Mining Communiqué

2013 Australia 3.0 Mining Group examined obstacles to digital transformation within the sector

The next generation improvements in mine productivity are likely to come from innovations in the digital economy, especially in the fields of automation and integration of the overall knowledge base seamlessly across the mining value chain. Digital productivity is core to this vision through dealing with large and complex data sets, extracting knowledge from data, building intelligent and automated machines suitable for remote operation and in integrating the mining process -- from exploration through mining, processing and transportation. Benefits from adopting a digital approach include the more effective use of scarce expertise, reduced process variance, and more informed and faster decision-making.

2013 Mining Resources Moderator Colin Farrelly

Mining Subject Matter Experts

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Gold Partner DMITRE SA Gov The Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE) is in a unique position to drive economic development and 'deliver results' for all South Australians.

Government
of South Australia

Department for Manufacturing,
Innovation, Trade,
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1. Building on success from the adoption of technology in Mining – "ICT in Mining Inventory"

The Australian Mining industry is currently going through a technology driven productivity revolution similar to that seen in Banking and Finance, Manufacturing and Petroleum over the past two decades. All major mining companies are now conducting significant initiatives to reinvent the way mining can take advantage of new technologies, including:

- remote operations,

- automated equipment,

- distributed and increasingly intelligent sensors,

- data-driven collaborative decision making,

- standardised practices embedded in common support systems,

- mobile technology for a flexible workforce,

- advanced data visualization and 3D design,

- and many others.

Colin Farrelly, Indigo Partners,
Australia 3.0 Mining Stream Leader

The implementation of these new technologies is bringing with it significant changes in mining practices as well as a variety of different models for developing strategic partnerships for innovation. The changes in basic mining practices also have implications for regulators and research organisations, who also need to adapt in order to help accelerate rather than impede the transformational change. We anticipate that this maturing of practices will follow a similar path as has occurred in other heavy industries experiencing significant increases in technology dependence.

At present there is a lack of widespread understanding of the initiatives already underway, the way they are being conducted and the benefits that result.   That is, in the mining industry (including mining companies, research organisations, suppliers and regulators) "*we don't know what we don't know*", because the collective knowledge of "*who is doing what?*" is very low.

This includes an understanding of the wide variety of current approaches to strategic partnerships for developing innovative solutions. The way different companies are engaging the R&D organisations and the service industries varies quite a bit. We also have a number of ICT related innovation investments led by R&D organisations, including CSIRO, NICTA, AMIRA, CRC Mining, CRC ORE, JK Mineral Research Centre and various other University based collaborative institutes.

A number of ICT related initiatives are also being driven by product and service companies with different areas of focus, such as Automation, Engineering, IT Services, and Mining ICT specialists.

Following the Australia 3.0 Forum in 2012, the CSIRO, AIIA and Deloitte Consulting have been working with the South Australia Department of Manufacturing, Innovation, Trade, Resources and Energy (DMITRE) to develop an ICT Roadmap for Mining. This has made a good start in compiling useful information of the various ICT related transformational initiatives in mining in Australia, as well as a number of recommendations for new initiatives. Refer:
http://www.southaustralia.biz/manufacturing_works/programs_and_initiatives/mining_industry_participation _office_mipo/ict_roadmap_for_minerals_and_energy_resources_project

There have also been a number of different proposals for technology innovation in mining bidding for Federal Government funding under the banner of the Industry Innovation Precincts. Refer:
http://www.aussiejobs.innovation.gov.au/programs/Industry-Innovation-Precincts/Pages/default.aspx

Pulling together a shared understanding of all the separate initiatives in mining and related industries would itself be a critical first step in the development of an ICT for mining roadmap that would underpin the development of key technologies in the same way that the semiconductor roadmap has facilitated the development of integrated circuit technology over the past 30 years.

a) Australia 3.0 – Recommendation 1

We recommend that an inventory of industry activities be compiled and made available on-line so that mining companies, research organisations, suppliers and government can better coordinate their individual efforts and not have to reinvent every component of the change. The resulting shared knowledge will increase the speed of uptake and the value of benefits achieved from the adoption of technology driven innovation.

The "ICT in Mining Inventory" would encompass:

  a) **Case histories of successful innovations, including challenges overcome and benefits delivered**
  b) **Collaborative research initiatives proposed or underway on technology enabled innovation**
  c) **Lessons learnt in governance practices for assessing and shepherding innovation**
  d) **Key contacts to follow up any specific item**
  e) **Processes and ongoing ownership to ensure the evergreen management of the inventory**

Australia 3.0 Forum – Discussions – 8th August 2013

The initiative was supported in principle. Points raised included:

- There was some concern about feasibility of an inventory when the industry does not like to share best practice.
- Research institutions are also often reluctant to share what they are doing.
- Dialogue between business and IT is the hard part - neither properly understands the challenges of the other.
- Existing dialogue is not institutionalized and seems to rely on individuals.
- Can be a struggle to get miners to tell case studies, and a risk that you overpopulate a directory with vendor sales stories.
- Just putting up the problems that need solutions would be worthwhile, along with the recognition that ICT can deal with the problem.
- Perhaps merge this with Recommendation 2 and use it to properly document existing solutions to known problems.

Proposed Next Steps:

Further assessment and discussion is needed on the existing proposals for development of ICT innovation in mining. If one or more of the proposals to government from Perth, Brisbane or Adelaide get approved, then it changes the way this recommendation would play out.

2. Ideas identification and coordination on ICT enabled innovation in Mining - "ICT Innovation in Mining Forum"

While there are many research organisations and collaborative innovation groups that include either mining innovation or ICT innovation in their brief, there is no specific group that focuses on ICT applied to Mining. Different research consortia often have one or two ICT innovation projects in their portfolios, but there is seldom any concerted effort to connect the different ICT efforts together.

Specialist mining software vendors, who have developed an active SME market over the last 20 years, also carry out ICT Research. Australian SMEs have often led the way, particularly in mine planning systems. These specialist vendors can struggle to keep up with the rapid trends in the ICT industry, largely because of their need to survive through the feast and famine cycle of the mining industry, when they are either too busy with new clients or else struggling with a lack of new income.

The disjointed nature of ICT research and development in mining means that the mining industry is not taking advantage of many of the advances in ICT in other industries and the different efforts are not leveraging experiences from each other. New approaches to ICT innovation are evident in the consumer market due to the impact of disruptive technologies, including cloud computing, mobile devices and social networking. New solutions can be bought to market very quickly, often involving global distributed teams using crowd-sourced funding.

There has, however, been a trend in recent years for large technology vendors in other industries to move into mining, which they see as one of the few global growth industries, and acquiring mining ICT vendors with a significant existing client base. This is bringing an influx of new thinking and new money into a software industry that needs the impetus.

Some of the new thinking is really old thinking from more technologically mature industries such as aerospace and defence. Examples include CAE acquiring Datamine in 2010, Hexagon acquiring Intergraph in 2010, ABB acquiring Mincom in 2011, Triple Point Technology acquiring Qmastor in 2011, Dassault Systèmes acquiring Gemcom in 2012 and Schneider Electric acquiring SolveIT in 2012.

This influx of outside expertise and finance should help accelerate the move to better ways of working simply because the pathways to success are already understood by the new players. There is no guarantee, however, that these global companies will continue to invest in a local Australian based software industry, particularly is there are added incentives in other countries to develop their local industries.

The first step in getting a greater degree of coordination happening in the mining industry would be to build a Forum that actively engages in an industry wide dialogue on what ICT innovations are required for the benefit of everyone. This Forum may also be the way to begin building the sustained community to drive an industry wide roadmap.

Australia 3.0 – Recommendation 2

We recommend that Government seed the facilitation of an Industry, Research and Government Forum that takes an active role in progressing joint "industry owned" initiatives to develop innovative technologies and processes.

A standing "ICT Innovation in Mining Forum" would

  a) **Share innovation ideas for increasing industry-wide productivity**

  b) **Build a "marketplace" for innovative ideas, participants, and providers, including managing an "Ideas Pipeline" and acting as a broker between idea originators and multiple funding avenues and mechanisms**

  c) **Lower costs for participants and build viable scale for providers**

  d) **Encourage commercialisation of innovations onshore with Australian and overseas providers**

  e) **Encourage broad sourcing of ideas through low barriers on participation (SME friendly)**

  f) **Provide ongoing ownership and management of the ICT in Mining Inventory from Recommendation 1**

Australia 3.0 Forum – Discussions – 8th August 2013

The initiative was supported in principle. There was debate (and no conclusion) on whether it needs the Government seeding it and the ongoing role the Government should take.

The key issue raised as a potential blocker was the ownership and sharing of IP. Many miners think technology IP gives competitive advantage, but there is growing recognition that competitive advantage of ICT technology has a short lived and that competitive advantage has more to do with your ability to use the technology, not control it. That is, real competitive advantage of technology is in the operating philosophy and how it's adopted into the operation (not the technology itself). Example being where two miners with the same piece of technology can attain vastly different results.

Mining companies may therefore be more willing to help develop industry wide solutions than they have been in the past. Mid-caps and juniors are more willing to expose their problems/challenges, their data, and share solutions (or work collaboratively to solve). It is much more difficult to facilitate this type of open innovation with the larger miners. It was also acknowledged that the juniors usually follow the majors, and it's often difficult to get juniors to invest in a technology if majors aren't contributing.

Other points included:

- Need to look at different legal frameworks to protect IP in sharing forums
- The regulatory regime may be a disabler of this sort of sharing
- Funding avenues and mechanisms are plentiful and in place but not necessarily well known, but there is definitely a need for a more widespread understanding of existing funding mechanisms.
- Need a process to identify problems rather than specific technologies.
- There are gaps is what is being funded – so need a way to identify the unmet needs or for problems that do not fit into existing funding mechanisms.
- Could include a process for Idea Identification in the recommendation (e.g. Idea Funnel type concept to filter and distil the most valuable opportunities)
- One of the functions of the forum could be to connect channel ideas/initiatives into existing research funding mechanisms and R&D providers
- Having multiple companies working on a solution is not necessarily a bad thing.
- Cost and risk sharing is a way to sell it to Midcaps and juniors.
- Difficult to engage with miners and ICT don't know how to frame their offerings.
- Vendors also have a role in helping ensure that new initiatives don't reinvent what is already in the market, although it is also recognized that sometimes vendors only deal with things superficially and therefore the conversation gets closed because of a view that the issue is solved.
- Leaving the task of the identification of challenges that admit game-changing ICT innovations in the hands of the mining sector alone might lead to important opportunities being missed – simply because of there might not be an adequate appreciation of the ways and settings in which ICT might deliver value.
- This cannot also be left in the hands of the ICT sector alone – lest we end up with a classic solutions begging for problems scenario.

Proposed Next Steps:

Same as for Recommendation 1 – Further assessment and discussion is needed on the existing proposals for development of ICT innovation in mining. If one or more of the proposals to government from Perth, Brisbane or Adelaide get approved, then it changes the way this recommendation would play out.

3. Collaboration to overcome technical barriers in ICT innovation - "Industry Standard Platform"

Most mining companies have made an effort to reduce the number of generic support applications by implementing common ERP solutions (such as SAP or Oracle), however the technical solutions (or core mining applications) have continually grown over the last 20 years, and it is common for a particular mine site to have dozens of different applications that are generally poorly integrated. This not only increases the support costs, but it creates an ICT environment that restricts the ability to coordinate across the value chain and makes it difficult for new entrants to provide solutions that can easily fit into an existing ICT environment.

The core mining applications are those that directly support the mining value chain; starting with exploration and mine planning systems, through to production and maintenance of mining equipment and processing plants, through to managing the product supply chain to customer shipment. Most of these systems, especially at the front end of exploration, mine planning and mining operations, are specific to the mining industry and are serviced by SME vendors who grew up in the industry.

The lack of dominant vendors and lack of common industry standards for mining means that the industry needs to continue to struggle with multiple applications that are not only hard to integrate, but present problems in consistency in the user interface and the ways they work.

The vendors that sell specialist applications in mining try to adopt general de facto standards for the user interface, but in many other ways their systems are unique, particularly in the way they deal with data. This uniqueness makes it difficult for people to learn and maintain their skills and makes it difficult for IT departments to integrate the systems.

To manage a collection of inconsistent applications, each mining company therefore needs to reinvent the overall architecture and this not only adds time and cost, but inevitably leads to constant change as new theories of IT architecture enter different companies at different times.

There have been a number of efforts to develop data and architecture standards that relate to mining, including:

- S95 – from International Standards for Automation (http://www.isa.org). Their ISA95 standards were developed for the manufacturing industries and have also been used by a number of mining companies and consultants for developing mining reference models.
- EMMM – the Exploration, Mining, Metals, and Minerals forum (http://opengroup.co.za/emmm) was formed as a subcommittee of the The Open Group Architecture Framework (TOGAF) to produce a set of reference models applicable to mining, including a Technical Standard, initially developed in South Africa and approved by The Open Group in March 2013.
- ADX – the Analytical Data Exchange group (http://adx4.org) has developed standards for data interchange among analytical laboratories and their clients.

- IREDES – the International Rock Excavation Data Exchange Standards group (https://www.iredes.org) which is developing data standards for communication between mining equipment and back-end IT systems, with an initial focus on underground mining equipment, primarily due to the involvement of underground equipment vendors from Scandinavia.

While these standards in mining have been slowly gaining traction, the effort from the mining industry globally pales in comparison to the efforts of the petroleum industry, where major global standards bodies are headquartered in USA (www.energistics.org and www.api.org), Canada (www.ppdm.org), and Europe (www.posccaesar.org). The investment by the petroleum industry compared to the mining industry over the last 20 years would be several orders of magnitude greater.

Another area for industry collaboration is in the development of wireless communications standards and associated spectrum management. High bandwidth and redundant communications across all working areas of a mine is now a fundamental requirement. This has been a challenge to date for the mining industry because of physical constraints imposed by the layout of mines, particularly in deep open cuts and underground workings. The application of more advanced wireless broadband solutions may be severely restricted by the policies for spectrum management implemented by different national regulators. Some technologies will simply not be available in some jurisdictions, or will be only available from Internet Service Providers and Telcos for rental at a premium price and with significant restrictions on usage.

Australia 3.0 – Recommendation 3

We recommend Industry, Government, Research and other players come together with appropriate resources to resolve technology regulation and standards issues hampering technology adoption in Mining. This will be most effectively achieved with seed facilitation by government to start the process, with ongoing funding and operation provided from Industry through the ICT Innovation in Mining Forum proposed in Recommendation 2.

Efforts on this "Industry Standard Platform" would focus initially on the potential for a common approach to:

- **Resolving spectrum assignment issues between regulators, suppliers and mining companies**
- **Agreement on data interchange standards specific to Mining**
- **Agreement on interoperability standards for automated equipment**
- **Development of common core business models, particularly for new technology-enabled processes**

Such collaboration in other industries has demonstrated the productivity gains that are achievable as a result of coordinated industry-wide initiatives, including the encouragement of an active SME market for niche solution

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There is definitely a need for some oversight and funding to facilitate the development of committees and on-going mining community collaboration, however careful consideration needs to be given towards the framework or structure of the funding body(s) to ensure government plays a role more as the facilitator not the controller. Doing anything on this topic will need serious funding. Addressing the specific sub-points raised:

Resolving spectrum assignment is vital to the mining and resources sector to ensure the security and reliability of the mobile mining applications. the provision/reservation of spectrum for the industry in regional Australia will be an enabler into the future to greater productivity and safety. This can only be acheived through a collaborative approach between a community of miners and the regulators. Perhaps initially starting with a Forum for the different stakeholders to get together – for example, one run by Queensland State Government on the safety related topic of proximity awareness for vehicles. The real challenge is to get global action happening on spectrum availability because it inhibits the ability for vendors to build and sell kit.

Data Interchange important - there are a number of standards organisations/working groups emerging made up from a collection of machine OEMs and applications companies driven through the realisation that interoperability between equipment from different OEMs is a serious requirement, particularly as the technology landscape evolves and as mining techniques change over time through the use of the technologies. Surprisingly enough the two largest OEMs are not active amongst the standards groups

Interoperability for automation is much the same - it is highly unlikely that a single OEM can deliver a complete end to end mining solution.

Regarding common industry models – these are used in other industries for standardisation, commonality and interoperability. There is sufficient evidence that interoperability can be achieved through a more open arena. What needs to be worked out is where the commercial motivator is for the equipment manufacturer to participate in the development of open systems and interoperability. For some of the larger OEM's that have market share in supply of equipment, they are challenged to see the business case to share.

Proposed Next Steps:

Further assessment is needed on the existing initiatives for interoperability and sharing. The key industry associations to get involved in this in a sponsoring role are Austmine, since they represent the major suppliers, and AMIRA, since they have previously developed standards for the industry.

4. Ensuring the future availability of required ICT skillsets - "Future ICT Skills Strategy"

A number of industry and education roundtables and studies were carried out by the in 2010 to 2012 largely addressing what was seen to be a looming skills shortage in the Resource industries that could be predicted based on the number of major new projects in the pipeline. The Business and Higher Education Round Table (www.bhert.com) held a number of meetings on this topic and have published Discussion and Position Papers. More recently, a study on "Exploring the social dimensions of autonomous and remote operation mining" was carried out by the Centre for Social Responsibility in Mining (CSRM), part of the Sustainable Minerals Institute, University of Queensland. Refer: http://www.csrm.uq.edu.au/publications/435-exploring-the-social-dimensions-of-autonomous-and-remote-operation-mining-applying-social-license-in-design

While many specialised skills are still in short supply, the recent cut backs by a number of mining companies have perhaps taken the heat off this issue, which is nevertheless still a serious issue over the longer term with new graduates and immigration not likely to match the retirement of the baby boomer generation.

In addition, the changing nature of mining, with the greater use of ICT in more automated and remotely operated operations, present some new challenges to the way the education sector can prepare the future workforce.

These various round table meetings raised a number of key questions, but there has been little progress to addressing the gaps. Some of the questions raised were:

- What are the ICT skills needed by the future site technicians managing automation equipment?
- The future remote operators will not have any first-hand experience in a physical mine environment, so how can that deficit in tacit knowledge be made up?
- What are the new skills required for the proper use of the future advanced analytical and visualization systems necessary to interpret the increasing amount and variety of operational data (Big Data).
- How can we ensure that graduates operational mining disciplines and ICT are properly equipped to have substantive conversations about the value that new technology can bring to the mining business?
- What are the structural changes happening to mine operations and workforce – what template does the mining sector have for managing automation and ICT-centric operations?
- What sort of training is needed on Technology Futures (the technologies that exist today and which we could foresee as part of the solution) and Disruptive Technologies (the technologies are on the horizon that may challenge current operational practices and embedded value chain models)?
- What are the future industry needs in terms of skills – do we really understand what the industry needs in the next 10 years to properly position for automation?

- Are there different needs from the major mining companies and the SME sector?
- What are the changing needs of the METS sector?
- What are options for up-skilling – including traditional approaches (executive education, graduate courses, undergraduate courses, specialist training courses) and non-traditional approaches (remote training, massive on-line open courses or MOOCs)?
- What is the training needed to understand the difference between project management and governance of mining projects versus large scale ICT and automation projects?
- With the changing nature of mining and greater use of ICT and automation, what changes can we expect to the 'social license to operate' between the mining sector, government and the community?
- Open innovation – who do you cluster with? What is the opportunity cost in corralling/protecting IP as opposed to the possible multiplier effect generated by open-source/crowd sourcing solutions? What does this mean to the link between teaching and R&D
- What role can ICT play in changing the way training and education is delivered?
- How can the business and higher education sectors collaborate better to ensure more graduates are attracted to the industry?
- What other industries (e.g. Agriculture, Petroleum, Military) have similar challenges and may have some of the solutions?
- What are the key stakeholder groups that need to be involved and aligned around these questions? (eg. Mining Education Australia, Australian Council of Engineering Deans, Australian Council of Deans of ICT, Minerals Council of Australia, AusIMM, relevant CRCs, etc).
- How can we keep a dialogue open on the shared challenges faced by the industry?

Australia 3.0 – Recommendation 4

We recommend that Industry, Government, Research and the relevant tertiary training institutions come together to plan and assure the availability of appropriate capability required for the future health of the Mining Industry. This will be most effectively achieved with seed facilitation by government, with funding and ongoing operation provided from Industry via existing mining and ICT industry associations. Developing a coordinated strategy will be help build and maintain future relevant skills well as retain industry knowledge through the peaks and troughs of the mining cycle.

This "Future ICT Skills Strategy" includes:

a) **Building relevant ICT literacy skills into the training of future Mining specialist and leadership positions (Geologists, Engineers, Managers, etc).**

b) **Building an understanding of the mining industry into the training of ICT and automation specialists**

c) **Developing company strategies to maintain future relevant skills, and advanced corporate knowledge through industry peaks and troughs**

d) **Developing industry strategies for keeping key experience within the industry. Eg: applying skills to cross-industry research, innovation and knowledge base building initiatives.**

e) **Addressing challenges presented by the retirement of the baby boomer generation and consequential loss of knowledge and experience, as well as the opportunities presented by encouraging industry participation from a more technology-savvy generation.**

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Agree in principle that such an industry strategy is needed, however the discussion just raised more questions. Other points included:

- Education needs to be adaptive to an evolving mining environment.
- The need for ICT skills is an issue for the whole economy in terms of attracting and retaining people in the ICT sector.
- Preferred the term Capability rather than Skills - as it's more permanent.
- The application of the knowledge is critical, hence the need for ICT specialists to understand mining and well as mining specialists to understanding ICT.
- An emerging issue is how much mining tends to work in silos based on functional expertise (geologists, engineers, metallurgists, marketers, etc.) and this does not fit the trend towards automated and integrated operations. This integrated world view needs to become part of the training for both mining and ICT specialists.
- Also need professionals with T-shaped skills (both mining and ICT) who are at the centre of the "IT/OT Convergence".
- Demand driven capability education – mining industry needs to engage – both miners and their suppliers
- Young people using the technology is not an issue, so the new skills they need is more complex. Retraining existing people in the industry may be a different need than what the new generation require.

Proposed Next Steps:

Further discussion is required with mining industry associations on this topic, particularly AusIMM and Austmine.

Also need to follow up with the groups and researchers who have specifically looked at this issue to see if there are any new proposals for progressing this topic. In particular, the Business and Higher Education Round Table (BHERT) and the Centre for Social Responsibility in Mining (CSRM).

What is the Australia 3.0 Communiqué?

Australia 3.0 leverages the collective wisdom of an invitation only grouping of some of Australia's leading Technology and Innovation thinkers and most experienced professionals to develop insight into the pivotal issues that will impact Australia's ability to succeed in the global digital economy.

A three month long dialogue focussed around the opportunities, threats and systemic barriers for Australia's digital economic future culminates in the endorsement of a series of targeted communiqués by a plenary gathering of over 300 of Australia's most eminent IT industry leaders.

Australia 3.0 is one of the Industry's peak thought leadership events hosted by the Pearcey Foundation, the Australian Computer Society (ACS), the Australian Information Industry Association (AIIA), CSIRO, NICTA, and the Federal Department of Innovation.

The Australia 3.0 2013 communiqué has been developed, refined and formally endorsed through the Australia 3.0 process online and offline culminating in endorsement and formal launch at a plenary forum operating as part of the 2013 iAwards ceremonies held at Crown Casino, Melbourne on August 8th.

Australian Success in the Digital Economy

The advent of the global Digital Economy should be seen as nothing less significant than the Industrial Revolution or the introduction of electricity. Australia is comparatively well placed to excel in the Digital Economy as a result of our knowledge capable workforce, natural innovative mindset, and relative economic strengths coming out of the GFC.

The Digital Economy can be seen in terms of economic efficiencies, in terms of trade, or in productivity terms.

It has been said that, rounded for error, 100% of humanity's productivity increases have come from Innovation, and 0% from regulation. The rate of adoption - embracing or missing - this opportunity for Digital Innovation will set up Australia's wealth for the next major wave of global economic development.

Anything that can be done should be done to lift the rate of Digital Innovation across the whole economy.

Acknowledgements

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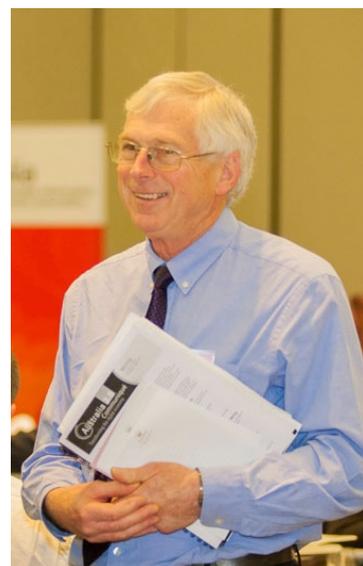
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Further Information

If you would like to get involved in Australia 3.0 please visit the website and subscribe for updates or email us

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