

**Capacity strengthening of member States and RECs  
to implement and monitor AMV-aligned policies and  
strategies**

**Training materials**



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## Background

A mineral policy<sup>1</sup> can be defined as the sum of government decisions and actions that influence the mineral system, and the ways in which the system itself affects the economy and society in general. Its elements are diverse and continually changing. Mineral policy contains more than laws and regulations that directly influence mineral exploitation, extraction and processing.

The principles of management of the mineral sector from the government perspective require the:

- Appreciation that the mineral sector is a part or constituent of the other sectors in the economy;
- Definition of the aims of the sector in the economy;
- Appreciation of the roles of and effects on the many actors of the economy;
- Coordinated and integrated approach;
- Macro-economic skills for designing overall integration of the mineral sector into the national economy; and
- Developing and implementing administrative and managerial procedures.

The overall goal of the African Mining Vision (AMV)<sup>2</sup> is to create “*a transparent, equitable and optimal exploitation of mineral resources to underpin broad-based sustainable growth and socio-economic development*”. The components of the shared vision are the following:

- A knowledge-driven African mining sector that catalyses and contributes to broadbased growth and development of, and is fully integrated into a single African market through:
  - Down-stream, upstream and sided-stream linkages;
  - Partnerships between the state, private sector, civil society, local communities and other stakeholders; and
  - Comprehensive knowledge of its mineral endowment.
- A sustainable and well-governed mining sector that effectively garners and deploys resource rents and that is safe, healthy, gender and ethnically inclusive, environmentally friendly, socially responsible and appreciated by surrounding communities;
- A mining sector that has become a key component of a diversified, vibrant and globally competitive industrialising African economy;
- A mining sector that has helped establish a competitive African infrastructure platform, through the maximisation of its propulsive local and regional economic linkages;

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<sup>1</sup> Department of Energy, Mines and Resources, 1974. Towards a Mineral Policy for Canada: Opportunities for Choice, p11.

<sup>2</sup> African Union, 2009. Africa Mining Vision.

- A mining sector that optimises and husband Africa's finite mineral resource endowments and that is diversified, incorporating both high values metals and lower value industrial minerals at both commercial and small-scale levels;
- A mining sector that harnesses the potential of artisanal and small-scale mining to stimulate local/national entrepreneurship, improve livelihoods and advance integrated rural social and economic development; and
- A mining sector that is a major player in vibrant and competitive national, continental and international capital and commodity markets.

It is safe to say that most member States subscribe to the AMV pillars, in one way or the other without expressing to do so. The key issue is how to achieve the goal of broad-based socioeconomic development. This requires definition of products and the required capacities to achieve them.

The essential thrust of the capacity building training is to provide key aspects of strategic planning and project management. This involves skills for designing overall integration of the mineral sector into the national economy.

## **Overview of the covered modules**

### **Module 1: Framework for benefiting from mineral resources development**

This module outlines links between mineral resources and potential benefits that contribute to growth. It encompasses various aspects of the tenets of the AMV. It also emphasises the importance of stakeholder participation.

### **Module 2: Skills development and Research and Development (R&D)**

This module emphasises the need for skills and knowledge development, which are critical for achieving the goal of broad-based socio-economic development. This offers space for innovation and employment creation for all, including women, youth and the poor.

### **Module 3: Knowledge and information sharing platform**

This module explores the essence of sharing knowledge and information on emerging issues that affect the industry. An approach towards best practice and working together through forums for discussing experiences and developments in identified key issues.

## Module 1: A framework for benefiting from mineral resources

### Objective

- Show pathways to deriving benefits from mineral development;
- Show benefits from mineral resources development to citizens;
- Show linkages with various stakeholders and importance of coordinated approach.

Most mineral-rich states wish to exploit their resources to benefit them. The underlying principles for deriving benefits from mineral resources start with long term issues as appreciated or faced by individual states. In most states, the first and foremost is the acknowledgment of inadequate or lack of capital to develop the resources and thus the centrality of attracting foreign and private investment. In this regard, countries aim to create competitiveness and address risks for industry (local and foreign) to invest and undertake exploitation activities, pay appropriate revenues while minimising harm. Competitiveness is the ability of a country to attract and retain investment. Risks include the complete range of legal and corporate frameworks. Attention to competitiveness and risk in the minerals sector has varied across member States depending upon the sector's priority in the economy.

There are then two ways through which benefits are extracted from the minerals sector. Firstly, revenues by way of taxes, duties, etc. paid to governments are then used for social obligations (education, health, infrastructure), and/or invested in sustainable assets that replace depleting assets and diversifying the economy. This avenue may also be termed as delivering on the five models of sustainability<sup>3</sup>:

- Natural capital – non-renewable assets and minimising harm to the environment;
- Human capital – health, knowledge, skills, etc., which are necessary for development;
- Social capital – institutions that help maintain and develop human capital in partnership with others (communities, businesses, NGOs, unions, etc.);
- Manufactured capital – goods and assets, infrastructure, technologies, processes, etc.; and
- Financial capital – sovereign wealth, bank deposits, shares, etc.

The extent of contribution of the sector to the economy will depend on the magnitude and stability of retained revenues and how these revenues are utilised<sup>4</sup>, when using the first pathway. These include policies, taxation, priorities, enhancing linkages, human capital, income distribution, investment in other assets, etc.

The second way, is using the extractive industries themselves to create the relevant linkages (upstream, downstream, side stream), heavily linking with industrial policy. All these are elements of the AMV, which are unpacked during the consultative process of developing a Country Mining Visions (CMV) or an AMV-aligned National Mineral Policy (NMP). Appropriate and adequate capacity in society is key in achieving the desired goals.

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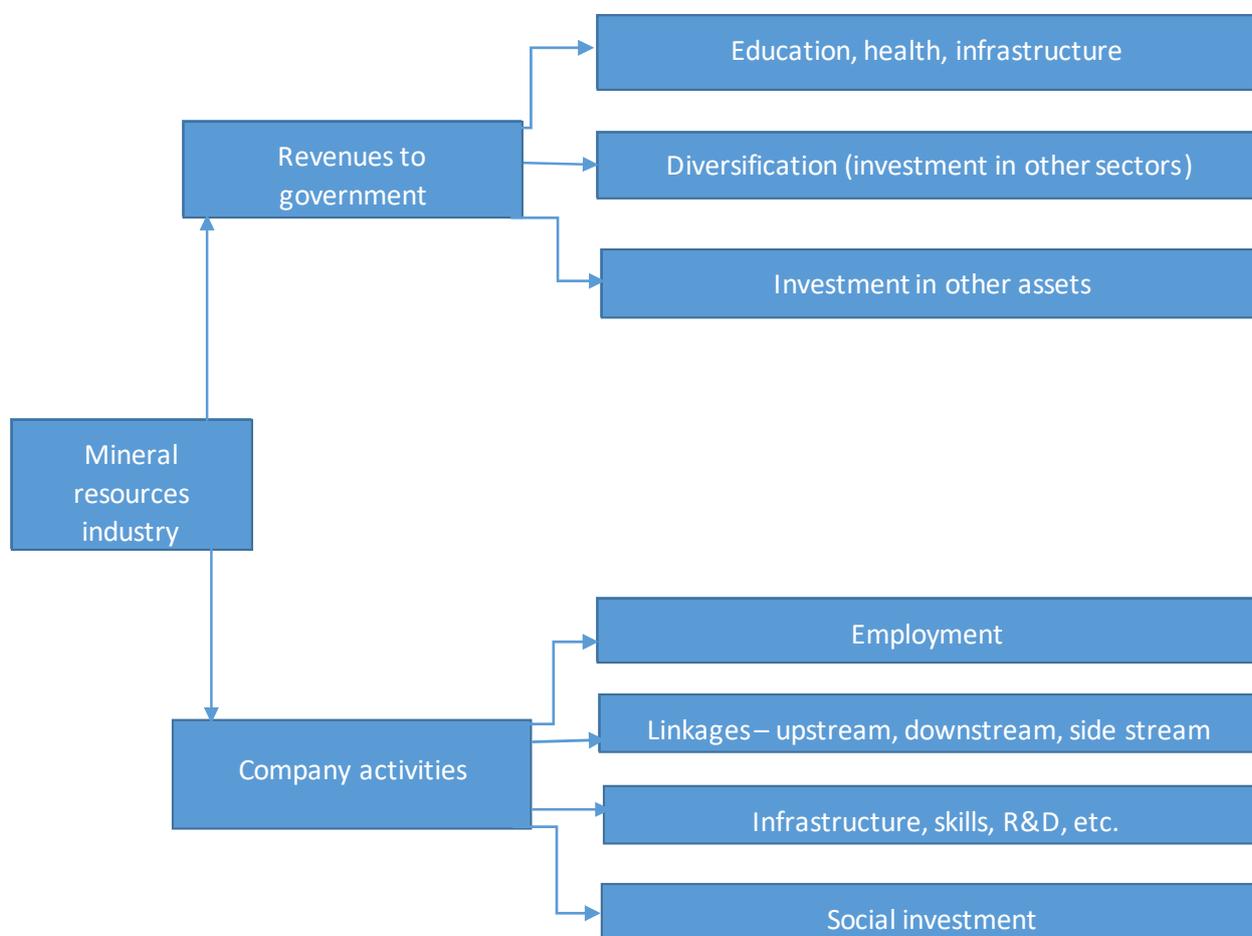
<sup>3</sup> Porritt, J., 2007. Capitalism as if the world matters.

<sup>4</sup> Otto, J. and Cordes, J., 2002. Historical perspectives on international law and policy.

Governments as facilitators, are then able to mobilise stakeholders in society to achieve these goals.

Figure 1

**A framework for benefiting from mineral resources**



Source: Bill and Melinda Gates Foundation, 2016.

Using the second pathway requires a deep and broader understanding of the mineral value chain with necessary and relevant linkages. The fundamental principle is to mobilise various stakeholders, coordinate efforts and act together to achieve the national goals. Embedding the minerals sector in the country’s industrialisation/development policy becomes important. Fully unpacking the role of mineral sector in the country, is vital.

In the development and implementation of a CMV or an AMV-aligned NMP, a prerequisite is an acknowledgement that a minerals sector is only part of the national economy<sup>5</sup>. As such, therefore, the sector must contribute or aim to achieve national objectives along with other sectors’ contributions. An understanding and appreciation of the national objectives is vital. Such objectives might include poverty reduction, raising per capita income, increasing or creating employment, industrialisation, favourable balance of payment conditions and many others. Secondly, an understanding and appreciation of the political, economic, social

<sup>5</sup> Buck and Elver, 1970; Mtegha, 2014.

and physiographic situation of the country is necessary to respond appropriately to any issues through the right policy instruments. These issues will include, for example, the nature and stability of government; level of infrastructure development; availability of risk and markets; level of skills, research and development and innovation culture, etc. All these will affect how policies evolve. In addition, the mineral sector has unique characteristics and it operates in a global village, in which case several issues must be considered.

Implementation, therefore, needs careful planning for potential benefits to be realised. In addition, allocation of resources to implement such plans rest with the legislature, which must be convinced of such proposals. To advance government agenda or objectives through the minerals policy, almost all African countries have re-affirmed their sovereignty over mineral resources and this has become fundamental to determine the rate and nature of sector development. An investor can only gain access to explore, develop, process and market products through relevant permits under specified conditions from governments. The implementation of policies would invariably depend on many factors, but skills and effectiveness of various relevant stakeholders are crucial in achieving the intended national objectives.

Any policy needs following up with an implementation plan, otherwise it is as bad as having none at all. Stakeholders are more interested in how the policy intents are implemented. While policy development is an intellectual process, policy implementation is operational in nature. Successful policy implementation requires commitment and support from all stakeholders.

### **Mineral sector governance**

This underscores inter-ministerial coordination and collaboration with many stakeholders. It is the hall mark for the sector to contribute to the broader economy. It comprises the analysis of segments of government and other state institutions – requirements; responsibilities for decision-making; both at national and regional level.

A wide consultative process with all stakeholders is normally used to develop information forming the national mineral policy or CMV, which is adopted by government. In a number of countries, failure to implement a minerals policy is lack of political will and/or lack of an implementation plan derived from information from the consultation process. Unfortunately, stakeholder participation in the implementation of the strategies is not entrenched. A mineral sector managed by only the Ministry or Department responsible for the sector cannot deliver on the prime goal of the AMV. Stakeholder engagement starts with alignment of various ministries, agencies and institutions of government to align the different priorities, laws and regulations; and given adequate management, material and financial support. Broad stakeholder dialogue and representation mechanism is an optimal route for development. Prioritised institutions are essential for facilitating programmes.

Developing an action or implementation plan should involve all stakeholders since it entails agreeing on strategies, organisational structures and allocation of resources (financial, material and human). Even better, it is more appropriate, easier and useful to use the same individuals or stakeholders that were involved in policy development to be part of crafting a plan of delivery. The stakeholders generate a lot of information during the construction of a

CMV or NMP, which in most cases includes how such policies can be implemented. This is because:

- They understand what should be done from policy;
- Appreciate the contributions and views of different stakeholders;
- Can list required results and actions of group responsibility; and
- Can modify plans from policy suggestions as needed.

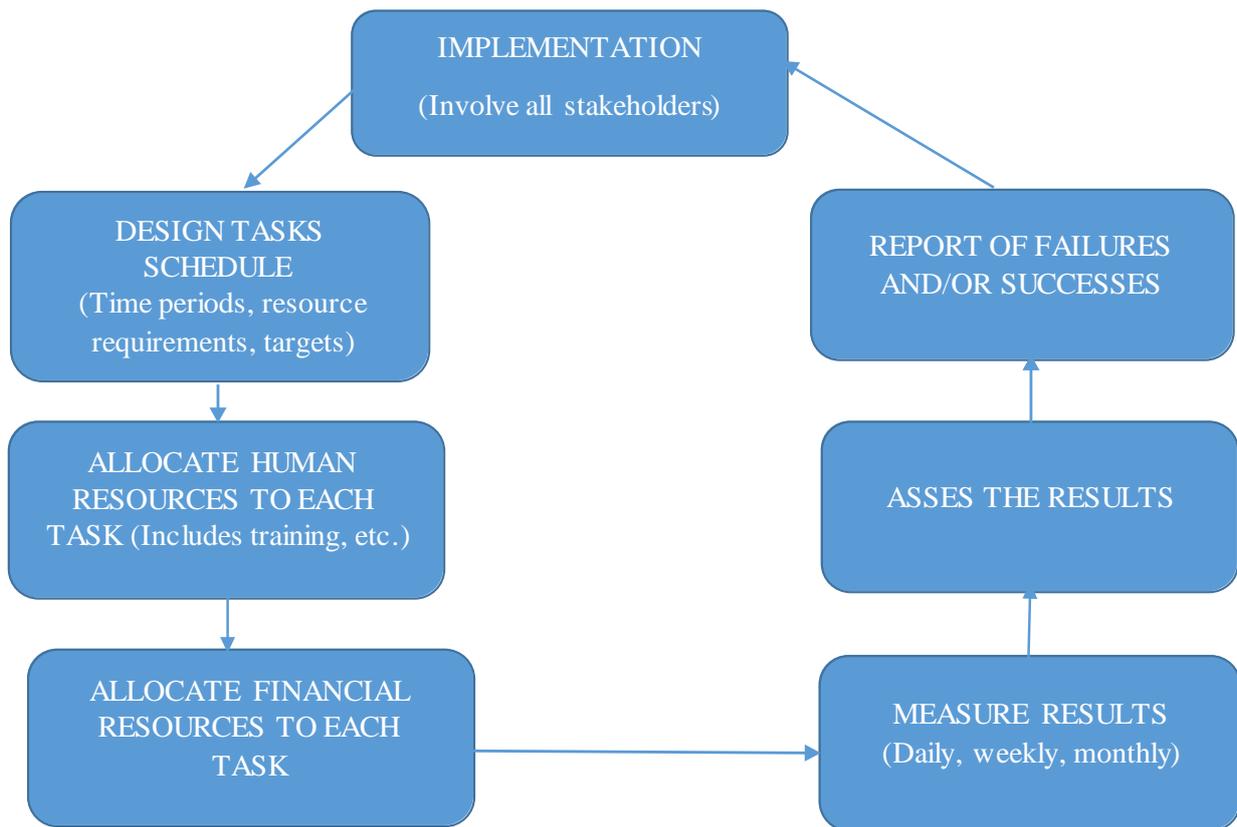
From this, they can be able to determine the type and form of information to have. In addition, they can also suggest or determine where and how to get this information for actions and decision-making. They would be able to define these actions on a time scale and resources required. Simply put, after the construction of a CMV or a NMP, there must be a next phase of developing an action or implementation plan, which outlines the targets and resources that are needed. These will specify the capacities that will be required to implement the action plan. Appropriate training will then be identified in many areas for various levels as necessary. See policy implementation in figure 2.

An analysis of the nine themes of the AMV indicates that collectively, they address the framework as discussed above. The nine themes are:

1. Mineral revenue and mineral rents management;
2. Geological and mineral information systems;
3. Building human and institutional capacities;
4. Artisanal and small-scale mining;
5. Mineral sector governance;
6. Research and Development;
7. Environmental and social issues;
8. Linkages and diversification; and
9. Mobilising minerals and infrastructure for development.

These themes aim to achieve sustainable contribution of the minerals sector to the socioeconomic development of member States and the continent. The immediate and most important beneficiaries of implementation are likely to include: government, specific communities, the private sector, institutions of learning and research, foreign and local investors.

Figure 2  
**Policy implementation**



It is critical that:

- There is programme alignment amongst the stakeholders or participants;
- Sufficient government resource mobilisation; and
- Supportive political governance and consistency when there are changes in government, i.e. changing political leadership.

Monitoring progress in this regard requires:

- Completing the required prioritised actions as planned; and
- Meeting guideline targets for improved human well-being or contribution to society from the sector as defined by the national and/or sector objectives.

This section aims to emphasise *participation processes*, a theme that will be recurring in other modules.

The initial focus should be on capacity building to implement policies, strategies and programmes through stakeholder ownership, coordination and collaboration. The next module deals with this subject.

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1. African Development Bank and Bill & Melinda Gates Foundation, 2015. Paper 1: A framework – Human development and the links to natural resources.
2. The Atlas of Economic Complexity: mapping paths to prosperity. Hausmann, Hidalgo et al, 2007. Center for International Development, Harvard University; ABC, Massachusetts Institute of Technology.
3. Otto, J. and Cordes, J., 2002. Historical perspectives on international law and policy.
4. Porritt, J., 2007. Capitalism as if the world matters.
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## Relevant reading

1. African Mining Vision, Country Mining Vision;
2. Your country National Development Policy or equivalent or Vision document;
3. Your nation industrial policy;
4. Your national minerals policy and implementation plan.

## Discussion questions

1. Can you identify linkages between the elements of your country's mineral policy to national objectives?
2. Is the drive for mineral economies to build stronger linkages of the mining sector with other industries realistic given current constraints? Give specific country case examples.
3. How has the interpretation of 'benefits' in the African Mining Vision informed mining regulation in your country? Expatiate on social investments, fiscal issues, environmental regulation, stakeholder engagement, and mining companies and government relationships.
4. What have been challenges to a regional approach to minerals benefiting member States?

## Module 2: Skills development and Research and development (R&D)

Three aspects needed for achieving the intended benefits of mineral resource endowment, from the review<sup>6</sup> of the implementation of the AMV through the AMDC, are:

- Strategy, management and monitoring system;
- Activities should be implemented by member states, with the help of partners; and
- Full participation of all stakeholders at all levels (country, regional, continental).

Studies<sup>7</sup> undertaken on the continent brought to the fore the following status on the situation on mining sector skills on the continent:

- Insufficient capacity across all stakeholders (government, private sector, civil society) in varying proportions; and
- Insufficient staff capacity/capability and infrastructure.

In the case of governments, the shortcomings include:

- Struggle to find local people with requisite skills for some vacancies;
- Struggle to keep professionals abreast of technological developments in their fields;
- Staff lack practical experience in mines inspectorates;
- Inadequate staffing and thinly spread across centres of mineral resources management;
- Inability to compete with remuneration of industry and abroad;
- Weak expertise in certain key areas, e.g. taxation, community relations, negotiations, environmental management; and
- Outdated infrastructure and equipment in government.

It is important to note that while capacity constraints exist, there are pockets of competencies in some countries.

In the case of industry, the capacity and/or capability issues include:

- Trained professionals leaving for opportunities abroad;
- Aging workforce;
- Certain skills are not available locally;
- Locals have very strong theoretical background and without necessary practical training; and
- Inadequate artisanal skills.

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<sup>6</sup> UNECA, 2017, Mid-Term Evaluation (AMDC).

<sup>7</sup> Cardno Emerging Markets Pty Ltd, 2012. African Mining Administration Skills Analysis; AusAID, 2012. Database of mining related educational and training programs and facilities .

Just like in governments, there are pockets of competencies in some countries.

In the case of civil society, the capacity and/or capability challenges are:

- Mining communities have very low literacy and numeracy skills;
- Poor engagement among government, mining companies and mining communities;
- Few NGOs involved in the mining sector;
- Inadequate funding available to NGOs; and
- Skills and training required for NGOs – management, fundraising, communications, etc.;
- Improved access to information regarding the mining sector;
- Build capacity of community leaders and communities in mining issues; and
- Insufficient capacity on the ground to drive sustainability initiatives beyond mining.

At regional levels, there are competencies, for example the TWN, SARW, TJN-A and ZELA, among others, which are active in mineral resource governance. These have been at the forefront in popularising the AMV.

In the case of mining academic institutions, most require:

- Infrastructure support;
- Strengthening staff capacity/capabilities;
- Support of student scholarships;
- Support of academic Chairs; and
- Developing curriculum.

There are considerable differences between institutions across the continent.

Against this background, there is need to strengthen capacity of member States and Regional Economic Communities (RECs) to implement the AMV. Skill shortages, both public and private as seen from above, limit productive capacity in higher value chains and more innovative government procedures. It is thus necessary to identify needed skills and take appropriate actions. For example, raw or semi-processed commodities offer little room for innovation and employment creation which could have beneficial spinoffs like empowering women, the youth and the poor. Higher value products are achieved only through increased skills and knowledge. Therefore, education should not be viewed as a social sector only but also a core sector for the productive economy. The education sector should reconcile these two sides of the same coin to provide competencies, knowledge and skills necessary to promote, develop and sustain the sector. The skills required for the sector should take into consideration opportunities along the mining value chain as well as those that link with other sectors of the economy. Figure 1 shows the mining value chain and hence the need for such skills.

Figure 1  
**Mining value chain**



Figure 2 shows policy making institutions and skills along the mineral value chain required for extracting benefits from mineral development. This may be classified as the second set of skills required for implementing the AMV.

Figure 2  
**Policy institutions architecture for mineral development**



Source: World Bank, 2017.

The third set of skills may be reflected as shown in figure 3, which refers to the various linkages – upstream, downstream, side-stream and lateral linkages. The figure shows skills and competencies in linkages the mineral sector has with the broader economy.

Figure 3  
**Mineral value chain linkages**

Source: Lydall, M., 2010.

In terms of training and capacity building, there are several models and combinations depending upon the target audience. Covid-19 has also demonstrated that a fair amount of training can be made online with many participants. Some of these models would include the following:

- Short courses & inter-country study tours and country programmes (peer learning, sharing experiences) – lectures, seminars, visits, etc.;
- Undergraduate programmes;
- PG support programmes;
- REC inter-linkages;
- Economic and technical capacity building; and
- Delivery through country programmes, RECs programmes and partnerships.

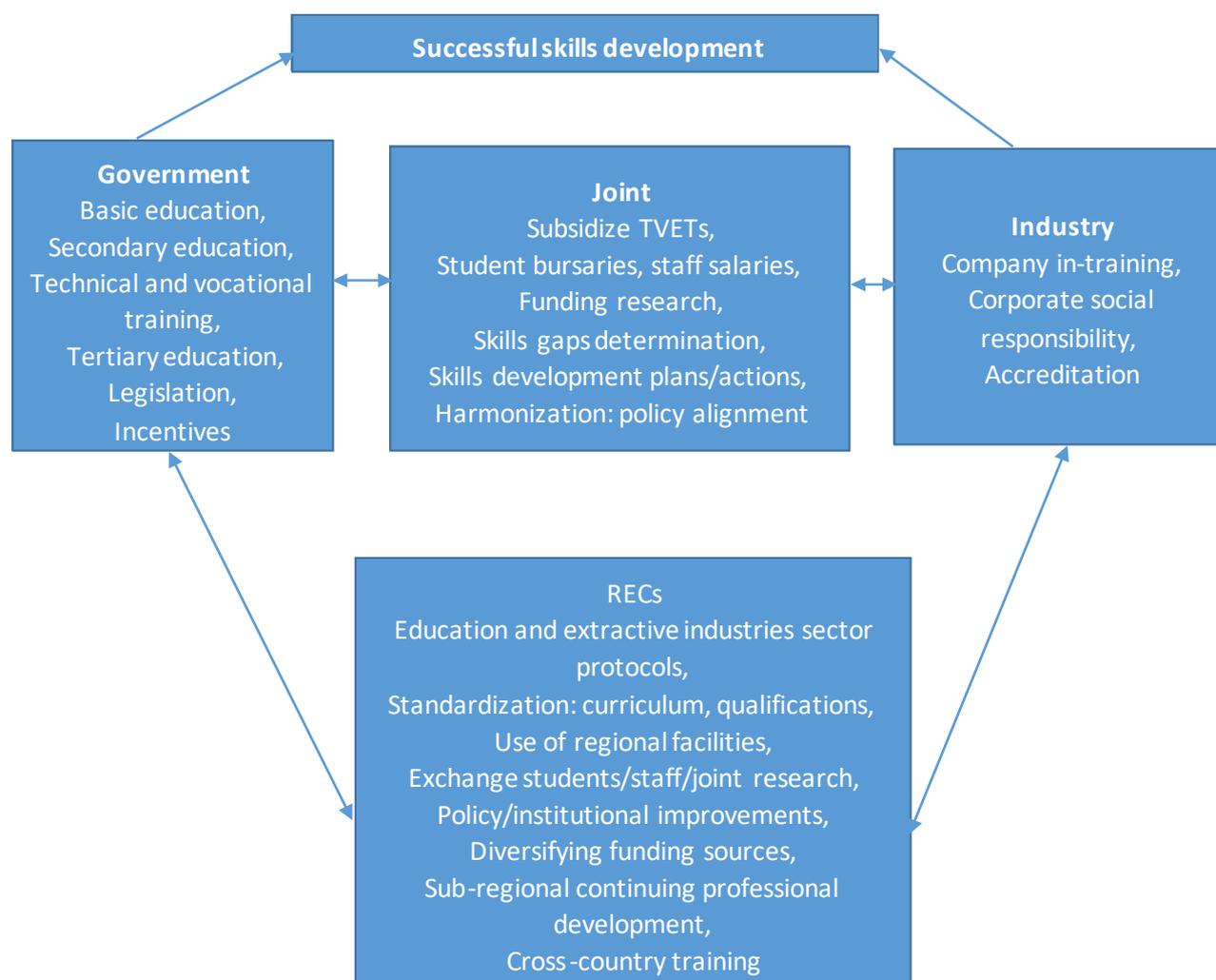
The role of government is coordination of various interested stakeholders and partners – policy coordination, developing regional and national accreditation frameworks. Collaboration between various stakeholders is needed to balance the needs of society and the

supply of the skills and knowledge<sup>8</sup>. This can take several types of mechanisms, for example, agencies. Each stakeholder in figure 4 has unique and joint or several roles in capacity building at various stages.

### The roles of various stakeholders in skills development

Figure 4

### The roles of various stakeholders in skills development



Source: AfDB and BMGF, 2016.

### Research and development

The research and development (R&D) envisioned in the AMV and Action Plan attribute to technical solutions and innovations for industrialisation. As indicated above, higher value products can only be achieved through skills, knowledge and innovation. Innovation requires investments in R&D. All segments of the mining industry should undertake R&D, including the areas that are considered non-core mining areas where the

<sup>8</sup> AfDB and BMGF, 2016. Paper 7: Leveraging extractive industries for skills development to maximise sustainable growth and employment

majority of the people are found. There are many problems in the sector's sphere that require different types of skills and levels. These span across all stakeholders, including government, industry, academia, civil society, etc. For example, there are societal and political issues that should aim to improve mining practice and all its segments, which might encompass mining and development, sustainable development, environment, etc. The definition of research and development would include increasing efficiency of mineral extraction and product development.

Anyone can initiate R&D, and if the idea is good it will be picked up provided it is published<sup>9</sup>. The range of areas will include:

- Social sciences – law, politics, management, human and community relations;
- Economics – basic economics, finance, accounting and money management;
- Humanities – including philosophy, languages, history;
- Engineering – mining, civil, process, mechanical, electrical;
- Science – environmental, biology, mathematics, physics, chemistry

There is a lot of relevance to mining related research. This then provides an opportunity for almost all mineral producing countries to promote R&D in any areas of mineral value chain to improve local activities and provide opportunities for shared experiences.

Encourage interdisciplinary and collaborative R&D. This will promote borrowing ideas from other disciplines and thereby providing cross-over employment opportunities, while building the image of mining in line with the objectives of the AMV.

Departments in universities could collaborate on interdisciplinary mining-related research, for example political scientists on mining law, economists on models of revenue generation, etc. African universities can also collaborate by undertaking R&D in various fields and collaborate with foreign universities which have already established avenues and track records.

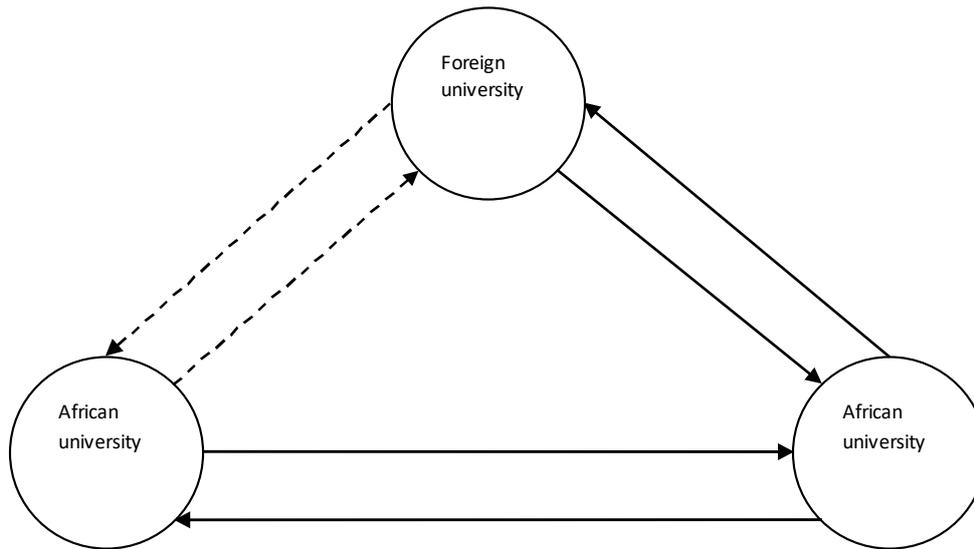
Figure 5 is an illustration of possible collaboration between African universities and foreign institutions. Not all African universities would collaborate directly with overseas institutions. The dotted line shows some connection indirectly between foreign entities and African ones but directly through the solid line. Exchanges of skills, knowledge and innovation would still flow benefiting all. This also holds for research institutions.

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<sup>9</sup> Caldwell, J. A. Technology review: Mining Research and education

Figure 5

### Collaboration between universities



### Linkages and diversification

The theme aims to promote linkages between mining and other economic and social activities. Value chain is a sequence of production or value adding activities leading to and supporting end users of a particular product<sup>10</sup>. The process is from inception to final consumption. Value chain encourages the investigation of the distribution of that value among various actors and promotes the search for upgrading strategies. Value chains have a geographic dimension, spanning national, regional or global depending on processes. At national level, it is important to know which links are within, how profitable and potential for bringing additional links.

Value chain analysis facilitates understanding of the distribution of returns from different activities of the chain. It involves breaking into constituent parts, helping to understand the structure and functioning and assessing the scope for systemic competitiveness. It also highlights chain coordination and showing a pattern of control, called governance, in the value chain. Some firms directly or indirectly influence organisation's chain production, logistics and marketing systems. Governments can make initiatives for other actors to take decisions in a range of activities to be domesticated in the national or regional economies.

Capacity development entails understanding the value chains of minerals for national or regional development and integration. This includes critical issue of skills in accessing information to opportunities (imports/production) data for decisions to be made and actions to be taken. At each stage of the value chain a decision is made whether benefits exceed costs. If costs exceed benefits at a stage, this will likely imply that government is subsidising business or, simply put, the tax payer is carrying the burden. These are policy decisions where benefits may be lying elsewhere.

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<sup>10</sup> Value Chain Analysis.

## Mobilizing mining and infrastructure investment

Africa's large infrastructure deficit, especially in transport and energy, wider investment in mining projects remains a constraint to increased mineral development. Natural resources driven development corridors (simultaneous infrastructure and mining investment) provide a great platform for mobilising investment.

The spatial development initiative (SDI) is a short-term, focused programme of specific activities and interventions to facilitate investment-led growth. It is a methodology aimed at creating opportunities for successful new fixed investments in identified specific areas and mobilising the requisite investment. Its objectives are to:

- Stimulate or increase levels of investment from foreign, regional and local sources;
- Promote regional economic growth and development; and
- Create sustainable employment.

The SDI is thus a tool for promoting inter-related infrastructure and large-scale resource sector investments (anchor projects) in defined areas, in order to realise the latent investment potential in the SDI "catchment" areas. The developmental impact of the SDI densification (collateral impact) is often greater than that of the high capital expenditure (capex) anchor projects. In general, the resource rents embodied in mineral resources tend to be much greater than those in other resource sectors (agriculture, forestry, fisheries), resulting in mineral anchor projects shouldering the costs of the trunk infrastructure (transport & power) through use-or-pay agreements that underpin their financing. However, the other resource-based investment opportunities (densification), realised through the mineral resource anchor project/s infrastructure, tend to impact economically on a much larger segment of the population (greater developmental impact).

However, the high development impact densification is critically dependent on:

- The condition that all of the trunk infrastructure is available to third parties (open access) at non-discriminatory prices and that the infrastructure is over-dimensioned to cater for the expected third party users; and
- The provision of feeder infrastructure is to connect other potential users to the trunk infrastructure. This SDI densification infrastructure is generally not concessionable through PPPs and oftentimes requires grant financing (from the fiscus or donors)

The SDI methodology in a defined Development Corridor (DC) project area entails the following elements of work:

- The scoping of the DC area as a means to achieving consensus amongst stakeholders on a conceptual business case in which a broad development objective and the main economic drivers are identified;
- The identification and profiling (project packaging) of viable resource anchor project/s and associated infrastructure (SDI trunk infrastructure);
- An intensive appraisal of existing economic activity on a sectoral basis;

- A scan for other viable investment opportunities (realisable through the trunk infrastructure) and the identification and profiling of requisite feeder infrastructure and sectoral economic projects (densification);
- The un-packaging of the major investment projects to maximise the backward and forward linkages (local supplier industries and beneficiation/Value Addition);
- The identification and removal of infrastructural, policy and regulatory, bureaucratic, or institutional constraints to investment as well as those steps required to overcome them (“de-bottlenecking”);
- The carrying out of project appraisals to develop a portfolio of investment projects that can be tested for feasibility and for which appropriate funding models can be developed; and
- Engagement with and mobilisation of private sector interest through the development of concession (PPP) documents and appropriate investment marketing strategies.

If the DC is a regional programme involving two or more countries, it is necessary to obtain buy-in from the participating governments and formalise an agreement through a Memorandum of Understanding (MOU) and organisational arrangements, particularly regular bilateral meetings. A project manager must then be appointed to drive the formulation of a business plan for implementation, which becomes his/her work contract.

From the experience gained on the South African Regional SDI Programme it is evident that there are a number of critical success factors that determine the relative success of any DC on which the SDI methodology is applied. These include:

- Obtaining initial political commitment and maintaining this throughout the SDI process;
- Installing an adequate technical capacity to implement the SDI work programme, usually through in-country project management;
- Keeping stakeholders focused on the agreed conceptual business case for the DC;
- Engaging in a targeted interaction with the private sector; and
- Effective institutional arrangements.

The role of government in facilitating Development Corridor would include the following:

- Initiating DC based on realising inherent economic potential through the provision of infrastructure rather than a tool for developing remote areas;
- Facilitating the engagement of all players in the economy (private, public and civil society);
- Engagement of all economic and infrastructure sectors;
- Embed corridor effort or strategy in the integrated industrial policy of the country; and

- Engage in regional integration efforts to facilitate DC development.

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7. UNECA, 2017, Mid-Term Evaluation (AMDC)
8. World Bank, 2017. Oil, Gas, and Mining – A Sourcebook for Understanding Extractive Industries
9. Value Chain Analysis, Anon

## Discussion questions

1. How is overall planning for skills development in your country?
2. How are skills determined and planned for the sector in your country? Which skills receive priority and how are they justified?
3. Sketch the interconnectedness of stakeholder participation in skills development in your country including regional collaboration.
4. Illustrate the structure of sector education system along the value chain in your country
5. Discuss the role of industrial policy in skills and capacity development in your country.
6. How else do you think sector skills can be enhanced, both locally and regionally?

## Module 3: Knowledge and information sharing platform

There are issues that emerge facing the mining industry in general from time to time which require concerted effort by member States. Some examples include the global challenge facing the issue of blood diamonds, which resulted in the Kimberley process; the effect of the disposal of gold stockpiles by governments on the international markets; technological advancements, markets and the effect of disruptions like Covid-19. A common approach to such issues goes a long way towards a common African agenda.

Such issues should form the basis of Forums of African Mining Ministers Responsible for Mineral Resources Development to engage in benchmarking issues on an annual basis; to review the status of the mineral sector and issues facing Africa; to decide what issues can be addressed as a group; to review where Africa had been the preceding year; opportunities for the future and how to proceed as a continent. If annual events are advocated, specific themes may be identified and focussed on periodically.

Neighbouring countries, countries with bilateral arrangements, Regional Economic Communities (REC's) and the AU Ministers Forum should have policies and programmes; and create a unity of purpose with specific programmes for working together. Relevant structures are already in place in some REC's like the SADC and ECOWAS, which already have harmonisation ideas. Building on these strengths will go a long way towards capacities for growth for all in the African mining sector.

In summary, therefore, an approach towards best practice and working together as a first step should start with forums for discussing experiences and development in identified key areas. The practice of concentrating only on specific projects does not take Africa anywhere.

This module will unpack two issues: the impending common adoption of fourth industrial revolution in the mining industry and the effect of Covid-19. These are real issues that need addressing as they affect the continent's mining sector.

### Discussing fourth industrial revolution effects in the mining sector

It is essential to understand the new technology revolution and implications in the African minerals sector. Digital transformation is now a priority for many industrial companies and mining companies are no exception. This thrust is not a future trend, but part of their strategy and research agenda<sup>11</sup>. It is therefore, important to understand the new technology revolution and implications in the African minerals sector. This segment reviews the elements of digital application and implications in the minerals sector.

The industrial revolutions may be classified through the following four stages:

- First, where water and steam power replaced muscle power;
- Second, where electricity was used for mass production;

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<sup>11</sup> PwC, 2016. Industry 4.0: Building the digital enterprise. South African highlights

- Third, where electronics and information technology was used to automate production; and
- Fourth, where there now is convergence across physical, digital and biological domains.

The fourth industrial revolution (4IR) is in the form of: computing power, digital devices, sensors, connectivity, analytics, cloud computing, cognitive automation, the internet of things, technological ecosystems and user interfaces. The 4IR has changed how humans live and work. It will disrupt lives of companies, individuals and communities. Mines in Africa will need to acknowledge the looming and real changes brought by 4IR and their impact on the role of the mineral sector in societies.

Mining companies face challenges and are consistently investing efforts to address them to remain profitable and competitive, among others. Some of these challenges they aim to address include the following:

- Declining ore grades;
- Deepening and complex ore bodies creating technical challenges;
- Commodity fluctuations, particularly downturns;
- Labour conditions;
- Regulatory conditions;
- Upward cost pressures;
- Safety considerations;
- Environmental and community pressures;
- Access to accurate/complete/timely data for meaningful decision-making; etc.

4IR provides enormous opportunities to address these, but at the same time this creates challenges for mining companies. These new challenges include the following, among others:

- New skills requirements;
- Changing workforce;
- Organisational restructuring;
- Adoption of new technologies; and
- The potential loss of social licence to operate

The future digital mine with 4IR will have, among other things, automated physical operations and digitised assets. Examples of 4IR applications in the minerals sector include:

- Automated equipment, to improve productivity, reduce costs, improve safety, etc.;
- Drones, for data collection, inspection, stock control and safety monitoring;
- 3 D printing, to reduce lead times and inventory holding costs for critical parts;
- Wearable technologies, for enhanced operator safety and support real time machine instructions;

- Internet of Things, for sensor network providing low cost real time data across operations; and
- ‘Digital twin’, to provide accurate digital model of the physical environment including geological, engineering and asset information to simulate business and operational decisions virtually.

This is all aggregated at a digital mine nerve centre, which brings together real data across the mining value chain, to improve planning, control and decision-making to optimise output, cost and capital expenditure, and improve safety. It improves visualisation, reporting and monitoring, etc. Digitisation extends to supporting processes and systems, which include supply chain, Human Resources (HR) and finance.

The potential of using digital technology to manage mines more effectively is identified as:

- Evidence-based insights having a 10-20% improvement potential;
- Integrating information having 20-30% improvement potential; and
- Redesigning integrated system – integration and optimisation of all technologies across the mine to work differently has a greater than 50% improvement potential.

### **The implications and responses**

- Skills development. Blend of technology enhancements and traditional learning. Job skills will require not only heavy emphasis on Science, Technology, Engineering and Mathematics (STEM), but also those that work with data and algorithms, and encouraging critical thinking, creativity, emotional intelligence, etc. This will form emphasis of reskilling employees as technology is employed. This goes for considerations in communities as well for appropriate local cluster development. The requirements of 4IR may necessitate the re-designing of mining and related qualifications in universities and other institutions of learning.
- There is potential and real loss of low-skilled labour in the sector. Those that are the most at risk are the routine and repetitive ones. At the macro-level, this gives rise to segregated “low-skill/low-pay” and “high-skill/high-pay” segments, which may lead to greater social tensions and inequality that are already common in mining communities. An increasing wealth gap may fuel tensions further.
- Digital mines have resulted in big shifts away for traditional mining technology, nature of resources needed to manage that infrastructure. This has serious implications on local content policies, among other things.
- The biggest beneficiaries of innovations are providers of intellectual and physical capital – innovators, shareholders and investors – with others, especially communities left behind. The key issue will be to interrogate how digital technologies could provide means to address social and economic inefficiencies in communities, stimulate local economic growth in ecosystems where mines operate and build self-sustaining communities to weather bad times. This requires

collective approach by mining companies, government and communities to inform digital strategies.

- Use a “shared value framework”, which uses the key concept that competitiveness of a business and the health of the community in which it operates are interwoven. Table 1 provides an example of shared value initiative.

**Shared Value Initiative – Extracting with a purpose**

<b>Reconceiving products and markets</b>	<b>Redefining productivity and value chains</b>	<b>Creating an enabling local environment</b>
Build local markets for intermediate products created by extractive activity (e.g. drinking or irrigation water, electricity)	Improve local workforce capabilities	Develop the local cluster supporting the extractive sectors
	Strengthen suppliers in the value chain	Invest in shared infrastructure and logistics networks
	Increase local disaster and emergency preparedness, response and rehabilitation capabilities	Partner with other local clusters and government in building community infrastructure
	Improve utilisation of water, energy and other resources used in operations	Play an active role in broad-based economic and community development
		Improve local and national governance capacity

Source: FSG, 2014.

**References**

1. Deloitte, 2018. The future of mining in Africa – navigating a revolution
2. PwC, 2016. Industry 4.0: Building the digital enterprise. South African highlights
3. FSG, 2014. Shared Value Initiative – Extracting with a purpose

**Discussion questions**

1. Recap implications of implementing 4IR and the digital mining economy.

2. What do you think will be some of the greatest challenges facing the transition to the digital mining economy?
3. Do you think 4IR is beneficial for most African countries?
4. What preparations should African countries make for the inevitable global adoption of 4IR?

## Discussing Covid-19

Global activities will not be the same as before Covid-19. There is a fair amount of uncertainty and lack of control; we therefore cannot assume it will be like switching off and switching on a light bulb to its original intensity. How a country or region adjusts to the new way depends upon how it perceives and responds to externalities and charts its agenda. This sets the tone for sector approaches. At the global level, the following are likely to happen:

- Globalisation might slow; □ Governments' roles will likely dominate for some time and setting priorities, for recovery and the new future;
- Slow recovery of economic sectors:
  - Savings and expenditure patterns
  - Consumer patterns might change or take long to ramp up
  - Global demand might reduce
- Minimising supply risks:
  - Developing local supply chains
  - Diversifying sources of inputs
  - Strengthening regional (neighbourhood) supply chains
- Emphasis on climate change:
  - Decarbonise economies
  - Increase development of alternative fuels

There are specific implications for the mineral sector requiring specific actions at country and regional levels. These are summarised in table 2 below as pointers for discussion.

### Dealing with Covid-19 in the mining sector – some issues for discussion

Phase	Global	Country	Sector
Pre-COVID-19	Interconnected	Private sector domination	Global chains
COVID-19	Closed: - Transport - Trade	Government role dominates: - Country isolates	Shut down/slow: - Support initiatives to communities

	<ul style="list-style-type: none"> <li>- Value chains</li> <li>- Each country to its own fate.</li> </ul>	<ul style="list-style-type: none"> <li>- Disaster relief strategies</li> <li>- Economy stagnates</li> <li>- Service/essential work only</li> </ul>	<ul style="list-style-type: none"> <li>- Support initiatives to the state</li> </ul>
Post COVID-19	Reboot	Reboot	Reboot
Phase 1	Reopen borders: <ul style="list-style-type: none"> <li>- Necessities</li> <li>- Cooperation and alliances</li> </ul>	Reopen economy: <ul style="list-style-type: none"> <li>- Government oversight and priorities</li> </ul>	Reopen operations: <ul style="list-style-type: none"> <li>- Safety of personnel, customers and business partners</li> <li>- Avoid transmission</li> <li>- Avoid recurrence</li> </ul>
Phase 2	Slow recovery <ul style="list-style-type: none"> <li>- Consumer confidence</li> <li>- Savings and expenditure pattern</li> </ul>	Re-programme: <ul style="list-style-type: none"> <li>- Indigenous knowledge based culture with traditional systems and values</li> <li>- Focus on services and SMMEs</li> <li>- Proactive economic policy</li> <li>- S&amp;T, R&amp;D aimed at self sufficiency</li> <li>- Growth in useable innovation</li> <li>- Environmental system (climate change) innovation</li> </ul>	Re-programme (the next normal): <ul style="list-style-type: none"> <li>- Revisit exploration strategies</li> <li>- Social participation in the economy</li> <li>- Linkage development in the local economy</li> <li>- Mechanisation and automation</li> <li>- Broadening markets and products</li> <li>- Remote working</li> </ul>
Phase3	Reform: <ul style="list-style-type: none"> <li>- Minimising supply risks</li> <li>- Developing local supply chains</li> <li>- Early warning systems</li> <li>- Emphasis on climate change</li> </ul>	Reform: <ul style="list-style-type: none"> <li>- Regional and continental focus</li> <li>- Implementation of regional and continental social contracts, with directed plans for incremental development</li> </ul>	Reform: <ul style="list-style-type: none"> <li>- Critical stages in the regional and global value chains</li> <li>- Broadening markets and products</li> <li>- Mitigating risks</li> <li>- Build resilient communities</li> <li>- Diversify input sources</li> </ul>

		<ul style="list-style-type: none"> <li>- Regional and continental social-economic policies</li> <li>- Regional stability and strengthening regional identity</li> <li>- Regional S&amp;T investment climate (sharing facilities)</li> <li>- Innovative application of regional indigenous knowledge</li> </ul>	
<b>Specifics</b>	<b>Climate change</b>	<b>Climate change</b>	<b>Climate change</b>
	Public demand for cleaner air	<p>High level stakeholder task team(government, civil society, industry, clean energy):</p> <ul style="list-style-type: none"> <li>- Develop strategies aligning potential growing market for key commodities with sustainable future</li> <li>- Mapping minerals and generating data for potential investors</li> <li>- Understanding supply constraints and demand patterns</li> <li>- Developing networks and raising awareness</li> <li>- Facilitating linkages among research and social communities</li> </ul>	<ul style="list-style-type: none"> <li>- The contribution of mineral sector on climate change (i.e. the sector's GHG emissions footprint)</li> <li>- Implementation of legislation and regulations to reduce emissions (i.e. carbon tax laws) – implications on the mineral sector (i.e. fossil fuels and energy supply in coal dependant countries)</li> <li>- Assessing the impacts of climate change on mining operations, supply chains and communities (i.e. given the increasing frequency of natural disasters)</li> <li>- The need for mitigation strategies to reduce</li> </ul>

		- Recycling rate improves availability of these minerals	GHG emissions and adaptation models to safeguard operations. - Opportunities brought by the need to exploit mineral inputs needed in green/renewable energy technologies (i.e. rare earths)
	<b>Consumer spending</b>	<b>Consumer spending</b>	<b>Consumer spending</b>
	- Might take long to come back to earlier levels - Might change	- Respond to Scenarios	- Respond to Scenarios
	<b>Broad contraction of economic growth</b>	<b>Broad contraction of economic growth</b>	<b>Broad contraction of economic growth</b>
	- Reduced global demand	Expand markets through regional and continental programmes	- Respond to Scenarios

## References

1. PwC. Mine 2020; World Bank, 2017. The Growing Role of Minerals and Metals for a Low Carbon Future.
2. Columbia Center, 2020. Don't Throw Caution to the Wind: In the green energy transition, not all critical minerals will be gold mines.
3. McKinsey & Company, 2020. The future is not what it used to be: Thoughts on the shape of the next normal.
4. K4D, 2020. Impacts of Covid-19 on inclusive economic growth in middle-income countries.

## Discussion questions

1. Recap implications of the effects of Covid-19 in African economies.
2. What do you think will be some of the greatest challenges facing the African mining sector post Covid-19 pandemic?
3. Do you think Covid-19 pandemic may have a silver lining to the African mining sector development and growth?
4. In your view, do you think that it may be wise to shift focus to development of renewable energy minerals?
5. At the regional and continental levels, what do you think Africa's options post-Covid19 strategies should be?

It does seem that stakeholders – globally, nationally and locally – do not have sufficient control of the environment and issues and definitely uncertain about the future. *In such an environment, therefore, the best way forward is to identify key uncertainties and develop scenarios to map possible options for appropriate decisions to move the sector forward on its path of continued contribution to development.*