



IGF

INTERGOVERNMENTAL FORUM
on Mining, Minerals, Metals and
Sustainable Development

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Innovation for Sustainability in the Mining Sector

March 4, 2017 1:00–5:00 pm

Room 201, Metro Toronto Convention Centre
255 Front Street West Toronto, Canada

OVERVIEW

Meeting the Sustainable Development Goals (SDGs) by 2030 will require unprecedented cooperation and collaboration among governments, the private sector, communities and non-governmental organizations. A [2016 study](#) by the World Economic Forum, the United Nations Development Programme, the United Nations Sustainable Development Solutions Network and Columbia Centre for Sustainable Investment showed that the mining sector has the opportunity and potential to positively contribute to all 17 SDGs, often in the poorest and most fragile and remote areas. However, this will require innovation and new ways of working together.

In parallel, we are in the Fourth Industrial Revolution and experiencing unprecedented change that will fundamentally change the way we work, live and relate. Driven by technological shifts and innovation, the scale, scope, speed and complexity is unlike anything experienced before. Possibilities are enormous and new ways of pursuing opportunity and value are required. However, we do not yet know how it will unfold.

This year's sustainability forum discussed the critical role that innovation will play in the mining sector and more widely globally to help achieve the SDGs. Governments, industry leaders and communities around the world are increasingly emphasizing innovation performance as a critical factor to secure economic, social and environmental goals. Innovation can help support competitiveness, transparency, inclusion and sustainability. This innovation can take many forms, including technology and digitalization, clean innovation, finance and business models, and partnerships and engagement.

Some 150 representatives from government, industry, civil society and academia gathered for an engaging discussion the day before the official opening of the [Prospector and Developers Association of Canada's](#) (PDAC) 2017 annual convention in Toronto, Canada.

The forum was co-hosted by the [Intergovernmental Forum on Mining, Minerals, Metals and Sustainability](#) (IGF), the [World Economic Forum](#) and PDAC. It brought together stakeholders from across the mining and metals industry to:

- Explore the role and types of innovation in the mining and metals sector critical to supporting the SDG agenda
- Present examples of innovative practice within the sector that can be shared or scaled
- Stimulate debate and idea creation within the sector
- Explore areas where more focus on innovation in the sector is required and what can be learned from other sectors
- Identify ideas and actions for different stakeholders to enhance the role of innovation in the sector to achieve the SDGs by 2030

The forum was structured around panel discussions and facilitated roundtable discussions.

PANEL 1: The Role of Innovation in Mining and the SDGs

This panel set the scene for the event by discussing current activities in areas of innovation round sustainability, sharing examples of good practice from within and outside the sector and exploring some of the challenges faced.

Cassie Doyle, Chief Executive Officer of the [Canadian International Resources and Development Institute](#), moderated a lively discussion about current activities in areas of innovation around sustainability, sharing examples of good practice from within and outside the sector and exploring some of the challenges faced.

The panel included:

- Stefania Trombetti, Director General, Lands and Minerals Sector, Natural Resources Canada
- Peter Sinclair, Chief Sustainability Officer, Barrick Gold
- Sonia Molodecky, Co-Founder and President, Global Indigenous Trust
- Carl Weatherell, Executive Director & CEO, Canada Mining Innovation Council

Stefania Trombetti, Director General for the lands and minerals sector at [Natural Resources Canada](#), spoke of the government's efforts to leverage expertise and funding for innovation. One example is the [CanmetMATERIALS](#) mining lab, which is leading work in developing technologies to improve all aspects of producing and using value-added products that are derived from metals and minerals.



“While government plays an important role in the innovation space, it’s also important to recognize we all play a role in innovation,” Trombetti said, noting that civil society can identify gaps and industry can contribute its expertise. She also discussed the need to share best practices to position industry as a leader in responsible and sustainable resource development.

Peter Sinclair, Chief Sustainability Officer at [Barrick Gold](#), said the mining industry is ripe for innovation and that this needs to happen in all parts of the mining business: human resources, the supply chain, and environmental and community relations.

“The industry will quickly run out of resources if we continue mining in the same way,” Sinclair said, explaining that we need to look for ways to reduce the mining footprint and create less waste and disturbance.

“Getting it right will reduce cost and impact,” he added, explaining that it will nonetheless require “a significant shift in mindset.” He cited two examples of innovative ways in which Barrick Gold has reduced its footprint: a new mining process employed in Nevada that eliminates cyanide use and a patented new technology used in Saudi Arabia that allows the use of wastewater instead of fresh water.

Sonia Molodecky, President of [Global Indigenous Trust](#), spoke of how Indigenous knowledge, expertise and perspectives can play a dramatic role in mining and in development.

“We’re starting to see really interesting examples of mining companies integrating traditional knowledge ... literally bringing life back to dead land,” Molodecky said. Traditional knowledge can mean the difference between a migratory path for caribou or the extinction of a species.

These perspectives can also inform and improve development projects, she said, citing a project with Peruvian dairy farmers who were struggling with the health of their cows. The Global Indigenous Trust helped to introduce Canadian organic farming practices and to plant more trees to improve both soil quality and human health.

Carl Weatherell, Executive Director of [Canada Mining Innovation Council](#), said the mining industry needs to transform itself. He noted that productivity is falling, as is return to shareholders. “If we don’t change the business of mining, we won’t have a business of mining.”

Weatherell spoke of the need to identify shared objectives such as reducing tailings and water use so that the entire industry can find answers to these complex problems.



ROUNDTABLE DISCUSSIONS

Participants self-selected the roundtable and innovation topic they were most interested learning more about. Each roundtable had a moderator who led discussion on one of the following four topics:

- Technology, including digitalization
- Clean innovation, including energy
- Business models, including financing
- Social innovation, including partnerships and engagement

Each table moderator facilitated a discussion around the following three key questions:

1. What current innovation have you seen that could be shared or scaled?
2. What are biggest gaps and why?
3. What concrete action(s) could be taken and by whom?

Notes from these discussions are available below.

PANEL 2: Innovation for Transformation: The next 15 years

Gillian Davidson, Head of Mining and Metals Industries at the [World Economic Forum](#), moderated a discussion about the opportunities for the mining sector and its stakeholders over the next 5–15 years to catalyze innovation through leadership and collaboration. The panel included:

- Stephen D’Esposito, President, RESOLVE
- Glen Gemerts, Executive Committee Chair, IGF
- John Thompson, Wold Family Professor in Environmental Balance for Human Sustainability, Cornell University
- Nathan Stubina, Managing Director, McEwen Mining

Nathan Stubina, Managing Director [of McEwen Mining](#), spoke of the immense amount of energy and resources required in a typical mining operation. “We’re good at making things bigger; we’re not good at making things better,” he said, noting that 90–95 per cent of every dollar spent on energy on a mining site is used to manage wastes. He gave an example of a typical mine where the ration is one gram per tonne. “If you had to explain to someone how much earth and water we use to make a one-ounce gold coin, it would be very difficult.”

As a small mining company, McEwan is forced to innovate in order to make a profit, Stubina said. He noted that there are no shortages of ideas, and McEwan often serves as a testing ground for innovations such as an exploratory probe that can search two kilometres below the earth without having to drill an expensive hole.

John Thompson, Professor of Environmental Balance for Human Sustainability at Cornell University, said: “Innovation usually fails because of people, not the technology,



and that's because we don't prepare. ... To collaborate effectively you've got to give up in order to get, and this industry of ours doesn't know how to give up stuff: they want to own everything."

Thompson outlined a number of innovations that can help get more metal from less rock. One such technology is a shovel sensor that can help determine whether the material should be taken to a mill or to waste.

"The other one is we don't mine—we can do in situ leaching. You have to think about very complex fracking, and if you think the world's opposed to fracking, wait until we get started. But the win is so enormous we have to start thinking about it where we don't mine—all we do is inject fluid into the ground and get our products out."

Glenn Gemerts, IGF Chair and Policy Advisor to N.V. Grassalco and the Ministry of Natural Resources of Suriname, spoke of the need to change "our mindset" to consider how "we transfer natural capital into human capital."

"People are looking for more than royalties. They're looking for education, a livelihood," Gemerts said, explaining that mining concessions should include a social contract in which all parties are involved.

Systemic change will require major policy reforms by governments, but mining companies also have a role to play. For instance, they could find innovative ways to transform waste into materials that can be used for local development. Mining companies can also serve as catalysts for and partners in change, he said.

Gemerts also noted the need to address the role of small-scale mining and how governments and industry can integrate these actors into development plans.

Stephen D'Esposito, President of [RESOLVE](#), gave an analogy about the typical slow pace of innovation. He mentioned that with regards to suitcases, it took 17 years from the introduction of the first rolling suitcase with wheels in 1970 for someone to add a pull-out handle. It wasn't until 2004 that the four-wheeled suitcase was introduced.

"Decarbonization of the mining industry is going to be required," D'Esposito said. "I suspect there will be green innovations: what is the relationship driver between the Teslas at one end and the lithium miners at the other end?"

He mentioned that there is a broader conflict in values between the public and the industry. We are in a situation of high-impact mining and low value from the point of view of not actually addressing values—it's mining versus a community or mining versus ecosystems, he explained. "There's an opportunity to have something going forward if mining decreases its impact."



CLOSING COMMENTS

PDAC Executive Director Andrew Cheatle closed the meeting and thanked participants for their engagement and insights and spoke of the “more positive atmosphere” at this year’s conference. “Our success is your success,” Cheatle said. “We look forward to doing this again next year.”

NOTES FROM ROUNDTABLE DISCUSSIONS

Technology, including digitization

What current innovation have you seen that could be shared or scaled?
Current - NGO + communities drive change/innovation in companies
Current – global database for ASM (PACT) – info + potential investment
Current - Multi-sector/stakeholder dialogue tables – Peru
Current – Global Fund for HIV – Ghana
Company approval adopted by government + funders to address social issues
Mining company response to Ebola in Sierra Leone
Use of technology to create visual models for describing complex designs to communities – video, 3D models
Public availability of real time remote sensing data
Geomatics – GOC – basis + satellite imagery - African
Public availability of real time remote sensing data
Data collection, databases, local stakeholder software, e.g.: ASM, communities, conflict mineral traceability
Global artisanal small-scale database, open data, digitalization
Current – Devonshire initiative
We know that underlying social issues in mining are similar everywhere
Beyond zero-harm framework

What are the biggest gaps and why?
Addressing best way to balance complexity with simplicity and clarity in messaging data
Gap in engaging communities. Data sharing should occur at the project design phase to truly integrate local/traditional knowledge
Gap in sharing data about environmental performance, e.g.: the EPA shares data on their website that is accessible and informative.
Hierarchy of knowledge/\$: companies have more than communities
Need more spaces to share
Common grounds (models/methodologies)
Finance new technologies
Understanding the return to the business from investment in the serial piece
Gap - Governance structures poorly managed locally (by gov'ts)
Challenge to reach consensus across diverse communities
Organizational culture is a challenge (societal is seen as a side dish)
Gap – fear of failure, change and uniqueness to assess risk
Automation eliminating jobs but alternative to the loss of this, value has not been addressed
Lack of measurement by the mining industry on procurement (local) and what works
Local capacity
Venture capital – open to new ideas?



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Local IT infrastructure
Lack of open source data access in all aspects of mining
Integrating mines ops + closure into local development
Procurement culture
Collaboration between ASM and LSM
Lack of aligned approaches to local development planning (gov't, corp, community)

What concrete action(s) should be taken and by whom?
Bring players – cross sector/region/district
Learning across industries
Drones
Bring different sciences and disciplines together
Greater cross-platform engagement in technology design at earliest possible stage to get problem definition and focus calibrated
Build strong communication between companies and communities
Recognize existing opportunities to innovate without a company – e.g.: local content
Establish incentive for leadership/push + pull to promote social innovation
Influence mine design in the early phases, integrate social knowledge and data
Action: Apply the IBA model to other communities (non-Indigenous)
Action: community benefits by 50%
Companies could partner and exchange information at the early design phase to truly integrate local/Indigenous knowledge and avoid limiting participation to “consultation.” Impacts could be reduced significantly.
Action: Initiative to change culture across corporation to give innovation a chance
Open minds to explore new avenues
Bring people to collaborate
We need a multidisciplinary approach that allows for cross data
Engage the supply chain in solutions, design and problem ID
Take action LSM-ASM – don't be afraid, build dialogue
Community ownership of waste rock + tailings, re-use business
Pilot studies – small steps before big cheques
More collaboration between ASM + LSM
Begin dialogue early – recognize that people live there
Build local solutions
Involve 3 rd parties in measurement
Real respect, real listening

Clean innovation, including energy

What current innovation have you seen that could be shared or scaled?
Diesel-free mining to electricity based – shift to renewables (Gold Corp)
Blasting advances
Using corporate targets
Battery-powered machines
Costs driving incentives to renewables
Wind farms near sites
Fully automated mines – Nevada – Chile (Barrick) Vale – conveyor belts
Energy – key to greater advance in renewables in ENERGY STORAGE TECHNOLOGY – advance in stationary energy, storage technology will make huge advances that can be saved? Stored? Sealed?
Mining sector – anchor tenant to be used as a catalyst for gov't to invest in renewables
3D printing for modelling



Innovation for Sustainability in the Mining Sector

Tailings? Trying systems to be reinjected into the ground
Hydrogen fuel cells
Assessing markets
+12 companies across H fuel cell value chain – new group – not working together – still gap in the investment
Gov't as coordinator – other industries
Strategic development planning
Access to CapEx
Industry + Gov't Q + Gov't C
Storage and manage
Hydro dam
Mine can't do it alone, bridge finance
Share – how do you store energy?
Lithium battery
Hydrogen fuel
Rehab sites for closure
Sloping for the sun
Alternative energy storage
Share – project remediation in pit SOLAR PANELS for community post closure (New Gold)
Kimberly, B.C. – Solar
Water – Nova Scotia – not enough, therefore protect
Proponent wants/needs water
Scale up available of water data
Canadian diamonds for a premium – what about all other metals? – like FSC

What are the biggest gaps and why?
Gaps – how can we bring energy for mines, share with community
Solar, \$ from community, gov't, all had to kick in DIFFICULT. But huge interest – TOURISM
Gaps – how to handle objectives not shared, go back to shared action, solid results, real time data, monitor together
Risk/benefit sharing
Force, compensation, legislation
Gaps – technical people, employees uncomfortable with social innovation
Learn by doing – i.e., engineers communicate corporate values
Regional emissions disputes
Carbon price differences move the pollution
Move the businesses
Gaps – impact of cleantech on employment – hi-tech – local population
Beyond blasting!
Extracting waste
Local impact of renewables
Financial – renewables playing role after mining closure (financial model for long-term profit)
Why is the case for extraction of minerals as integral to clean energy + renewables so quiet?
More investment in education to mentor social investments
Reclamation projects – social impacts – local employment and environmental benefits
Gaps – working together
Conveners matchmakers (trusted and effective, i.e. gov't)
Stability
Gov't – common metric for deciding, not always same city v. rural
Biggest gap – first thing is to measure clean energy but the second this is to share its cost effectively with the community
Gap in the infrastructure to share energy and water with community surrounding the mine
Gap – critical material supply chain, e.g., lithium
These supply chains don't currently exist



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Opportunity for gov't to help create those new supply chains, e.g., by partnering with start-ups
Gap – lack of coordination and collaboration between mining projects; e.g., instead of making one large wind farm, people are building three separate, competing projects. However, coordination allows us to achieve critical mass and social licence to operate, gov't can act as coordinator
Gap – culminate impact assessment – share with mining companies
Reducing water inputs
Solar in rural areas, local community services
Run of river
Working across and within sectors to promote renewables
How to broaden to providing clean energy to local communities
Linking tailings/energy water and corporate reputation and local communities

What concrete action(s) should be taken and by whom?
3 rd parties to talk to these issues
Partnership with other relevant sectors, in IT, clean/renewables
“Flow thru” share models to finance innovation
Concrete actions: gov't could work with other multilateral to help create supply chains for lithium
Investment by governments on basic geologic data to help spur increased investment for mining sector to find new materials like lithium
Concrete action: find ways to encourage private investors – the policy framework must be there
Renewable powering of desalination
Supplying the clean energy revolution
Impacts of fueling “supplying” clean energy for host countries env/mat compliance
Working w/ gov't for a clear, strategic policy and program
Role of competing trade-offs in new technologies
Action – raise the bar in mineral production
Robust modern mining logistics
Canadian metals are branded?
Premium price paid
BMW & INTEX may be mining to pay but intermediated not paying premium
Action: Capacity mapping
Motivation
What – whom: convene, match, make, gov't
Industries
Comm + industry – incentives
Identify shared objectives
Action: chain of custody of water date
Direct to all @ same time
From lab to online
From in steam analyzer to online
Visualizations
Action – whom: partnership – JV – catalyst industry + consultant, in his best interest – needed good examples, exercise expertise
Innovative learning capabilities
Local jobs for IT v. people, truck driving fleet
Water – from tailings
Economics – JV gov't, brainstorm
Use of brackish salt water
More collaborating
Lots companies dabbling, —> We. Waste and water

Business models including finance



What current innovation have you seen that could be shared or scaled?
Specific funding to expand on specific areas. EWB
Government agencies providing support capacity building
PPPs – public-private partnerships
Collaboration model. Investors – mining ex, communities F.N.
Social funds Loans – social funding at local level
Joint venture partnership
Impact benefit agreements company +F N + Community
Network of mining regions to share best practices
“National Trust” – community involved or manages
Diversion of tax to local infrastructure
Community development fund
Standards of best practice include socioeconomic that supports finance
Financial bottom line linked to socio-economic results
Community dev. Corp.
Equator principles that link finance to sector
Shared stakeholder participation
Expanding the innovation above? “crowd sourcing innovation”?
Energy storage
Trucks – automation
What are the biggest gaps and why?
Engagement/preparation
Limited community involvement
Financing projects that should not be financed
Silos
Complete ecosystem approach
Application to financial models
Competition blocks maintaining of innovation
Creative ways to finance
Safety
Abandoned mines
Community certification systems
Better link between business development and community development
Alignment of boards with operations
Government support
Resources
Infrastructure gaps
Collaboration
Capacity mapping
Financing capacity building
Data and ROI – assessing long-term impact
National standards
Equity stake in parent companies
Measuring the economic prosperity
What concrete action(s) could be taken and by whom?
Host government expand reporting systems to include social information
Direct communication with all of local society (3 families) on a regular basis – conflict prevention
Promote M/S national dialogue tables
Improve understanding of specific demands, needs (Early stages)
Experience from other sectors
Participatory monitoring (IND – GOVT – COMM)



Impact benefits? – independent organizations?
Support to local business
Strategies to economic growth – diversification of economy
Replicate existing good models, contextualize, show case best examples
Bigger players to help lead innovation
Modeling positive impact of innovation
Joint development ventures with communities
Disseminated best practices
Access to data, sharing data, databases
Innovation hub – open source
Document pos. impact (standards, innovation, human rights) to determine financial benefit
Make it a business case
Financing for concept to feasibility
Vehicle for innovation sharing
Foster best practices
Educate and certify communities to facilitate benefits
Incentivizing contracting
Current: company that provides cell minutes for local information gathering

Social innovation, including partnerships and engagement

What current innovation have you seen that could be shared or scaled?
Gold Corp – Gender issue (providing knowledge has not afforded women social issues open)
Current corporate movement from philanthropy to sustainability
#DisruptMining
Task-oriented approaches
Ex. Newmont Suriname ASM zones
Innovation Interested Base – early engagement and negotiation of participation agreements in exploration. Values cased to identify shared opportunities
Innovation: start of dialogue series brining new disciplines to learn
Examples: collaborative tasks – risk assessment, budgeting, stk analysis/mapping – are opportunities to get to know people and build requests
Innovation – Kaska bilateral governance, tripartite, chiefs, secretariat, WGS on topic, TRC, risk IPRP WK planning
Innovation DMS views, SLO + investment local. Network as a tool to find solutions
Innovation – Mineral exploration sustainable development standards (coming up in October 2017). In order to be certified, companies will have to comply with many principles such as “innovation.” Under this principle, companies must be aware of new “innovations” and apply them following positive cost benefits and analysis
Innovation: Communities creating their economic development, independent of the mine
Ex. Hudbay Minerals - Dialogue process – BET. Rural/indigenous communities in 2 different countries
Innovation: AMLA – African mining legislation atlas. Partnerships, LEG + AFDB? citizen engagement extractives
Mongolian community development agreements renewed each year
Innovation – Local workforce 50% indigenous people, women
Suncor fuel tank farm (storage facility in oil sands) JV – 35% ownership & natural gas pipeline JV, small collaborations
International exchange program connecting rural communities from Peru with Indigenous nations from Canada
Current - 50/50 partnership NGO in Uganda
Changing approach to community dialogue
Foster dialogue
Gold Corp Challenge – Red Lake district



GIDT Regional approach in development goals, Peru
Current- UNICEF use of texting
Current – Communication – internet for constant updates

What are the biggest gaps and why?
Gaps – missing voices at the table: Women
Tech wins vs Social wins – political avoidance, scope of attention
Organizational culture gap. Own it! Lack real support, failure & learning
Senior leadership setting car for procurement and innovation vs. risk aversion
Team time to market delays and shrinks implementation and benefits
Very low level of public management and empowered leaders to facilitate sustainable development
Gaps - generations mindset
Gap ‘Δ’ culture – embedding the concept of innovation into corporate culture
Governance, Gender, Environmentalism: time required to integrate knowledge transfer
Absence of national standards
Gap – Trickle down effects to become inclusive to all members of a community influenced by the mine
Very low level of public management and empowered leaders to facilitate sustainable development
Community not at the centre of the focus
Gaps – incentives – from the top, pilot new ideas so that if you fail you can limit the harm
Time & Skills, economic dev. Regional approach to workforce
Social innovation models exist – benefits shrink, impact vs. historic lens – business objectives
Need for a lot of social training in professional layers of the mining industry
Gaps – communication on new policies and idea to all interested/invested parties
Advocacy of standards
Where are drivers?
Should we understand each other’s time scale
Understanding mineral exploration to operations
IBA – new every time, persistent legal framework
Gaps – competitive advantage impacts on collaboration
Mining company is OTHER Indigenous
Geo-engineer is not trained in culture/social problems
Some dissidence between goals and implementation (CSR)
Very serious problem – voluntary standards?
Empowering communities through interactions with industry and other community shared learning
Lack of sustainability knowledge/capacities to deal with social challenges
Absence of the gov’t often at the level of the project
Gap – how to help community to understand what sustainability development means
Gap – Corporate culture resistance, corporate knowledge shared internally
Gap – research – from civil society + gov’t, not available from companies
Gap – Government not interested in partnering locally, leaving companies to manage social issues
Long-term thinking + commitment – leadership involvement
Gaps – capacity/availability (over-consultation time, education, funds, turnover), time, politics (can be overcome/parking lot + keep moving forward)
Assumption that partners/engagement is difficult
Getting over the mental hurdle of not being able to walk together, that we are too different

What concrete action(s) should be taken and by whom?
Actions (chart) – rewiring the machine + new business models scaling up, talk to and engage different perspectives, treating social innovation in the same way as tech innovation, co-creating and collaboration for innovation, changing power dynamics and governance ownership, sharing knowledge



Innovation for Sustainability in the Mining Sector

about innovations, internal engagement to create alignment, cultural shifts, standardizing ways of working, incentivizing innovation/allowing small steps
Exchange best practices in long-term dialogue
Independent certification schemes
Action: use smaller providers to increase local procurement
Engagement at early stage (industry)
Action: cross-industry sharing forum
Establishment of national standards such as TSM (Ecuador/Argentina)
More \$ and resources to CSR
Govts + Knowledge + Innovation Models
Define well implemented zones of a project
Direct comm with national, subnational and local levels
Actions: investigate use of social enterprises
Action – forum for local collaboration of companies on success/failure of social innovation w/ local detail
Action – forum for exchange of corporate information on social innovation
Investigate use of social enterprises
More transparency
Non-regulatory investment agreements
Mining companies like rules (make them clear)
Fallacy of CSR
3 rd party validation (culturally adaptive)
It's complicated
Can slice of CSR pie. Come from World Bank.
Strategies to economic growth – diversification of economy
Local government empowerment – dialogue
Action- develop industry wide open sustainability app
Broader, more representative dialogue (higher level)

