



Modernising the Mining Life Cycle: What Artificial Intelligence Means for the ISM

Sibanye-Stillwater Centre for Sustainable Mining at the University of Johannesburg

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INNOVATION



COMMITMENT



ACCOUNTABILITY



RESPECT



ENABLING



SAFETY

Modernising the Mining Life Cycle: What AI Means for the ISM

Approach to this Presentation (Applying AI to ISM Commission 2)

1

ISM2: Geometry of mineral deposits and **MRM**



Start with Definition of ...
Then, ask how it is affected by ...?

2

The bigger picture is a process of mine **MODERNIZATION**



We started a digital journey that may lead to autonomous systems for mining

3

Mining WoW requires readiness for **AUTOMATION**



What is happening?
Digital brought AI into the workplace!
What now?

4

AI and ML considerations for **ISM Commissions**



Strengthening the work of the ISM to enable the Mine of the Future



What is Mineral Resource Management?

The multi-disciplinary MRM function is well established (in South Africa) with Professional qualifications and Councils for registration of practitioners and professionals

Macfarlane (1996, 2006) Definition of MRM

“an integrated activity which identifies, evaluates and provides an optimal extraction plan of the mineral resource, to produce a quality product which satisfies the business objectives of the company, and the requirements of the customer, in a dynamic environment”

This requires accurate Information on the Orebody; Best practice mine planning and optimisation; Control of finances, personnel and equipment; and Managing the recovery of minerals and residue facilities in a dynamic environmental and socio-economic setting. Interpreted from amongst others, Grobler (2018)



What does it mean for the work of the ISM?

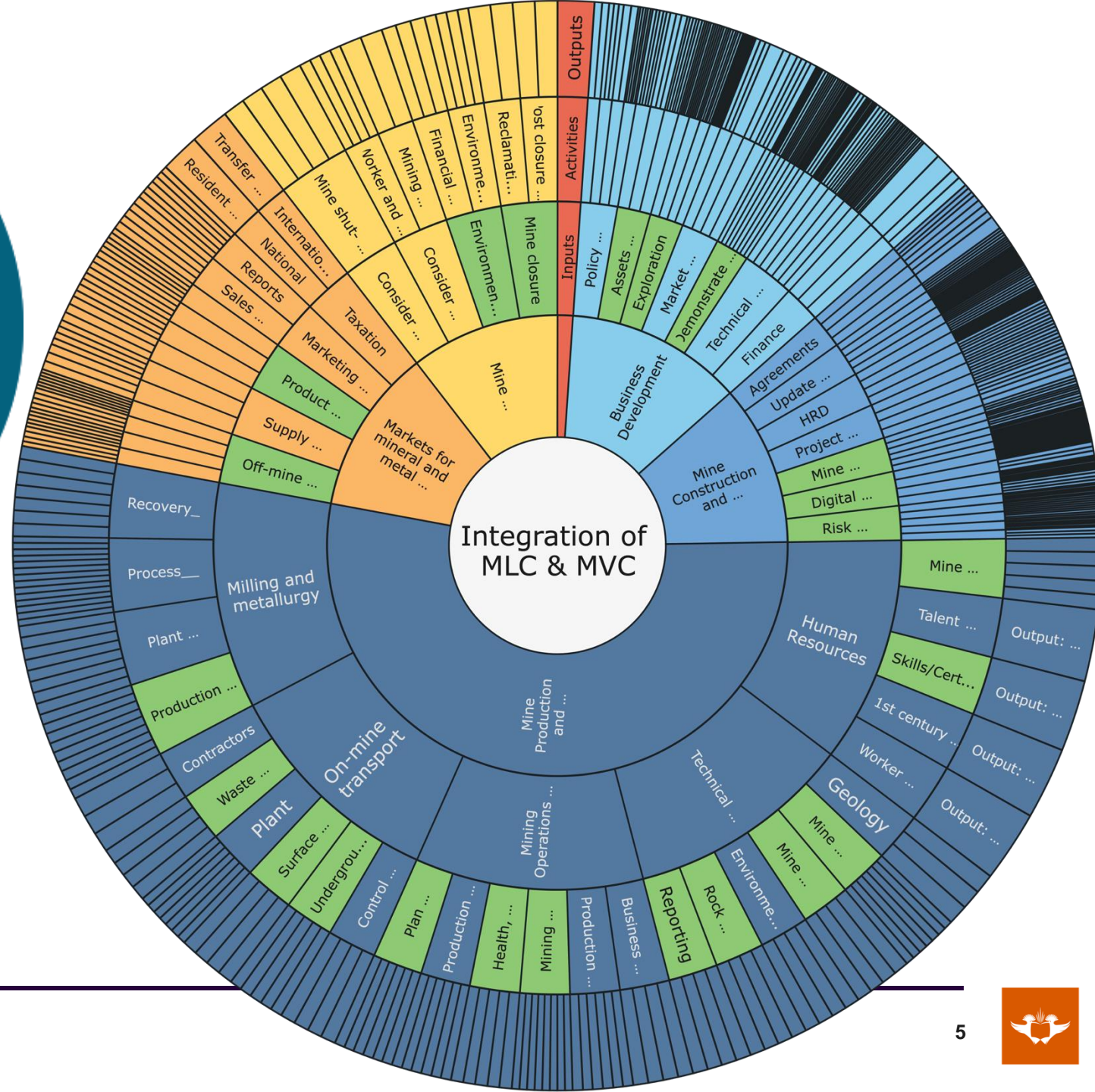
MRM function is a dynamic, scientific field of knowledge and expertise, which explains

- Why the ISM organises regular scientific congresses (Generate and share leading practices)
- Why the ISM has established Commission 2, along with other specialised fields (Commissions)
- Why the ISM publishes congress proceedings and the work of its commissions

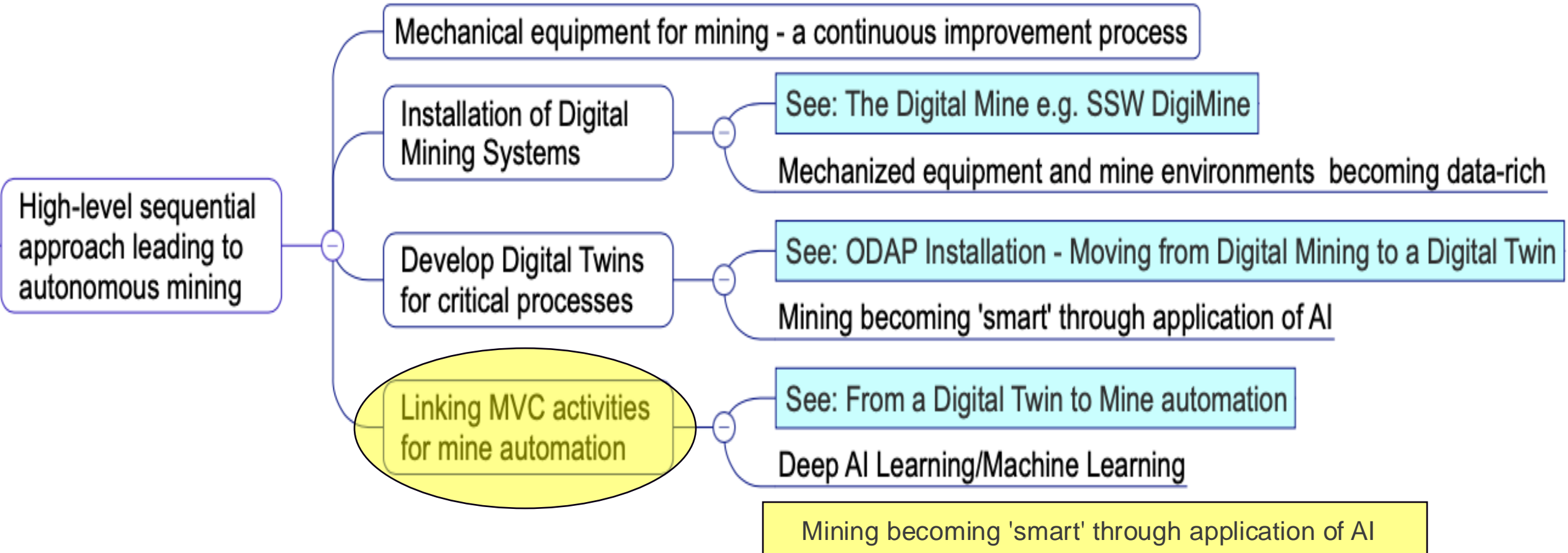
Commission work is multi-disciplinary and broad, which explains

- Why ISM 2 work overlaps with other ISM Commissions
- Why the ISM collaborates with other Societies in Mining, Engineering, Geodesy, Geology & Geophysics
- Why policy-makers and governments support the work of learning societies like the ISM





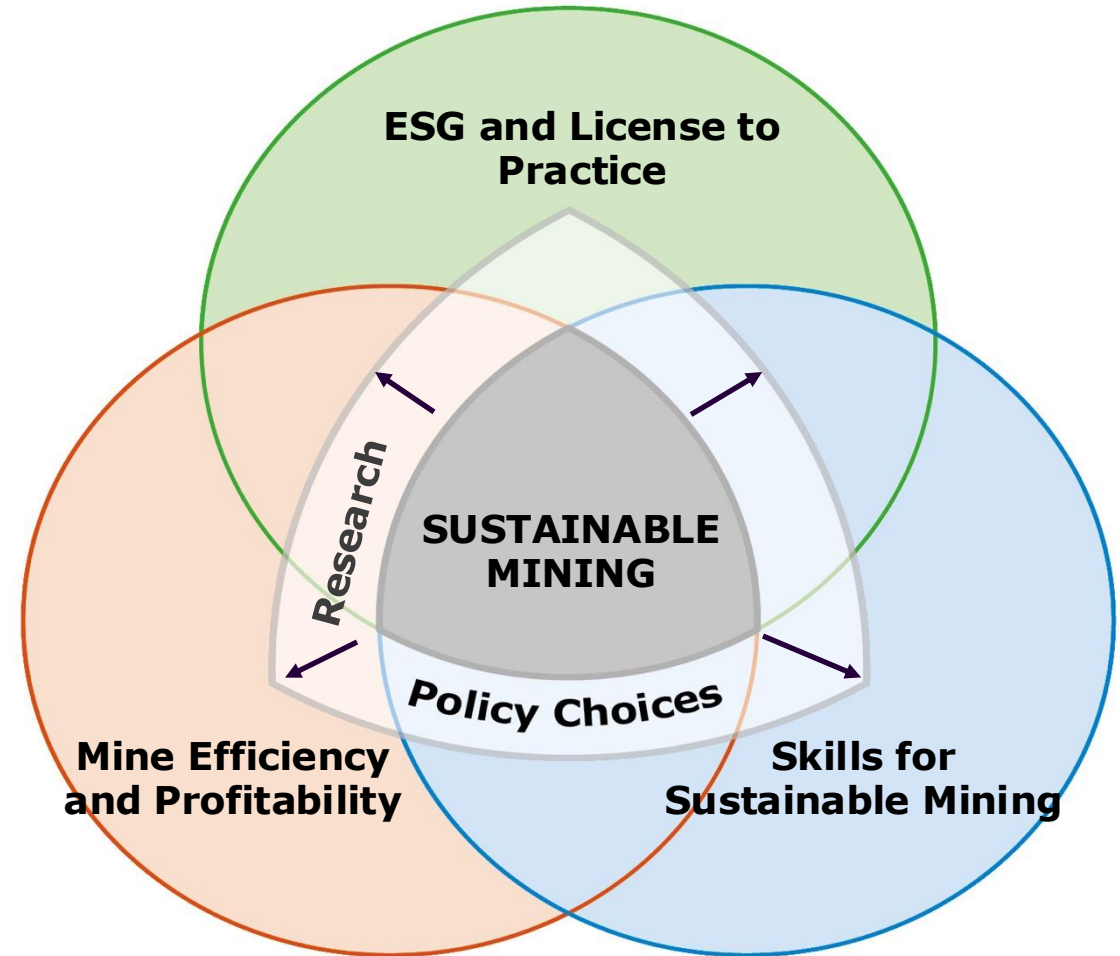
The Mine Modernization Process



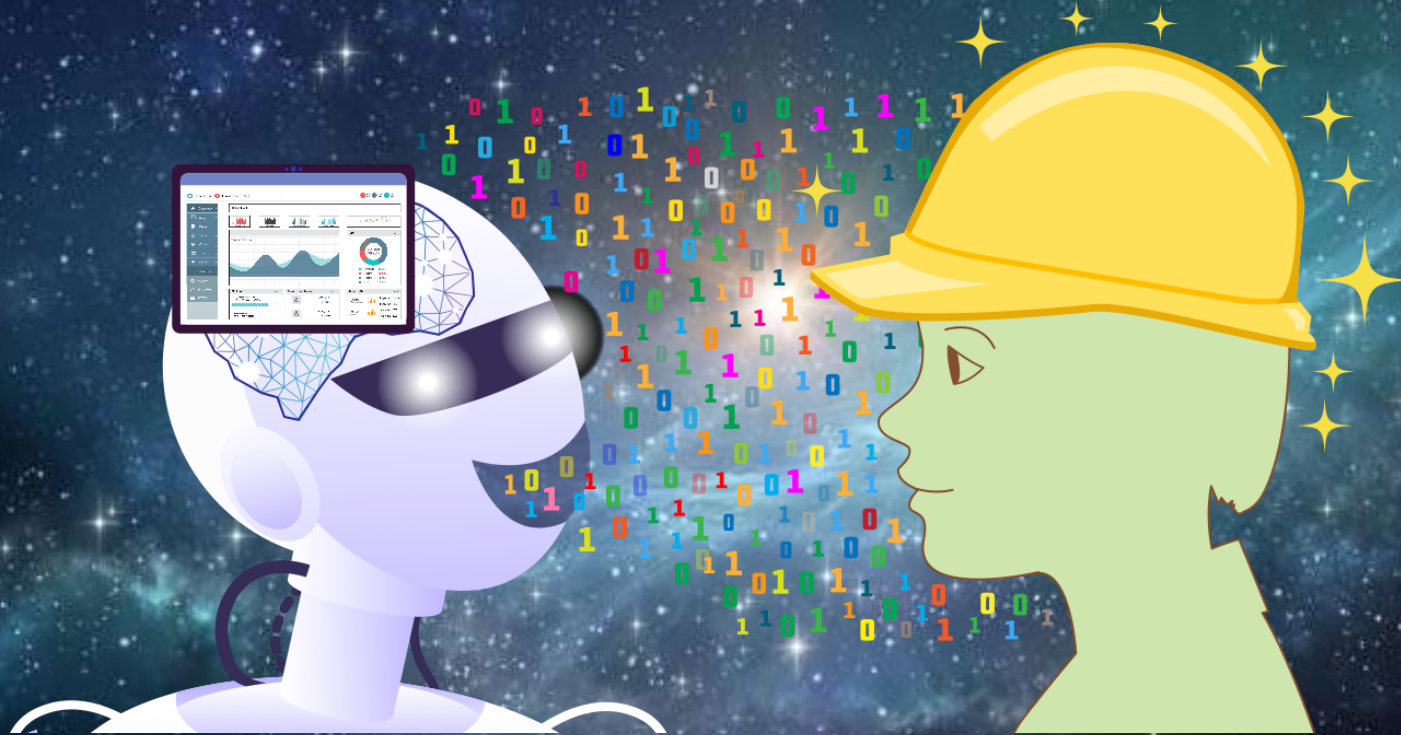
What Digitalization means to Sustainable Mining

1. Benefit through Smart, Green Mining Engineering
2. Quicker and Better decisions from monitoring data and other information, e.g. Mine access control and yes-or-no-propositions
3. Predicting (seeing) the future, e.g. Forecasting of anything there is data on
4. Classifying things in a meaningful way, e.g. Delineating safe and no-go areas
5. Making the best, rational decision in a given context

These will make mining better



What now?



*Man and machine collaboration is no longer avoidable.
We must develop the knowledge and skills for this world of work.*

Considerations for ISM

Develop the knowledge, skills and competence for this (AI) World of Work

- Why? So that the ISM and its members remain relevant
- How? Active commissions, who are taking their work seriously and generate leading practice standards
- Then, Universities and skills providers must disseminate knowledge through learning programmes

Role of the ISM

- ISM members must actively participate in Commission work and at ISM events
- Commissions must identify and discuss leading practices
- ISM meetings and events must generate the body of knowledge to inform an AI-powered World of Work
- For this to happen, members must know their industries, practice professionally, compile leading practice case studies and share their research through publications and ISM conferences



A few AI Examples affecting the work of ISM Commissions

AI is enabled by digital systems and software that are fundamental to the work of the ISM, e.g.:

1. Data collection: Combining AI with statistical methods to define accuracy and establish rule compliance
2. Control surveys: See next slide where new techniques generate big data systems
3. Survey techniques: Use of AI for automated instrumentation and on-board calculations
4. Deformation monitoring: Applying AI to real-time systems of surveillance, modelling to generate risk alerts
5. Mapping: Applying AI to SLAM, 3D reality capture, extracting more layers from existing data sets (satellite)
6. Tracking/reconciliation: Using AI for tracking personnel, equipment, material/inventory, etc.
7. Connecting point clouds through fusing close-range photogrammetry (CRP) and laser scanning databases
8. Predictive Modelling: AI predictions from remote sensing data using Machine Learning Algorithms

Basically, AI is applicable to all problems that can be solved through algorithms and processes, e.g.:



What the ISM can (should?) do about this

Standards development for the Mine of the Future, e.g.:

1. Standards for the integration of AI with fundamental surveying practices on collection, processing and presentation of survey data
2. Standards for multiple-source big-data systems, cataloguing and deciding on fitness-for-use
3. Contributing to standards setting for international reporting of mineral resources and reserves to enable national policy-making, planning and international comparisons
4. Contributing and informing qualifications development for globally-aligned professionals
5. Updating requirements for professional practice and registration e.g. Sign-offs and Protection of the public





Thank you



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