
IGF

INTERGOVERNMENTAL FORUM
on Mining, Minerals, Metals and
Sustainable Development

INDABA 2020

# IGF SUSTAINABILITY FORUM

# MINING 4.0: HOW TECHNOLOGY AND INNOVATION ARE TRANSFORMING THE MINING SECTOR

**February 3, 2020 | 14:00–16:00 | Roof Terrace Room**
**Cape Town International Convention Centre | Cape Town, South Africa**

## MEETING SUMMARY

The Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF) hosted a Sustainability Forum on February 3, 2020, with participants of the African Mining Indaba in Cape Town at the Roof Terrace Room of the Cape Town International Convention Centre. The theme of the forum was ***Mining 4.0: How technology and innovation are transforming the mining sector***. The IGF partnered with the International Council on Mining and Metals (ICMM), the World Economic Forum (WEF), the Organisation for Economic Co-operation and Development (OECD), and the Tax Justice Network Africa for this year's annual forum.

More than 100 participants attended the interactive discussions on the challenges and opportunities of innovation and new technologies in mining through the lenses of skills development and the future of work, as well as the implications for government revenues. Participants came from diverse sectors, including government, the private sector, civil society, international organizations, and academia.

## SESSION 1: BUILDING SKILLS FOR A SUSTAINABLE FUTURE

This first session was devoted to exploring a number of key questions facing the industry: What do new mining technologies mean for the future of work? What types of skills will be needed, and how can mining companies, governments and others ensure that local stakeholders have the necessary skills to allow mining to make its proper contribution to sustainable development?

An expert panel lead by Aaron Cosbey, Senior Associate from IGF, and comprised of Aidan Davy, Chief Operating Officer of ICMM; Jörgen Sandström, Head of Mining and Minerals Industry Group of WEF; Kemal Öskan, Assistant General Secretary of IndustriALL Global Union; and Froydis Cameron-Johansson, Head of International and Governmental Relations of Anglo American, shared their experience on these complex issues with the audience. The summary of the discussions follows.

**Aaron Cosbey** set the context by noting that the session would focus on what new technologies mean for the relationship

between mining companies and their host communities as well as their host countries. He noted that mining is in the midst of a wave of profound transformation: disruptive, creative destruction, similar to that which has already revolutionized manufacturing, retail, communications, entertainment, and other sectors. The technologies involved are in fact syntheses and adaptations of innovations that have developed outside the mining sector: artificial intelligence and machine learning, blockchain, drones, geographic information systems, electric vehicles, renewable energy generation and storage, cheap radio-frequency identification sensors, 5G, the Internet of Things, and the processing capacity to handle big data. Brought to bear on the mining sector, all of this comes together to mean the mines of the future will be data-rich optimized environments. They will look quite different from the mines of today, with more efficient operations using less energy, emitting fewer greenhouse gas emissions, logging fewer accidents, exploiting previously unviable resources, and opening up new opportunities for women and youth in the sector.

Cosbey observed that these are all very good things but that any technology has both positive and negative impacts, and anticipating and addressing the negative is crucial if we hope to benefit from the positive impacts that new tech can provide. He prompted the panellists to reflect on these issues from their distinct perspectives.

## OPPORTUNITIES AND CHALLENGES REGARDING TECHNOLOGICAL AND INNOVATIVE ADVANCEMENTS IN THE MINING SECTOR

In line with Aaron Cosbey's initial remarks, **Jörgen Sandström from the WEF** opened by simply stating the future is here: 5G has rolled out in all industries and 6G is being tested in mining. At Davos, the discussions focused on social cohesion, with some predicting twice as many jobs being created by the Fourth Industrial Revolution. He noted that, as a sector, it will be incumbent on mining to reskill 1 in 10 people over the next 10 years and to consider how to support employees on pathways to social mobility. That means the right education and the right skills aligned with the right jobs—better jobs.

He argued that we are not looking at an entirely negative future on the job front but highlighted that technologies are developing at an accelerating pace and that, as a result, a number of tasks and abilities are likely to be performed by machines. He stressed that these would open new opportunities for the mining sector, but that the sector would have to manage this transition to ensure that gains are maximized, negative impacts are contained, and opportunities are shared equally, regardless of gender, age, and origin.

Sandström focused in particular on the need to facilitate the implementation of a positive and proactive approach to better tackle the future employment and the related skills needed for the jobs of the future. Key programs would have to include reskilling and upskilling of existing labour, targeted programs to attract new talents, strategies to facilitate inter- and intra-industry employees' redeployment, and new ways of thinking about corporate responsibility to support those who would be displaced by automation.

He stressed that we need good data and aligned policy, with policy lighthouses or beacons to help better coordinate between business and their associations and with a reskilling delivery mechanism that works for all stakeholders. Focusing on closing the skills gap with accelerators such as good policy is critical. The WEF Mining and Metals Community Task Force, established as part of the Shaping the Future of the New Economy and Society Platform, can help to increase awareness and identify and promote leadership. He acknowledged that tensions are high because of fears of job loss and agreed that some jobs—such as accounting, payroll desks, assembly, stock keeping, financial analysis, and driving—are being replaced. But he reiterated that there will be new and better jobs and ended with a few examples of current jobs and future jobs to show the difference.

**Aidan Davy from ICMM** began by outlining the opportunities and challenges with the advent of technological changes such as increased


digitization, automation, and the other high technologies in the mining sector. Based on his experience with ICMM membership and in recent publications, he detailed the positive dimensions and potential that technology and innovation bring to the sector. From an industry perspective, technology and innovation have great potential to:

- Optimize operations and improve mineral processing and recovery rates.
- Increase productivity, as exemplified by a recent decision by one American company to roll out machine learning technology across mines in the Americas with the goal to raise its copper production across their portfolio of assets in the Americas by about 5%.[1]
- Enable safer mining activity overall with a lower carbon footprint and therefore reduced greenhouse gas emissions.
- Salvage or reverse a declining trend in productivity. In an era of declining ore grades, the application of technology and innovation sustains productivity gains as opposed to losses. A reference was made to the McKinsey Mine Lands Productivity Index, which demonstrated a decline in productivity in the mining sector between 2004 and 2014 that, in some cases, was running at about 10% per year. The data showed that a reversal was only made with a sustained focus on reducing headcount and boosting labour productivity.

Davy further contended that mining has been a significant driver of development in the past 20 years in many resource-dependent countries, including in Africa.[2] However, he explained that the challenge remains whether the social progress and economic gains over the past two decades are going to be sustained over the next two decades as technology and innovation accelerate.

Davy recognized that, realistically, local communities are the most vulnerable to changes due to advances in technology and innovation. In terms of employment, jobs that are traditionally staffed locally or nationally (drilling, blasting, truck driving, etc.) are expected to decline, given the trend toward automation. However, higher-skilled jobs, such as those linked to data analysis and remote central operations, will be more in demand. Unfortunately, the communities to be likely adversely impacted are those that are perhaps least well positioned to take advantage of the economic opportunities that will come with advances in innovation and technology. These will stay out of reach by virtue of shortcomings in social and economic infrastructure and related factors, such as the often limited levels of educational attainment and skills base in remote communities.

In addition, alternative economic opportunities available to mining communities will probably be compromised as sectors such as agriculture, tourism, and manufacturing are subject to the Fourth Industrial Revolution. In remote mining

[1] See: Freeport turns to artificial intelligence to raise copper output by 90,000 tonnes. (2019, November 3). *Financial Times*. https://www.ft.com/content/88628dc0-fe32-11e9-be59-e49b2a136b8d

[2] ICCM. (2018). *Role of mining in national economies: Mining Contribution Index 2018* (4th ed.). https://www.icmm.com/website/publications/pdfs/social-and-economic-development/181002_mci_4th-edition.pdf

communities, there is a direct correlation between communities' expectations of benefits from mining operations and their proximity to those operations.

There is also a gender dimension to technological advances: mining has traditionally been a male-dominated sector. Because technological changes impact jobs that are predominately physical and manual, the types of jobs often carried out by men will likely be more affected than those of women. However, women will not necessarily benefit from this reversal and the technological advancements in the sector, as fewer women are involved in science and technology, engineering, and mathematics and will not have a competitive advantage in the mining sector.

## ROLE OF INDUSTRY IN ENSURING THAT LOCAL STAKEHOLDERS HAVE THE NECESSARY SKILLS TO ALLOW MINING TO MAKE ITS PROPER CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

When asked about the role of industry in the effort to reskill workers, Davy further stressed that there must be a shared understanding of the skills required for mining communities to thrive in an uncertain future characterized by technological advances and the inevitability of mine closures. He noted that the definition of reskilling needed to be expanded beyond job training to include entrepreneurial training and leadership skills. In addition, partnerships between mining companies, governments, and local communities will be necessary to effectively plan for sustainable, diversified local economies. Davy emphasized the following elements:

- There is a need to understand the changing nature of the skills that are going to be required for participation in the economy of the future. This will require mining companies and the industry working together with governments and educational institutions in civil society.
- There is a need to develop pathways for communities and others to obtain the necessary skills for economic participation, leadership, and economic diversification.
- There is a need to collaborate on catalytic partnerships to deliver support and to acquire skills at scale. Collaboration between institutions such as ICMM, WEF, IISD, the World Bank, the International Finance Corporation, Mining Share Value, and many others is a good path to understanding the nature and scope of the evolving skills landscape and to identifying opportunities for partnerships in supporting the delivery of critical skills for a common future.

## A "SOCIAL LICENCE TO INNOVATE" AND COLLABORATIVE REGIONAL DEVELOPMENT

**Froydis Cameron-Johansson from Anglo American** shared concrete and pragmatic examples of initiatives undertaken by Anglo American in the area of innovation. Anglo American has rolled out a robust innovation program called "FutureSmart." It aims to identify the technologies that will affect the mine of tomorrow in terms of finding safer, more efficient, and environmentally friendly ways of unlocking mineral value such as reducing the physical footprint, the potential for mines that are waterless, have no tailings dams, or have a very low carbon footprint, etc. Furthermore, Anglo American is committed to its purpose as a company, which is to re-imagine mining to improve people's lives.

However, she highlighted the challenges faced by companies in developing countries in trying to achieve a just transition and delivering on companies' core values. Examples from existing literature and strategies are conceived for countries that have a really structured welfare state and very high-functioning education systems, such as OECD countries. For a company investing in a country such as South Africa, where there are structural challenges with employment (unemployment rates that are at least over 25%), the challenges are very different.

Cameron-Johansson noted that reskilling might be too easily proposed as a solution to the changes wrought by automation. In some cases, there will simply be an irreconcilable gap between the skills needed in the mine of the future and the skills that existing workers can acquire. Moreover, she cautioned, we need to be careful with our assumptions if we claim

to be doing workers a favour by eliminating meaningless repetitive jobs. Have we tested that assumption in dialogue with those that are doing those jobs?

Anglo American has developed five principles around a concept called "a social licence to innovate," which is still at an early stage. The principles address how companies should conduct themselves in considering the impacts of new technology: listening, engagement, collaboration with those affected, transparency, and being true to purpose in viewing new technology as improving peoples' lives.

Anglo American has also adopted a collaborative regional development approach that fundamentally rethinks a mine as an economic catalyst to create independent economic opportunities for the community. This starts by identifying socioeconomic development opportunities that offer the greatest potential in a region, using spatial planning and analysis and working with development agencies, non-governmental organizations, and the community. Projects are designed to become part of the regional development plan—not Anglo American's regional development plan but the local government's regional development plan. Capacity building for municipalities is another key for success to ensure strong leadership and capability in project management and governance.

## JUST TRANSITION

**Kemal Öskan, Assistant General Secretary of IndustriALL**, a global union federation, pointed to the lack of inclusion of workers in the debate on automation and skills for a sustainable future, the very same debate that will determine the future of their careers. Neither companies nor workers know with certainty the degree to which technology in mines will affect employment, but there are examples from Australia, the United States, and Canada that indicate significant job losses. Some estimates place the loss at 20 million jobs in the mining industry throughout the world. For Öskan, this gap in dialogue must be filled to ensure workers' acceptance of the measures to be taken by mining companies. The search for the social licence to innovate must necessarily include dialogue and collaboration with, and acceptance by, local communities as well as workers.

He pointed to the auto industry as an example of where that kind of collaborative process had worked. They started with an analysis of what kinds of skills would be needed in the future, and then unions and employers sat down together to discuss the best ways forward toward, taking into account the perspectives of all sides.

He argued that information sharing and consultation should be held at the project, national, and global levels to generate a common vision and understanding of a just transition. Broader reforms and discussions about sustainable industrial policy and education policy in partnership with governments will be critical in supporting the transformational changes to technology and automation.


## SESSION 2: TECHNOLOGY AND THE FUTURE OF GOVERNMENT REVENUES

The second half of the forum focused on the roles and impacts of new technologies in mining on tax revenues from the sector, and what types of partnerships and strategies will ensure that mining revenues for developing countries do not erode.

The panel discussion was moderated by Howard Mann, Special Advisor, Tax Base Erosion and Profit Shifting (BEPS), IGF, and participating panellists included Kingsley Chanda, Commissioner General of the Zambia Revenue Authority; Alvin Mosioma, Executive Director of Tax Justice Network Africa; and Lee Corrick, Senior Advisor, Transfer Pricing, OECD.

### OECD/G20 INCLUSIVE FRAMEWORK ON BEPS

The panel began with a brief update on the OECD/G20 Inclusive Framework on BEPS on the Two-Pillar Approach to Address the Tax Challenges Arising from the Digitalization of the Economy.[3] **Lee Corrick, OECD**, recalled the recent progress made during the Paris meeting in January 2020 but also noted that there are challenges to be met in order to reach a consensus. The agreement on the "Unified Approach" was an important step forward, as was the commitment of the international community to reach a political consensus for a long-term solution to the tax challenges arising from the digitalization of the economy by the end of 2020. Corrick expressed the view that the consensus will resolve the different policy approaches among G20 countries, including, in particular, the issues between the United States and France on digital sector taxes. However, a number of technical challenges and policy differences remained among the participants that would need to be resolved in order to reach an agreement. These include:

1. The safe harbour approach proposed by the United States for the implementation of Pillar One.[4]
2. The so-called digital differentiation that will apply slightly different rules for very large businesses versus other businesses.
3. The regional segmentation, as suggested by some members, of the inclusive framework to take into account regional factors.
4. The proposed binding nature of dispute prevention and resolution mechanisms, as well as the scope of the dispute resolution mechanism. The importance of this issue for the African region, where a majority of members are strongly opposed to any form of mandatory binding arbitration tax sovereignty, was noted.

[3] See the OECD and G20's January 2020 statement here: https://www.oecd.org/tax/beps/statement-by-the-oecd-g20-inclusive-framework-on-beps-january-2020.pdf

[4] The "safe harbour" approach was proposed in a letter from the U.S. Treasury Secretary to the OECD Secretary General in December 2019. For more details, see: https://www.oecd.org/tax/international-community-renews-commitment-to-multilateral-efforts-to-address-tax-challenges-from-digitalisation-of-the-economy.htm

## NEW TECHNOLOGY, INTELLECTUAL PROPERTY RIGHTS AND THE POTENTIAL TO SHIFT TAX REVENUE

Panellists were invited to reflect on how government revenue might become more vulnerable to profit shifting with the expansion of new technologies and related intellectual property rights. **Howard Mann** set the context that new technology that is rich in intellectual property rights is causing a significant shift in weight to the part of the value chain that comes before construction or operation and is located primarily in the intangibles in developed countries.

Corrick recognized that the problem is complex, global, and prevalent in many industries, not only in the extractive sector. He further stressed that the problem is not new but is being amplified by the BEPS debates globally. Drawing from OECD experience in collaborating with a large number of African countries' tax administrations over the past 10 years, it was noted that the valuation of intellectual property has long been recognized as one of the most difficult issues in transfer pricing. It requires important resources and capacity in the tax administrations and highly specialized skills. In this context, the African continent is unfortunately not well equipped yet with the expertise to appropriately consider complex intellectual property rights and transfer pricing issues and related disputes. However, a few African nations have started to follow some OECD countries in adopting advanced pricing agreements as the preferred approach to preventing disputes.

**Kingsley Chanda, Commissioner General of the Zambia Revenue Authority**, shared his experience from a government perspective on how the shift to a higher presence of intellectual property rights and intangibles in the mining process is impacting the capacities of African administration to collect revenue. He highlighted some challenges arising in the African context in dealing with the issues of intellectual property rights and transfer pricing practices, including:

- The lack of tax administration capacity and the lack of adequate information and communications technology infrastructure.
- The lack of expertise or resources for undertaking complex audits of mining companies.
- The potential losses of tax revenue, such as personal income taxes due to employment loss as a result of technology.

However, Kinsley acknowledged that new technology could bring more opportunities to increase government revenue as costs are reduced and efficiency and profitability in mining operations improved. Conscious of their lack of capacity, more and more African countries are moving toward simpler fiscal schemes on production or taking a stake in mining companies.

**Alvin Mosioma from the Tax Justice Network** concurred with other panellists that investing in new technologies, building capacities, and enhancing human resources within tax administrations will be unavoidable if African countries are to tackle the challenge of the transition of the mining sector to new technologies. He also identified double tax agreements with countries where intellectual properties are located as a risk to forgoing revenues, especially when the intellectual property is located in a jurisdiction considered a "tax haven." African nations should therefore be more involved in the global reforms in order to streamline and modernize the existing double tax agreements landscape.

Overall, the panel agreed that technology could be both an opportunity and a challenge with regard to national efforts to increase revenues, depending on how prepared and capacitated the tax administrations are.

## STRATEGIES TO SIMPLIFY TAX SYSTEMS

Panellists further discussed the rationales and strategies to simplify the tax systems. Leading the discussions, Kinsley reiterated that the complexification of mining operations and accounting systems and the limited capacities of African tax administrations to audit those systems is a reason to resort to simpler strong tax regimes and monitoring mechanisms. Kinsley gave an example of the Mineral Value Chain Project, where the tax administration monitors the production of minerals from the entire value chain from production to export. This project provides data that can later be reconciled with the reporting data from mining companies. One element here was the need to learn from experience how a mining company can be

producing at a loss for many decades without any opportunity for the country to levy corporate income tax. Following such experiences, the Zambian government is increasingly entering into agreements and building partnerships with investors to take significant stakes in their business.

Investment in the same level of technology used by mining companies is unaffordable for most African countries. Therefore, the cost of technology is an additional argument for African countries to go outside the traditional tax regimes based on profit and have simpler ways and means of benefiting from the main activities in their country. Standardizing tax-related technologies may help in this regard.

Mosioma further emphasized that the debate is more complex, as the digital debate has not clarified whether digital sales tax is a gross tax or a revenue tax, but it appears that it is not a profit tax. Furthermore, the complexity of the mineral valuation and the tales of unsuccessful attempts to collect corporate income in more than a few countries suggest the need for simpler tax schemes. Corrick closed the discussion on this question by highlighting that other fiscal tools might be used, such as production-sharing agreements rather than profit-sharing agreements. In either case, governments might face the same challenges as they face in current corporate income tax regimes.

There was broad agreement in the room that developing countries should explore innovative ways and long-term solutions to BEPS issues in the mining sector through simplified regimes. The view was also expressed that a more comprehensive reform at the global level should ensure that profits from companies face the same level of taxation regardless of their location.

## NEW TECHNOLOGY, DATA AND GOVERNMENT TAX REVENUES

Mann framed the final discussion question around the opportunities that come from a very data-rich mine: investments in technology result in companies having access to real-time data on the various characteristics of their operations (i.e., information on ore grades, quantity produced, schedules of production). Panellists agreed that more data is certainly useful when it is well understood and used, but to turn data availability into opportunities, certain conditions must first be met:

- Governments must necessarily invest in digitalization, including tax administrations.
- Governments should learn more about complex multinational organizational architecture and understand the integration between affiliated companies.
- Comprehensive solutions must be found across the different economic sectors.
- Data should be collected in a more "standardized approach" or hosted in more standardized platforms and language to avoid swamping tax administration with different sets of data that require different skills and analysis systems (software).

Increased co-operation and information sharing among tax authorities in jurisdictions where the same multinationals operate was also seen as essential to preventing deliberate tax avoidance.

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