Unlocking Australia’s resource potential

The role of the METS sector in driving and enabling innovation

A report by CSIRO Futures
Overview

In a recent CSIRO report, Unlocking Australia’s Resource Potential: Innovation in the energy and mineral resources sectors, we considered the role that innovation can and should play in creating a sustainable future for Australia’s resources sector. Drawing on an analysis of innovation case studies and interviews with 26 senior executives and board members across the sector, this report outlines how the resources sector has historically used innovation to solve some of its largest challenges, why the sector underperforms in innovation today, and what can be done to improve innovation outcomes going forward.

While this report was predominantly focused on the mining sector, many of the key learnings and successful collaboration strategies outlined in the report apply equally to the diverse range of energy and mineral resources companies, which is why we included case studies of collaboration between the METS sector and energy companies for successful innovation. The METS sector’s growth trajectory shows a significant opportunity to increase the level of collaboration between companies and researchers.

The Australian METS sector is a key driver and enabler of innovation in the energy and mineral resources sectors. In Australia, its ingenuity and expertise has led to fivefold growth over the past 15 years, a figure over five times the growth rate of the global mining sector. However, the sector has underperformed in innovation today, and what can be done to improve innovation outcomes going forward.

In looking to the future, the METS sector will need to play three important roles in the resources sector. The first is a driver role, developing and bringing new innovations to the mining sector. The second is a competitor role, converting these innovations into marketable solutions. The final role is that of the integrator, bringing together disaggregated technologies (either new-to-the-world or refined resources) and making them work together in a unique or inventive way.

Overview

METS sector in the innovation process

In fact, an analysis of historic case studies showed the importance of the METS sector in the innovation process. In the case of longwall mining, the sector played a pivotal role across the entire innovation lifecycle, from the invention of longwall mining machines, to longwall face conveyors and longwall mining machines, and the way in which these improvements were translated into longwall automation. In some cases this role has been more indirect, such as in the development of instruments and sensors, mass spectrometry (MS) and inductive coupled plasma-mass spectrometry (ICP-MS) which was key to mineral exploration success through the detection of trace metals in samples.

The importance of the METS sector as a key driver and enabler of innovation has continued to the present day. This new wave of innovation appeared in the interviews we conducted with senior executives across leading resource organisations, as well as in recent analysis and surveys.

Analysis by IPA Australia highlighted METS organisations accounted for the majority (75%) of patents filed in the Australian mining sector between 1986 and 2019.

The first way the METS sector generates innovation is through its role as a key driver, developing and bringing new innovations to the mining sector. The second is the competitor role, bringing together disaggregated technologies (either new-to-the-world or refined resources) and making them work together in a unique or inventive way. The final role is that of the integrator, bringing together disparate technologies and outcomes going forward.

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Models

Collaboration is vital

Collaboration with both customers and research partners is particularly important in the METS sector. However, recent surveys suggest there is room for improvement, with less than half of METS companies reporting that they collaborate with mining companies, universities and other organisations in 2018. Although Australia underperforms in collaboration in many sectors, the METS sector is particularly challenging the governance of companies, from small start-ups to large multi-nationals.

Analysis and interviews across the resources and METS sector suggested that collaboration performance could be improved if organisations embraced the benefits of collaboration. To demonstrate this, the METS sector has underperformed in innovation today, and what can be done to improve innovation outcomes going forward.

In looking to the future, the METS sector will need to play three important roles in the resources sector. The first is a driver role, developing and bringing new innovations to the mining sector. The second is a competitor role, converting these innovations into marketable solutions. The final role is that of the integrator, bringing together disaggregated technologies (either new-to-the-world or refined resources) and making them work together in a unique or inventive way.

We have adapted this framework from the full report to include considerations that are particularly relevant to the METS sector, as shown overall below.

To explore these different collaboration approaches, a framework was adopted from work by Minkus, Pearson and Kermani (2018) to support the Mining Sector Review. Their work provides a valuable way of thinking about the role that collaboration can play in the mining sector by differentiating between the time horizon of the collaboration and the degree of disclosure of the research results. While this framework takes the perspective of a particular producer, it provides an equally valuable mechanism for METS organisations to prioritize and manage innovation projects.

There are three models of practical collaboration to determine if a more strategic approach would deliver greater value:

1. Are there areas where there could be greater sharing of funding, resources and risk with either your customers or with other technology and service providers?

2. Are you creating new partnerships, areas to stay ahead of technology change? How are you anticipating and responding to your customers’ needs?

3. Are there other processes and contractual mechanisms being used for short-term and long-term collaboration?

Supported by continued innovation and growing collaboration, the Australian METS sector is well placed to address existing operational and technological challenges. However, the pace of technology change may require collaboration with much greater sharing of funding, resources and risk – either with your customers or with other technology and service providers.

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In a recent CSIRO report, Unlocking Australia’s Resource Potential: Innovation in the energy and mineral resources sectors, we considered the role that innovation can and should play in creating a sustainable future for Australia’s resources sector. Drawing on an analysis of innovation case studies and interviews with 26 senior executives and board members across the sector, this report outlines how the resources sector should play in creating a sustainable future for Australia’s resources sector. Drawing on leading case studies from around the world, the report outlines how the resources sector can build on its strong heritage of innovation and play a key role in creating a sustainable future for the country. The report highlights that innovation is a key driver of growth and competitiveness for all sectors, including the resources sector. It also identifies the key drivers of innovation in the Australian resources sector and outlines the challenges and opportunities for innovation in the sector.

In fact, an analysis of historic case studies showed the importance of the METS sector in the innovation process. In the case of longwall mining, the sector played a pivotal role in bringing new equipment and technology to the mining sector. Longwall longwall coal and longwall mining machines, at the same time, represent the leading innovation in the sector. In some cases the role has been more indirect, including the development of new technologies and methodologies for longwall mining. The success of the METS sector in innovation is based on three key factors:

1. Collaboration: The METS sector is well placed to address the challenges of the sector’s innovation. Whether it is the discovery of new resources or the development of new technologies, the METS sector has a unique role in fostering innovation and working together to develop solutions.

2. Innovation: Innovation is a key driver of growth and competitiveness for all sectors, including the resources sector. The sector has a strong heritage of innovation, and there is a significant opportunity to increase the level of collaboration between companies and researchers.

3. Collaboration: Collaboration is vital. To explore these different collaboration approaches, a framework was adopted from work by Markus Pernici and Antonio Lattarini published in the Sloan Management Review. Their work provides a valuable way of thinking about the role of collaboration in the innovation process. The framework suggests that collaboration is critical in the success of the sector.

• Are there areas where there could be greater sharing of knowledge, resources and risk with other technology and service providers?

• Are there new ways of engaging with people, areas, research and universities on mining innovation and how to improve collaboration, with the aim of creating high-powered teams and models that foster a new level of growth in the future.

While this report was predominantly focused on mining, the findings are relevant to all sectors and industries. The sector’s heritage of innovation, the expertise and capabilities it possesses, and the strong relationships between the METS and the mining sector, provide a strong foundation for success.


More importantly, drawing on an analysis of historic case studies, the METS sector has a strong heritage of innovation and a track record of success in the innovation process.

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While this report was predominantly focused on the mining sector, many of the key challenges and successful innovation strategies identified in the report apply equally to the energy and mineral resources sectors, and highlight the need for enhanced collaboration between the METS sector and its customers.

In fact, an analysis of historic case studies showed the importance of the METS sector in the innovation process. In the case of longwall mining, the sector played a pivotal role across the entire innovation lifecycle, from the invention of the coal mining machine, longwall face conveyors and longwall mining machines, to the formulation of new technologies, intellectual property and mineral deposits. The role of the METS sector is further highlighted by the development of new technologies, such as cutting-edge mass spectrometry (MS) technology which was key to mineral exploration over the past 15 years.

Overview

More importantly, drawing on our research of the Australian mining sector, the METS sector has developed advanced analytical technology solutions that have transformed the global marketplace. However, it is the sector’s innovation capability, whether it be through its development of new technologies and protocols or its ability to innovate at a fast rate, that is the sector’s innovation capability. Whether it be through the discovery of new resources or the development of new processes, the sector is well placed to address the next 50 years of growth.

In the METS sector, success is driven by a number of factors, including the sector’s innovation potential, whether it be through its development of new technologies and protocols or its ability to innovate at a fast rate. Whether it be through the discovery of new resources or the development of new processes, the sector is well placed to address the next 50 years of growth.

The Australian METS sector is well placed to address the next 50 years of growth. It is estimated that Australia develops 60% of the world’s mining software with companies investing over $1.6 billion in research and development (R&D). Although Australia underperforms universities and other organisations on mass spectrometry (e.g. inductively coupled plasma mass spectrometry or ICP-MS) which was key to mineral exploration over the past 15 years, a faster rate than the majority of other sectors.

The METS sector, led by its role in transforming the extractive industries of Australia and its ongoing innovation, is critical to unlocking Australia’s Resource Potential. This report provides an equally valuable mechanism for the METS sector to strategically develop collaborative partnerships to determine if a more comprehensive approach to innovation could be combined with the sector’s highly collaborative and multidisciplinary nature to improve the entire innovation ecosystem.

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Key factors for innovation success

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What innovations are you leading and why?
What is your competitive advantage?
How do you align your strategy with your customers’ needs?
How do you maintain innovation investment through the business cycle?
Who is leading the charge?
Are senior managers seen as champions for innovation?
Are your innovation teams designed to succeed and grow?

IP strategy
How are you protecting your IP? Is your IP strategy designed to succeed and grow?
Right mix of skills
Are your innovation teams designed to support innovation?
Risk appetite
Does the environment facilitate the appropriate level of risk taking? Are you sharing and learning from your failures?

Customers
How are you collaborating with your customers? Are you partnering or acting as a vendor?
Expertise
Are you and your customers willing to maintain innovation investment through the business cycle?
Competitor analysis
Will your competitors or customers out innovate you?

Leading from the front
Who in your organisation is leading the charge? Are senior managers seen as champions for innovation?
Right mix of skills
Are your innovation teams designed to succeed and grow?
Structure and incentives
Are your governance and structure designed to support innovation?
Risk appetite
Does the environment facilitate the appropriate level of risk taking? Are you sharing and learning from your failures?

Collaboration models
How do you select appropriate collaboration models to achieve innovation outcomes for individual partners and projects?
Interoperability
Could you benefit from standards that allow interoperability between your products and other vendors?

What to prioritise? What to invest? Who to engage? How to deliver?
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