition security”. (NDP: 2012, p34)

While some of these objectives may be modest in terms of the ideals of an equitable society as envisaged in the country’s constitution, their attainment would constitute a major advance from current levels of social inequity. The plan identifies a variety of actions required in the economic and other areas of social endeavour to realise these outcomes. It calls for a social compact of joint and varied actions by various social partners – government, business, labour and broader civil society.

This chapter deals with the role that the mining sector can play in attaining Vision 2030, proceeding from the understanding that the sector has a critical contribution to make, given its historical role in the evolution of South African society, the endowments that the country commands and the position the sector occupies in the socio-economic dynamics of South African society. The core argument is that the collective of partners in mining – private companies, workers, mining communities and the state – need together to develop a vision and programme that aligns with the objectives of the NDP.

The central hypothesis of the chapter is that the sector contains massive potential to make such a contribution. This is informed by two considerations. Firstly, the resource curse¹ that has afflicted most mineral-exporting economies – pertaining to such challenges as diversifying the economy, major swings in economic growth and value of the currency, limited diversification of the economy and difficulties in dealing with inequality and corruption – is not the natural order of things. Proceeding from the understanding that a resource curse is a product of social agency, this chapter argues that strategic planning and focussed interventions can produce the inverse of this phenomenon. Mining can serve as a catalyst for an industrialisation drive, a skills and technological revolution and, broadly, as a bedrock of societal efforts to deal with poverty and inequality.

¹ Resource curse refers to challenges that mineral-exporting countries tend to face in diversifying their economies, with a minerals boom-bust scenario, volatility of the exchange rate, and complacency in human resource development and productivity.

Secondly, pursuing a developmental path that includes mining as part of its core strategies is unavoidable for South Africa. The mineral endowments that it commands dictate that the country should find ways of utilising them to the benefit of society. Beyond this, the global dynamics of industrialisation, urbanisation and a growing 'middle class'; the pursuit of new energy sources such as hydrogen and fuel cells; and technological applications that require a variety minerals – all these and more speak to a sector with major potential. Viewed beyond mere extraction and export, in the context of an industrial cluster, the impact that mining can have on the entire economy beggars the pessimistic belief that mining is a 'sunset industry'. South Africa needs consciously to exploit this comparative and competitive advantage.

Post-1994, the mining industry has had its ebbs and flows in the context of a changing society and contradictory dynamics in the global economy. These range from rates of investment to contribution to the Gross Domestic Product; racial and gender dynamics in terms of ownership, management and Board composition; as well as labour and community relations. As other chapters in this book show, insufficient progress has been made across all of these indicators. What is even starker is the fact that, while the country is one of the most highly endowed in terms of mineral reserves, the mining sector features at fifth position globally with regard to value added to GDP (SA DMR: 2013 as cited from Global Insight); and "has failed to match the global growth trend in mineral exports" (NDP: 2012, p42). This has to do not merely with the complex geological location of the endowments, nor anything related to deliberate diversification of the economy as such. Rather, it is a consequence of lack of an overall societal strategy and divergent interests among the major role-players, with such issues as poor infrastructure and policy weaknesses also playing a major role. This chapter provides a framework on how these deficits can be addressed, so the mining industry can realise its full potential as a critical part of the country's development trajectory.

The next chapter of this book focusses on the application of the visioning approach to the Platinum Group Metals (PGM) sub-sector. Besides providing a concrete illustration of how a vision can be crafted at a sub-sectoral level, the PGM case study is informed by the reality of PGM deposits that are estimated at constituting over 80 percent of world reserves. (SAMI 2009/2010, and Wilson & Anhaeusser (1998) as cited in the 2012 ANC State Intervention in the Mining Sector (SIMS) Summary Report, p5). The variety of usages of PGMs in relation to reduction in greenhouse gas emissions in combustion engines, the nascent hydrogen economy, medical and surgical instruments, jewellery, among others, speak to the utility of these minerals well into the future. Further, the sub-sector has been experiencing difficulties in terms of its cost-price ratio, labour relations, and community partnerships – all of which threaten the sustenance of many operations. Indeed, it is in this

intersection of danger and opportunity that strategic thinking and social compacting can immeasurably stand South Africa in good stead.

Generic attributes of the mining sector

As reflected in other chapters of this book, the mining sector has been at the core of the evolution of the South African political economy.

Over the past 100 years, the South African economy evolved on the basis of two pillars: mining and agriculture. In the early years, the manufacturing sector grew in the main to service these two industries and provide for a growing domestic consumer base as well as markets in developed countries. (National Planning Commission Diagnostic Document 2011, p7/8)

From the turn of the 20th century, with the discovery of diamonds around Kimberley in the (now) Northern Cape and gold around Johannesburg in the (now) Gauteng Province, the mining industry can be said to have profoundly influenced South Africa's spatial patterns of economic development, human settlement and infrastructure networks. It was the driver of the evolution of South Africa's manufacturing sector as well as energy sourcing and intensity. While its proportion of Gross Domestic Product (GDP) has declined especially since 1994, mining's combined contribution – taking into account direct mining activity, forward and backward linkages and the induced effect – stood at about 18.7 percent in 2012. (Polity, 2013). In 2005, it contributed 50 percent of primary and beneficiated merchandise exports, 50 percent of Transnet's rail and ports volume, 16 percent of electricity demand, 30 percent of liquid fuels from Sasol's coal-to-liquid process and 93 percent of electricity generation, which is from coal power. (Swanepoel, Mining Summit presentation, 2006)

According to the Manufacturing Circle:

...manufacturing is also still tied to the mining industry, depending to a large extent on the health of this sector for its own wellbeing. The impact then of the precipitous decline in the mining sector's contribution to GDP from above 20% in 1980 to 8% in 2016 is clear, alongside a global sourcing strategy by mining conglomerates as they became global players post 1994; as is the uncertainty created by the modern-day Mining Charter. (Manufacturing Circle, 2017, p10)

Mining's contribution to the evolution of the country's skills base is reflected in the fact that one of the country's premier universities (Witwatersrand) started off in 1896 in Kimberley as the South African School of Mining. (<https://www.wits.ac.za/about-wits/history-and-heritage>) Similarly, it influenced much of the evolution of South African trade unionism and even the configuration of political parties and political discourse. The white colonial political establishment reflected dynamics

of alliances and conflict among the agricultural and mining moguls, in the earlier years configured around the Afrikaner and English establishments. Policies on land tenure were developed at the turn of the 20th century to meet the needs mainly of the emergent mining sector.

As resistance to the apartheid colonial system reached its peak in the 1980s, the captains of the mining industry were among the first sections of the white ruling class to initiate interactions with the banned African National Congress (ANC), seeking accommodation in a negotiated settlement.

It is logical that, today, contestation around inclusion of black people in the mainstream of the economy plays out most intensely in the mining sector. This is reflective of a deep sense of grievance around sharing of the sheer wealth of mineral endowments that South Africa commands, estimated by Citibank at about US\$2.5-trillion, the largest in the world. (TimesLive, 2012) As detailed in a chapter in this volume, there is much contestation around the issue of ownership, and the Chamber and government have been locked in battle in the courts around a new Mining Charter. Whatever the detail of the issues under debate, the fact of the matter is that, across all measures of economic empowerment, the sector is still far from reflecting the demographics of the country.

Table 1: South Africa's Mineral Reserves, World Ranking, 2009 Production & Nominal Life (assuming no further reserves) at 2009 Extraction Rates

MINERAL	RESERVES				PRODUCTION 2009			LIFE
		Mass	%World	Rank	Mass	%World	Rank	Years
Alumino-silicates	Mt	51	*	*	0.265	60.2	1	192
Antimony	kt	350	16.7	3	3	1.6	3	117
Chromium Ore	Mt	5500	72.4	1	6.762	*	1	813
Coal	Mt	30408	7.4	6	250.6	3.6	7	121
Copper	Mt	13	2.4	6	0.089	*	*	146
Fluorspar	Mt	80	17	2	0.18	3.5	5	444
Gold	t	6000	12.7	1	197	7.8	5	30
Iron Ore	Mt	1500	0.8	13	55.4	3.5	6	27
Iron Ore - incl. BC	Mt	25000	~10	*	55.4	3.5	6	451
Lead	kt	3000	2.1	6	49	1.2	10	61
Manganese Ore	Mt	4000	80	1	4.576	17.1	2	874

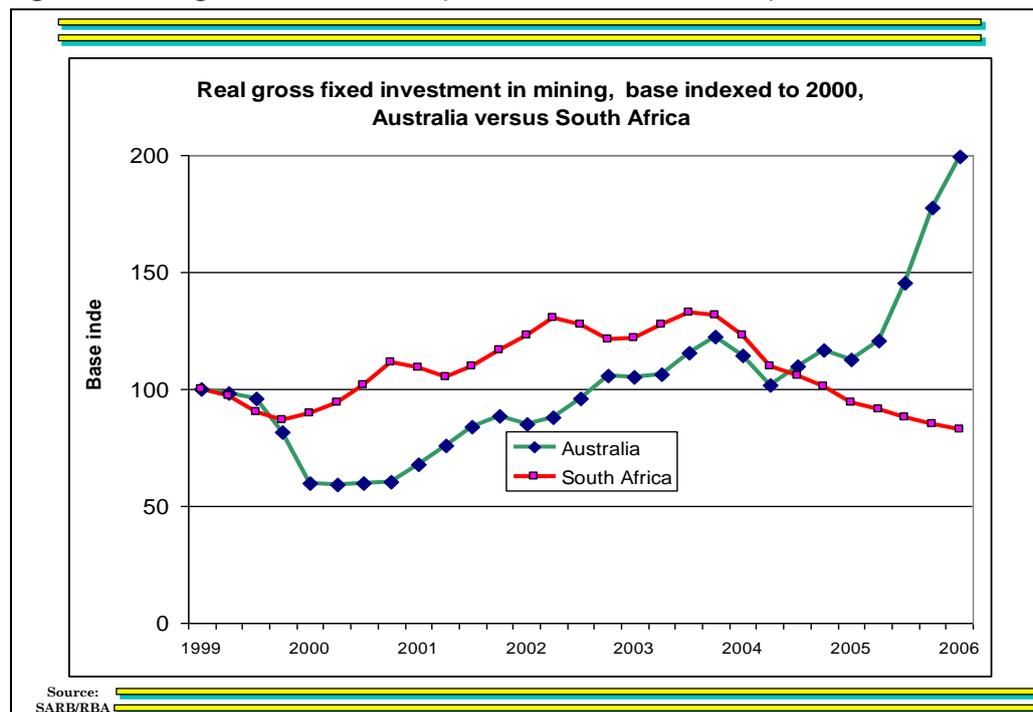
Nickel	Mt	3.7	5.2	8	0.0346	2.4	12	107
PGMs	t	70000	87.7	1	271	58.7	1	258
Phosphate Rock	Mt	2500	5.3	4	2.237	1.4	11	1118
Titanium Minerals	Mt	71	9.8	2	1.1	19.2	2	65
Titanium- incl. BC	Mt	400	65	1	1.1	19.2	2	364
Uranium	kt	435	8	4	0.623	1.3	10	698
Vanadium	kt	12000	32	2	11.6	25.4	1	1034
Vermiculite	Mt	80	40	2	0.1943	35	1	412
Zinc	Mt	15	3.3	8	0.029	0.2	25	517
Zirconium	Mt	14	25	2	0.395	32	2	35

Sourced from SIMS Report Slide presentation, 2012, p12), citing: SAMI 2009/2010, DMR 2010; and Wilson & Anhaeusser 1998: "The Mineral Resources of South Africa", CGS Pretoria (for BC- Bushveld Complex)

As shown in Table 1, most of these endowments are estimated to have lifespans that amount to hundreds of years into the future. Yet, as mentioned above, South Africa ranked only fifth in terms of value added to GDP in US dollars and fourth in terms of mining employment. Its investment trends compared to Australia (refer Figure 1) was counter-cyclical to the mining super-cycle of the past decade, a trend that seems to persist in terms of levels of investment against the backdrop of resurgent mineral prices. The Chamber of Mines estimates that the mining sector expanded by 3.7 percent and employment by 1.6 per cent in 2017. (Mining Weekly, 2018) However, according to the Chamber's 2017 survey, in a 'more certain and conducive' environment, capital spending stretching over four years could be 84 percent higher. 'The impact on employment creation, according to the survey results, would be nearly 48,000 people.' (Chamber of Mines, 2017, p3)

A number of factors, pertinent to the crafting of a long-term vision, account for this: not least the short-termism in the outlook of most mining companies in terms of generating shareholder value, policy uncertainty in a polity that is transforming from a colonial past, poor relations with workers and communities, and persistence of old production as well as management and labour-sourcing methods.

Figure 1: Mining fixed investments (South Africa and Australia)



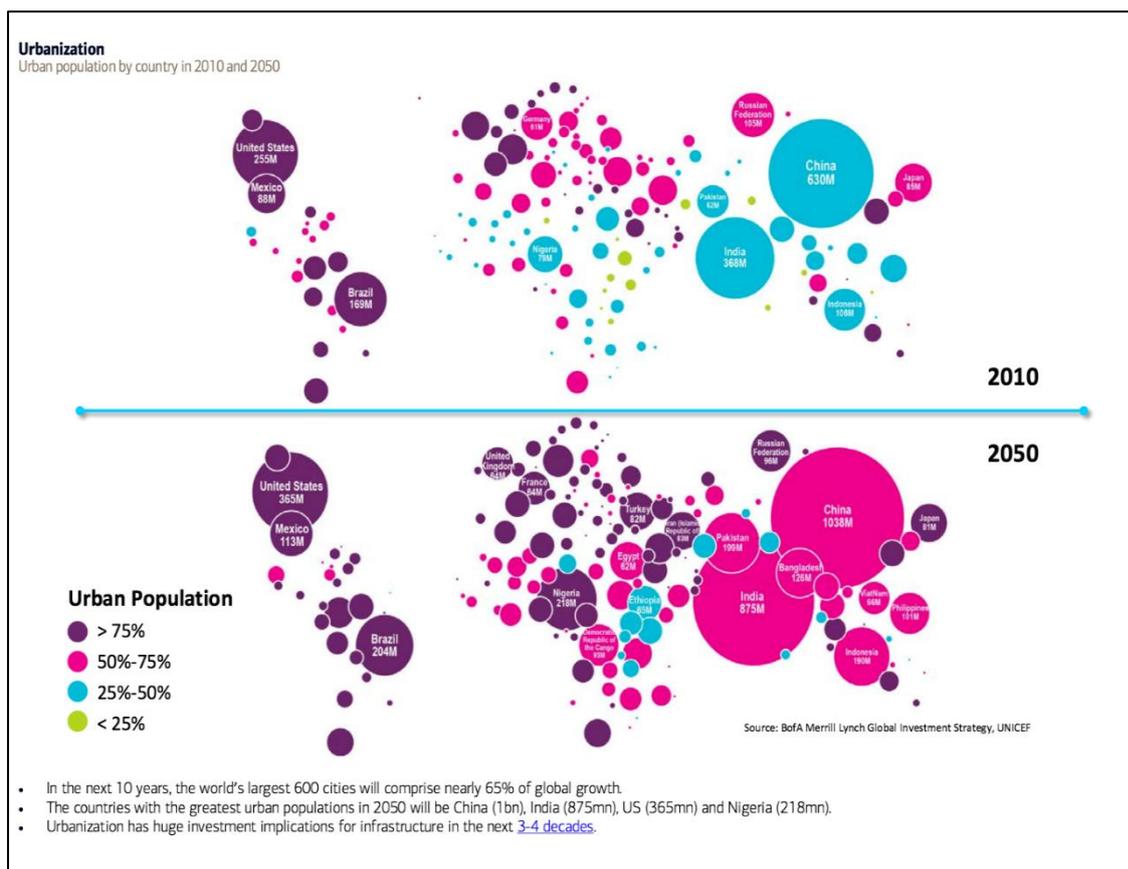
Source: Bernard Swanepoel, Vice-President of Chamber of SA Mines: Presentation to Mining Summit, September 2006

Motivation for visioning: a sunrise industry

Given South Africa's mineral endowments, the country cannot avoid using mining as a critical platform in defining its growth and development trajectory, if only on the basis of self-interest. But there is more to this argument than sheer self-interest.

The first reality that informs this argument pertains to global demand for minerals, most of which South Africa has in abundance. According to Cynthia Carroll, former Chief Executive Officer of AngloAmerican plc, it is estimated that some 3-billion more people would live in urban areas by 2050; and as early as 2025, global cities would have to construct "the equivalent of the entire land area of Australia...in residential and commercial floor space, which would require US\$80-trillion worth of investments". (Mining Weekly, 2012) These trends, which will be even more manifest in developing countries, including those in Asia and Africa, will also influence, and in turn be impacted on by, the growth of the middle strata and consumption patterns. For instance, "the global car fleet...[is] projected to double to 1.7-billion by 2030". (Mining Weekly, 2012) This is further illustrated in Figure 2 below.

Figure 2: Trends in urbanisation to 2050



Source: truehuenews.com/2015/09/06infographics

In addition, as China climbs up the manufacturing sophistication ladder, low-end manufacturing is shifting to countries that seek to industrialise, such as Vietnam, Bangladesh, Ethiopia, Rwanda and Kenya. While the so-called Fourth Industrial Revolution may disrupt these trends, it will take a few decades before its impact affects all areas of manufacturing. At the same time, India has embarked on a new trajectory of high economic growth, comparable to China in the past three decades. Thus, it is expected that demand for minerals will remain high well into the future, albeit on a more muted scale. What is also worth noting is that a combination of urbanisation, large infrastructure projects and an emergent 'middle class' should, steadily, transform African countries from being largely exporters to significant consumers of industrial minerals. Already, according to Kaizer Nyatumba of the Steel and Engineering Federation of Southern Africa (SEIFSA), sub-Saharan Africa has become the most important market for metal-product exports from South Africa. (Engineering News: 2018)

The second reason – which also emphasises the need to differentiate between cyclical factors and long-term structural ones in relation to demand for commodities – is the fact that many of the minerals are needed for emergent technologies and to improve performance of existing applications. This applies to high-tech materials and new energy sources, chemical as well as water and food sectors, logistics and life-sciences. Two examples in this regard are platinum group metals

(PGM) which are not only used in auto-catalysts but also in proton exchange membrane fuel cells in the emergent hydrogen economy; and the titanium-aluminium-vanadium alloy which finds application in high-speed aircraft and jet engines. On the extreme, it can also be argued that South Africa's coal deposits, with a lifespan of some 121 years (refer Table 1 above), can also be utilised in a manner that reduces the country's current carbon footprint: for instance, through more advanced coal-fired power stations, underground coal gasification, and as sources for hydrogen.

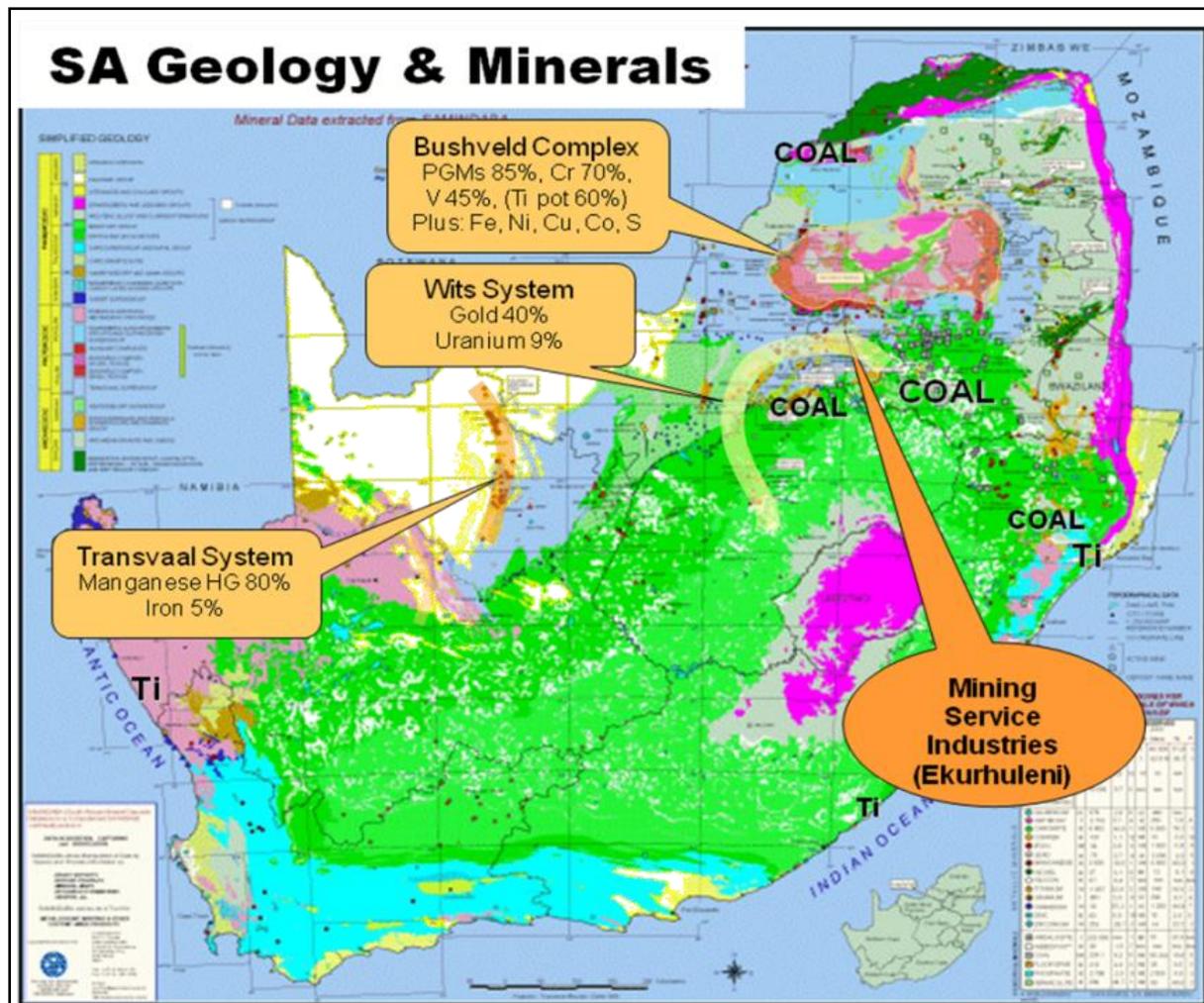
The third reality about the central role mining can play in South Africa's development trajectory going forward pertains to all-round capabilities that the country has mustered over the years. As pointed out earlier, one of the premier universities in South Africa (Wits) emerged towards the end of the 19th century as a school of mining. With the endowments the country commands, the complex location of some of the minerals and the depths at which they have to be accessed, South Africa has over the years developed related manufacturing, engineering and other skills that are globally renowned. This is reflected in export of mining equipment, skills pertaining to turnkey services 'in new mine design and operations', as well as the number and quality of patents. (Kaplan et al, 2012, as reported in Mail Guardian, 08/03/2013).

With regard to sophisticated beneficiation efforts, the government has sought to bring together research centres in universities and the mining sector in a partnership on Hydrogen South Africa (HySA) for the fuel cell industry; and promoted focus on the part of the Council for Scientific and Industrial Research (CSIR) on the application of such materials as titanium. In other words, building on historical learnings and focussing on current and future possibilities, the country has the potential to develop unique capabilities and the necessary human resources in a mining cluster. Much of the skills and equipment have applications beyond the mining sector as such.

The fourth consideration pertains to the role of mining in infrastructure development within South Africa and the rest of sub-Saharan Africa. At one level is the issue of supplies for such infrastructure programmes. It is estimated, for instance, that infrastructure spending in sub-Saharan Africa would grow "from \$70-billion in 2013 to \$180-billion by 2025" (Engineering News, 2014). This presents a major opportunity for supplies, most of which are processed from the very minerals that the continent produces. At another level is the infrastructure required by the mining industry such as energy and water, the transport value chain and other services. Given the location of these endowments (refer Figure 3), these mining operations and related activities can also have a major impact on the country's spatial development, both in terms of export routes, provision of these minerals to locations of industrial activity, and the possibility for such industrial and other activities being systematically developed closer

to the mining operations and possibly leading even to the emergence of new cities and much needed rural development in these areas.

Figure 3: Spatial geology of South African minerals



Source: SIMS Report Slide presentation, 2012

In summary, South Africa's mineral endowments present a unique opportunity for a new industrialisation drive and advancement in the economy as a whole. This applies across the value chain: from mining equipment and services, to extraction, infrastructure development, beneficiation, skills development as well as research and development. Along with this, there are many vistas for more profound empowerment of the previously disadvantaged including workers, women, communities and entrepreneurs. This requires a deliberate strategy to develop a mature mining cluster that touches virtually every aspect of the South African economy and political economy, including adaptation to new realities in terms of application of technology and labour sourcing. In other words, mining in South Africa can, in earnest, become a sunrise industry. The

responsibility to take advantage of this opportunity lies as much with the state as it does with mining companies, workers, mining communities and indeed society at large.

Before turning to the building blocks of Mining Vision 2030, we briefly reflect on the paradigms, contestations and policy interventions that have been at play around the mining industry. This is covered at a high level, as most of these issues are canvassed in some detail in other chapters of this book.

Overview of contestation and evolving paradigms

As indicated earlier in this chapter, the mining industry has been central to the evolution of the South African political economy. In this context, during the years of colonialism and after 1994, political and economic contestation has revolved in large measure around the mining sector; and efforts to abolish the colonial polity and eliminate its socio-economic impact have always placed the issue of the role of this sector at the top of the agenda. Mining was at the core of the British invasion of the provinces controlled by the Dutch settlers at the turn of the 20th century and the subsequent compromises struck among the whites premised on the alliance of “wealthy Boer farmers and the imperialist mine-owners” during the formation of the Union of South Africa in 1910. (South African Communist Party, SACP, 1962, p19) The colonial political alliance sought to “squeeze the last drop of cheap labour out of the African people” primarily in mining and agriculture. (SACP, 1962, p19)

The economic dominance of English-speaking mine-owners spawned a movement among the politically-ascendant Afrikaner elites campaigning for their own pound of gold. Given the leading role of some Jewish families in the sector, this campaign opportunistically also contained tinges of anti-Semitism: “...Hoggenheimer appeared precisely at a time the Witwatersrand mining magnates appeared to dominate politics”. In the cartoon sketches, “the overweight and diamond-studded Randlord was depicted as having inordinate power”. (Shain, 2016) In time, the extant mining magnates sought to ameliorate this by assisting in the growth and expansion of Afrikaner-led mining companies such as Federale Mynbou, which later became Gencor on the back of major acquisitions of the 1960s. (Gencor Ltd Company Profile)²

The contestation was and remains even more intense between the mine-owners and the workers. In the Rand Revolt of 1922, white workers fought against the weakening of the colour bar in the mining

² It is not the purpose of this chapter to interrogate the seeming parallels between the historical Hoggenheimer discourse and the current debates within the ANC on ‘white monopoly capital’, intellectually intriguing as this may be.

industry and perpetrated violence against blacks, demanding job reservation; yet with tinges of a socialist outlook, reflected in the slogan: ‘Workers of the world, unite and fight for a white South Africa’. (Byrnes, ed: 1996)) On a larger scale, while the major strikes of black mineworkers such as in 1946 – and later in 1987 and 2012 – had as immediate demands issues pertaining to wages and working conditions, they were largely undergirded by a deeper sense of grievance around issues of ownership of mineral wealth and the character of the socio-economic system.

It is against this background that the 1955 Freedom Charter, adopted by the African National Congress (ANC) and its allies had as one its core economic propositions (which resonates to this day) the demand that “the mineral wealth beneath the soil, the Banks and monopoly industry shall be transferred to the ownership of the people as a whole”. (Freedom Charter, 1955)

Over the years, the issue of ownership has been at the centre of contestation around the mining industry. Broader strategic reflection within the liberation movement, beyond ownership, started to find expression in the early 1990s as the ANC prepared for government:

The ANC will, in consultation with unions and employers, introduce a mining strategy which will involve the introduction of a new system of taxation, financing, mineral rights and leasing. The strategy will require the normalisation of miners` living and working conditions, with full trade union rights and an end to private security forces on the mines. In addition, the strategy will, where appropriate, involve public ownership and joint ventures.

Policies will be developed to integrate the mining industry with other sectors of the economy by encouraging mineral beneficiation and the creation of a world class mining and mineral processing capital goods industry. (ANC, 1992)

This is further elaborated in the Reconstruction and Development Programme (RDP) adopted by the democratic government in 1994, in which the development of “South Africa’s mineral wealth to its full potential and to the maximum benefit of the entire population” is outlined. The RDP included such issues as facilitating mineral development, assisting small-scale mining ventures, value addition through technology development, affirmative action and development of human resources. (Reconstruction and Development Programme, RDP, 1994)

The Mineral and Petroleum Resources Development Act (MPRDA) of 2002 sought to codify all these varied objectives proceeding from the premise that “South Africa’s mineral and petroleum resources belong to the nation and...the state is the custodian thereof”. It emphasises issues of equitable access, expanding opportunities for those historically disadvantaged, role of the sector in promoting

economic growth and employment, sustainability and local development. (MPRDA Government Gazette, 2002) The attendant Mining Charter promulgated in 2004 elaborated on incentives and disincentives to ensure that the established companies promote the empowerment of black people and women in terms of ownership, governance and management structures, professions and other skilled jobs, social and labour plans, as well as procurement and enterprise development. Critically, ownership was defined as embracing employee share-ownership schemes and beneficiation. Pursuant to the principle of custodianship, mineral royalties were introduced through the Mineral and Petroleum Resources Royalty Act finalised in 2008.

It is asserted in a chapter of this book that, while there has been some progress in terms of ownership and other measures of empowerment as defined in the Act and the 2004 Mining Charter, the basic structure of the industry still reflects the situation during the apartheid era. Critically, in terms of evolving paradigms, it is further argued that from the mine-owners' resistance of the early 2000s, there is now acknowledgement of the importance of empowerment and some level of compliance. But this is largely a reluctant tick-box exercise. Further, since 1994, a number of major mining companies have transferred their primary listings to foreign shores. At the same time, an attempt to address these deficits and speed up the empowerment project has resulted in a careless approach on the part of the Department of Mineral Resources (DMR), as reflected in contestations around the amended Mineral and Petroleum Resources Development Bill and 2017 draft Mining Charter. Poor consultation with other stakeholders, including business and mining communities, and a dogged determination to proceed in spite of protests, resulted in court challenges and, by early 2018, a change in the leadership of the Ministry and the initiation of meaningful stakeholder interactions.

More comprehensive paradigmatic reflections on mining – across the value chain – emerged with the SIMS report of 2012, instructively, arising from a debate within the ANC on ownership and calls for nationalisation. The report proposes the forging of a mature industrial cluster that takes into account linkages pertaining to fiscal policies, backward and forward nexuses as well as knowledge and spatial considerations:

International experience indicates that the growth, development and employment potential of our mineral assets can only be realised through the maximisation of the mineral economic linkages (e.g. Sweden, Finland, Brazil, China, etc.) as proposed by the Africa Mining Vision. The mineral linkage industries can survive beyond the resource exhaustion and provide the nurseries for more generalised industrialisation and job creation. (SIMS Summary Report, 2012, p36)

In the context of the debate on the draft of the new MPRDA, the ANC and government have sought to designate some minerals as strategic, so as to ensure their availability at reasonable cost for beneficiation. (ANC, 2012) Following up on the SIMS Report, the South African Department of Trade and Industry in 2013 initiated the Mineral Value Chain Study. This has led to a more systematic approach to the role a mining cluster can play in economic growth and development. Arising from this, recent iterations of the Industrial Policy Action Plans allude to the importance of the mining value chain in the economy as a whole.

Parallel to, and somewhat influenced by, the SIMS Report, the conceptualisation of the role of mining at a more strategic level also found expression in the 2012 National Development Plan. It argues:

If the [pitfalls of a resource curse] are consciously avoided, and if the mineral endowments are used to facilitate long-term capabilities, these resources can serve as a springboard for a new wave of industrialisation and services for domestic use and exports. (NDP, 2012, p112)

Most probably inspired by a discourse that had started to take shape among other sectors of society, the Chamber of Mines in 2012 commissioned a research report on what the content of, and process towards, Mining Vision 2030 may look like. This includes such issues as how mining can support national development, how the profile of operations is bound to change with modernisation, spatial considerations and how the sector can come to terms with its past. It also proposes that the Mining Industry Growth Development and Employment Task Team (MIGDETT) made up of representatives of government, business and labour, appropriately expanded, should be utilised as a platform of engagement among the partners in developing such a vision. (CSMI, 2012)

Mining Phakisa, an offshoot of the NDP, provided a platform in 2016 for comprehensive interaction among government departments, workers' unions, mining houses and non-governmental organisations out of which a joint institution has been set up, seeking to position the sector as a "centrepiece within a new, cohesive mining cluster that requires across-the-board competitiveness". According to Edwin Ritchken, this initiative also seeks to confront the downsizing of mining research and development facilities when the capability in the Chamber of Mines was "transferred to the public-sector Council for Scientific and Industrial Research (CSIR), where it had been badly under-funded". (Engineering News, 2016) In addition to this are initiatives that have been carried out through the Department of Science and Technology, pertaining to the 'hydrogen economy' and fuel cell technology, as well as such minerals as titanium, a versatile alloy, and lithium which is used in batteries for energy storage.

It is instructive, though, that when the MIGDETT leadership met in 2015 to review progress in the implementation of the Mining Charter and to plan for Mining Phakisa, the issues covered in their report focussed on ownership; housing and living conditions; procurement and enterprise development in terms of capital goods, services and consumable goods; employment equity; human resources development; mine community development and sustainable development. (Ramathodi, 2015) The draft Mining Charter gazetted in 2017 identifies as one of its primary objectives the promotion of “beneficiation of South Africa's mineral commodities by South African-based companies” and identifies incentives towards that end. (DMR, 2017) However, it does not at all refer to the need to forge a mining industrial cluster.

What the foregoing in this section speaks to is an acknowledgement among all social partners of the importance of mining in the history, the present and the future of the South African economy. This has evolved with time beyond ownership and labour relations to encompass the broader strategic questions about the totality of the value chain and as such the role of the sector in the economy as a whole. It is subject to debate whether this has developed fully to exercise the mind of all government departments and indeed of all social partners. The next section explores the building blocks of Mining Vision 2030. It is informed by ideas from all the initiatives briefly outlined above; and it seeks to use them as the foundation and pillars of the vision.

Building blocks of Mining Vision 2030

In the remaining sections of this chapter, the building blocks of Mining Vision 2030 are outlined. The starting point in this regard is the motivation outlined earlier regarding the opportunities that present themselves at domestic, regional and global levels. In the same manner that mining was central to South Africa's industrialisation drive and broader political economy over the past century, it can play a central role in the country's growth and development trajectory going forward – in a new context, much different from the mineral-based industrialisation of the previous era.

Though organised differently in terms of areas of focus, the building blocks identified hereunder are in part inspired by work done in a number of studies such as the 2012 proposals developed by the Centre for Sustainability in Mining and Industry, the 2009 African Mining Vision of the African Union, the 2012 SIMS Report, the 2012 National Development Plan and the 2014 World Economic Forum Scoping Paper on Mining and Metals in a Sustainable World. What follows is a brief outline of relevant highlights from these studies.

Based on interviews with stakeholders, the 2012 CSMI report argues for an appreciation of the role mining can play in supporting national development, the changing profile of the sector and mining

operations, the need for 'regional-scale plans', and the imperative for the sector to come to terms with its past. It also identifies gaps in terms of human resource development programmes, re-investment of resource rents, environmental considerations and "deeper consideration of natural resource constraints" (CSMI, 2012, p4).

The National Development Plan (2012) identifies constraints and opportunities in the development of the mining sector such as certainty on property rights, the need to develop linkages with sectors other than mining, research and development, regional partnerships and, as with CSMI, MIGDETT-related process issues. "...[I]t should be possible", the NDP asserts, "to create about 300 000 jobs in the mining cluster, including indirect jobs" by 2030. (NDP, 2012, p151)

The Africa Mining Vision (AMV) identifies continent-wide interventions on resource-potential data, state contracting and negotiating capacity, resource development and governance, societal capacity to manage mineral wealth, attending to infrastructure constraints as well as dealing with artisanal and small-scale mining. (AMV, 2012)

In addition to identifying matters pertaining to ownership and governance, the SIMS report argues for a mature mining cluster connected in a mutually-beneficial manner to other sectors of the economy. It identifies economic linkages through which such a cluster can be developed: fiscal, backward, forward, knowledge and spatial. It also addresses the regional dimension. (SIMS, 2012)

Asserting a sustainable approach in which investors "value and trade metals and mineral resources based on a shared understanding of and commitment to economic and social development", the WEF Scoping Paper promotes mineral-intensity reduction in economic activity, as well as reuse and recycling of minerals. It also notes the rise of automation technologies, 3D printing and other elements of the so-called Fourth Industrial Revolution which would change skills required in, and employment profile of, the mining sector. (WEF, 2014, p8)

All these observations are of much relevance and do serve as an important backdrop to this outline of South African Mining Vision 2030. For purposes of presentation, the outline of the Mining Vision is categorised into the following issues: extraction, infrastructure, modernisation, backward linkages, forward linkages, research and development and issues of ownership. Generic issues that intersect with all these, such as human resources, social and labour plans, informal mining, post-mining dispensations and utilisation of land are briefly dealt with under one section.

These matters are dealt with briefly and at a high level, given that: each of the issues requires detailed plans that elaborate concrete steps; some of the matters are canvassed in the other chapters of this book; and such are the varied properties, uses and dynamics for each class of

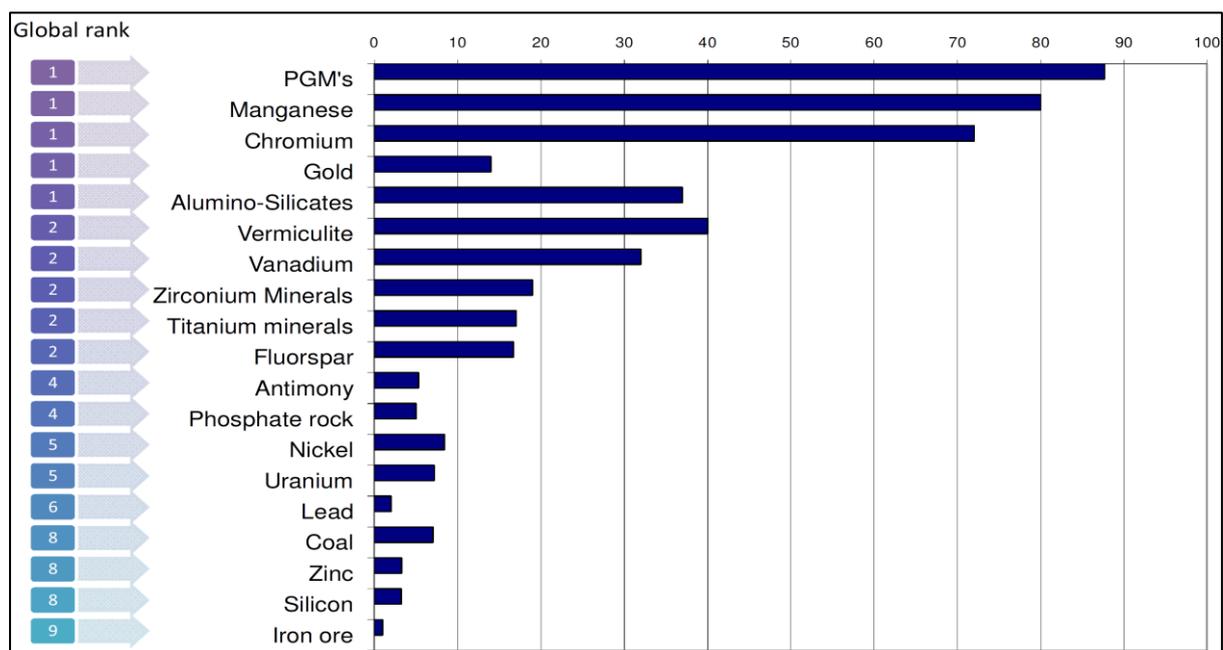
minerals that it is not possible in a single chapter to reflect on each one of them in detail. The proposals should therefore be understood as an organising framework for Mining Vision 2030, rather than the vision as such.

Judicious extraction and exports

Extraction and export constitute a critical part of South African mining and they should form part of the sector's long-term vision. As argued above, various factors in the global economy will continue to drive demand for natural resources, including particularly minerals that South Africa has in abundance.

As illustrated in Figure 4 below, South Africa ranks quite high in terms of many globally-strategic minerals, with over 30 percent of global reserves of PGMs, manganese, chromium, alumino-silicates, vermiculite and vanadium.

Figure 4: South African reserves of key minerals, based on 2008 data (horizontal axis shows % of global reserves)



Source: Baxter (2011) cited in MISTRA publication (2013)

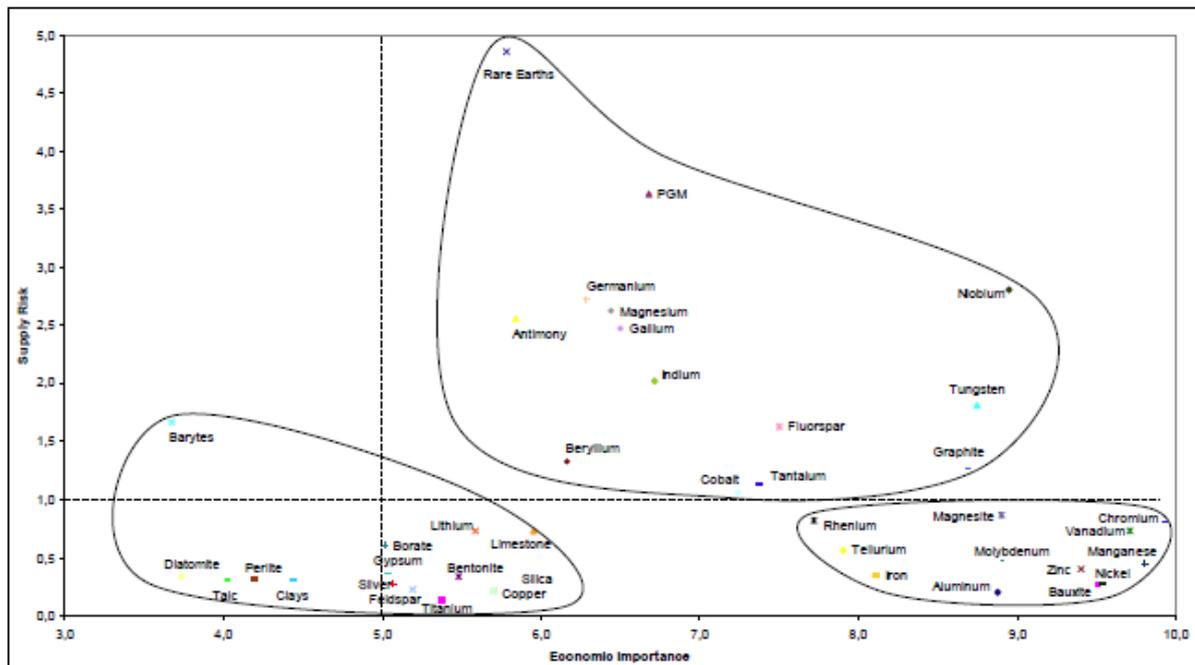
On the one hand, while the super-cycle created mostly by China is ebbing, other countries such as India, Indonesia, Vietnam, Ethiopia and Rwanda – with large economies and populations, or in the midst of rapid industrialisation as part of global value chains – are taking the baton. Indeed, “almost half of the world's population have not yet started the journey toward a higher standard of living”, which is a major driver of the mining industry. (Engineering News, 2017) On the other, many of these

strategic minerals are critical for new technologies, including the green economy, as discussed in the chapter in this volume dealing with matters related to the Fourth Industrial Revolution.

Mineral extraction, the NDP estimates, can create 100 000 additional jobs in around eight years if the sector were to grow at about 3 to 4 percent. (NDP, 2012, p146). This, similarly, would increase the foreign exchange and tax revenue that the country needs. South Africa needs to ensure that it takes advantage of global demand of these commodities, whilst taking into account the trends and principles (reduce, reuse, recycle) identified by the WEF. A judicious approach to extraction should embrace these principles – as an opportunity rather than a threat – and out of such considerations, extraction rates should be aligned to desired nominal life of the reserves that the country has (refer Table 1 for nominal life estimates).

A deliberate approach also needs to be adopted with regard to raw materials that are designated as strategic by South Africa's trading partners. In other words, South Africa's mineral endowments place on the country the responsibility to ensure global security of supply. For instance, in a report by an Ad Hoc Working Group on critical minerals, the European Union ranks raw materials that are economically important and/or face supply risk. As shown in Figure 5 below, many of these are found in significant quantities in South Africa. (EU, 2010) While the subjective nature of the assessments can be contested, the fact that, in an exercise of this nature, the bloc ranks source countries on the basis of governance and environmental protection speaks to the extent of such dependence and sense of insecurity – with South Africa in 2006 featuring as an EU import source that accounts for some 79 percent of chromium, 60 percent of PGMs and 33 percent of manganese. This kind of dependence and the strategic calculations that derive from it apply to many of the major global powers, East and West. Viewed negatively, this can present a danger for the South African body politic. But approached strategically and positively, it is a major opportunity for the crafting of mutually-beneficial terms of engagement.

Figure 5: Ranking of critical raw materials for the EU



Source: EU, *Report of Ad Hoc Working Group on defining critical raw materials, 2010, p6*

A visionary approach to extraction and exports has to include the creation of an environment conducive for investments, proceeding from the understanding that mining investments are long-term in nature and take many years before projects can break even. On the one hand, the private sector needs to embrace the variety of measures introduced by government to ensure inclusivity in ownership, management and the professions, worker rights, community development, environmental responsibility and other indicators (embracing both race and gender) contained in empowerment charters, some of which are dealt with later in this chapter. Aside from considerations of ethics, sense and sensibility, these measures should be seen as a necessary condition for sustainable social cohesion, which is in the long-term interest of investors. On the other hand, policy-makers have consciously to relate to private operators as partners. Government needs to understand the logic of investor imperatives and mining operations and act as a strategic facilitator of investment and a professional regulator and enforcer of statutes. In this way, disasters such as the unseemly contestation around the 2017 Mining Charter would be averted.

Such a professional and strategic approach on the part of the public sector should apply across the chain of the extraction sub-sector, from geo-survey capacity to management of trading arrangements.

Mining infrastructure development and opportunities

There are three dimensions from which the issue of mining and infrastructure needs to feature in developing a long-term strategy for the sector.

The first one is about the spatial location of the endowments and the infrastructure demands for mining operations and trade. As illustrated in Figure 3 above, South Africa's endowments are concentrated variously in a few parts of the country, with the Mpumalanga Province coal basin, Gauteng gold reef and the Northern Cape ("Transvaal") system historically being the most prominent. Over the past few years, the rise of the Bushveld PGM complex from the western Rustenburg node and the eastern edge in Burgersfort, the Waterberg coal basin and more intense activities in the Northern Cape has reconfigured spatial concentration of operations. This reality has defined the configuration of the country's infrastructure.

Quite often, however, this has not been addressed in a proactive manner; and the country does not have a framework to respond to the changing spatial intensity of mining operations. A long-term strategy for mineral extraction and its other linkages demand all-round infrastructure programmes to provide for the operations (electricity, water, human settlements and other needs), to ensure basic processing capacity for the raw materials, to manage a variety of community development issues, and to avail efficient transportation of the minerals to the industries that need them and for export. As the spatial location of the activities shifts, there should be deliberate infrastructure plans (a turnkey framework) defining the role of each partner in their realisation. This demands dexterity and creativity on the part of the state-owned enterprises charged with providing such infrastructure – including forward planning, partnerships in sourcing capital, concessioning arrangements that ensure mutual benefit between the infrastructure companies and the mining operators, and an 'open access' or 'shared use' infrastructure model to benefit the economy and society at large.

The second, related, dimension is at a macro-policy level. It pertains to the manner in which, historically, mining carved up South Africa's economic geography. A visionary approach would ease the upheavals that come with new discoveries and the end of the extraction life-cycle. This should be informed by basic principles of spatial planning. Heightened economic (mining) activity naturally results in migration of large numbers of people to areas experiencing such activity and the demographic exuberance can hardly be controlled. In a country without 'influx control' or Chinese-type *hukou* or *hujj* system³ of managing migration, the plans need to take account of this reality. Integrated approaches among government departments and state entities (e.g. public enterprises, energy, water, transport, education and housing) in terms of planning and project implementation are fundamental to this.

³ A system of registering households in terms of areas in which they are meant to reside, work and get social benefits; also variously prevalent in other East Asian countries.

Proceeding from the premise that mine operators also have a responsibility within and beyond the prescripts of social and labour plans, individual mining companies should not only allocate resources for these responsibilities; but also pool these resources and partner with all spheres of government in providing such services. At a macro-level, national spatial frameworks and plans pertaining to infrastructure needs should be developed in rolling pre-emptive cycles taking into account the shifting centres of mining operations. Such plans should be linked to the designation of relevant transport/development corridors linked to these operations. At a provincial and local level, mine operators, along with other sectors, should take active part in the development of provincial economic strategies and municipal integrated development plans. They should also take it as their responsibility to provide varied capacities where such are required, especially at local level. Related to this (and discussed later) is the issue of bold decisions on the location of upstream and downstream operations, as well as creative ways of preparing for, and managing, post-mining dispensations. Critically, South Africa needs to envision the emergence of new cities that combine various activities in the mining value chain and other sectors of the economy. In this regard, dynamics in the Waterberg and Burgersfort areas need to be interrogated – against the backdrop of the rise and decline of the Rustenburg belt – to ensure that spontaneous private-sector-based activities are harnessed through deliberate long-term planning led by government.

The third dimension pertains to how the infrastructure programme for mineral extraction and trade can spawn focussed industrialisation. South Africa spends some R1-trillion every five years in infrastructure programmes and a large part of this supports mining operations. As indicated earlier, large amounts are increasingly being allocated to such programmes in sub-Saharan Africa. From rail to roads, ports, housing, water and other infrastructure linked to mining operations, so massive have these programmes become that simple commercial logic dictates that supplies for the infrastructure projects should as much as possible be sourced from the region. For instance, given the rail networks being developed, the manufacturing of whole or parts of locomotives, carriages, signalling and braking systems, and railway tracks can be undertaken in South Africa and other parts of the region. Attached to this should be focussed economic diplomacy that includes, beyond agreements on trade, a drive towards standardisation in the infrastructure products such as railway gauges. An approach of this kind should extend from mining operations to issues of post-mining rehabilitation and technologies attached to this such as the productive use of mine dumps and processing of acid mine water.

South Africa and other parts of sub-Saharan Africa need to undertake these activities with a keen eye on the necessary division of labour. Critically, this should also be spurred by the realisable

ambition to attain such efficiency and excellence that these supplies for the infrastructure programmes not only feed the region; but also position it as a necessary part of the global value chains of the original equipment manufacturers. For instance, the American General Electric group which is supplying Transnet's locomotives has many operations across the globe. Aside from the negative reports regarding China South Rail (CSR) on whether it is meeting its localisation commitments, the partnership with CSR against the backdrop of the supplier value chain of China's mammoth 'One-Belt One-Road'⁴ initiative presents opportunities that would redound to the benefit of South Africa and the region for many decades to come. Needless to say, localisation programmes are easier said than done. Monitoring capacity is crucial to ensure that objectives set are actually realised.

The incessant bugle of modernisation

The bugle of modernisation has sounded, and none can escape its incessant call. The form that modernisation takes, ranging from automation to management practices, and the consequences it unleashes will depend on whether there is deliberate planning. Such planning should proceed from the premise that, fully embraced, technological change can be phased in and therefore optimally managed. But there should also be appreciation that the trajectory of modernisation cannot be fully predicted. The sector should therefore also be geared to respond to technological disruptions.

South African mining is renowned for the complexity of its geological formations, especially with regard to endowments that have been mined for over a century such as gold, which are now located in narrower tabular reefs and lie deeper into the bowels of the earth. While this presents an objective condition which in itself demands more creative methods of extraction, subjectively, the old mode of operation generally is slowly disappearing as new technologies come on-stream. Productivity and competitiveness dictate that South African mining generally should follow global trends. But beyond this, South Africa's old methods of extraction and labour-scouring still dominate, while the character of the labour force is changing, with younger and more educated workers joining the labour force. Their expectations of wages, as well as working and living conditions are much different from the previous era: without modernisation, these expectations increasingly collide with cost curves, thus rendering many operations unsustainable. At the same time, on a global scale, shareholders and customers expect responsible mining that takes into account environmental concerns including energy- and water-intensity, in addition to safety and other working conditions. Research by the Chamber of Mines predicts that, without a change in mining methods, South African

⁴ China's programme to build major multiple road, rail and sea links across Asia, the Middle East, Europe and Africa.

gold and platinum mining would become unsustainable within the coming two decades. (Mining Weekly, 2016)

What then are some of the emergent operational technologies? We categorise the instances quoted below for illustrative purposes in terms of their primary impact. This is not meant to detract from the fact that virtually all of the categories do affect productivity and safety, for instance. Issues pertaining to research and patenting are addressed in a separate section. Various editions of the Mining Weekly journal are the main source of the examples cited in this section.

Productivity: Technologies that are showing huge potential to improve productivity range from select blast mining (SBM) to raise-boring technology which is fully automated and operates at great depths, platinum-fuel-cell-powered ultralow-profile bulldozers, a remotely navigated stope-cutting system operated from a surface control-room and so on. At a more advance level, high-precision swarm robotic mining which combines automation and digitisation, drones utilised above- and below-ground, driverless remotely-controlled haul trucks and loaders, three-dimensional printing and medical imaging equipment are also being introduced. All these and other technologies create possibilities massively to improve productivity by extending mining hours, ensuring better mineral recovery, and reducing costs in a manner that could also lead to the resuscitation of mining operations that had become uneconomical.

Safety: In addition to the technologies and systems identified above, many initiatives are being undertaken to reduce the dangers associated with mineral extraction. Non-explosive mining which uses foam to break rocks in an inert way which does not require hand-drilling is one example of this. There is also increasing adoption of slot borer machines which can drill reefs as small as 100 centimetres compared to the heights required for humans to operate, let alone conditions of heat, dust and tremors which negatively impact morbidity and fatality rates in mining operations. The same applies to other ultralow-profile machinery attached to some of which are sweepers and dozers operated by batteries in narrow areas.

Environment: Beyond the 'reduce, reuse and recycle' principles propagated by the WEF, some of the technologies being introduced to enhance environmentally-friendly mining include underground-coal-to-gas initiatives which would not only reduce the carbon footprint; but also allow for exploitation of unminable coal. The usage of hydrogen-fuel-cell-powered bulldozers can also be linked to this system, as would on-site electricity generation. In the recent period, there have been attempts at agro-mining or phytomining where plants which have properties to accumulate high concentrations of minerals are used as metal crops. They can be used in sub-economic zones or to

harvest tailings in mine dumps. Research also points to a process of coarse-particle recovery which requires less energy in crushing and grinding and allows for water to be extracted and recycled. The product can be dry-stacked, and as such tailing dams would not be required. Other technologies are now being used to treat acid mine water; and some propose that the potassium nitrate and ammonium sulphate from such waste water can then be used to produce agricultural fertiliser. The same applies to how zinc mines can be linked to the production of sulphate fertiliser in deliberate cluster arrangements. This is in line with systems thinking as outlined in another chapter of this volume.

These illustrations speak to the multiple positive outputs and outcomes that a systematic adoption of technology can yield. The process needs to be planned for and adopted as an integrated system, allowing for advancement across the whole front of mineral extraction. This implies a combination of smart approaches in a future 'digital mine':

smart surveying and mapping visualisation systems, smart climate control systems and energy savings, smart rock engineering systems, smart data processing and smart mine design, mining planning and decision-making... [A] mine of the future [would] include underground communication systems that allow for real-time intervention to manage all risks, lamp room camera systems – environmental, health and safety monitoring for security, preventing illegal access, monitoring worker health and face recognition and underground drone technology – a floating technology that sees, maps and collects data. (Mining Weekly, 2015)

Modernisation should also encompass procurement and supply chain management to improve efficiency and to eliminate nepotism and corruption.

Overall, all these initiatives would clearly have serious implications for the labour-intensity of the extractive leg of the mining industry. As elaborated later, the mining cluster needs to be examined as an integrated system ultimately to determine the net employment effects.

Enhancing backward linkages

Upstream mining-supplier industries and services present the most critical opportunity for South Africa to benefit from its mineral endowments. A number of factors have seen to the development of capacities in this area: the learnings that South Africa has accumulated over the years of the evolution of its mining industry; the complex nature of its geology in terms rock formation and depth of mining operations; and the relative self-sufficiency pursued during years of anti-apartheid sanctions.

In an important intervention on this issue, Kaplan (2012) demonstrates that South Africa ranks among the best globally with regard to mining equipment and specialist services. Many of the companies operating in this area are South African, and in some areas, they compete quite well with global transnational corporations. Some of them are medium- and small-sized companies. Given the specificity of demands in the country's mining sector, they have developed what Kaplan refers to as 'economies of scope' (as distinct from 'economies of scale'). South Africa features quite high in terms of patent numbers and quality – alongside the United States and Australia. (Kaplan, 2012) What is also critical is that technologies developed for the mining industry such as hydraulic and haulage equipment lend themselves to usage in other economic sectors.

The Manufacturing Circle, citing the World Bank, similarly asserts that manufacturing “provides the scope to develop world-class mining equipment and capabilities, as well as the best means of processing South Africa's own natural resources and driving innovative activity.” (Manufacturing Circle, 2017, p8)

What then hampers the development of this subsector; and what needs to be done to deal with these challenges? There are immediate factors related to the global slowdown in demand and challenges of mining policy uncertainty. However, there are deeper issues which require attention in the context of Mining Vision 2030. At the core of this is industrial policy. Kaplan asserts that mining “equipment and specialist services, despite being by far the most competitive and export-oriented part of the capital goods sector, receives no particular or special attention” in government's industrial policy. (Kaplan, 2012, p7)

The need to address this issue is now recognised across the board, including in the NDP which calls for “substantially more attention” to be “devoted to stimulating backward linkages or supplier industries (such as capital equipment, chemicals and engineering services)”. (NDP, 2012, p147). What is required, as the Department of Trade and Industry has in the recent period argued, is the incorporation of these critical imperatives in government mining policy and praxis. This includes using the Mining Charter as a key tool for mining-related local procurement; and support for the supplier industry in terms of skills, research and development, capital and operational expenditure and exports. A supplier cluster that addresses these challenges would be critical to ensure implementation. A narrow focus on Black economic empowerment that can be exploited for fronting and import purposes should to be discouraged. (the dti, 2014)

Arising out of Mining Phakisa⁵, one of the initiatives has been the establishment of Mining Equipment Manufacturing of South Africa (MEMSA) where government and original equipment manufacturers operate from one centre to develop trackless, rail-bound, pump- and battery-driven and other equipment. Attached to this is the need more deliberately to insert South Africa into global value chains, including through co-operation with transnational Original Equipment Manufacturers (OEMs). Critically, the further growth of the mining industry in sub-Saharan Africa offers great opportunity. It therefore stands to reason that, besides promoting the value-addition that would derive from the sub-sector's inherent strengths, the country's economic diplomacy should be geared towards fostering an understanding of the competitive and comparative advantages the various countries have, and the standardisation that would help expand economies of scale across the region.

While the current focus in the contestation around the 2017 Mining Charter is on issues of ownership, the discourse needs to be broadened to address the major opportunities attached to upstream mining supplies. Related to this, in an organic process, black industrialists would also emerge. Critical in this regard is the urgent challenge to deal with poor alignment and co-ordination within government.

Enhancing forward linkages

Forward linkages or beneficiation is, for good reason, a prerogative passionately propagated by most nations particularly developing countries, as it speaks to the issue of societal benefit from natural endowments. Beyond this, there are also debates about the costs. It is in this context that the NDP argues:

Beneficiation or downstream production can raise the unit value of South African exports. In this regard, resource-cluster development, including the identification of sophisticated resource-based products that South Africa can manufacture, will be critical... In general, beneficiation is not a panacea because it is also usually capital intensive, contributing little to overall job creation. (NDP, 2012, p146)

The NDP qualification is also influenced by factors such as the energy-intensity of most beneficiation industries, against the backdrop, during its adoption in 2012, of the electricity challenges South Africa was experiencing.

⁵ An initiative where government departments, mining companies, unions and NGOs worked together over a number of weeks to position mining as a catalyst for economic growth

Unlike with backward linkages, South Africa has not developed much capacity in relation to most of these opportunities. While the steel industry, agricultural ‘minerals’, electricity-generation and coal-/gas-to-liquids technologies had been among the most advanced in the world, these were driven by need in the context of limited industrialisation philosophies of the 20th century and the imperative in later years to circumvent economic sanctions. Otherwise, historically, the country sought more to earn foreign exchange from the export of minimally-beneficiated minerals and pursued backward linkages to improve extraction efficiency. Attempts in the post-1994 period to change this trajectory have hit the wall of import parity pricing which effectively reflects abuse of market power, such that domestic steel prices, for instance, are ‘in the highest quartile’ in the world. (the dti,2014)

The question is whether it is possible, in the medium-term, to develop an approach that benefits the country, the economy and the various players in the sector and related industries! At the level of principle, there is agreement that the country should diversify “away from resource extraction and reliance on commodity exports towards ... manufacturing, value-adding and more labour-intensive growth”. (the dti, 2014, p4) Opportunities for beneficiation are identified in three categories of minerals: manufacturing (e.g. steel and iron ore, nickel, copper and zinc); infrastructure (e.g. those for manufacturing plus cement which would also incorporate gypsum, limestone and coal); energy (e.g. coal, uranium and gas); and for agriculture (e.g. phosphates, potassium and sulphur). To these can be added jewellery for such precious metals as gold, diamonds and PGMs. According to the dti, downstream potential exists in a variety of areas (Refer Table 2).

Table 2: Assessment of beneficiation possibilities

Quantec HS - 4 digit, 2013	Export Value, Rands	Downstream Potential	Downstream Jobs
H7110: Platinum, unwrought, semi-manufactured or powder form	R 81 319 519 856	High to medium	Medium (catalysts)
H2601: Iron ores and concentrates, roasted iron pyrites	R 73 998 564 487	Very High	Very high (manufacturing-autos, construction)
H7108: Gold, unwrought, semi-manufactured, powder form	R 63 571 314 217	Medium to low	Low (jewellery)
H2701: Coal, briquettes, ovoids etc, made from coal	R 55 855 559 400	High to medium	Medium (polymers)
H7202: Ferro-alloys	R 34 821 623 292	Medium to low	Low (SS)

H2602: Manganese ores, concentrates, iron ores >20% Manganese	R 15 029 874 497	Medium to low	Low (Fe-alloys & Stainless steel)
H2610: Chromium ores and concentrates	R 13 131 271 379	Medium to low	Low (Fe-alloys & Stainless steel)
H7102: Diamonds, not mounted or set	R 12 162 947 876	Medium to low	Medium (jewellery)
H7601: Unwrought aluminium	R 11 064 742 022	High to medium	Medium (parts)
H2614: Titanium ores and concentrates	R 5 999 252 818	High to medium	Low (pigment, metal)
H7204: Ferrous waste or scrap, ingots or iron or steel	R 4 802 413 299	Very High	Very high (manufacturing)
H7606: Aluminium plates, sheets and strip, thickness > 0.2 mm	R 4 584 915 868	High to medium	Medium
H2603: Copper ores and concentrates	R 4 541 138 458	High to medium	Medium (wire, brass)
H7404: Copper, copper alloy, waste or scrap	R 4 439 989 630	High to medium	Medium (wire, brass)
H2615: Niobium, tantalum, vanadium zirconium ores, concentrates	R 4 331 548 972	Low	Low
H2618: Granulated slag (slag sand) from iron & steel industry	R 3 420 317 958	High	High

Source: the dti (2014), Presentation: *Upstream mining and downstream mineral value chain issues and action plan (from Quantec HS - 4 digit, 2013)*

Table 2 shows that few of the categories with high to medium beneficiation potential translate into equivalent potential with regard to job creation. Many of the downstream opportunities such as aluminium smelters are very energy-intensive. South Africa thus needs to determine whether it should revive the preferential electricity pricing approach in order to attract and service such investments – and thus the surpluses it should command in terms of electricity-generation. Further, as argued earlier in this chapter, to the opportunities outlined can be added PGM and fuel cell technology, vanadium and jet engines and other minerals attached to emergent technologies.

How then can the constraints to forward linkages be addressed? These pertain to the infancy of the beneficiation industry generally and matters related to monopoly pricing. Quite logically, if a comprehensive approach is to be adopted on this matter, some of the endowments would need to be classified as ‘strategic minerals’, as resolved by the ANC at its 2012 National Conference. (ANC,

2012) This, it can be argued, is not contested among the partners in the industry. The question is how this is done and with what implications!

Firstly, it would be better that, rather than confer powers to a Minister, willy-nilly to declare such 'strategic minerals', this should be the product of consultation linked to a clear industrial strategy. Secondly, rather than relying on blunt instruments such as legal provisions that impose actual 'developmental prices', there should be negotiation around a cost-plus approach that takes into account the gate price and transportation costs. For precious minerals such as PGM, gold and diamonds, as opposed to the 'bulkies' (e.g. coal and iron) other relevant formulae can be devised. Such approaches would need to be combined with firm measures to deal with market distortions including cheap (often dumped) imported inputs. This should be handled in a manner that does not encourage operational and management practices that undermine domestic productivity and competitiveness. In addition, a comprehensive cost-benefit analysis needs to be done on the trade in scrap metals including its impact on prices and such economic crimes as cable theft. Indeed, calls have been made that, at the very least, there should be a tariff placed on the export of scrap metal⁶.

Given the infancy of the South African beneficiation sector, consideration should also be given to systems of vertical integration: with mining companies, at least in the early stages of the development of a beneficiation industry, holding shares in linked entities and assisting with funding, human resource development, research and, where applicable, off-take. The PGM sub-sector seems to have adopted this approach in relation to the nascent fuel cell industry⁷. Added to this is the intervention by government to create dedicated PGM Special Economic Zones that offer a variety of incentives. As with backward linkages, development of domestic capacity should focus on South African companies; but consideration should also be given to the forging of partnerships with transnational corporations, in a manner that helps to insert relevant beneficiation activities into global value chains.

While the discourse on beneficiation has focused on manufacturing or physical industrial activities, South Africa needs creatively to look beyond this. For instance, in relation to the PGM industry: platinum could be designated as a foreign exchange reserve and the minting and promotion of

⁶ This is one of the proposals emerging from the ANC National Executive Committee lekgotla held in January 2018

⁷ Anglo American Platinum has been engaged in research on electricity generation in rural areas working in partnership with fuel cell producers and, along with Implats and Sibanye, these companies have started using fuel cell technology in mining equipment and electricity generation.

platinum coins can be expanded. Further, the broader question of ‘financial beneficiation’ needs to be interrogated: in terms of Metal Exchanges for endowments that South Africa has in abundance⁸.

Research and development

In the section above on modernisation, various emergent technologies were identified, and it is quite evident that there is preparedness and even enthusiasm on the part of mining companies operating in South Africa to embrace new technologies. Research on, and production of, equipment in the country has mostly undergirded extraction, spurred on by the desire to improve productivity and safety, and to minimise the negative environmental impact that mining operations exact. There are also some commendable research activities in beneficiation, as in PGMs and fuel cell technology, vanadium and lithium for manufacturing of strong light materials and energy storage, respectively.

With regard to forward linkages, citing work by Marin et al, Kaplan (2012) identifies the many positive attributes of the South African mining sector – driven by market requirements, advances in science and technology, as well as market context and market volume. ‘South Africa has developed a technologically sophisticated and globally competitive mining equipment and specialist service sector’ (p1), as reflected in the number and quality of patents, the fact that South Africa is a “world leader and first to market in a host of mining equipment and especially services” in large measure provided by South African companies. This capacity had developed during the pre-1994 era with government support; and had tapered off after the attainment of democracy. Weaknesses pertain to poor alignment between the Departments of Science and Technology and Trade and Industry – between blue-sky research and technical product-oriented research – as well as the lack of focus, poor government support, and the degrading of institutions (such as CSIR Miningtek). As such, “Australia is increasingly becoming the location of choice for research and development on the part of South African firms and indeed of South Africans themselves”. (p6).

There have been conscious attempts, through Mining Phakisa and the setting up of MEMSA to reverse this situation. However, though R100-million had been earmarked for mining research and development for 2018 – from R5-million in 2014 – this pales into insignificance compared to the estimated R4-billion that other developing mining countries spend. (Mining Weekly, 2017)

Mining Vision 2030 therefore should include allocation of more resources for research and development, and better co-ordination between blue sky research and industrial policy. The

⁸ Among other things, metal exchanges would assist with price discovery and help smooth out market volatility. The Mapungubwe Institute (MISTRA), working with Pan African Investments and the Johannesburg Stock Exchange has initiated research into the desirability and practicability of establishing a PGM Exchange.

initiatives around PGM-based fuel cell technology – ranging from research support to operationalisation of technology and establishment of Special Economic Zones – demonstrate the potential in this regard. However, there is also the need to cut the time between conceptualisation of industrial strategies and implementation, setting of clear guidelines on localisation, and corresponding human resource development strategies that undergird the paths chosen.

Success would largely be dependent on conscious adoption of what Ferreira and Perot (2013) in the MISTRA publication on the hydrogen economy refer to as a Triple Helix approach. Citing Leydesdorff and Etzkowitz (1998), they argue that in a triple helix arrangement, “the institutional domains of government, university, and industry, in addition to executing their customary objectives, assume the roles of the other actors”, with deliberate knowledge and operational flows among these partners. (MISTRA, 2013, p107)

A critical element in enhancing the research and development initiative is what the SIMS report refers to as knowledge linkages. It argues for the reinvestment of a large part of taxes from mining into the training of engineers, artisans and technicians, and for deliberate strategies to discourage the emigration of research and technical skills. While estimating that mining could create some 200 000 additional jobs in about 10 years, the NDP argues that, potentially, a further 100 000 jobs could be stimulated through linkages (NDP, 2012).

Research and development, in the context of a long-term vision, should address issues across the value chain of the industry and its environment. This includes interrogation of global market demand and tailoring activities to extract maximum benefit, as shown in the case of the Richard’s Bay Coal Terminal case study cited by Pogue and Ferraz (2016). It should also extend to geo-survey expertise and how society can collectively benefit from its endowments. Critically, research should also focus on the political economy of the sector, including its history, changing demographics of the workforce and labour relations, incentivisation of workers rather than just the managers, issues of ownership and general inclusivity, and relations with mining-affected communities and government across the spheres. A network of research partners, straddling the value chain, should form part of the Triple Helix.

Expanding inclusivity in ownership

Issues pertaining to ownership and progress in advancing black and women empowerment, as a critical part of policy imperatives in the post-1994 period, are canvassed elsewhere in this volume. The fundamental observation in this regard is that the mining sector is still largely white- and foreign-owned.

How should these matters be approached in the context of a long-term vision? In the first instance, the step taken in the 2002 MPRDA to declare mineral resources as the property of the nation as a whole with the state as custodian was a logical starting point. Licensees would be afforded the right to explore, prospect, mine and trade and would pay a royalty fee to the state. Secondly, the logic behind the empowerment imperative, as it applies in this instance to ownership, needs to be embraced by all: proceeding from the premise that correction of a historical injustice of deliberate exclusion is a logical, ethical and constitutional imperative. Thirdly, in macrosocial terms, demographic balances in ownership of the country's mineral endowments is in the long-term interest of all South Africans. Failure to address this issue can only breed social anomie.

It should also be underlined that the state itself acts not only as custodian and regulator; but it also has the right to own and/or operate mines through a state-owned company. Many years after this was asserted in ANC and government policies, little has come of efforts to merge the various state entities operating in the sector and to expand the ownership and operations of state-owned entities.

The weaknesses identified by MIGDETT include the fact that there has been little focus on share-ownership by workers, the so-called employee stock ownership plans (ESOPs). There has also been inadequate attention to meaningful participation by communities. Mining Vision 2030 should address these matters, also as an important contribution to dealing with inequality and ensuring that all stakeholders become a full part of the mining sector at all levels. This should be undergirded by systematic approaches to deal with matters of worker representation at decision-making level, agreed processes of identifying the most appropriate arrangement (or combination of arrangements) in each instance in terms of ESOPs and profit-sharing, and financial education of the beneficiaries.

Reckless as some of the decisions by the previous Minister of Mineral Resources appeared to be as reflected in both the content of, and process around, the 2017 draft Mining Charter, they are impelled by palpable impatience among various strata within the Black population. Perceptions of opportunism and unethical behaviour on the part of specific government actors should not detract from the factual reality that breeds such impatience on the issue of ownership.

But how can some of the detail under contestation be addressed in the context of developing Mining Vision 2030? Firstly, the contestation around these issues should preferably take place in frank interactions among the partners rather than in the courtrooms. Indeed, the majority judgement of the High Court (Gauteng local division) in April 2018 in favour of the 'once-empowered, always-

empowered' principle has confounded, rather than decisively resolved, this and related complex issues. (BD: 2018)

Secondly, it may be better to avoid retrospectivity in dealing with the ownership empowerment principle, accepting that the beneficiaries have indeed benefitted, even if they may have exited specific entities or the sector as such. Thirdly, whatever ownership percentages are pursued, they should be within magnitudes and time ranges that decisively enhance empowerment, and are also reasonable and not destructive of the investment environment. Fourthly, going forward, the experiences of other empowerment schemes such as those of SASOL and MTN – which confine BEE share disposal to previously-disadvantaged persons – should be considered. Fifthly, the state needs more strategically to use its regulatory powers and procurement muscle (through state-owned enterprises such as Transnet and Eskom) as leverage to encourage direct involvement of Black people in the ownership and operation of mines. Lastly, when approached as a cluster with a variety of linkages, across the entire mining value chain, this sector can also play a critical role in the emergence of black industrialists; and this can include vertical integration with both the private and state mining entities.

Some generic issues

In this section, brief assertions are made on other issues that are pertinent to the realisation of the core matters outlined above. This treatment is not meant to detract from the importance of these issues in relation to Mining Vision 2030. Rather, some of them are either dealt with in other chapters of this book, or would require such specialised treatment as this chapter is unable to provide.

Jobs and human resource development: Modernisation will definitely have a negative impact on the labour-intensity of the extractive subsector of the mining industry. As outlined earlier, this has started to play out in a number of operations, and the trend itself cannot be resisted for long. Nor can the stakeholders in the industry and broader society adopt a Luddite⁹ approach to the bugle of modernisation. Critical factors that need to be considered in such modelling include: the quality of jobs that would emerge from modernisation; job opportunities from operations in areas either ignored or abandoned as unminable; improvement in safety standards; sustainable post-mining activities; and the employment opportunities that the establishment of a mature mining cluster would generate in backward, forward and other linkages. To determine the net effect of these and other factors requires appropriate modelling, as well as clear plans on how to phase in

⁹ Named after Ned Ludd, an apprentice who is said to have destroyed a textile machine during the late 18th century, Luddite is used to refer to workers who protested the introduction of machines that rendered their jobs obsolete in Britain during the Industrial Revolution.

modernisation in a manner that preserves employment as much as possible. A critical stream of the visioning should be a systematic approach to knowledge linkages and the allocation of resources and expertise to the development of human resources. This should include an assessment of opportunities across the board, along the lines attempted by the dti in Table 2.

Social and labour plans: The Mining Charter argues for systematic approaches to the development of human resources, labour relations, and community development around mining settlements. One of the most critical lessons from the 2012 Marikana tragedy, the 2014 platinum strike as well as social instability in mining areas generally, pertains to community infrastructure development, the living-out allowance and related practices. While many mine operators have allocated resources for community development, a major weakness relates to the extent of co-operation between the mining houses and various spheres of government. The major deficit in this regard is the level of social compacting, with each partner identifying and playing the role that is required of it. A long-term vision should oblige mining companies to be more actively involved in the conceptualisation and implementation of municipal and provincial development strategies and plans – an approach that demands a major mindset shift on the part of all the stakeholders. Systems and structures of accountability to communities need to be improved and should involve the highest levels of the companies. The capacities and reputational capital of each of the partners needs to be mobilised for a common purpose and for common benefit.

Utilisation of land: Mining houses own large tracts of land, most of which lies fallow. Especially in the context of Mining Phakisa, as described in a chapter of this book, creative initiatives are starting to emerge on how such land can be used for agricultural and other purposes. Mining Vision 2030 needs to encompass a systematic approach to this issue on a national scale, with possibilities that would help address not only the challenge of land hunger; but also contribute to community development, job-creation and enterprise development.

Post-mining activities: Another chapter in this volume addresses the matter of cleaning up after mines are long gone. This matter is also interrogated in other works, including the two chapters by Fatima Ferraz (2013) in the MISTRA publication on *South Africa and the Global Hydrogen Economy: The strategic role of Platinum Group Metals*. The latter is particularly instructive in terms of outlining a theoretical model that should inform extractive activities from the start, so as to ensure sustainability in the long term. In addition to this, an indication was given earlier in this chapter on how new technologies can reduce such environmental disadvantages as water usage, tunnelling and extraction of large quantities of rock and soil, energy intensity and so on. All these and other

initiatives, including what Ferraz (2013) refers to as secondary beneficiation, need to form part of new approaches to mining.

Informal mining: The issue of informal mining is treated elsewhere in this volume. Historically, South African policy-makers and mining operators seem largely to have buried their heads in the sand on this issue. The belief that law-enforcement on its own can resolve this matter is shattered every time scores of illegal operators are 'discovered', piles of dead bodies are lifted from the bowels of the earth and inconsequential evocative statements are uttered by leaders. A long-term vision for mining needs to take on board a comprehensive understanding of the factors that drive the scourge of illegal mining, from the macrosocial to the detailed operational issues. In this regard, as argued in this volume, informal, artisanal and small-scale mining need to be embraced as part of economic inclusivity and poverty alleviation. Experiences across the continent and further afield would stand South Africa in good stead in addressing this issue, taking into account both intended and unintended consequences of such programmes.

Conclusion: the framing paradigm and praxis

An acknowledgement of the role the mining sector has played in the evolution of South Africa's macrosocial dynamics and polity is fundamental to the development of a mining sector vision that can and will be embraced by all stakeholders. The South African mining industry has played a central role in the social exclusion that has historically defined South African society, the legacy of which the country continues to experience. Land dispossession, rural underdevelopment, the migratory labour system, the energy intensity of South Africa's economy and the country's subordinate relationship with developed economies across the globe are some of the blights that the mining sector has historically wrought on South African society.

The inverse of this is the positive force that mining has been to the development of the South African economy. The industrialisation that the country experienced over the past century owes much of its dynamism and relatively advanced character to the mining sector. Though much of the direct contribution to industrialisation may have been skewed towards backward linkages, the indirect ripple effects in the manufacturing sector and the contribution of mining to the development of South Africa's economic infrastructure speak not only to a history that should be acknowledged; but also to a dynamic potential that should be harnessed for the country's future development trajectory.

An appreciation of this reality is a critical starting point in defining the collective mindset that should inform the development of Mining Vision 2030. Acknowledging the negative consequences of past

injustice and embracing the potential of a future mutually-beneficial trajectory – with a mining industry that catalyses South Africa’s development going forward – constitute important first steps towards that common future.

Mining Vision 2030 should have this paradigm as its point of navigational reference. Arising out of this should then be general plans that address the variety of building blocks outlined in this chapter: judicious extraction and exports that also ensure global security of supply, the role of mining in infrastructure development, industry modernisation, backward and forward linkages, research and development and issues of equitable ownership and community development. Added to these are factors such as quality of jobs, safety standards, environmental responsibility and the attendant skills revolution.

Quite clearly, all of these issues need to be addressed at a generic level. However, the generic approach will need to be complemented by plans that are relevant and applicable to specific subsectors such as the PGMs, iron and steel, coal, gold and other minerals. At each level, policy-makers, operators, workers communities and other partners should see themselves as catalysts for a new industrialisation drive across the economy, and as core participants in addressing the marginalisation that afflicts society as a whole. Social compacting – characterised by the identification of common objectives and a commitment collectively and variously to contribute to their realisation – should define the relationship among the partners. The Triple Helix approach that brings on board policy-makers, operators and researchers is also fundamental. Vertical integration should be used to help forge and support emergent sub-industries.

The state has a central role to play as custodian of the country’s mineral endowments: as a regulator, owner-operator, leading force in skills development, and as a facilitator of the necessary macroeconomic environment conducive for investment in and growth of the mining sector.

The private sector has, as a starting point, to view itself as an integral part of societal efforts to attain national objectives at the same time as it pursues the reasonable returns that are integral to its very existence. This should include a deliberate focus on the emergence of the multifaceted mining industrial cluster, and on imperatives outlined in the empowerment charter such as skills development, equitable representation in professional and management positions, social and labour plans, as well as ownership and profit-sharing arrangements that include meaningful worker and community participation. In the context of an emergent mining industrial cluster, the organic rise of black industrialists will also find practical expression.

The union movement and mining workers generally have to help define and at the same time adapt to the changing environment in the mining sector. This applies to the opportunities and challenges pertaining to modernisation and the emergence of a mature mining industrial cluster. Attached to this is the need for creativity on the part of unionists in taking advantage of opportunities that come with constitutional freedoms, without succumbing to the allure of social distance between worker-leaders and their constituents. The unions are also called upon to tailor their organisational approaches to the changing environment, including the transformation of the demographics of the workforce. It is also critical that, in their crafting of organisational strategies and tactics, unions keenly factor in the concrete circumstances of the sector and how to respond to realities of 'fat and lean years'.

The community sector, particularly mining-affected communities, require the level of organisation and strategy-development which ensures that mining operations in their localities redound to the benefit of all. In this regard, consistent community democracy, equitability in terms of traditional hierarchies and gender, active involvement in the crafting and implementation of social infrastructure programmes, skilling in management of resources, and long-term approaches that include extra- and post-mining activities should be encouraged to ensure maximum community benefit.

Appropriate organisational forms are critical for all the social partners, particularly in the negotiations around, as well as crafting and implementation of, the long-term vision. For government, required are integrated approaches that bring together all relevant departmental functions (primarily mining, trade and industry, science and technology, housing, transport, water and environment) and the sub-national spheres. The Chamber of Mines and related sectoral organisations have an important role to play in this regard – a function that they can only adequately fulfil if they enjoy respect among their constituents and other social partners alike.

For purposes of crafting the vision and monitoring its implementation, MIGDETT, which is made up of representatives of government, business and labour should be expanded and appropriately capacitated. Such a platform, also referred to as MIGDETT+, would serve as the organisational mechanism for social compacting, with requisite strategic foresight and technical capacity.

Mining Phakisa – arising from efforts to implement elements of the NDP – which has provided a platform for interaction among government departments, labour unions, mining houses and non-governmental organisations seems to have embraced the MIGDETT+ approach, and has the potential to serve as the technical infrastructure for these discussions and for monitoring the

implementation of the vision and plans. It should also be emphasised that the formal platforms of interaction should not preclude informal interfaces (and mini-compacting at sub-sector or geographic levels), as long as these ultimately feed into the larger formal processes.

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