

Technology innovation for the mineral resources sector

Australian mineral resource exploration and development can only deliver positive economic and community benefits if it remains efficient and sustainable through ongoing investment in technological innovation.

The mineral resource sector

The mining sector has been a key contributor to the Australian economy, underpinned by large export earnings and capital investments. Australia is a leading producer of minerals for the world and produces 19 minerals in significant amounts from nearly 400 operating mines. Over the past decade, economic growth has increased demand for mineral products worldwide.

The economic extraction of previously uneconomic mineral deposits has been made possible as a result of innovations and improvements in mining techniques and processing technologies.

As part of the resources cycle, excessive expansions in mining operations have led to oversupply in some commodities. Further, many companies view exploration in Australia as mature and are moving their exploration efforts to other countries with perceived higher potential for new discoveries. This has led to a continuing decline in minerals exploration investment in Australia.

To remain competitive and continue to grow, the minerals industry in Australia needs to ensure it continues to invest in the discovery of new resources, significantly improves productivity, and addresses all aspects of cost and licence to operate.

The ongoing development and application of new technology will be a key element in bringing new economic opportunities for Australia's minerals sector. Investing in advances in technology that act as solutions to sustainable development of the industry will be vital for developing higher environmental standards without compromising business objectives.

Enhanced engagement and knowledge translation between researchers and industry players of all sizes, is needed so that Australia can remain globally competitive. Producers in Australia must engage in the best up-stream and down-stream technologies to enhance productivity outcomes.

Improvements in exploration, development, mining, processing, remediation and social/community engagement will have some specific requirements based on location and geology that cannot be totally reliant on importing technology solutions.

In combination with the innovative mining equipment, technology and services (METS) sector, there is great opportunity to expand research and development (R&D) conducted in Australia to support local requirements.

The vision

The Academy envisages that the minerals industry will continue to be a major contributor to Australia's prosperity while striving to make a net positive impact on both the environment and community. Licence to operate issues - including energy and water use, emissions, and managing environmental and heritage impacts - will remain crucial. Respectful engagement across sectors to enable confidence in decision making will be more important than ever.

Technical innovation has a major role to play in meeting these economic, social and environmental objectives, and as so many are site specific, there needs to be an ever expanding effort to research and develop a range of technologies to achieve these objectives. This technical innovation should also provide opportunities for new industries supplying equipment, consumables and services to the global mineral resources industry.

The development challenges

The mineral resources industry will continue to face a broad range of challenges to remain competitive. The impact of the economic challenges of falling commodity prices, supply and demand fluctuations and exchange rates need to be cushioned by enhanced productivity.

Technological innovation-led productivity can be built on a foundation of exploration technologies that can find additional economic deposits. Improvements also need to be sought continually in drilling, blasting, excavation stability, load and haul, crushing, beneficiation, extraction, transport and quality control.

Environmental impact issues (including emissions footprint) and post-production development and remediation are important from the perspective of the social licence to operate and financial viability. Water issues such as below water table mining, dust control, mineral processing, waste water recovery, and ground water quality need to be appropriately managed and monitored.

Ongoing improvements to health and safety processes will be critical in ensuring a safe and incident free workplace.

Encouraging education and infrastructure development will be important for local and regional development, as will working with the social sciences and humanities for better workforce, family and community outcomes. Boosting science, technology, engineering and mathematics (STEM) education will be important for meeting future workforce needs. However, at present there are declining positions for vacation students, while in parallel there are increasing demands for 'on the job' experience and emerging skills such as data analytics.

Each of these issues require active engagement across a range of stakeholders to deliver solutions, so developing evidence-based information on the performance and impacts of mineral development is important for public debate and to influence policy.

Priority focus areas

Mineral resource management driven by technology, science and innovation will be important in advancing the sector.

Priority focus areas include:

- » **Exploration:** Australia has challenges as well as advantages in exploration methods, instrument development, and data processing and interpretation. Barriers to exploration derive from the widespread cover of potential mineralisation by highly weathered and transported materials.
- » **Productivity, growth, technology and innovation:** Productivity improvements are required for Australia to remain a leading resource and energy exporter. It will be essential to access and analyse large volumes of data to identify and monitor improvements. Appropriate technologies will increase productivity and streamline processes.
- » **Research and development:** R&D needs to be funded across the cycle to ensure continuity of work, efficient use of R&D assets (human and equipment) and to prevent loss of knowledge mid-development. Incentives must be developed to encourage industry to invest in R&D in Australia.
- » **Innovation, commercialisation and intellectual property:** The resource sector in Australia must develop strategies for rapid commercialisation and deployment of new technologies. This is particularly important to underpin the Australian METS sector, which is an area of growing competitive advantage, but one that will need to continually introduce improved technologies if it is to maintain an international leadership position.
- » **Knowledge transfer, skills and education:** New technologies are changing the skill sets for trades and paraprofessionals. Professional skills are also at risk due to the declining number of academics as a result of high salaries in industry, plus globalisation of R&D. Australia must maintain appropriate education infrastructure and forecast the skills that will be required to support the way mines will operate in the future. Collaboration between the resources industry, academia and government is crucial in specifying the gaps and unproductive overlaps in the national research effort. In addition, collaboration will be important for the development of professionals through both practical and theoretical training, graduate placements and internships, scholarships and ongoing ways to keep academics informed by the latest practices.
- » **Sustainable development and social licence to operate:** Sustainable development of the minerals industry should aim to have a net positive impact on both environment and community, including improved health and safety outcomes. The use of technical innovation in lifting sustainable development should emphasise proper scientific assessment of risks and technological solutions.

The way forward

The Academy believes that to ensure Australia has an efficient and sustainable mineral resources sector, three themes need to be considered in an integrated approach to effective policy:

- » **Theme 1: Exploration**
Australia can ensure the sustainable and competitive future of a commodity-diverse minerals industry through future world-class exploration for, and discoveries of, the highest value traditional and non-traditional resources. Development of long term competitive funding of R&D in this field is needed to achieve this.
- » **Theme 2: Productivity**
The development of technology-based industries to provide equipment, consumables and services to the mineral resources sector needs to be fostered, along with the development of yet more innovative technologies in mining, beneficiation, and metallurgical processes. Measures are required to increase the collaboration between publicly funded researchers and the mining sector.
- » **Theme 3: Sustainability**
There need to be more effective processes in place to take into account the environmental, social and economic costs of Australia's mineral resources industry. More accessible and expanded collections of evidence-based information on the environmental impact of mineral development will be important to inform the public debate and influence government policy.