MINING EQUIPMENT TECHNOLOGY SERVICES

SECTOR COMPETITIVENESS PLAN 2019 UPDATE

Australian Government
Department of Industry, Innovation and Science
Industry Growth Centres

METS Ignited is an industry-led, government-funded, Growth Centre for the mining equipment, technology and services (METS) sector.

METS Ignited works with Australian suppliers to the mining industry, local and global miners, research organisations and capital providers to improve the competitiveness and productivity of the sector.

To find out more visit www.metsignited.org

Contents

List of Tables 3

List of Figures 3

Executive Summary 6

1: Significant Trends & Influences–2018 11

- 1.1: The upturn in the mining sector 11
- 1.2: A source of economic data on the METS sector 12
- 1.3: The application of digital technologies in the Mining Value Chain 15
  - 1.3.1: The Internet of Things (IoT) and Data Analytics 15
  - 1.3.2: Artificial Intelligence (AI) and Machine Learning (ML) 15
  - 1.3.3: Automation, Autonomy and Robotics (AAR) 15
- 1.4: The rise of Social Performance 16
  - 1.4.1: Responsible mining and sustainability 16
  - 1.4.2: Safety 16
  - 1.4.3: Environmental Stewardship 17
  - 1.4.4: Community Licence 17

2: Trends and influences over SCP 2016 20

- 2.1: Aligned Strategy 20
- 2.2: Global Brand 21
- 2.3: Internationally Competitive 22
- 2.4: Collaborative and Innovative 23
- 2.5: Skilled for 2026 24
- 2.6: Regulatory Environment 25

3: Impact of the Trends and Influences on the METS SCP 20 28

- 3.1: Sector strengths (internal) 28
- 3.2: Sector weaknesses (internal) 28
- 3.3: Sector threats (external) 29
- 3.4: Sector opportunities (external) 29

4: How METS Ignited is addressing the trends in the SCP environment 32

5: Appendix: Stakeholder interviews 36

List of Tables

Table 1: METS Ignited's responses to the trends influencing the METS Sector Competitiveness Plan 32

Table 2: Stakeholders insights and feedback 36

List of Figures

Figure 1: Future business trends 11

Figure 2: The METS sector rebounded after 2015/16, with two consecutive years of GVA growth 12

Figure 3: Employment in the specialised METS sector has followed the mining economic cycle, but experienced strong growth overall 12

Figure 4: Businesses with >$2m in revenue generate nearly 70% of sector revenue; similarly, 80% of jobs are in businesses with 5 or more employees 12

Figure 5: While the sector has grown overall, at segment level four distinct groups have grown at different rates over the long term 13

Figure 6: Australia's total specialised METS exports were estimated to be worth $13bin 2014, with 67% being indirect exports 13

Figure 7: The largest segments in export contribution were manufacturing, transport services and wholesale trade 13

Figure 8: Exports from the specialised METS sector grew significantly in the first half of the decade, after a contraction following the GFC 13

Figure 9: Potential opportunities available to influence regulation and policy 25

Executive Summary

Executive Summary

The Mining Equipment, Technology and Services (METS) sector comprises a significant portion of the Australian economy, contributing an estimated $92b in gross value added (GVA) in 2017/18[1]. The sector consists of specialised METS suppliers and non-specialised suppliers. The specialised part of the METS sector provides services such as mine construction, geological survey services, and the manufacturing of mine-specific equipment. These are goods and services that specifically support mining activities. The remaining, non-specialised part of the METS sector provides other goods and services used in the mining supply chain, such as financial services, travel and accommodation, that are not specialised to mining but are used also by other sectors. In 2017/18, it is estimated that the specialised METS sector contributed $47b in GVA (51 per cent), with the non-specialised sector contributing $45B.

This compares with the 2017 Deloitte Access Economics report to the Minerals Council of Australia that found the total economic contribution by Mining and METS together to be $236.8b or 15% national gross domestic product. Total jobs in both sectors are approximately 1.1m or 10% total employment, suggesting that total Specialised + Non-Specialised METS employment is greater than 800,000, a very large number by any account.

There are about 90,000 businesses in the specialised METS sector. This includes businesses of all sizes, from large multinationals to small and medium sized businesses, and through to small contractors, consultants and sole traders. For reference, this compares to 130,000 businesses in the retail trade sector and 84,000 businesses in the manufacturing sector. Only about 7% (6,700) of these businesses generate revenue of $2m or greater. These businesses are responsible for nearly 70% of the total revenue of the specialised METS sector. Within this set of firms, there are about 1,500 businesses generating more than $10m revenue annually. These are the businesses that are likely to provide most future impact to the sector and are the ones that METS Ignited must target.

[1] METS Sector Demographics Report, AlphaBeta, 2018

METS Sector Competitiveness Plan (SCP)
The METS SCP prepared in 2016 provided a snapshot of the industry at the time, seen through the eyes of the various stakeholder groups. The Aspirations, Strategies and Actions developed via the SCP consultation delivered a 10-Year view of success for Australia's METS sector and how the sector could achieve this success. The SCP was particularly influenced by the fact that the mining sector had been in an abnormally long growth phase in its typical economic cycle—12 years compared to the usual 4–7 years of growth—and was in the middle of an abnormally deep contraction.

This update focuses on the trends and influences within the sector that will influence the SCP for its next major update. This is not an update of the METS SCP at this time, but is designed to identify the changes that will be required as the next mining economic cycle develops, the Australian economy and social / environmental expectations change, and the international competition further develops. It also comments on other trends such the growing digital capabilities in all sectors, the growing awareness among miners and METS of the value to be derived through collaborative approaches to addressing mining's Key Challenges, and the opportunities emerging from the trend towards new energy sources.

Finally, this update indicates how METS Ignited is responding to these situational changes via its priority initiatives, projects and activities for FY2020 and beyond, as described in its Annual Business Plan.

2019 Update Key Changes

Since the development of the SCP in 2016, there have been some important changes in the economy and in the sector which provide the foundation for this 2019 Update. These are:

1. The recent upturn in the mining sector, its sustainability becoming apparent in mid-2018, and the impact of this on Australia's METS companies.
2. The rapidly growing application of digital technologies including the Internet of Things (IoT), Data Analytics, Artificial Intelligence (AI) and Machine Learning, Automation and Autonomy, and Robotics developments, along the entire value chain from exploration through to shipping and rehabilitation.
3. The increasing importance to the mining sector, especially the global miners, of Social Performance including safety, environmental stewardship and community licence.
4. The continued and increasing importance of the minerals sector to Australia's economy.

Strategic Initiatives

METS Branding and Narratives

Transformative Automation in METS and Mining (TAMM)

Industry-Driven Research Funding

Project Funds for Collaboration

Future Management and Skills Program

Challenge-Based Innovation Platforms

National Accelerator Program

International Markets Program

METS Business Improvement Pilots (Qld)

Regulation Opportunities Roadmap

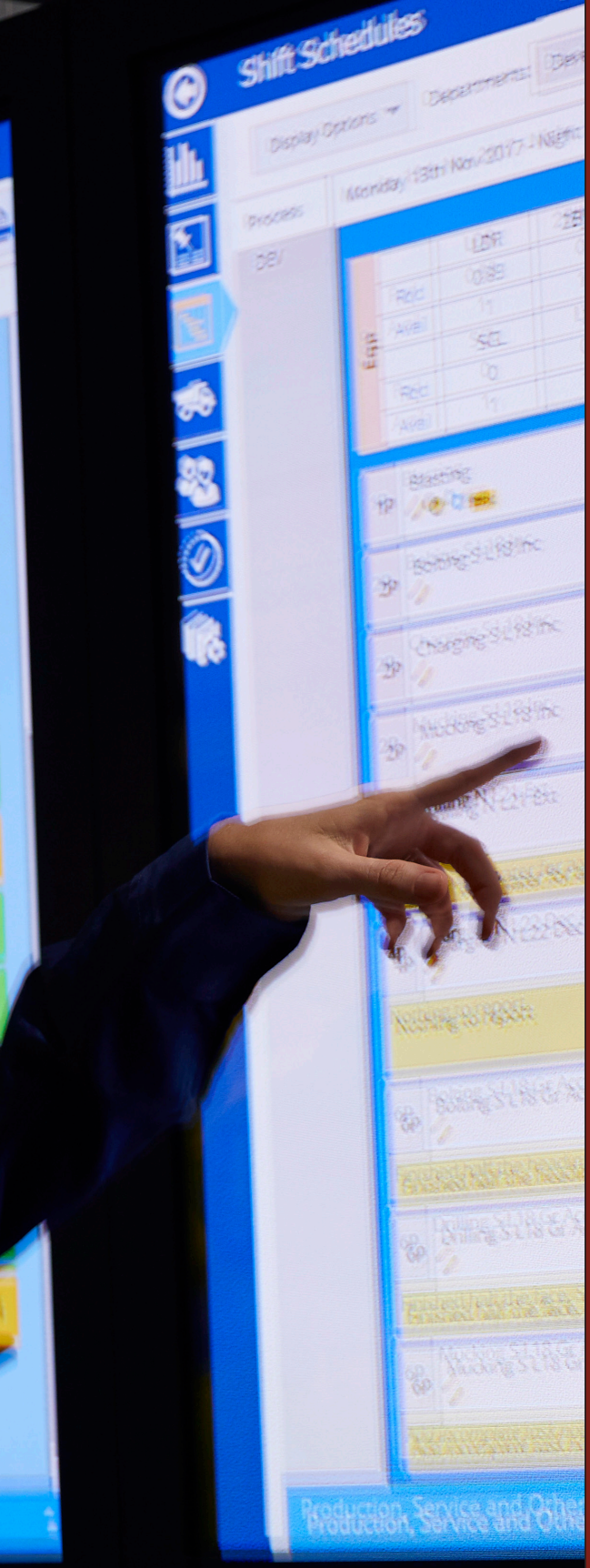
Enabling Initiatives

Marketing and Communications

Sector Competitiveness Plan Updates

Industry Knowledge Priorities Refinement

Internal Skills and Organisation



1

Significant Trends & Influences 2018

Significant Trends & Influences - 2018

1.1 The upturn in the mining sector

In the early 2000s the minerals industry was thought by much of the population to be replaced by the high-tech and services sectors, however the minerals sector in Australia completed its longest growth cycle in recent history at the end of 2012, with the completion of the mining construction boom. Since that time, production volumes of minerals have grown by an average of over 4% per annum[2], confirming the impact of the mining construction boom on production levels since 2012.

In 2018, Australia's resources exports—including minerals, metals and petroleum—generated $248b in revenue. This is the highest-ever annual export value and accounted for 72% of Australia's goods exports. Trade data from the Australian Bureau of Statistics had coal as Australia's number one export earner in 2018[3], with higher prices and export volumes supporting a record high $66b in export revenue. 2018 was also another strongly performing year for Australia's world-leading gold industry, with $20b of gold exports based on rising production at existing operations and new mines opening up in Western Australia. This upturn also includes the increasing global interest in energy minerals and critical minerals, both of which are increasing in importance to Australian mining over time.

The outlook for METS for at least the duration to the next downturn in mining's economic cycle is very positive, as noted in Figure 1 below. This does however assume that Australia invests to become part of the growing digitisation of mining and does not simply wait to be supplied by the established global METS suppliers.

Fundamental trends suggest positive outlook for the METS sector in the near to medium term

Production Levels will steadily increase
Production levels are forecast by the Office of the Chief Economist to increase by 7% between 2017-2020 as new capacity comes online, with modest increases in the key commodities of Iron Ore and Coal, and more significant increases in smaller commodities.

Mining investment will stabilise above pre-resources boom levels
Reserve Bank analysis has estimated that mining investment will stabilise in the range of 2.5-4% of GDP, which is above pre-boom levels. If investment achieves the mid-point of this range this will exceed the levels seen in 2017/18.

There is the prospect of an "investment in productivity" dividend
Prior AlphaBeta research has identified the potential for substantial productivity improvements in the resources sector through investment in technology and automation. This investment would increase demand in the METS sector both directly and as a result of the increased output generated by the resources sector (that would need to be supported).

Figure 1: Future business trends

[2] https://tradingeconomics.com/australia/mining-production
[3] https://www.australianmining.com.au/news/coal-leads-australian-mining-to-2018-export-record/

1.2
A source of economic data on the METS sector

Since the preparation of the first METS 10 Year SCP in 2016, the Federal Government's Office of the Chief Economist (OCE) has conducted further analysis to better quantify the sector to help drive both national and State METS sector policy. METS Ignited (MI) has enhanced this information via a study conducted by economic consulting group AlphaBeta[4] to seriously improve the views by governments of the METS sector. The size of the Australian METS sector has more than doubled since 2005/06.

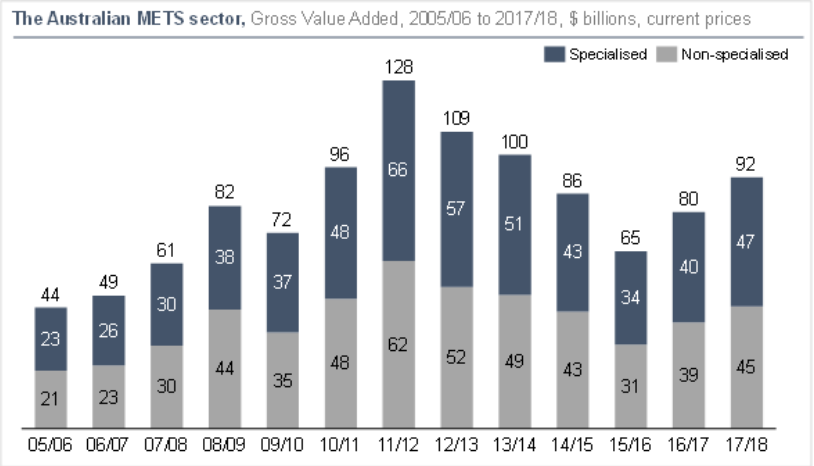
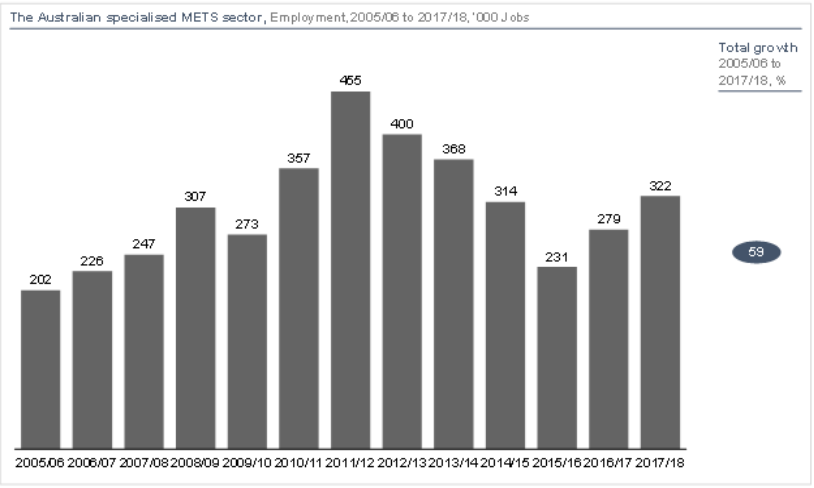


Figure 2: The METS sector rebounded after 2015/16, with two consecutive years of GVA growth

The METS sector is also a significant contributor to employment in Australia, with around 322,000 jobs in the specialised part of sector in 2017/18. This represents just over 2.5% of total employment in Australia. Employment in the specialised METS sector peaked in 2011/12 at 455,000 and then fell back to pre-boom levels in 2015/16, as shown in Figure 3. Over the last two years, job numbers have grown strongly.



NOTE: Employment levels are calculated using employment-to-output and employment-GVA ratios estimated based on ABS data, which can be quite volatile

Figure 3: Employment in the specialised METS sector has followed the mining economic cycle, but experienced strong growth overall

There are about 90,000 businesses in the specialised METS sector. For reference, this compares to 130,000 businesses in the retail trade sector and 84,000 businesses in the manufacturing sector.

Only about 7% (6,700) of these businesses generate revenue of $2m or greater. These businesses are responsible for nearly 70% of the total revenue of the specialised METS sector. Within this set of firms, there are about 1,500 businesses generating more than $10m revenue annually.

A similar picture emerges for employment in the sector. Thirteen per cent of businesses employ 80% of specialised METS sector workers, with the remaining 87% of businesses employing fewer than five employees each.

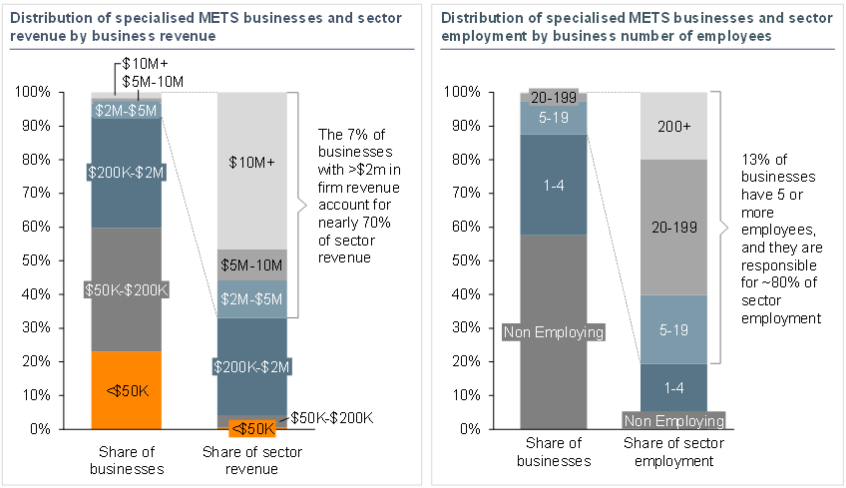


Figure 4: Businesses with >$2m in revenue generate nearly 70% of sector revenue; similarly, 80% of jobs are in businesses with 5 or more employees

[4] Reference to Sector Metrics report by AlphaBeta

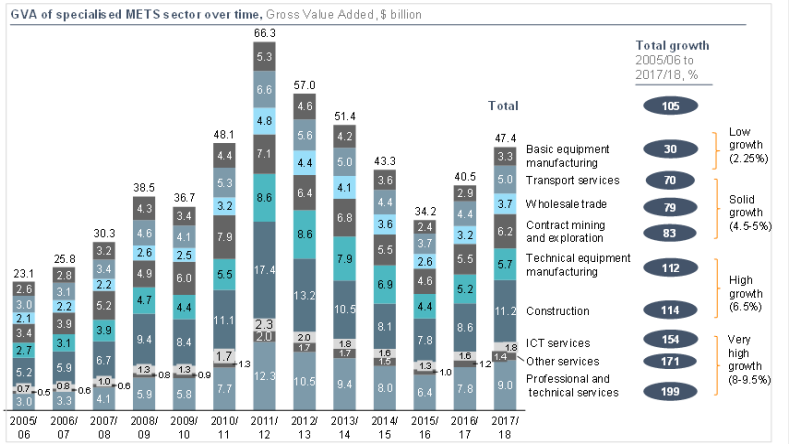


Figure 5: While the sector has grown overall, at segment level four distinct groups have grown at different rates over the long term

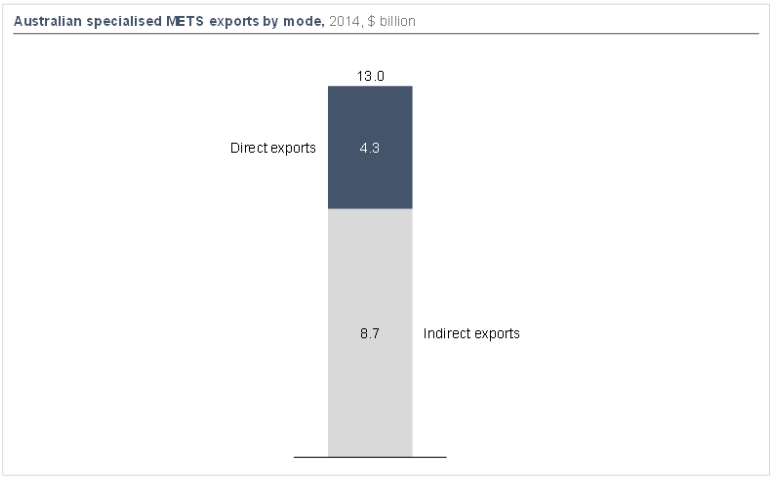


Figure 6: Australia's total specialised METS exports were estimated to be worth $13b in 2014, with 67% being indirect exports

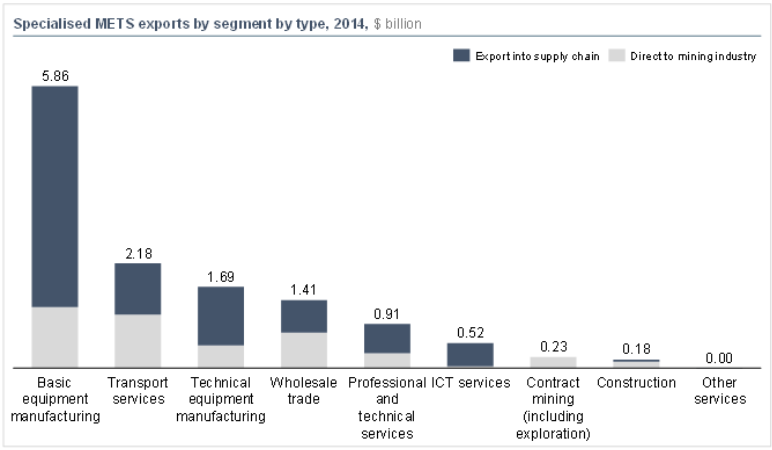


Figure 7: The largest segments in export contribution were manufacturing, transport services and wholesale trade

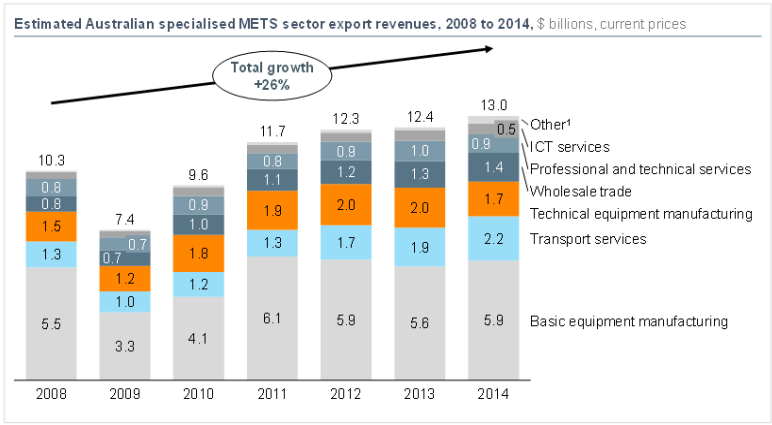


Figure 8: Exports from the specialised METS sector grew significantly in the first half of the decade, after a contraction following the GFC

NOTE: Contract mining, other services and construction segments are zero or negligible so are shown together as "Other".

Several key success factors emerged from expert consultations as common to successful firms across different METS segments. Specifically:

- Skill and expertise of key people was the most commonly cited driver of success.
- Innovation and creating unique IP are central to success in most METS segments.
- Successful METS firms are solutions-focused rather than product-focused firms, aligning products and services with customers' actual problems.
- To navigate the mining industry's cycles, successful METS firms either create a highly specialised product which will always be in demand, or serve customers beyond the mining industry, to ensure resilience in downturns.
- In addition to these overall themes, discussions highlighted specific factors that are important to success for large firms and small METS firms respectively.

Large firms draw success from leveraging their scale, including their size, reputation, and participation in multiple sectors and geographies. They can deliver the largest projects, support customers globally, and are perceived as offering stability and security.

Small METS firms have specific drivers of success and also face specific challenges. Key themes that surfaced included:

- Responsiveness, flexibility, and adaptability to the customer is a key advantage and driver of success for small METS firms, often the reason a customer will choose a small firm over a large one.
- Small METS firms, especially technology-driven start-ups, need an immediate market to get off the ground—so a partnership with a mining company or government investment is an important lever.
- Navigating the procurement processes of big mining companies is a key challenge, as is the challenge of scalability. Successful firms need to offer unique IP/innovative solutions and have strong pitching skills, and may need to partner with larger METS firms.
- Some small METS firms have also leveraged early access to export markets to grow their businesses, benefiting from providing skills into less crowded marketplaces for METS products and services

1.3
The application of digital technologies in the Mining Value Chain

1.3.1 The Internet of Things (IoT) and Data Analytics

The mining sector in Australia is often characterised by its remoteness and scale of operations, particularly in the bulk commodities. These characteristics lend themselves to the application of digital technologies right across the mining value chain from resource identification and characterisation through extraction, processing and remediation. The performance of large scale mining operations can be measured, monitored and managed through the remote collection of data, sourced from every part of the mining process.

This rapidly increasing range and volume of data provided via the rollout of digital technologies is the basis for greatly improved understanding of complex operations and real time decision-making. Much of the digital technology is being developed by small, local, niche organisations that have an intimate understanding of the various stages of the minerals value chain. The niche solutions are increasingly being 'connected or integrated' to allow optimisation of increasingly larger parts of the minerals value chain.

The increasing breadth and depth of data collection achieved through the rollout of new digital technologies enables the application of data analytics to derive deeper understanding of what is happening in mining and minerals operations. Data Analytics (also known as Data Science) allows operators to identify and optimise key processes that impact most on business performance. The impact of process adjustments can be monitored and optimised in real time. The report, Staying Ahead of the Game[5], commissioned by MI and NERA and developed by AlphaBeta, noted that "integrated data analytics and machine learning are expected to have the greatest impact, increasing value added in the sector in 2030 by about AUD$10B... This is unsurprising, as the use of integrated data analytics can greatly improve equipment utilisation, e.g., it can be used to identify and remedy bottlenecks in production."

1.3.2 Artificial Intelligence (AI) and Machine Learning (ML)

The increasing breadth and depth of data collection achieved through the rollout of new digital technologies also enables the application of AI and ML techniques to the mining process. AI and ML allow operators to increasingly automate the mining processes. Using algorithms developed through machine learning, processes can be adjusted in real time, with impacts of the adjustments being monitored to provide further system 'learning' and further improvement.
Extract from, "What are the key developments in AI", by Bernard Marr[6]

In industry, [AI] is employed in the financial world for uses ranging from fraud detection to improving customer service by predicting what services customers will need. In manufacturing it is used to manage workforces and production processes as well as for predicting faults before they occur, therefore enabling predictive maintenance. The field of research which has been most fruitful in recent years is what has become known as "machine learning". In fact, it's become so integral to contemporary AI that the terms "artificial intelligence" and "machine learning" are sometimes used interchangeably. However, this is an imprecise use of language, and the best way to think of it is that machine learning represents the current state-of-the-art in the wider field of AI. The foundation of machine learning is that rather than have to be taught to do everything step by step, machines, if they can be programmed to think like us, can learn to work by observing, classifying and learning from its mistakes, just like we do.

1.3.3 Automation, Autonomy and Robotics (AAR)

Mining operations lend themselves to the application of AAR. In addition to the remote nature of the majority of Australian mine sites, many of the tasks carried out are hazardous and others highly repetitive. Remoteness—AAR addresses site labour challenges. Hazardous—AAR takes people out of harms way. Repetitive—AAR automates tasks bringing higher productivity through continuous operation and improved consistency/quality.

In 2018, an economic analysis of potential opportunities and impact of technologies such as data analytics, automation and robotics on Australia's mining and oil and gas industries in the next decade was commissioned by the MI and NERA Industry Growth Centres and prepared by AlphaBeta[7]. This represents the first in a series of reports to help Australian resources companies, their suppliers, educators, researchers, and governments understand the opportunities that enthusiastically adopting digital automation technologies will bring to growth, skills and employment across Australia's regions and cities.

The purpose of the report is to attempt to predict the nature and scale of how Australia's resources industries, including both the producers and their supply chains, might change if they fully embraced the latest advances in operational technologies such as analytics, automation and robotics. The report further analysed what these changes mean for employment and workforce development (especially in the operations areas across regional Australia), and the wider economy.

The analysis reveals a tremendous opportunity for Australia. Embracing the use of automation technologies in Australia's resources industries could, if coordinated and well-managed, add $74b in value to the Australian economy, both regions and cities, and create over 80,000 new jobs by 2030. Managing change well is not just about adoption, but is also about seizing new opportunities in technology supply and developing the required workforce skills.

[5]Staying Ahead of the Game, NERA & MI Economic Analysis Report prepared by AlphaBeta, April 2019
[6]Bernard Marr, What are the key developments in AI, Forbes 25 April, 2017
[7] AlphaBeta report *Staying Ahead of the Game*, March 2019

1.4 The rise of Social Performance

1.4.1 Responsible mining and sustainability

In 2015, world leaders adopted the Sustainable Development Goals (SDGs) to support the 2030 Agenda for Sustainable Development. The goals define global sustainability aspirations to 2030. The SDGs came into effect in all countries, including Australia, in January 2016. Described as the 'blueprint to achieve a better and more sustainable future for all', the 17 goals describe specific outcomes across the three dimensions of sustainable development: **economic prosperity, social inclusion and environmental conservation.**

The International Council of Mining and Metals (ICMM) has developed 10 Principles[8] for responsible mining. The key principles covering social performance are as follows:

Principle 2
Integrate sustainable development in corporate strategy and decision-making processes.

Principle 5
Pursue continual improvement in health and safety performance with the ultimate goal of zero harm.

Principle 6
Pursue continual improvement in environmental performance issues, such as water stewardship, energy use and climate change.

Principle 7
Contribute to the conservation of biodiversity and integrated approaches to land-use planning.

Principle 8
Pursue continual improvement in social performance and contribute to the social, economic and institutional development of host countries and communities.

Principle 9
Facilitate and support the knowledge-base and systems for responsible design, use, re-use, recycling and disposal of products containing metals and minerals.

Principle 10
Proactively engage key stakeholders on sustainable development challenges and opportunities in an open and transparent manner. Effectively report and independently verify progress and performance.

1.4.2 Safety

Australia's minerals industry is committed to the principle that every individual—regardless of where they work, whether as a direct employee or contractor, and whatever tasks they undertake—should have the same high standard of workplace safety. Minerals Council of Australia (MCA) member companies maintain that:

- all fatalities, injuries and industrial diseases are preventable
- no task is so important that it cannot be done safely
- all hazards can be identified and their risks eliminated or minimised as far as reasonably practicable
- everyone has a personal responsibility for the safety and health of themselves and work mates.

Australia's mining industry has a global reputation for safety...to send people home safely each day...so much so that governments in countries with developing mining economies send legislators and regulators to Australia to understand our benchmarks in safety. As a part of this, management is increasingly held accountable for the safety of their staff and Industrial Manslaughter is back on the government and industry agenda.

Operators actively seek solutions to enhance the safety of their employees and contractors. Innovations that support environmental protections are given priority as part of social licence, CSIRO's Reflexivity program is gaining traction as a community engagement tool.

[8] https://www.icmm.com/en-gb/members/member-commitments/icmm-10-principles

1.4.3 Environmental Stewardship

There is no doubt from the daily media that a significant proportion of the community believes it is especially important to be, and be seen to be, acting environmentally responsibly. The global mining community has large legacy issues to manage, including climate change, tailings dams and abandoned mines.

The MCA supports the well-established 'avoid-minimise-mitigate' hierarchy to managing land, including in regards to land disturbance and native vegetation clearing. Given that the location of a geological resource constrains mining operation locations (particularly where ore is mined), there may be instances when it is necessary to manage impact on biodiversity values through the use of offsets. Recognising its responsibility as a temporary custodian of land, the industry's goal is for mined land to be available for future economic activity, conservation or community use.

1.4.4 Community Licence

The global mining industry, and especially the Australian industry, is increasing its engagement with communities to ensure transparency around the economic, environmental and social impact of the operations in their regions.

Ernst & Young (EY) annually publishes the top ten business risks facing the mining and metals sector. Social Licence to Operate (SLO) has again been identified in 2018 by EY as one of the top ten risks. EY states that:

'managing the needs and expectations of communities, governments, employees and other stakeholders who provide companies with their social licence to operate can be a delicate balancing act of agendas and issues. Environmental accidents, employee strikes and worker fatalities suffered by some companies can result in collateral damage for the whole industry. There needs to be a shift from a reactive and compensation model of social investment to one that is far more strategic and collaborative.' (2018)

The Australian Institute of Company Directors/KPMG Trust Survey 2018: Maintaining the Social License to Operate[9] echoes a fundamental principle of social licence—the local or regional community in which an organisation operates was selected as the third most critical stakeholder for Australian boards (in the top three for 35% of respondents), followed closely by government (34.8%) and shareholders (33.4%). This acknowledges that the people who live and work around an organisation and its assets or operations—and therefore are most likely to be directly impacted by these operations—are key custodians of an organisation's social licence.

The future of SLO will continue to evolve including key changes of:

Societal participation (beyond local communities)—social media and the Internet moving information faster than ever before will see issues-based stakeholder participation en masse. Companies will need to strategically manage this engagement.

Mushrooming disclosure regimes—an increased level and extent of disclosures on impact, both positive and negative, will be needed alongside measures of value being created to local, regional, national and global communities. Investors will also be relying heavily on such disclosures.

Governance founded on an accountability framework—frameworks will measure performance not only on financial, environmental and social metrics, but also on stakeholder inclusivity and responsiveness.

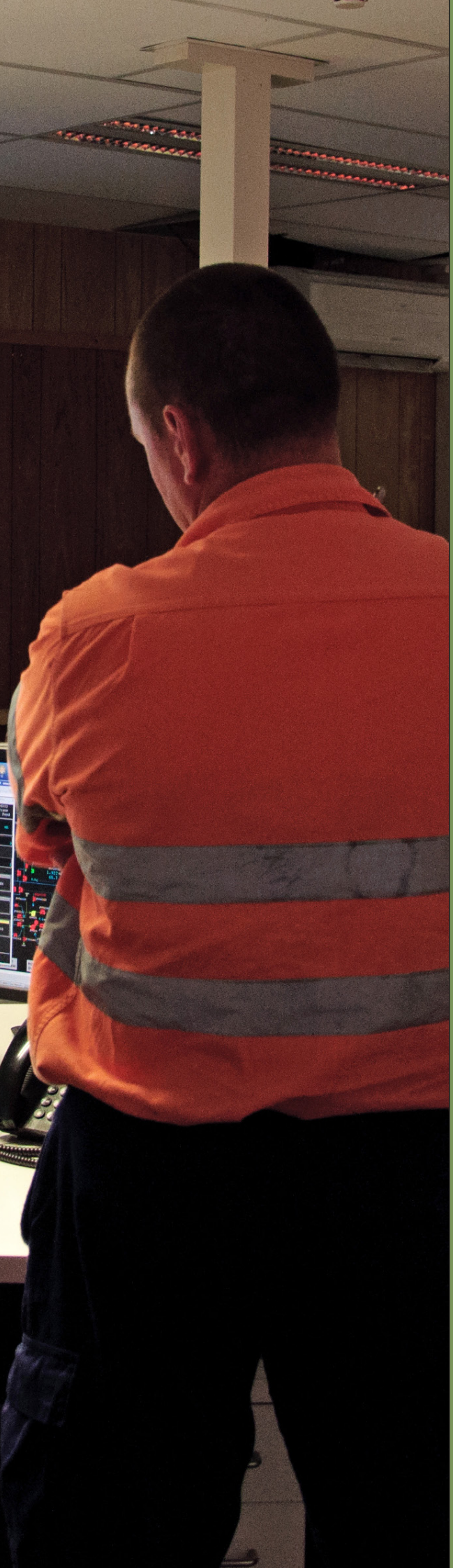
Minority voices amplified—rights of indigenous and other minority communities facing not just direct impact, but generational misgivings, will block project proposals due to the cumulative impacts of ongoing expansions and new tenements.

A focus on ownership—new business models will be sought whereby community or locally-owned operations would be favoured over traditional models. Inclusive (or social) procurement will be a key pillar of such models.

Litigation increasing—there will be more litigation, especially for past damages. Provisioning will therefore become a key issue for companies and regulators.

[9] https://aicd.companydirectors.com.au/-/media/cd2/resources/advocacy/research/pdf/66457-1-coms-kpmg-ags-trust-survey-report-a4-28pp-v8.ashx


CADIA VALLEY OPERATIONS - Current Status
CADIA
RWY
PRODUCTION
LG PARAMETERS
HG PARAMETERS
ML601
6792 KW
ML602
6850 KW
ML607
2113 KW
FLOAT FEED WET TONS
941 Tons/hr
ML001
17487.6 KW
417 TNE/H
FLOAT FEED WET TONS
2,129 T/hr
ML002
9728.1 KW
ML003
9640.0 KW
ML2004
ML005
429 KW
DELL



2

Trends and Influences over SCP 2016

Trends and Influences over SCP 2016

2.1 Aligned Strategy

Evidence would suggest the "Aligned Strategy" chapter remains relevant as development and publication of "METS Roadmaps" by various Government and Non-Government bodies together with variously published KPIs (Key Performance Indicators) continue to merge around common themes.

METS Ignited is seeing the adoption of crowdsourcing methods providing METS with greater access, than ever before to mining roadmaps and critical business drivers, with mining operators integrating data-driven and evidence-based decision-making. Newcrest Crowd and BHP Olympic Dam, for example, are following other global miners in providing a forum for METS companies to prepare and show case solutions to real challenges.
An interesting situation may be emerging amongst the major global miners (Tier 1 and Upper Tier 2) in that some of these companies realise their social and productivity performance can be improved by collaboration between themselves to enhance common technical challenges. Chilean operators have been collaborating on operational problems that beset a number of the miners for many years. The Expande supply innovation program is currently being piloted in Australia with the support of METS Ignited. These activities hold the potential to be significant drivers for supply chain collaboration.

There is still an imperative however, to create more robust partnerships between miners, METS companies and researchers, to improve innovation. Furthermore, based on Project Fund collaborations, there are significant opportunities to identify, adopt and adapt innovation from other sectors into mining as a faster alternative to development totally inside the sector.

2.2 Global Brand

Three significant brand-related activities have emerged since the development of the SCP in 2016, described below. These not only have impact for Australian METS in the international markets, they also influence Australia's youth perceptions of the sector as an attractive field in which to plan their careers.

1. IMARC is becoming globally established. Attendance in 2018 doubled from 2017 to approximately 7,000. More international companies are attending. Increasing numbers of innovative METS companies are participating in the Innovation stream organised by Austmine. In 2017, METS Ignited introduced the concept of METS Monday prior to the conference opening, highlighting collaboration activities in workshops on selected topics relevant to both METS and miners. Both METS Monday specifically and IMARC generally provide the appropriate venue for strategic discussions with the C-suite of miners and government and research representatives.

2. An initiative, coordinated by Austrade and chaired by the mining industry's Andrew Forrest, has been launched to develop a Nation Brand for Australia. The Nation Brand initiative is here to market the entire country – the twenty five million people in Australia, every state and every corporation. We need to strengthen Australia's global position to capitalise on the depth of both our human and natural talents and create a brand that serves businesses now, and the ones our children will go on to start tomorrow. Andrew Forrest AO.

This initiative will run for a number of years and is in early stages of consultation around Australia. From a METS sector viewpoint, this initiative will provide overarching messages for our firms selling in Australia and internationally, however METS Ignited will delve more deeply into the role of branding and narratives that provide an advantage for Australian METS in the domestic and global markets.

3. Within the framework of the Nation Brand, but as a separate MI initiative noted in the 2016 SCP, is the development of a set of narratives that Australian METS companies can adopt within their marketing in Australia and overseas, essentially strengthening the value proposition of Australian METS.

In 2018–19, MI undertook a research programme seeking to determine narratives, values, brand attributes and rhetorical pitch elements used by METS companies that successfully export, with a view to developing a consistent and valuable position when communicating about Australian METS internationally. A series of closed focus groups discussed the characteristics of previously successful export positioning by Australian METS companies, as well as Australian METS perceived sector strengths and attributes to contribute to a concerted global position. While this project set out to illuminate the characteristics of successful METS positioning for export opportunities, it became evident that this must be underpinned by strong, unified and purposeful domestic positioning. Results from the research focus groups included the collation of a set of Shared Values, which are particularly useful for METS SMEs that are seeking to provide messaging to their markets that bolster Australian METS domestic and export success. These are:

Key Value 1
Credibility, trust, reliability, providing proven solutions.

Key Value 2
Expert, specialised, high quality.

Key Value 3
Committed, long-term, valued partner.

Importantly, the values identified by participants in this project differ from those commonly used by government and advocate organisations. Innovation is notably absent from the favoured values or attributes in every instance, with participants citing connotations of risk, instability or newness which contradicts the perceived need for trust and credibility. Anecdotal evidence however, points to international recognition of Australia's METS sector's ability to provide innovation in the areas of social licence, renewables, remediation and environmental protection. These continue to be important drivers for industry support and broader stakeholder goodwill.

There is a sizeable shift in METS product/service delivery gearing towards digitally enabled solutions. The METS global brand narrative will need to incorporate attributes to support and promote digital capability within the sector.

It is important as well as gratifying to see the acronym 'METS' increasing in use around the global mining supply communities, including in Latin America, Canada and Scandinavia. This in itself is providing opportunities to bolster the Australian METS brand internationally, e.g. via requests for strategic partnerships with overseas organisations involved in mining innovation and supply, that can help Australian METS SMEs find their feet more quickly in international markets.

2.3 Internationally Competitive

While there have been some significant wins by Australian METS companies internationally, there is still much to be done to develop a more collaborative approach to overseas market opportunities, with companies coming together to provide integrated, comprehensive services to large overseas mining companies.

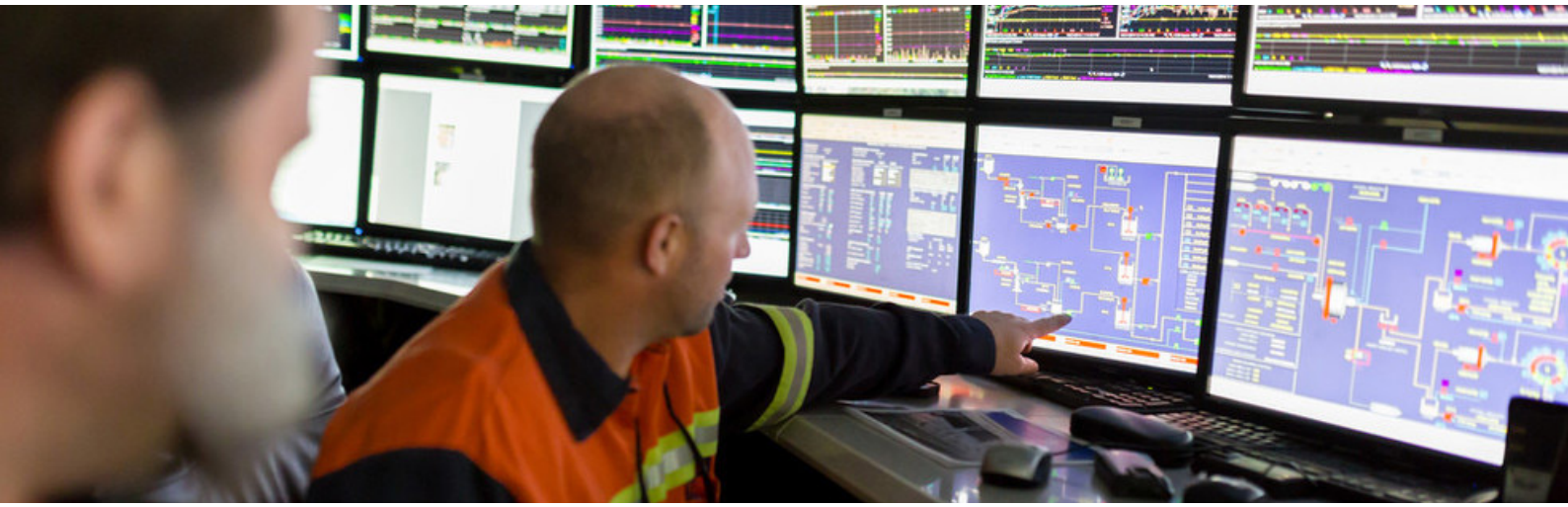
Lack of scale, limited patient capital and still-developing strategic management expertise are weaknesses for Australian METS in 2018, as they were defined in the SCP in 2016. The programmes by Entrepreneurs Program (EP) and MI have barely touched the surface of these industry constraints. In the "delivery" phase of METS Ignited, the current phase in which METS Ignited is focusing on delivering impact to the METS sector via its priority initiatives, these issues should be addressed via serious collaboration amongst the major industry organisations (i.e., Minerals Council of Australia, Austmine, AusIMM and governments).

Analytics, automation and robotics solutions can come from any sector. Once they are identified and adopted by miners, competitors will struggle to remove them from operating mines. Already, Tier 1 and upper Tier 2 miners are deploying digital innovations to improve their operations from all sectors around the world. Conversely, innovators in other sectors are also starting to notice the opportunities in mining and Australia's METS companies will lose business and longer term viability if they are not aware of these cross-sector competitors.

Some stakeholders perceive a two-speed METS economy in Australia. While there is a significant number of Australian METS companies who are aware of the international technology developments (e.g., digital developments) and international business model developments (e.g., servitisation), it is acknowledged that there is a larger number of METS firms who are not aware of these global changes, or do not know how to adapt their businesses to leverage these changes.

Global METS companies continue to threaten the Australian METS sector; there is an opportunity for Australian METs to define niche roles as enablers and to develop or adopt open architecture solutions.

The "clustering" business model was coined in the US as a result of research by Michael Porter in the 1980s. It was adopted widely in Europe across all sectors from the early 90s, and is now making inroads into mining supply chains around the world. This "co-opetition" model of parallel collaboration and competition has not been adopted in Australia to any great extent, but has been shown overseas in different cultural environments to deliver rapid innovation and competitiveness. Newer METS SMEs with younger management appear to be adopting clustering more easily than traditional METS firms. Clustering must be fostered to improve the international competitiveness of Australian METS generally.



2.4 Collaborative and Innovative

Mining company procurement processes in general are not perceived to have changed over the time period since the SCP was first developed in 2016. There are certainly pockets of improvement mainly around the activities which drive new approaches by miners, e.g., involvement in hackathons, accelerators and challenge-based innovation platforms such as the Newcrest Crowd, Goldfields competition and BHP Supply Innovation being piloted at Olympic Dam. For the normal procurement of mining supplies, the processes are still long and onerous and the procurement of innovation is subject to the same processes as that for standard or repetitive products and services. It is difficult for SMEs to navigate and fund these processes. Members of the METS Ignited Board perceive that an index of miner performance in this area of business would likely have an impact on miner behaviour.

Early indications suggest METS Ignited's Collaborative Project Fund activities and Collaboration Platforms are leading to successful outcomes for the small number of firms that have participated. Extending these initiatives to larger numbers of miners and METS companies will be very beneficial, especially if miners decide to apply some of their SLO budgets to enhance regional business participation in supply innovation (along the lines of the BHP Supply Innovation pilot at Olympic Dam).

Given the financial contribution to Australia's GDP, the mining and METS sector in Australia is severely under-represented by large collaborative research programmes such as Cooperative Research Centres (CRCs), Australian Research Council (ARC) Industry Transformation Research Programs (ITRPs), CRC-Projects and ARC Linkage grants. As a result of recent focus by MI to help industry identify, define and develop bids for such programmes, the number of applications for these programmes is increasing. Examples of these are the new CRC Minex (Minerals Exploration), CRC FBI (Future Battery Industries) and CRC SmartSat (Smart Satellites). An ongoing constraint in collaborative innovation has been the issue of Intellectual Property protectionism. The MI Collaborative Project Funds, in which customers of the consortia of METS companies are generally provided matched funding (rather than providing funding to the METS suppliers themselves) to implement or demonstrate innovation in their operations, has challenged the notion that the customers who pay for the initial projects should have a substantial share of the IP. For innovative METS companies, retaining their IP is the key to growing their business and becoming more robust and long-term suppliers in both domestic and international markets. Some of the miners now recognise that the benefits to their operations from collaboration far outweigh the financial returns from IP ownership.

Continued investment in the METS sector is required. Transformation of mining through the application of analytics, automation and robotics requires the role of Australian METS companies to be reconsidered... how do Australian METS fit in as a crucial part of the supply chain? Interoperability and global standards development that are a part of this change, as is the use of data and how it can be presented in "real time," means that remote operations become increasingly more feasible. In addition, the use of sensors, combined with other data sources, results in better detection of abnormalities, preventing environmental and human harm, thereby improving the mining industry's social performance.

The issue of Remote Operations Centres (ROCs) deserves attention. Australia is leading the world in the implementation of these primarily on the back of the Tier 1 miners seeking productivity improvements, access to skilled staff in the major cities and the benefits of bringing operational data into one location where experts are readily on hand. These ROCs are generally fulfilling these requirements but there has been a backlash against them due to the fact that they reduce employment in the regions where the mining operations exist. In other words, the miners' local social performance is compromised. This issue is ongoing at present and must be viewed with the debate on the strengths and weaknesses of a Fly-In-Fly-Out (FIFO) workforce.

2.5 Skilled for 2026

Since the development of the SCP in 2016, a number of trends have continued. Innovation, people and skills combined with technological advances will deliver a more globally competitive minerals sector that delivers fulfilling careers in highly paid, high-skilled jobs[10].
Key findings by EY in this report include:

- 77% of jobs in Australian mining will be enhanced/redesigned due to technology within the next five years
- Productivity increases up to 23% can be achieved with the rollout of new technologies, costing more than $35B
- An injection of $5b to $13b in workforce capability will be needed over the next decade to unlock future productivity gains
- Australian education and training systems need to be modernised to deliver higher certification and fit-for-purpose qualifications.

New technology and innovative practices will enhance the performance and productivity of 42% of Australian mining jobs, with a further 35% of occupations being redesigned and upskilled leading to more valuable employment opportunities. Automation will provide the opportunity for reskilling into other areas.
EY's study also identified that Australia's education and training system needs to be modernised by offering improved course structures and enhanced movement between universities and the vocational education sectors. Future university degrees will need to have a mix of the latest scientific, technical and trade skills along with soft skills including collaboration, team building, communication and creativity. A decade-long investment by industry and government in general skills incorporating mathematics, data analytics, computing and change management will boost productivity in the minerals sector.

Australian mining will continue to take advantage of innovation, technology and new ways of working to create high-paying, high skilled jobs. Industry 4.0 is continuing to blur the lines within and between industry labour markets. This offers opportunities to leverage knowledge and expertise across sectors, as well as develop cross sector talent pools that can endure mining cycles. State and federal governments are increasing their investment in STEM programmes to primary and secondary schools to encourage more students to pursue STEM based careers. State Government programs such as the Gateway to Industry in Schools program are resulting in stronger collaboration between regional businesses and school leavers.

The Queensland Minerals and Energy Academy (QMEA), a partnership between the Queensland Government and the Queensland Resources Council (QRC), provides a talent pipeline of work-ready employees into the resources sector and other supporting Science, Technology, Engineering and Mathematics (STEM) industries.

Similarly, the Australian Mines and Metals Association (AMMA), have launched the Bright Future STEM program, a national school-based STEM resources and energy industry program that will engage 9–11 year-old girls and boys to provide them with exposure to female STEM professionals, encourage an interest in STEM careers and give insight into future STEM employment in the Australian resources and energy industry.

Further support is provided to teachers through the STEM Professionals in Schools program, partnering teachers with STEM professionals to enhance STEM teaching practices and deliver engaging STEM education in Australian schools. STEM Professionals in Schools is funded by the Australian Government Department of Education and Training.

Research into secondary students' awareness of METS and mining as a career has resulted in national action by industry associations, State governments and leading educators to attract the future workforce. This project has created a shift in the national education programme for the talent pipeline for METS and mining—both AusIMM and MCA are already leading a range of programmes as a result of this research, as evidenced by the launch of a study by EY of future workforce needs at Minerals Week 2019.
The need for a profile of a METS career has evolved. Companies requiring certain capabilities to be able to deliver innovative (and especially digital) products and services to customers will be able to obtain these from individuals who may have a foundation in a non-traditional METS education such as data science but can rapidly obtain domain knowledge on the job or via micro-credentialing. Public awareness of the impact of AI, automation and robotics on future employment opportunities is growing. School leavers are looking for assurance that the educational pathway they chose will empower them to develop their careers, rather than becoming redundant. The sector as a whole needs to address this concern, with proactive communications and case studies, but always in the positive sense that METS and mining must be able to attract Australia's youth to the sector.

Leading educators are identifying, developing and promoting "skills pathways" that include micro-credentialing to ensure a skilled workforce has ongoing relevance in a rapidly changing industry landscape. The attractiveness of the METS sector as a career sector needs to be emphasised and differentiated from mining in the eyes of the community, especially parents of prospective vocational and tertiary students.

Programs are emerging to meet the needs of employers. A collaboration between Rio Tinto, South Metropolitan TAFE and the Western Australian government is set to make history with new, high-tech courses in automation. These nationally-recognised qualifications, the first to provide pathways to emerging jobs in the area of automation, were launched in Western Australian TAFE Colleges and to high schools from 2019.

[10] EY's Skills Map for the Future of Work 2019

2.6
Regulatory Environment

Governments are finding it increasingly difficult to drive coherent policy and regulatory change in most modern democracies due to the rise of social media and community disengagement from mainstream political discourse. Australia's METS sector could do well to look less at governments to provide a supportive regulatory environment, and more to move upstream to tackle social performance issues at their source. The mining and METS sectors must tackle community engagement seriously and generate the necessary goodwill within society to enable the continued growth of the sectors and support from the communities with their most important asset, their people.

The opportunity for regulatory improvement is beginning to appear in the form of environmental and social performance issues within the community, e.g., regional employment, the impact of Remote Operations Centres, tailings dams, general environmental stewardship in the form of sustainable closure and remediation of mine-sites, renewable energy, as well as the ability to retain regional youth to participate in the economic and social growth of regions.
Governments are increasing the financial assurance to be posted by mining companies to assist the remediation and rehabilitation of mine-sites. Significant private sector conglomerates that have been involved in mining in the past are starting to see the business opportunities associated with mine-site closure using the substantial funding held by governments. At this point, legislation and regulation make it difficult for non-miners to access these sites and hence there is a need for regulatory change to allow the innovations of environmental METS companies to find their way to these sites. Given the long time-frames over which communities can apply pressure to socially non-performing industries in their regions, there is clearly an opportunity for regulatory change to facilitate both the community good and an economic return.

Opportunities for new investment vehicles and ratings are emerging from the global interest in socially and environmentally responsible investment. These can help to encourage enabling regulation that brings certainty to the investment, development and rollout of emerging technologies like environmental analytics, robotics and automation for increased worker safety and even to the ideal of zero-entry mining.

The Council of Australian Governments (COAG) offers a new opportunity for the METS and mining sectors to take the lead in collaboration with communities to effect real change and to attract the attention from relevant governments. MI has an opportunity to promote all changes within the regulatory environment with the potential to impact/support positive interactions between METS and miners, and/or improve goodwill from the broader community.
The figure below presents a view of the opportunities available to the METS sector to influence regulation and policy, starting with a near term Horizon 1 and extending to the long term Horizon 4.

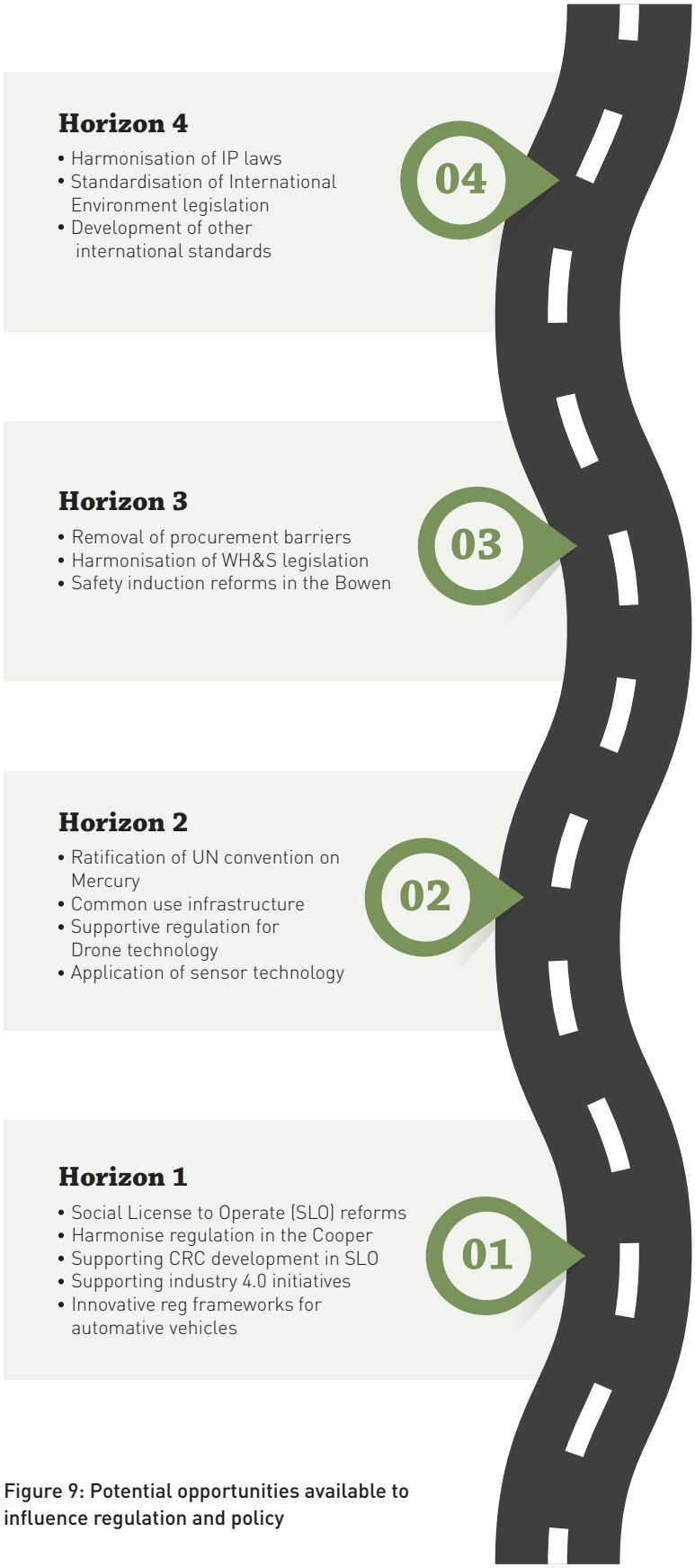
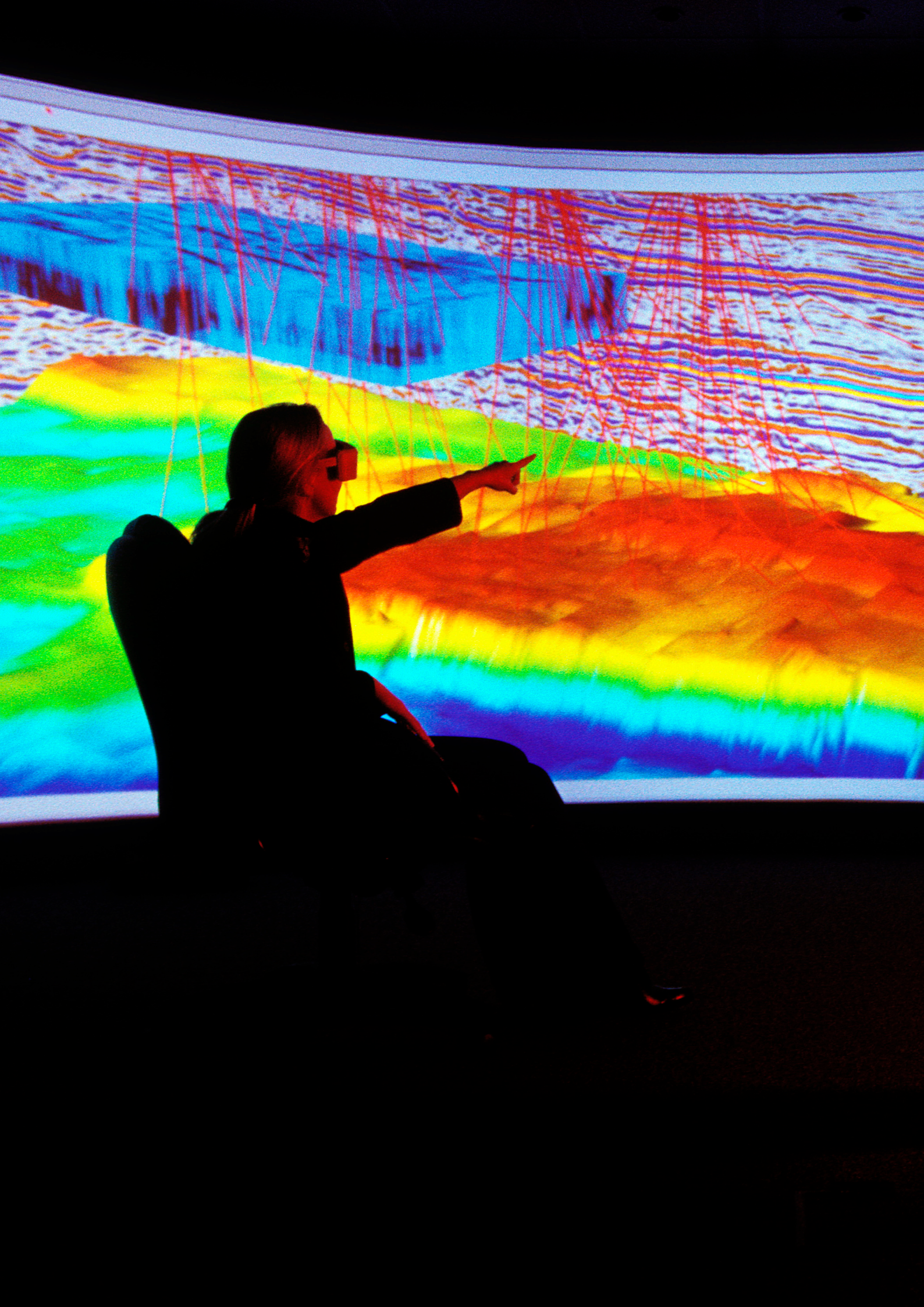
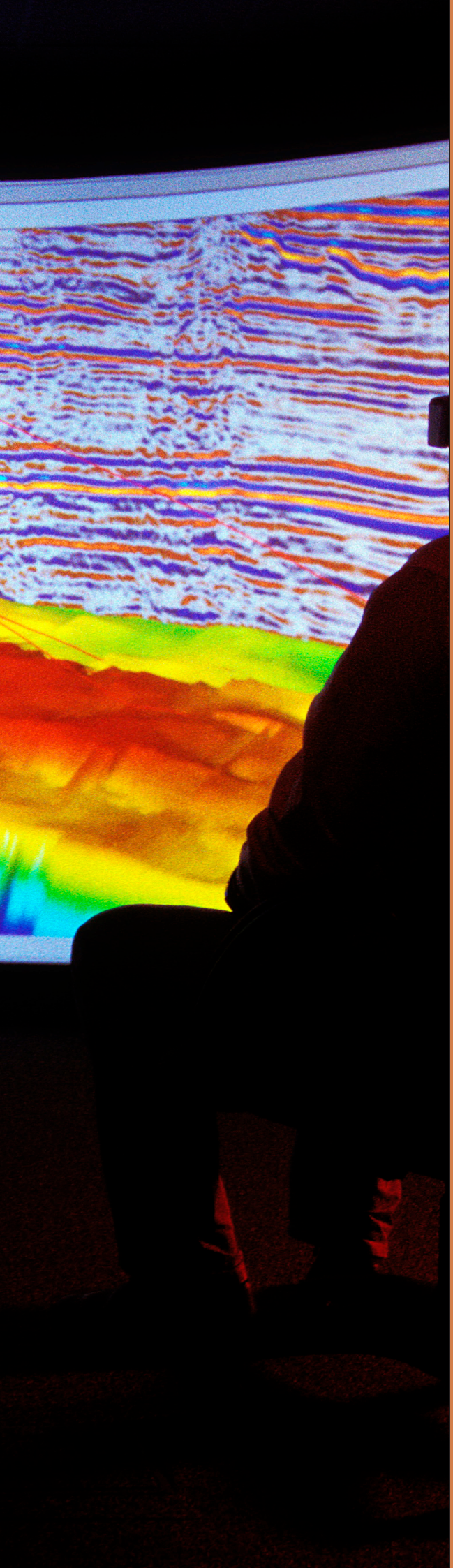


Figure 9: Potential opportunities available to influence regulation and policy



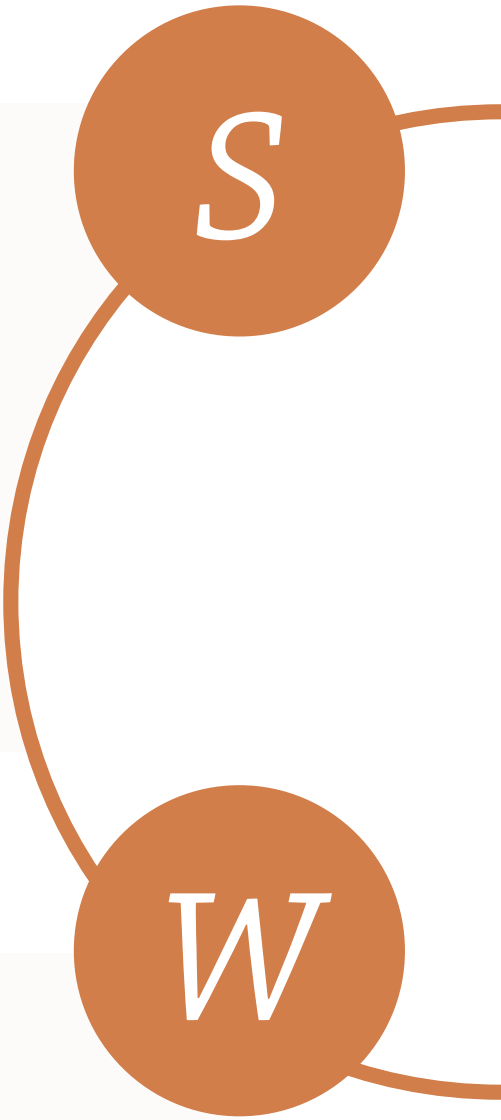


3

Impact of the Trends and Influences on the METS SCP

The impact on the METS SCP of the various trends and influences in the sector is best summarised via a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. Input from METS Ignited Board and Staff as well as from the interviews conducted with our key stakeholders suggest the following.

3.1 Sector strengths (internal)



- Deep understanding of mining operations, opportunities and challenges – "smart mining managers" who have demonstrated resourcefulness in a solutions driven culture
- A track record in innovation for mining over the past century driven by the need to improve operations or reduce costs in a remote operating environment
- The ability to effectively integrate into mining operations many others' products and technologies
- Large community of start-ups (as defined by venture capital investment around the world)
- Very effective Australian education and research systems graduating skilled, innovative people
- Global leaders in mining safety and developing rapidly in social performance.

3.2 Sector weaknesses (internal)

- A culture of independence that has limited our ability to collaborate/ cluster to increase addressable market, especially in our small and medium enterprises and in our research communities
- Access to patient capital for start-ups and especially scale-ups (to grow a significant proportion of globally sustainable medium size companies)
- International market knowledge and business / management capabilities to address these markets due to our traditional focus on the Australian domestic market
- Currently a 2-speed digital sector, with a relatively small number of very capable and innovative firms but a larger number that struggle to manage the changes and opportunities facing the sector
- Capacity (i.e. numbers of firms) able to operate digital products and services in mining operations.

T

3.3 Sector threats (external)

- The rapidly developing digital capabilities in major global METS and in other sectors
- Challenge or mission based innovation and platforms that are being rolled out in the Americas and Europe (also a major opportunity for Australian METS)
- International clusters that are aggregating supply
- Social licence
- Australia's youth do not see the METS and minerals industry as an attractive place to work; fear jobs will become redundant, and have low awareness of the variety of jobs available in the sector

O

3.4 Sector opportunities (external)

- An emerging opportunity to bring METS solutions to the end user, through collaboration platforms and other formal arrangements.
- Challenge or mission-based innovation platforms (also a threat for Australian METS)
- Digitalisation including adding value to customer offerings using data and analytics to identify opportunities for improvements and commercialising them.

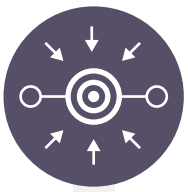
This SWOT analysis will be refined for the 2020 SCP Update and translated into strategy and confirmation of METS Ignited's priorities.

4

How METS Ignited is addressing the trends in the SCP environment

How METS Ignited is addressing the trends in the SCP environment

Table 1: METS Ignited's responses to the trends influencing the METS Sector Competitiveness Plan



Aligned Strategy

Current Trends

- Increasing collaboration for innovation and commercialisation
- Rapid advancements in analytics, automation and robotics globally
- Australian Miners understanding of METS strategic value to Australia

MI Response/Initiatives

- Development of challenge-based innovation platforms
- Establishment of the TAMM (Transformative Automation in METS & mining) initiative
- Collaborative Project Funding

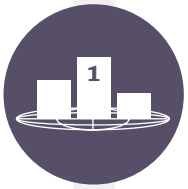
Global Brand

Current Trends

- Narratives promoting Australian value propositions including digital innovation
- IMARC reputation is building internationally
- Increasing importance of social and environmental performance
- Australia Nation Brand via Austrade

MI Response/Initiatives

- Facilitation of a METS brand and narratives for Australia including via TAMM
- Continuing support of IMARC
- SLO initiative from Regulatory Opportunity Roadmap
- Linkages to Austrade for soft landing for METS in major markets



Internationally Competitive

Current Trends

- Escalating global interest in energy minerals
- Continuing need to build pathways to increase commercialisation
- Increasing international business model of clustering of large and small firms
- International digital skills and capabilities are progressing very rapidly e.g. OEMs
- Interoperability and global standards

MI Response/Initiatives

- METS branding and narratives to increase global competitiveness
- Facilitation of CRC/ARC projects including Future Battery Industry
- Fostering clustering for growth of addressable market especially in the digital space (e.g. TAMM)
- Continuing dialogues between METS firms and global suppliers
- Relationship with Global Mining Guidelines group

Collaborative & Innovative

Current Trends

- Collaborative project fund activities and platforms are generating early wins
- Increasing challenge-based innovation leveraging crowdsourcing techniques
- Move to open collaboration and away from IP protectionism
- Increasing data range and volume enables greater understanding of complex operations and real time decision making

MI Response/Initiatives

- Collaborative Project Funding
- Expanding challenge-based innovation and platforms for this
- Facilitating enhanced supply chains e.g. via the TAMM initiative
- Continuing to foster more industry driven research CRC/ARC program
- Setting priority on enabling digital mining supply chains via the national TAMM initiative

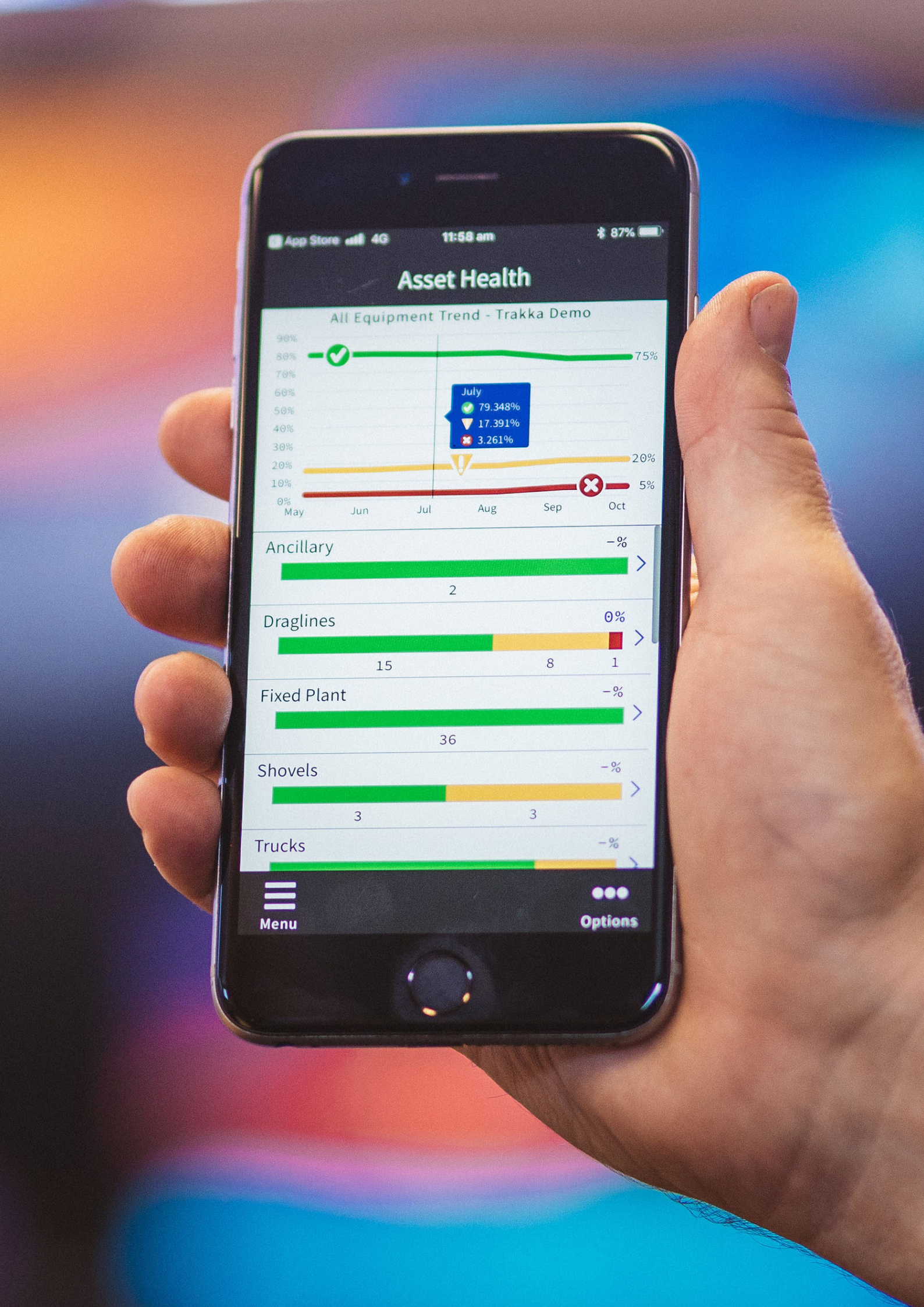
Skilled for 2026

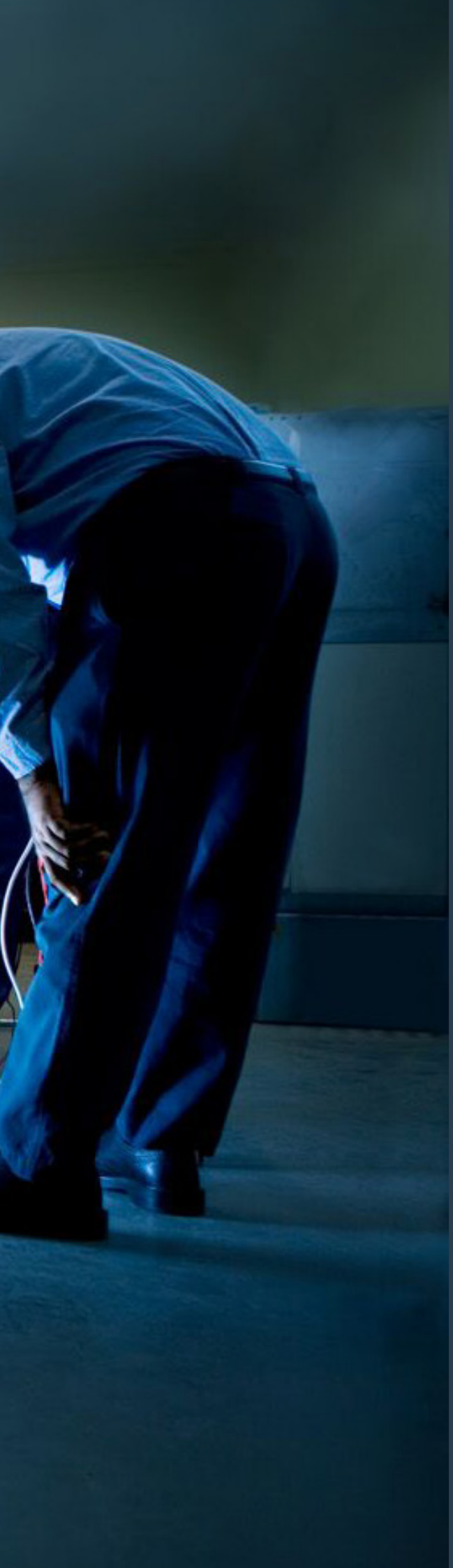
Current Trends

- Attracting students into the sector is becoming increasingly important as the number of students is declining
- Introducing data science into most products and services
- Need for multi-skilled employees
- Challenges managing millennials; 75% of the 2025 workforce will be millennials
- School leavers are digital natives

MI Response/Initiatives

- Facilitating online capability development and education
- Improving capabilities of METS companies by skills development directly via Masterclasses and online education videos.
- Develop micro credential pathways for upskilling
- Educate school leavers on career pathways in METS
- Partnerships with industry organisations for capability development programmes


App Store 4G
11:58 am
87%
Asset Health
All Equipment Trend - Trakka Demo
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
May
Jun
Jul
Aug
Sep
Oct
75%
20%
5%
July
79.348%
17.391%
3.261%
Ancillary
-%
2
Draglines
0%
15
8
1
Fixed Plant
-%
36
Shovels
-%
3
3
Trucks
-%
Menu
Options



5

Appendix

Stakeholder Interviews

The impact on the METS SCP of the various trends and influences in the sector is best summarised via a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. Input from METS Ignited Board and Staff as well as from the interviews conducted with our key stakeholders suggest the following.

Question:
What's changed in the mining/METS sector in the past couple of years that you believe is fundamentally shifting the landscape for METS supply into mining?

Table 2: Stakeholders insights and feedback

Engineering Supplier (Global)	
	1. Not much change at all in past 2 years. The way business is being conducted is about the same. More commercially innovative – clients talk about innovation-tech but not much is changing. The key challenges we are seeing are: **2.** Mining of extremely low grade ore **a.** Ore sorting **b.** Minimal foot print **3.** Clients like still to be first to be second (i.e. risk averse) **4.** SLO is increasing in importance but permitting processes have lengthened **5.** Amount of waste (& tailings) is under extreme scrutiny and this will require METS to respond with technology not just for tailings waste, but mine waste generally. There shouldn't be tailings dams any more. We must discuss these challenges, even though we may be reluctant to comment.
Equipment supplier (global)	
	1. Big change of late across many minerals operations is going to brownfield customer base – overwhelmingly site based: **a.** Decisions more site-based re process optimisation and process changes – metallurgical rather than exploration or extraction. **b.** METS need to be really engaged with operating sites, rather than H/O but the expanse of the country is so great that its expensive and difficult **2.** People making decisions on sites are more amenable to dealing directly with tech providers, rather than using internal or external engineering companies. **a.** Both these open up many opportunities but sales cycle is typically 1 to 2 years **3.** Industry trend from H/O is in digital, AI, Automation – this can be seen from miners websites re the topics of their 'announcements' i.e., strategy and implementation. **4.** Business cases are very important – we must demonstrate the value proposition. We have built standard tools for our business that are 'value calculations' re total cost of ownership (TCO). **5.** Client Challenges – every sale is around solving a problem (need to talk to clients about their challenges – METS Ignited's Supply Innovation programme with BHP is what's needed.
Mining value chain optimisation SME	
	1. No single big thing, but the main changes are: **a.** Key item is 'availability of data' in past 1-2 years. In the past, it's taken a longer time to hold discussions – mining operations now have more readily-available data **b.** Less concern about the Cloud – now 1/10 miners express this concern whereas it used to be 1/5. Some clients now also saying Cloud can help decrease operating costs. **c.** Starting to see some generational change in minds with younger people coming in to roles who can speak our language.
Industry advisor	
	1. Now in real production phase – not boom by any stretch, but are busy –all parts of the sector **2.** Greater appetite for SMEs to engage in business improvement programmes such as ERP systems, marketing and digital marketing/social media, and upgrading QA systems. **3.** We are seeing a stratum of innovative SMEs doing smart things for miners under the radar e.g., data science, maths, performance improvement **4.** SMEs getting in the miners' doors is still difficult, but still no focus by METS on working / collaborating in the supply chains with incumbent suppliers.

Industry advisor

4. SMEs getting in the miners' doors is still difficult, but still no focus by METS on working / collaborating in the supply chains with incumbent suppliers.
5. Many existing SMEs have a limited awareness/scope of what they provide, especially the potential for servitisation.
6. Need a paradigm shift around traditional benchmarking– things are moving too fast these days.
7. Not sure that METS SMEs have the full picture of what is happening i.e., other sectors / overseas.

Industry association

1. Political landscape around mining industry has changed – more apparent now than 5 years ago
2. Resources sector will continue to underpin Australia's economy for the foreseeable future, and this needs to be better understood by the community.
- **a.** 2005 Resources 4.5% of GDP
- **b.** 2018 Resources 8.8% of GDP ---- In both political and economic sense

3. Role of digitalisation in underpinning the resources sector – Industry 4.0 Taskforce will allow Australia to compete even though labour costs are comparatively high.

Other Growth Centre

1. Re mining, how can miners reduce carbon footprint, e.g., Japanese can reduce C emissions by the value chain improvements rather than the fuel e.g., using digital means to reduce waste and improve value chain efficiency
2. Industry is not seeing all intelligence and capability to drive sector under servitisation
- **a.** Early, emerging business models of co-creation and servitisation are facilitated by medium prices for commodities at present

3. Remote operation Centres – While particularly relevant for O&G, this is an Australian strength
4. Interoperability – EPCs need to work across each other's spaces
Note that the Indian Government is looking to switch energy to gas including the emergence of Hydrogen & Energy Minerals.

Research organisation

1. Previous phase, miners focussed only on production. Now miners are looking for market differentiation
- **a.** Alternative ways to process
- **b.** Ore quality/mineralogy
- **c.** Cost reduction (e.g., energy intensity)
- **d.** Water (especially in drought)

Market is starting to drive innovation.
2. METS are now starting to diversify e.g. into Energy, Transport, Agriculture, Services
- **a.** Looking to provide "solutions" for multiple sectors
- **b.** Starting to hear the words 'Resources Equipment Technology & Services"
- **c.** One local METS firm is now working in other sectors including secondary mining of waste streams and agricultural products also now in the Americas

3. The mining sector is starting to take ownership of rehabilitation.

Research centre

1. All our participants have cranked up operations significantly and we are now struggling to keep up
2. More focus by miners to get things done on site
3. Miners more amenable to co-creation partnerships and METS companies are also more measured in their engagement with miners
4. Some miners starting to realise their competitive advantage is their ore bodies and hence they are not focused on owing IP
5. Major thrust from all users (miners) into more socially and environmental responsible approach to water, energy, tailings, waste streams, etc., including from site-based personnel
6. Miners (large ones) are losing confidence in the traditional large global METS companies
- **a.** Looking at new partnership arrangements to deliver more/better outcomes

Industry organisation

1. "Ton of things" has changed, especially digital transformation and investments in technology
    a. Mining companies and large METS companies making investments into tech companies > do we have a role to play in investment in technologies?
2. The leading METS firms have built channels to the market (e.g., Orica etc) and now looking to add more value to these channels via new products and services
    a. Mining is just a first market – there are now opportunities to move to adjacent markets.
    b. Companies are coming into mining from other sectors, often for specific "challenges"
    c. Sensors as a platform – cost has dropped incredibly which means that more applications are available.
3. Energy producers investing more in renewables rather than in early stages of the supply chains i.e., the energy minerals
4. There is a lack of people to resource digitalisation in mining
5. Even people in METS companies in business a long time do not know what they are missing by not having digital savvy business models – they are leaving a lot of money on the table.

Industry organisation

1. Openness of miners to collaborate – they are actively seeking out our members. Rate of technological change is so great that miners are starting to feel they can't keep up. Many miners now have their open collaboration platforms, e.g., BHP/Expande, Newcrest, and Rio Tinto to launch one soon.
2. In this growth phase of the cycle, there is more interest in technology and innovation – more tech companies joining our organisation than before
3. But METS is developing a 2 speed sector
    a. Leading companies
    b. Companies who don't know how to manage the new changes.

Australian Government
Department of Industry, Innovation and Science

Industry Growth Centres