

# SECURING AUSTRALIA'S FUTURE MINERALS WORKFORCE

## Supporting STEM learning and career paths

The minerals industry is proactively working to prepare for changes to the skills composition of its future workforce, addressing SDG4 – Quality education: Ensuring inclusive and equitable education and promoting lifelong learning opportunities for all. While focused on SDG4, this case study also supports SDG8 – Decent work and economic growth.

These changes flow on from the evolving nature of work and workers and increasing technology adoption (such as automation, robotics and artificial intelligence) across the mining value chain.



4 QUALITY EDUCATION



 **Cardno**

The changing nature of the minerals industry workforce requires new approaches across the entire learning lifecycle, including within the Australian education sector.

Through industry-wide collaboration and company-specific initiatives, Australia's minerals industry is taking a leading role to secure its future workforce and provide new career pathways for existing and new employees. This case study shows how the minerals industry embeds SDG4 within its core business by supporting employee, student and community training, education and development. Also shown is how social investments can support broader access to quality education.

Relevant Australian SDG4 indicators include participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex.<sup>1</sup>

### SDG4 – Quality education

The skills, knowledge and learning gained through quality education are building blocks for healthy and prosperous lives. Quality education also equips people with the tools necessary for innovative solutions to the challenging and complex problems facing the world today.

Science, technology, engineering and maths-related (STEM) skills are increasingly important to live and work in a globalised world. Around 70 per cent of all future jobs will be STEM-related.<sup>2</sup>

The SDG Compass suggests that companies can contribute to SDG4 by collaborating with governments and the higher education sector to develop programs that meet workforce needs.<sup>3</sup>

Australia's future national productivity requires workers that can fill STEM-related jobs in order to withstand global competition.

### Drivers for SDG4 inclusive and quality education in Australia

Studies established a relationship between education outcomes and diminished health, unemployment, low wages, social exclusion and teenage pregnancy.<sup>4</sup> In Australia, students with lower socio-economic status, Indigenous students and those residing in regional and remote areas can experience lower educational opportunities, experiences and outcomes.<sup>5</sup> As a significant employer in rural and regional Australia, the minerals industry is well-placed to support programs and interventions that contribute to improved outcomes for these students.<sup>6</sup>

The marked decline in STEM subject participation in schools over the last decade is concerning and is prompting a number of questions, including whether Australia will have enough STEM-skilled professionals for future jobs across the economy. A significant gap also exists in women's participation and tertiary enrolments in STEM; only 16 per cent of university and vocational education and training STEM graduates are women.<sup>7</sup>

### STEM learning and education in the Australian mining sector

Australia has a highly-skilled and adaptable minerals workforce. For example, 29 per cent of its workers hold a Certificate IV level qualification or higher—above the national average and one in five workers hold a bachelor degree or higher.<sup>8</sup> Apprentices also make up 4 per cent of the minerals workforce, well above the national all-industries average of 2.1 per cent.

Australia is a global leader in minerals higher education, moving from a state of near collapse in 2000 to a unique, innovative and collaborative model developing world-class mining graduates.<sup>9</sup>

According to Australia's Chief Scientist, Australia loses female talent at every stage of the STEM pipeline from primary school through to entry and involvement in the workforce.<sup>10</sup>



**STEM** Science, Technology, Engineering, Mathematics

### Preparing for the future minerals workforce

Broader skills and capabilities important to the future minerals workforce include core technical skills coupled with cognitive and interpersonal skills in addition to specialist skills in complementary disciplines. STEM skills are becoming even more important as companies embed digital thinking into strategy and practice.<sup>11</sup>

However, the supply of suitably qualified minerals professionals in Australia is dwindling. From a minerals industry perspective, the transition from the mining construction to the production phase resulted in less employment demand in some disciplines. Falls in commodity prices and perceptions of a 'post-mining boom' further contributed to a pronounced drop-off in minerals education tertiary enrolments since 2012.<sup>12</sup>

Companies and industry organisations continue to develop new partnerships and approaches to encourage people to pursue further education and learning.

The World Economic Forum counts STEM literacy as a measure of the future readiness of countries, enabling students to thrive in the 'known unknown' of future careers.<sup>13</sup>

### Preparing for the future minerals workforce

On 17 May 2018, industry, academia and governments convened the first Minerals Industry Education Summit. The summit examined current and future workforce needs, the

1 Australian Government, Quality Education, Australian Government, viewed 4 October 2018.

2 Pricewaterhouse Coopers, A Smart Move: Future-proofing Australia's workforce by growing skills in science, technology, engineering and maths (STEM), April 2015, p. 14. As referenced in [www.riotinto.com/ourcommitment/spotlight-18130\\_22976.aspx](http://www.riotinto.com/ourcommitment/spotlight-18130_22976.aspx).

3 Global Reporting Initiative, United Nations Global Compact and WB SCD, SDG4, GRI, UNDC and WB SCD, viewed 3 October 2018.

4 Committee for Economic Development Australia, How unequal? Insights on inequality, April 2018, chapter 3, p. 57.

5 *ibid.*, p. 50.

6 Minerals Council of Australia, Submission to Senate Select Committee on the Future of Work and Workers Inquiry, January 2018, p. 7.

7 Office of the Chief Scientist, Women in STEM – A story of attrition, Australian Government, 2016, viewed 17 October 2018.

8 Department of Education, Industry Outlook: Mining, Canberra, 2014; and Minerals Council of Australia, Miners at Work, Canberra, 2018.

9 Minerals Council of Australia, Submission to Senate Select Committee on the Future of Work and Workers Inquiry, January 2018, p. 11.

10 *ibid.*

11 Productivity Commission, Shifting the Dial: 5 Year Productivity Review, Report No. 84, Canberra, 3 August 2017, p. 83-84.

12 Minerals Tertiary Education Council 'Key Performance Measures Report 2017', Minerals Council of Australia, p. 3.

13 M Timms, K Moyle, P Weldon & Pru Mitchell, Challenges in STEM learning in Australian Schools, Australian Council for Educational Research, 2018, p. 3.

education and training landscape and discuss a collective response to changing skills requirements, educational challenges and the recruitment and retention of qualified professionals. Participants discussed how to work with students, the education sector, industry and governments to plan for the future minerals workforce.

Further informed by the summit, industry-wide and cross-sector collaboration is continuing as partners work to develop a national strategy that will:

- Create post-graduate qualifications providing a pathway for graduates of other engineering disciplines to qualify as mining engineers
- Identify skills and capabilities to enable the existing minerals workforce to upskill, cross-skill and re-skill through Vocational Education and Training, including micro-credentialing
- Mapping career and employment pathways to show the opportunities and pathways into the minerals industry
- Forecast future employment needs and opportunities across the industry.

### Minerals Tertiary Education Council

Through the Minerals Tertiary Education Council (MTEC), Australia's minerals industry has invested more than \$50 million over the last decade in a range of minerals-related tertiary education programs. This has led to the development of new, innovative programs to educate, train and ready Australia's minerals workforce.<sup>14</sup>

A key initiative is Mining Education Australia, a joint venture between MTEC partner universities—the University of Queensland, University of New South Wales, University of Adelaide and Curtin University in Western Australia—to combine teaching resources for delivery of high-quality third and fourth-year mining tertiary education.<sup>15</sup> It is a world-first approach to delivering a consistent curriculum across institutions, garnering international attention. Partner universities rank within the World's Top 10 Minerals and Mining Schools.<sup>16</sup>

Another major initiative—the Minerals Industry National Associate Degree in mining engineering and minerals geoscience—is an associate degree supported through MTEC. It provides para-professional qualifications to support entry or upskilling into the minerals industry. The Associate Degree in Mining Engineering is delivered at the University of Southern Queensland while the Associate Degree of Geoscience is delivered at Central Queensland University, providing access for students in regional Australia.<sup>17</sup>

### Supporting diversity and inclusion

In addition to company-specific initiatives, the MCA acts as a central point to support for programs encouraging girls and women and Indigenous students to pursue an interest in STEM careers. Key partnerships are with Aurora Education Foundation (to support the career aspirations of Indigenous students), the Indigenous Australian Engineering School and Robogals Asia Pacific (to encourage girls to develop an interest in engineering).

In addition, the MCA along with a number of its member companies are corporate partners of the Clontarf Foundation. The foundation supports young Aboriginal

and Torres Strait Islander men to achieve their education, employment and life goals.

MCA also coordinates industry support for the national Teacher Earth Science Education Program. The program assists the professional development of science teachers through nine professional development modules. Online resource and minerals kits are also provided at no cost.<sup>18</sup>

MCA research shows many young people know little about careers in the mining industry, underlining the importance of industry-wide efforts for a youth-focused awareness campaign and broader future minerals workforce strategy.<sup>19</sup>

### In action: Rio Tinto

Rio Tinto is a leading global mining group focused on finding, mining and processing mineral resources. Its goal is to deliver strong and sustainable shareholder returns from its portfolio of assets and pipeline of projects. Australia is home to about half of Rio Tinto's global assets, with operations spanning aluminium, copper and diamonds, energy, minerals and iron ore.

Rio Tinto is a long-term partner of initiatives supporting literacy and numeracy, vocational education and training.

### Developing Australia's first qualification in automation

In 2017 Rio Tinto announced a partnership with the Western Australian Government and South Metropolitan TAFE to support development of new technology and innovation career pathways. This collaboration recognises the need for skills to support new roles within the workforce being created by automation and digitisation.

For example, a range of new roles were created when Rio Tinto introduced driverless trucks at its Western Australian Hope Downs 4 iron ore mine in 2014. This included entirely new roles as controllers to operate and monitor driverless vehicles, pit controllers to monitor and manage vehicle operations on site and communications and systems engineering specialists to provide detailed fault diagnostics.<sup>20</sup>

Rio Tinto has committed \$2 million to support industry, government and the education sector to collaboratively develop and deliver new nationally-recognised qualifications in automation. The qualifications will be available through TAFE colleges and high schools in Western Australia from 2019. The collaboration will also see development of complementary programs to build digital skills.<sup>21</sup>

### Partnering with Scitech

Scitech is a not-for-profit organisation aiming to increase the awareness, capability and participation of Western Australians in STEM disciplines. Rio Tinto's long-term partnership with Scitech supports outreach programs across the state as well as a two-day 'RoboCup' robotics contest. Students apply skills like coding, robotics, engineering, programming and maths in a fun—yet competitive—environment during RoboCup.<sup>22 23</sup>

### Partnering with Murdoch University

Rio Tinto's partnership with Murdoch University facilitates various activities to encourage the interest of students in

<sup>14</sup> Minerals Council of Australia, *Modernising STEM education for Australia's future mining workforce*, MCA, viewed 15 October 2018.

<sup>15</sup> Minerals Council of Australia, *Minerals Tertiary Education Council*, MCA, viewed 27 September 2018.

<sup>16</sup> Mining Education Australia website, MEA, viewed 27 September 2018.

<sup>17</sup> Minerals Council of Australia, *Workforce, Education and Skills* viewed 1 October 2018.

<sup>18</sup> Minerals Council of Australia, *Minerals Tertiary Education Council*, MCA, viewed 27 September 2018.

<sup>19</sup> *ibid.*

<sup>20</sup> Michael Gollschewski, 'Case study: Automation and Australia's future workforce', in CEDA (Eds) *Australia's future workforce?* Melbourne, 2015, p. 73.

<sup>21</sup> Rio Tinto, *Rio Tinto partners with TAFE to deliver Australia's first automation qualifications*, Rio Tinto, Melbourne, viewed 4 April 2018.

<sup>22</sup> Rio Tinto, *Can robots future-proof Aussie kids?* Rio Tinto, viewed 1 October 2018.

<sup>23</sup> Shannon Fleming, *WA Students Compete with STEM Skills at 'Robotics Olympics'*, SciTech, viewed 28 September 2018.



Photos: RoboCup Junior 2018, Scitech

This case study demonstrates practice of *Enduring Value*:

- **Principle 2:** Integrate sustainable development principles into company policies and practices
- **Principle 3:** Uphold fundamental human rights and respect cultures, customs and values in dealing with employees and others who are affected by our activities
- **Principle 9:** Contribute to the social, economic and institutional development of communities in which we operate.



chemistry, physics, maths, statistics and engineering. It also seeks to give students an insight into mining careers and show the steps to get there. It is focused on building an inclusive, modern picture of STEM careers, including encouraging more women and young Indigenous people to participate in science and technology.<sup>24</sup>

#### A long-term collaboration

For more than a decade, the Rio Tinto Centre for Mine Automation at the University of Sydney has pioneered world-class research to develop new mining technology. Through its work, the centre also supports the education of mining engineers and technicians and more than 10 PhD scholarships have been awarded to support automation research over this period.<sup>25 26</sup>

#### Key outcomes

Contributing to quality education through targeted initiatives, cross-industry collaborations and investment has secured and enhanced Australia's world-class minerals education sector. This approach has helped develop job-ready mining professionals.

Creating a network of minerals tertiary education providers in mining regions has supported skills retention and development in regional areas. This has flow-on benefits for other industries that may require the same or similar skill sets.

Development of a para-professional qualification is assisting people of different backgrounds and experience to join or advance within Australia's minerals workforce.

#### Lessons

- Existing industry-wide collaboration and company-specific initiatives, coupled with new interventions and innovation, are fundamental to securing Australia's future minerals workforce
- New partnerships that challenge traditional ways of doing business can support enhanced outcomes. An important part of the success of approaches is identifying and remaining committed to shared goals.
- Local efforts, including in regional areas, to support education and awareness may have a significant impact and represent a win-win for companies and employees
- Effective partnerships with other organisations, including small not-for-profit organisations that share similar goals and values enable fit-for-purpose approaches to common challenges. For example, Rio Tinto's partnership with Scitech supports a locally-based approach to engagement with students.

<sup>24</sup> Rio Tinto, *Can robots future-proof Aussie kids?* Rio Tinto, viewed 1 October 2018.

<sup>25</sup> The University of Sydney, *Celebrating a decade of smart mining solutions*, The University of Sydney, 5 December 2017, viewed 28 September 2018.

<sup>26</sup> The University of Sydney, *Australian Centre for Field Robotics*, The University of Sydney, viewed 28 September 2018.