AMIRA P260:

An exemplar long-running university-business collaboration project delivering results for researchers and industry alike

Adelaide, Australia

General Information

Title	AMIRA P260
Pitch	An exemplar long-running university-business collaboration project delivering results for researchers and industry alike
Organisations	University of South Australia, AMIRA International
Country	Australia
Author	Dr. Todd Davey (Science-to-Business Marketing Research Centre)

Nature of interaction

- ☑ Collaboration in R&D
- ☑ Commercialisation of R&D results
- ☑ Mobility of staff
- ☐ Academic entrepreneurship
- ☐ Governance
- ☐ Lifelong learning
- ☑ Joint curriculum design and delivery
- ☐ Mobility of students
- ☐ Student entrepreneurship
- ☑ Shared resources

Supporting mechanism

- ☐ Strategic
- ☑ Structural
- ☑ Operational
- ☐ Policy

Summary

The AMIRA P260 project, involving researchers from the University of South Australia and major sponsors from the minerals and mining industry, has a unique project structure that allows it to deliver strategic-basic research outcomes as well as immediate, economy-driven results for partners. Now in its eighth iteration and running for over 29 years, the project has involved over 100 sponsor operations. P260 is an exemplar university-business research collaboration that has delivered proven outcomes including 300 refereed research publications, an excellent record of employment for the 50 PhD students and the total benefits delivered from the project exceeding $1AU billion (€670 Million).

Introduction & Overview

1. BACKGROUND

AMIRA P260 is a 'family of projects' that has been running since 1988 and is a collaboration between the University of South Australia (UniSA), large mining and engineering companies, SME supply-chain suppliers and other research institutes, which are brokered and managed via the AMIRA International, a resources industry research and development association. The project has been described by AMIRA International as 'one of the sector's "flagship" projects'.

Now its eight extension, each project iteration focuses on a set of particular issues to do with the flotation and separation of minerals, agreed upon by the consortium. As an example, the P260F project iteration, which ran from 2010 to 2014, focused on the influence of process mineralogy and pulp chemistry on the flotation of fine and coarse minerals. The latest project iteration, P260G, is focused on issues associated with value selectivity and rejection of waste in, mainly, copper and gold flotation, with current project partners ('sponsors') including Newcrest Mining, Votorantim (Brazil), Xstrata Technology, Outotec (Finland), Magotteaux Australia (Belgium) and Newmont Mining (US).

Each project iteration also has two streams of research activity: (i) general research, which tends to more basic in nature and addressing a generic challenges facing the industry; and (ii) 'Critical path' research, which is more applied to a problem confronting individual projects partner's ('sponsors') operations. All results of the projects are shared between all the project partners.

Originally the project involved large 'R' (research) and small 'd' (development); however, over the years the balance has shifted to smaller 'r' and large 'D', as the developed knowledge has grown and been applied. Increasingly the programme has also been called upon to increase the knowledge capacity and depth of talent in the sector to address skills gaps. Australia has historically fallen short in training and educating professionals in the area, producing only 40 out of 5,500 graduates worldwide in 2009[1] despite the underserved demand for such professionals in Australia alone[2].

The current P260 project will continue until at least 2018 and has involved more than 30 mining, chemical and engineering companies worldwide, including major leaders BHP Billiton, Xstrata/Glencore, Vale, Rio Tinto, Anglo American, Cytec, Dow and Unilever. P260's good practice is evidenced through the ongoing and "repeat business" funding commitments made by industry partners[3], including:

- The project has addressed problems related to site and ore specific characteristics at over 100 different sites world-wide.[4]
- Since 1994, Australian-based Glencore (formerly Xstrata) has supported the project over two separate periods totalling 20 years,

- A Belgian-owned international supplier of grinding material, Maggotteaux Australia, has committed uninterrupted support for 21 years from 1997 to 2018.
- Beyond the P260 project, many of the sponsors have also engaged the UniSA minerals research team through separately funded one-to-one projects and consultancies,
- BHP Billiton invested in the minerals research infrastructure at UniSA to the tune of $AU2.5 Million in 2009 (ca €1.7 Million). [5]

Since 1994, the Minerals and Resource Engineering (MRE) Research Strand of the Future Industries Institute (FII) (formerly the Ian Wark Research Institute, 1994-2015) at the UniSA has become a central research provider within the project. Their expertise in the separation of substances with particular focus on minerals, and ability to tailor the processing method to the circumstance is supplemented with a very well-developed understanding of how industry works and the needs of the industry. Given their experience, their long-term involvement underpins the ability for P260 to deliver quality basic research outcomes, develop researchers for the industry whilst delivering specific value for industry partners to justify their investment.

One of the issues the project faces is Australia's diminishing educational and research capacity in mining and minerals. A report on the education needs of the industry found that, just for Western Australia alone, 12,000 metallurgy graduates would be needed in the coming years[6]. This factor, combined with the problem that metallurgy departments at many universities have closed or reduced in size/subsumed into Chemical Engineering in Australia, with the market for education moving overseas (Australia has 30 graduates annually to China's 2,500 plus), highlights the skills shortage that exists in Australia.

2. OBJECTIVES AND MOTIVATIONS

The P260 project has some more general objectives for the project and stakeholders as well as some specific research related objectives.

The vision for the project is to improve understanding of factors that control the separation efficiency of minerals containing base and precious metals in the flotation process.

More generally the P260 project aims to aggregate the resources of the minerals and mining sector to solve common, site-specific issues and address long-term challenges faced by the sector through research, and build stakeholder knowledge and capacity. Moreover, it seeks to do this through the entire minerals and mining value chain by developing technology and information for 'sponsors' (those companies investing in the project) operation tools, methods and protocols for use by sponsors. [7]

Finally, the project aims to increase capacity, in terms of knowledge and numbers of personnel. This objective contributes to the project's problem solving capabilities, ability to transfer technology to sponsor's operations[8], as well as to its ability to generate the next technologists for the industry.

More specifically the research within the project attempts to:

- Increase recovery of value minerals in sponsor flotation plants;
- To achieve this for increasingly complex and ores of decreasing grade;
- Address the longstanding challenge of recovering value in coarse, composite and fine particles;
- increasing the rejection of gangue minerals in order to improve selectivity in sponsor flotation plants and ores, thereby improving final product grade and value;
- Assess the impact of reducing water consumption, improve performance while using marginal water sources (e.g. saline/seawater) in flotation, and develop strategies to mitigate against negative impact;
- Value extraction from tailings and waste streams
- Independently assess new technologies in problem solving; accelerate adoption;
- Develop tools for industry that value-add to process performance information (lab or plant)[9].

3. STAKEHOLDERS

AMIRA is the key stakeholder coordinating the entire project. It is a member-based, not for profit company with about 70 organisations paying an annual membership fee. Started by a group of CEOs in the 1950s who wanted to pool common problems of industry and to address these. They have four offices in Australia, USA, Chile and South Africa.

Depending on the iteration, the project includes a range of stakeholders who are united around the research focus of the project. As an example, the P260G iteration of the project has a flotation focus and involves:

- Mining companies (end-user) - Newcrest Mining, Votorantim (Brazil), Xstrata Technology, Outotec (Finland), Magotteaux Australia (Belgium), Newmont Mining (US),
- SME suppliers to the mining companies - which are generally technology providers to the supply chain and are linked with the end-user (mining companies) through the project,
- Government - involvement of government is limited to providing funding to support blue-sky research, e.g. infrastructure grants and university block funding.
- Researchers / students - doctoral and post-doctoral researchers / students are funded through the research. They are encouraged to develop multiple company contacts and try to focus their work on issues that might include one or multiple partners,
- Experienced technical staff - are also employed as part of the project, especially for supporting the case studies (research projects involving site work, addressing the needs of the projects sponsors).

Implementation

4. INPUTS

The input involved in the P260 project can be grouped into three type of resources: human resources, financial resources, and physical resources.

Financial resources

Most of the investment for the project is industry money raised from industry participants (known as 'sponsors'), either mining or technology / supplier companies interested in the results or this stage of the programme. From the money invested into each iteration of the project, researcher teams are paid, needed equipment is purchased and AMIRA International's on-going management fee is serviced. Although financed primarily by industry, the capital is leveraged through matching funds from government (where appropriate) to enhance resources, and enable an indirectly-relevant research effort, which could have some future benefit. As an example, a public sector investment of almost $AU1 million (ca. €670,000) from three consecutive Australian Research Council linkage grants was leveraged from $AU27 million (ca. €18 million) from industry partners.

Physical resources

The research partners offer their existing facilities and equipment for use within the project, whilst existing IP brought in from the respective partners is described in the project contracts. The equipment offered by the UniSA includes a 'full range of equipment' from crushing, grinding, flotation (conventional flotation, column flotation, fluidised bed flotation, etc.), mini flotation pilot plant (includes regrind and cleaner flotation) and leaching equipment. To complement the engineering infrastructure, a wealth of advanced analytical and characterisation instrumentation is available within the University, through nationwide networks of flagship facilities and access to the Australian Synchrotron and research reactor at the Australian Nuclear Science and Technology Organisation (ANSTO). Physical resources available at UniSA alone constitutes over $AU60M investment (ca €40 Million).

Human resources

The majority of the human resources employed within the project are research personnel from the respective research partners, with the UniSA a mainstay research partner. Depending on the research focus of each project iteration, research teams with specific competencies are engaged. Through the life of the project, over 160 staff and post-graduate students have been involved. The mining companies tend to have their own R&D team however do not always have the same expertise and capabilities as the scientific team of the project. Each research partner offers an extensive network of research collaborators that might be brought into specific project iterations as a core partner, or whose expertise is accessed for specific-purpose problem solving during the project. An example of this was the P260F iteration, which

engaged with the University of Sao Paulo (USP), for work associated with apatite flotation at Brazilian operations. The particular expertise available at USP and the impact of local conditions on the problem at hand required such a partnership. Preceding collaborations with USP in other R&D already prepared the way for this strategy. Over the years, the P260 project has built a network of key company and academic people and groups across the globe.

5. ACTIVITIES

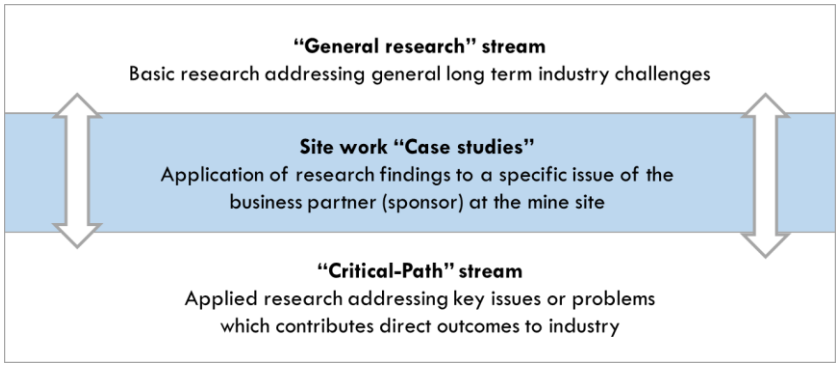
Cooperation in R&D activities

The high level of trust engendered during the long history of the project, enables a unique research structure to the project consisting of two parallel streams:

Generic research: provides funding for PhD students and tends to lasts the lifetime of the project iteration (3-4 years). This form of research is generic in nature and addresses longer-term technical challenges facing the industry and is researched primarily by PhD students and other researchers, the results of which are contributed back to the entire consortium. Because it is quality strategic basic research, it offers very good publishing opportunities

'Critical path' research: this form of applied research is shorter than the lifetime of the project iteration and addresses the technical challenges facing a company or mine site and is a combination of laboratory test work and mine site surveys and tests, e.g. flotation tests, sample collection etc., on real ores/plant samples. The topic of these technical challenges are related to the overarching research topic of the project iteration, which runs parallel to generic research and can inform future research, and includes PhD students and researchers who collaborate with company researchers. The results of this research provide direct, implementable outcomes to the 'sponsoring' company partner and the knowledge attained is fed back to the consortium. An example is the examination of the chemistry and hydrodynamic regimes of three Cu/Mo operations (three different companies) led to transferable strategies that increased both Cu and Mo recovery performance as well as enabling increased tonnages at all three plants (P260E, 2006-2010).

Case studies - Solutions to problems are usually ore or site-specific, and thus, each mine is different and each with its own unique floatation and separation challenges. This requires a more customised approach to problem solving at that mine and the research to generally be



undertaken at the mine site. Because of this, the critical path research is informed by the generic research trialled on sponsor ores at this site in applied site work known in the project as 'case studies'.

The entire research collaboration is underpinned by a multi-disciplinary approach to problem solving.

Potential research for future project iterations

During the project, issues might come up and they are documented. With 12 months to run on the iteration, these issues are considered as topics for the next iteration and supplemented with a road-mapping exercise determining future pathways for mineral processing and the mining industry. Road-mapping involves detailed discussions at company offices and operations, with both existing and potential new sponsors. Distilled from industry feedback, 4-5 topics are included in the proposal and circulated by AMIRA International. strategic basic research. Secondary feedback is used to update and tailor the proposal according to specific company needs.

For each project iteration, the mining companies (sponsors) can choose to be a general sponsor or to be a case study. New sponsors can get access to previous results of the project through the many iterations and from those, can make suggestions for future work. This database is accessed through servers at AMIRA International or directly from the researchers. Those companies that then flag their interest in being involved in specific elements, then receive an individualised proposal for what they will receive.

Consulting research

Having built a trusted relationship with the project partners, the research group at the UniSA is often subsequently engaged through separately funded individual projects and consultancies. This allows P260 partners to engage the researchers for specific-purpose research related to a topic that does not fit into the P260 project as well as allowing more cross-disciplinary engagement of the University's research base and protect sensitive, competitive information.

Commercialisation of R&D outcomes

Technology that is developed during the project is given to the researchers, whilst the mining companies are awarded perpetual use of the IP created during the project. Suppliers get the first right on the IP and are given 18 months to take up a license.

Capacity building (collaborative curriculum development and delivery / professional mobility)

The P260 project not only unites the supply chain around R&D but also around future skills development for the entire industry through the development of industry-ready researchers and industry-researcher training.

The project provides a focus for capacity building for mineral processing in Australia. With mineral processing being only a small part of university-bound chemical engineering programmes, the project inspires collaborative training of research-capable postgraduates in science and engineering disciplines, the PhD students working on a mix of fundamental and applied projects.

A further contribution of the project to capacity building is through technology training for mining companies and suppliers, to upskill them to be able to utilise the results of the project and to develop deeper knowledge of minerals processing.

Finally, the UniSA research team engage undergraduates from the Advanced Materials Science Degree (BSc, Advanced Materials) in the project through industry projects**,** which target issues faced by the project partners. Undergraduates are 'immersed' in a culture of multidisciplinary research together with the physical presence of research staff/students, early exposure to, and understanding of, the industry drivers; routine industry presence and formulation of undergraduate projects and undergrad projects associated with long running applied research. All postgraduate students have a supervisory panel that must have industry advisors, as a matter of UniSA policy.

Governance

Members of the UniSA research team have been invited to sit on governance boards within the state e.g. in commission related to copper development.

Management activities supporting activities

One of the ways in which management support the activities is through the AMIRA P260 technical meetings which bring together the project partners. These are preceded accompanied by major report (typically up to 200 pages) and, where possible, are held at a sponsor company site or in coincidence with an industry-relevant event (conference, etc.). These meetings have been found to be an important part of the project and its success, as they offer an opportunity for knowledge exchange between project partners and takes place every 6 months.

6. OUTPUTS

The project has also resulted in a high number of positive outputs, including:

- Maintenance of long-standing relationships based on being able to deliver practical outcomes,
- More than 300 refereed research publications have been spawned with in excess of 4,000 citations to date., countering the "myth" that industry-relevant research is difficult to publish,
- More than 50 PhD students have graduated through the project with 41 now working in various parts of the mining and processing sector and the remainder in academia or research agencies. The majority of applied science/engineering students spend periods at company sites,

- Approximately 100 sponsorships over 29 years have occurred (1988-ongoing), including mineral processors, engineering, technology and chemical suppliers,
- both incremental and step changes in processing performance have been achieved,
- A number of one-to-one 'spin-off' projects have been created,
- The project has also branched off into areas of focus such as sensors, resulting from their increased reputation in Australia arising from this project,
- Positive reputational effects for the UniSA have been experienced as well as for the industry representatives involved in the project,
- Specific benefits to industry identified included improving recovery, increasing price realisation and avoiding penalties; and reducing operating costs [10],
- Applications of new technologies that helps the suppliers and the end-user mining companies toward technology assessment and early adoption.

7. IMPACTS

An excerpt from a review by the Australian Government of Research Policy and Funding Arrangements documenting 'case studies on university-business collaboration', which documented the P260 success story, stated:

'*Repeat business from major industry sponsors attests to the quality and relevance of the research outcomes… Independent studies by RMDSTEM Ltd revealed more than $1 billion value added to the minerals industry over the programme lifetime. Industry partners secured a 22:1 return for every research dollar invested.*'[11],

The $AU1 billion value added (ca. €670 Million) calculated includes sponsoring site operations ($318 million) via technology transfer of research outputs, expected value ($273 million), through broader implementation, and future opportunity value ($412 million).

Since 1988, the project has involved over 100 company operations from the minerals and mining industry, from multinational corporations to local SMEs[12]. The longevity of the project and the repeated investment of companies involved with one iteration of the project for future projects, attest to this extra value provided by the project.

Support & Influencing factors

8. SUPPORTING MECHANISMS

The UniSA has promotes itself as the University of Enterprise, with a dedicated Deputy Vice Chancellor and Vice President for Research and Innovation responsible for research cooperation.

The new Future Industries Institute was formed, at UniSA, with the specific brief of enhancing industry engagement. The AMIRA P260 project stands as the model for successful University-Business cooperation.

Further support for the project has been provided by the university through the provision of salaries (at times), access to students, provision of equipment and facility as well as tenured staff.

The project has at times benefited from policies mechanisms such as ARC Linkage grants, with the last iteration benefitting from two additional students being funded.

9. BARRIERS AND DRIVERS

Barriers

Economic pressures can affect the emphasis of the R&D activities of companies, and connected to this, their **willingness or ability to fund research activities**. For the industry partners, incremental improvement can be as important as more radical innovation forms and the attitudes to this can limit the cooperation.

At times, companies restructure and this can make it **difficult to maintain effective contacts**.

Furthermore, **not every company is willing to share their knowledge** and to open their innovation channel to others. Their own R&D attitudes can mean that they are more open or closed in their innovation, which can then affect their ability to enter the consortium or to participate in it.

There has traditionally been a perception (rightly or wrongly) that mining industry research should be funded by industry, and that it is not ‘real research’ but more ”development”. As such, there is a tendency for competitive grant applications to be more successful in areas which are more “blue sky”. This together with the high demands of proposal writing and the high levels of competition make it difficult to get these government grants. In recent years however, this environment is changing, with successive governments developing innovation policy and allocating research funding with more emphasis on outcome-driven research, with industry co-investment.

Drivers

The existence of mutual respect and trust underpin the project, as does the existence of a mutual goal that is executed throughout the project. All actors are interested in research, both early-stage and applied, as well as capacity building in the area.

The primary motivations for **companies** are the ability to tap into future research developments in the industry, access problem-solving capabilities and increasingly, to access future talent. All this leads to bottom line, economic impact.

For **academics**, the ability to perform highly variable work; the growing importance of their work as ore grades reduce and science becomes increasingly necessary; the potential to see practical outcomes to industry, to an end-user within a reasonable timeframe; to have real world relevance for their work and make an impact and to benefit from publications in respected journals. An example of the latter is that 90% of the lead researcher's publications have come from industry funded projects.

The UniSA is motivated by research drivers such as the development of world-class research capabilities, the education and training of PhD students and the employability of their graduates. With the State government looking towards mining as a flagship economic and employment driver within the state, the University enjoys substantial local reputational benefits.

For **AMIRA International**, the coordinating company, the motivations are to utilise their network connections in a positive way, to earn income through project management and to build a reputation for the projects that it manages and the partners with whom they work– with the end game being the economic success of its member companies.

10. FUTURE CHALLENGES

Maintaining the project in the face of landscape challenges and also science and innovation changes is one of the biggest challenges for the project. This challenge is comprised of a number of related issues including the challenges of:

- creating a project that is current, relevant and pushes the boundaries for all partners,
- operating with a reduced project funding (potentially) due to economic challenges and cycles for mining companies,
- trying to get buy-in and adoption of the solutions and technologies,
- improving the processes in terms of a reduced energy footprint and impact on the environment as well as seeking greater efficiency,
- managing the needs of each partner, because there is no one-sized-fits-all approach to R&D,
- dealing with complex and lower grade ores (researchers)
- adapting and using their research in other areas (researchers). As flotation involves particle separation, there is interest in cross-industry knowledge exchange e.g. from

the food industry. The team at UniSA is multi-disciplinary, flexible and work across other industries so are able to make critical connections and exploit synergies.

11. CONTEXT

UniSA has a world rank of 288 (QS) and 351+ (US News) whilst having a ranking of 25 [13]for the universities under 50 years old (generally younger universities tend to be more nimble and market oriented) and, relevant to AMIRA P260, ranked 69 (6th in Australia) in Engineering and Technology (THE), providing it with a strong selling proposition for external collaboration. National research quality rankings have shown UniSA's overall university ranking climb steadily from 17th to 14th to 8th in the Excellence in Research Australia (ERA) in 2010, 2012 and 2015 respectively. Furthermore, 97% of research at UniSA was rated world-class or above, according to the 2015 national Excellence in Research for Australia evaluation, is Australia's youngest university to receive 5 stars in research (QS Stars Ranking, 2015) and rated 6th overall in Australia for innovation (Reuters Top 75: Asia's Most Innovative Universities 2016).[14]

South Australia's capital city, Adelaide, is ranked **177th most innovative city in the world** behind Sydney, Melbourne and Brisbane but above Perth in the Innovation Cities Index 2015-16[15]. As determined by a Federal Government review of its economy in the wake of automotive manufacturing closures, areas of comparative advantage for South Australia were assessed to be food and agriculture; advanced manufacturing; health and biomedical products; oil and gas; mining equipment, technology and services; tourism; and education[16].

Some of the **state industrial highlights include that it has some of the largest mineral and resource deposits in Australia**, 25% of the nation's defense budget, 50% of the country's installed wind-energy generation capacity and 60% of the nation's wine exports[17]. South Australia is also the largest producer of wind energy in Australia.

With a relatively small population of over 23 million, Australian economic strengths rest instead on its relatively efficient GDP per capita, which ranks it 19th in the world according to the World Bank[18], or seen another way, its ability to convert its own factors of production into outcomes., **Australia has a number of comparative advantages** globally that have enabled this, especially its natural endowments. These allow prosperous business and export trade in the areas of minerals and agriculture, strong public institutions and political stability, a well-educated, proximity to large Asian markets and a highly skilled workforce. Its clean, green image, especially in agriculture and food exports, is a further asset for use when building Australian innovation capabilities[19].

12. KEY SUCCESS FACTORS

Sense making process

It was seen as crucial to develop a vision and strategy that fits with the culture and experience of the university. Neither a command and control 'top-down' approach, nor a pure 'bottom-up' approach was found to be suitable. Rather the university had to go through the process of *sense-making*, an interactive and iterative process of finding the sense and articulating it. It was a matter of looking within the university, and seeing how SFU can best celebrate and

make use of its capabilities. In other words, it was central to bring the strengths to the surface and build on these strengths; not to focus on overcoming weaknesses.

Stakeholder integration

Within the sense making process, the implementation of an iterative and process through engagement with different stakeholders was seen as critical for the development of a long-term and widely shared vision. The extensive consultation process enabled moving from President Petter's intuitive sense, to an affirmed vison and strategy, and a shared lexicon around it.

'A shared vision is like wind in the sail'

This quote by SFU President Petter highlights the importance of the shared revision on the latter development and acceptance of the university strategy, as well as all associated initiatives, structures and actions. The shared vision contributed especially to the rise of initiatives that came from people that were external to the university management (e.g. students, faculty, or people from the community).

Further Information

13. MONITORING AND EVALUATION

The role of AMIRA International is an important aspect of the project and for the monitoring and evaluation of the project, which helps to ensure practical outcomes for the industry partners. Given the potentially large amount of competing mining and supplier firms involved in the project, not only is it beneficial for the project to have an 'impartial' project management team, but also an intermediary who understands both industry and researcher.

Some of the mechanisms for monitoring and evaluation in place used by AMIRA International in executing their role include:

Formal sponsors review meeting (sponsors only) group meetings with open discussions are a leading tool for the monitoring or the project, because it allows open and frank conversations about the projects progress and output.

Further mechanisms include evaluation sheets, informal conversations with mining companies and suppliers involved in the project, and impact assessments undertaken.

14. SUSTAINABILITY MEASURES

In order to manage expectations and ensure outcomes, AMIRA International staff remain involved throughout the operation of each project iteration.

Research results from the previous project results are available for all project members of future project iterations.

The project also generates a large amount of documentation as part of the research process, which documents issues for future research.

Long term financial sustainability of the project is indirectly reinforced by the control measures within the project, which are designed to ensure substantive outcomes are delivered to project partners.

Maintenance of employment security of a core team of researchers and technical staff has been central to the long-term viability of the project and the confidence of industry.

15. TRANSFERABILITY

The structure and approach for the project could easily be mirrored by other research-related projects in other industries or faculties.

A difficult element to transfer could be the positive culture for university-business cooperation within the MRE strand at UniSA and their ability to manage to produce positive outcomes for the sponsors as well as themselves.

16. AWARDS AND RECOGNITION

In the ATN-Go8 Excellence in Innovation Australia Trial measure of impact, the project was lauded as an outstanding Case Study in the 2012 Excellence in Innovation (EIA) assessment of research impact, and stands as an excellent example of strong, long-term industry engagement by UniSA[20].

In the 2018 round of Excellence in Research Australia (ERA), impact of research will be measured for the first time. UniSA is using the AMIRA P260 project as its Case Study submission in the 09 Engineering discipline.

UniSA has nominated the research leadership team of the AMIRA P260 project, Prof Bill Skinner and Assoc. Prof. Max Zanin for the 2017 Prime Minister's Prize for Innovation which

"is awarded for the innovative translation of scientific knowledge into a commercially available product, service or process that has had substantial economic, social and where relevant, environmental benefits."[22].

17. PUBLICATIONS AND ARTICLES

Government of South Australia (2014). Investing in Science, retrieved from http://statedevelopment.sa.gov.au/upload/science/investing-in-science-plan.pdf

Commonwealth of Australia (2011). A Compendium Of Case Studies For The Australian Innovation System Report 2011, retrieved from https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Policy/AustralianInnovationSystemReport/AISR2011/wp-content/uploads/2011/07/Case-Study-Compendium.rtf

18. LINKS

UniSA – P260 project

http://www.unisa.edu.au/research/ian-wark-research-institute/news-and-events-ian-wark-institute/news-archive/evaluation-of-benefits-from-amira-international-p260-projects/

19. CONTACT PERSONS

Prof. Bill Skinner
University of South Australia
William.Skinner@unisa.edu.au

Mr. Joe Cucuzza
Managing Director, AMIRA International Ltd.
joe.cucuzza@amirainternational.com

20. REFERENCES

[1] Jan Cilliers (2010). International Mineral Processing Council 2010. Presentation, IMPC 2010, Commission on Education, Brisbane, Australia. IMPC 2009/12
[2] FastStream Recruitment (2011). Fast Stream Mining Global Employment Review 2011, retrieved from http://www.faststream.com/WebFiles/ContentFiles/Mining-Review.pdf
[3] Commonwealth of Australian, Case studies on university-business collaboration - Review of Research Policy and Funding Arrangements, Nov 2015, retrieved from: https://docs.education.gov.au/node/38981
[4] Commonwealth of Australian, Case studies on university-business collaboration - Review of Research Policy and Funding Arrangements, Nov 2015, retrieved from: https://docs.education.gov.au/node/38981
[5] Commonwealth of Australian, Case studies on university-business collaboration - Review of Research Policy and Funding Arrangements, Nov 2015, retrieved from: https://docs.education.gov.au/node/38981
[6] Ernst & Young (2012-13). Top 10 Business Risks for Mining and Metals, Business Risks Facing Mining and Metals, retrieved from
http://www.ey.com/Publication/vwLUAssets/Business_risks_facing_mining_and_metals_2012_-_2013_Executive_summary/$FILE/Business_Risks_in_Mining_and_Metals_Executive_Summary.pdf
[7] Commonwealth of Australian, Case studies on university-business collaboration - Review of Research Policy and Funding Arrangements, Nov 2015, retrieved from: https://docs.education.gov.au/node/38981
[8] Max Zanin UniSA pdf
[9] Commonwealth of Australian, Case studies on university-business collaboration - Review of Research Policy and Funding Arrangements, Nov 2015, retrieved from: https://docs.education.gov.au/node/38981
[10] Commonwealth of Australian, Case studies on university-business collaboration - Review of Research Policy and Funding Arrangements, Nov 2015, retrieved from: https://docs.education.gov.au/node/38981
[11] http://w3.unisa.edu.au/unisanews/2014/September/story8.asp
[12] Commonwealth of Australian, Case studies on university-business collaboration - Review of Research Policy and Funding Arrangements, Nov 2015, retrieved from: https://docs.education.gov.au/node/38981
[13] http://www.australianuniversities.com.au/rankings/#qsunder50ranking
[14] http://www.unisa.edu.au/Documents/Research/UniSA%20Research%20Brochure_Final_WEB.pdf
[15] 2thinknow Global Innovation Agency (2015-16). accessed on 06/05/2017 via: http://www.innovation-cities.com/innovation-cities-index-2016-2017-global/9774
[16] Commonwealth of Australia (2014). Growing Opportunities: South Australian And Victorian Comparative Advantages, Report of the Panels for the Reviews of the South Australian and Victorian Economies · April 2014) accessed on 05/11/2015 via: http://www.industry.gov.au/AboutUs/CorporatePublications/ReviewofSouthAustralianandVictorianEconomies/Documents/GrowingOpportunities-SouthAustraliaandVictoria.pdf
[17] Government of South Australia (2014). Why South Australia, accessed on 05/11/2015 via: http://www.southaustraliagov.co.uk/invest/22,why-south-australia-

[18] World Bank. Database updated on 14 April 2015. Accessed on 14 April 2015.

[19] http://www.abc.net.au/am/stories/s114236.htm & http://www.theaustralian.com.au/business/in-depth/australia-the-clean-green-food-bowl-of-asia/story-fni2wt8c-1226623265405 & https://ideas.repec.org/p/ags/uneewp/12899.html

[20] Rowbotham, J., (2012), Selling Research Benefits Easy, The Australian, accessed on 29/11/2015 via: http://www.theaustralian.com.au/highereducation/selling-research-benefits-easy/story-e6frgcjx-1226525835625