## Submission to the SAPC Research and Development Inquiry

# University of South Australia Minerals Processing R&D
# Real Value to the Resources Sector for More than 30 Years

- Recognised by industry, governments and academia as a world-leading researchers
- Three decades of long-term industry partnerships, value at >100 site operations
- Independent assessed value of over $1 billion delivered to the sector
- Produced >100 postgraduates, 85% employed in sector, 15% academia

**Background**

Since the late 1980's, UniSA (formerly SAIT) has undertaken extensive, industry-driven R&D in the beneficiation of mineral commodities, through basic, strategic and applied modes. This long-term research effort has been multi-disciplinary approach involving physical chemistry, metallurgy, applied physics, chemical/process engineering, applied mathematics, polymer chemistry, statistics and data analytics, etc.

In 1994 The Ian Wark Research Institute was established, led by founding Director Emeritus Laureate Prof John Ralston AO. "The Wark™", as it came to be known, was named after Sir Ian William Wark (1900-1985), who had been a leading light in minerals and materials research in Australia and was responsible for the founding of the CSIRO Division of Industrial Chemistry. Building knowledge of particle and materials interfaces has been the clear focus, along with application of that knowledge across varied industries, e.g. food, pharmaceutical processing. Minerals processing continued as a strong pillar within The Wark (1994-2015) and, subsequently, within the Future Industries Institute (2015-present), at UniSA.

Researchers at Future Industries Institute: Prof Bill Skinner (1992-present), Prof David Beattie (2000 -present), A/Prof Marta Krasowska (2007 -present), A/Prof Craig Priest (2006 -present), Adjunct A/Prof Max Zanin (2003-present), Adjunct Prof Jonas Addai-Mensah (1993-present), Emeritus Laureate Prof John Ralston AO (1985-present)

With key discipline collaborators: Prof David Lancaster (Optical Physics), A/Prof Bronwyn Hajek (Applied Maths), A/Prof Anton Blencowe (Applied Chemistry), A/Prof Jixue Liu (data mining/analytics).

UniSA has been in the forefront of minerals processing R&D for more than 30 years. Moreover, the major advances in fundamental understanding of the key processes involved, have been made in collaboration with industry partners – translated to real world outcomes.

During 2006, an independent evaluation of one long-term project (see AMIRA P260 Case Study), elicited several statements of praise regarding our resource sector R&D -

- *'Major Strengths are quality of people, equipment resources, instrumental techniques, reputation, attracting high quality students, and now accumulated knowledge in field of practical flotation work. Presently an unparalleled body of knowledge base with huge practical experience in flotation: a world class team,'* - Dr. Megan Clark, BHP Billiton
- *'Australian national treasure'* – Australian Academy of Science
- *'The WARK is positioned at the scientific frontier of our industry'*- AMIRA International

**Value/productivity gains through R&D (* indicates SA sector activity) in –**

- Froth flotation, chemistry and hydrodynamics*
- Recovery improvement*
- Selectivity (grade) improvement*
- Fundamental surface processes*
- Dewatering (water recovery/recycle)*
- Flocculation and dispersion*
- Dry processing – comminution and beneficiation*
- Leach processing and electrowinning*
- Process intensification*
- Magnetic, electrostatic, gravity separation*
- By-product extraction*
- Comminution (grinding) chemistry*
- Value from tailings/reprocessing*
- Impact of mineralogy*
- Coarse and composite particle recovery*
- Gangue rejection*
- Process water impact and mitigation*
- Plant surveys, sampling and analysis*
- Ion exchange for processing & water treatment*
- Processing reagents (environmentally benign)
- New processing technologies*
- Frother chemistry*
- Surface analysis and synchrotron science*
- Price realisation*
- Energy and water saving*
- Characterisation tools and models
- Online sensor development*
- Microfluidic device/processing*
- Opex reduction*
- Collector chemistry
- Professional education/workshops*
- Acid mine drainage
- Postgraduate education*
- Fine/Ultrafine particle recovery*
- Removal of penalty elements*
- Rheology in processing*
- Independent assessment of technologies*

**Commodities/Supply Chain (* indicates SA sector activity) –**

- Base metal sulphides – Cu, Pb, Zn, Ni, Mo, Co etc.*
- Gold and other precious metals*
- Platinum group metals
- Uranium*
- Industrial minerals – mineral sands, phosphate, talc, kaolin, bauxite/Bayer, etc.*
- Engineering, unit operations (METS)*
- CritMin – Li, REE, graphite, Co, Zr, Mn, Nb, etc.*
- Iron ore (magnetite, hematite)*
- Oxide ores*
- Mineral sands*
- Value-add products – synthetic rutile, titania pigment production.
- Reagents*

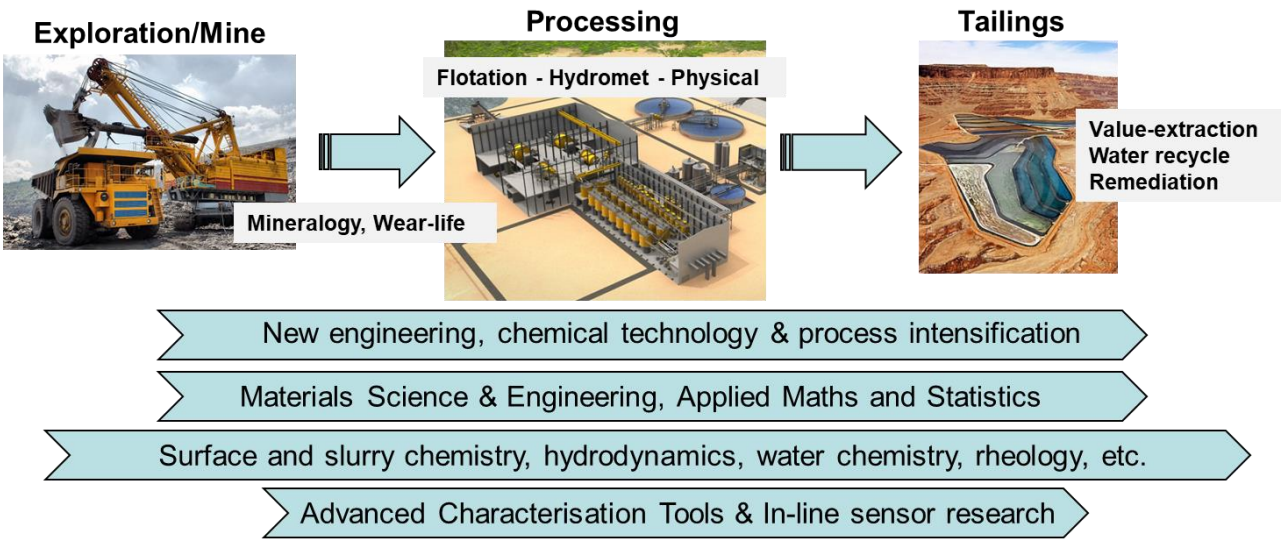



**Figure 1. UniSA value contributions across the mineral beneficiation value chain.**

**Assessments and Metrics**

The University of South Australia positions its R&D around 6 Research Themes –

- An Age Friendly World
- Transforming Industries
- Scarce Resources
- Cancer
- Healthy Futures
- Transforming Societies

Minerals process, and resource sector R&D in general, while directly addressing Transforming Industries and Scarce Resources, also provides the materials and tools that are fundamental to meeting the technological challenges across all sectors of societal endeavour.

The Commonwealth monitors university research performance and impact via two distinct metrics. Excellence in Research for Australia (ERA) which looks at research quality (relative to world standard) using a combination of research output metrics and peer review, and Engagement and Impact (EI)m which looks at the translation of research into economic, environmental and social outcomes.

Though these measures are constantly under review and modification, UniSA has performed outstandingly and consistently and, in particular, in disciplines central to minerals processing – Resource Engineering and Physical Chemistry maintaining the highest ERA rankings of 5 (well above world standard) at these 4-digit Fields of Research codes.

**Table 1. Excellence in Research Australia (ERA) Rankings for key, minerals processing related disciplines at UniSA**

| | UniSA | | | |
|---|---|---|---|---|
| **Discipline (4-digit Field of Research)** | **2010** | **2012** | **2015** | **2018** |
| 0914 Resource Engineering & Extractive Metallurgy | 4 | 5 | 5 | 5 |
| 0306 Physical Chemistry | 5 | 5 | 5 | 5 |

Further to this, the introduced EI measure saw UniSA's Case Study, based on the 30-year success in the AMIRA P260 Flotation series of projects was rated "High" in terms of impact (see Case Study).

**Table 2. Engagement and Impact Assessment 2018 – UniSA – Case Study rated "High".**

| **Field of Research (2-digit Unit of Assessment)** | **Title/Description** |
|---|---|
| **09 Engineering** | |
| | Thirty year sustained impact for mineral processing – AMIRA P260 Flotation |
| **Priority** | Resources |
| **Challenge** | Technologies to optimise yield through effective and efficient resource extraction, processing and waste management. |

https://dataportal.arc.gov.au/EI/Web/Impact/ImpactStudy/1225#impact-tab

**Post-graduate Education**

Minerals processing R&D at UniSA has acted as an attractor of post-graduate excellence, with >100 PhD's and Master's graduates in related fields, with 100% employment in an 85/15 industry to academia ratio.

**Highlights – Major, Notable Initiatives**

*AMIRA P260 Flotation* (series of projects 1988-ongoing), ~100 mining companies and sites worldwide. >22:1 return on investment to 2012 alone, at $1.3B. See Case Study.

*ARC Special Research Centre in Particle and Materials Interfaces* (2000-2008), $7.5M.

*Australian Minerals Science Research Institute*, AMSRI (2006-2010), UniSA (HQ), U.Melb., U.Newcastle, UQ, BHP Billiton, Rio Tinto, Anglo Platinum, Xstrata/Glencore, Phelps Dodge Corp., Orica. Largest ARC Linkage Grant ever awarded at the time at $8.6M, plus $7.5M industry and $6.5M from universities and the SA State Govt.

*CSIRO Cluster Grant, Preconcentration and Agglomeration to Enhance Heap Leaching of Nickel Laterite* (2009-2011), $6M.

*Australia-China Joint Research Centre for in-line chemical and mineral sensing for sustainable mineral processing*, DIISRTE - Australia-China Science & Research Fund (2016-2020), Magotteaux Australia. $1M.

*ARC Centre of Excellence in Enabling the Eco-Efficient Beneficiation of Minerals* (2020-2027), U.Newcastle (HQ), UniSA, UMelb., Monash, Deakin, UQ, UNSW, Curtin, CSIRO., total $35M from ARC. $0.2M to UniSA Node from SA State Govt.

**Success in Minerals Processing Related Competitive Grant Funding and Industry Collaboration**

Since the late 1980's UniSA has been equally successful, and active in national competitive grants in minerals-relevant areas, industry-grant collaborative funding and direct industry contract R&D. Major initiatives aside (highlighted above) it is in collaborative R&D with matching Commonwealth support and direct, 1-1 and industry consortia projects (multi-year, multi-company). UniSA has been extremely successful in winning The ARC Linkage Grants, leveraging industry support for research teams. Fifteen (15), 2-3 year ARC Linkage (LP) grants have been secured since ~1990.

UniSA has had a longstanding success in multi-year, multi-company consortia R&D, via the brokerage of AMIRA Global. The AMIRA P260 series was one of these, however there have been a further sixteen (16), of these projects covering industry challenges ranging from, for example, fine grinding (P336, P336A), through benign processing reagents (P498, P498A, P498B with three associated ARC Linkage Grants), to assessing dry comminution and subsequent processing (P1185). Estimated income from such project R&D exceeds $40 million. The importance of such long-term R&D and close contact with the sector cannot be underestimated. Constant awareness of industry challenges and the ability to transfer and implement knowledge gained through more strategic-basic research, allows for rapid uptake into the sector.

Just as important is supporting infrastructure and facilities. UniSA has been at the forefront in this area, processing unsurpassed mineral processing laboratories and equipment, and hosting nodes of two key NCRIS-funded national facilities, the Australian National Fabrication Facility (ANFF) and Microscopy Australia (MA), comprising flagship fabrication and characterisation equipment and instrumentation.

**Case Study – Demonstrated Contribution to Productivity/ROI and NPV**

In 2012 the Go8 & ATN Universities participated in an impact assessment exercise, Excellence in Innovation Australia (EIA). The AMIRA P260 Flotation project, involving researchers from the University of South Australia (UniSA) and major minerals and mining industry end-users, was chosen as UniSA's Case Study to the trial and was independently assessed and evaluated by RMDSTEM Ltd. The project series was shown to have created ongoing impact for the world's mining industries through improved management of separating minerals by flotation: improved recovery and/or grade of minerals, optimal price realisation, avoiding penalties and reducing operating costs. AMIRA P260 has delivered over $1 billion to the sector, a 22:1 return on investment (ROI) for over 100 industry sponsors, as well as environmental and safety benefits from efficient energy and water usage and process improvements. AMIRA P260, has a unique project structure, delivering strategic-basic research outcomes as well as immediate, economy-driven results for partners for over 30 years.

In 2017, the AMIRA P260 series was recognised by the European Commission for University-Business Co-operation as an exemplar of joint R&D and value delivery. The project was analysed as a Case Study and specifically highlighted in the 2017 Final Report to the European Union. AMIRA P260 was one of only two Australian Case Studies and the only resources-based project to feature in a total of 52 Case Studies across all European countries, Canada, USA, South Africa and Israel.

STRUCTURAL MECHANISM FOR JOINT R&D CASE STUDY EXCERPT: AMIRA P260

The AMIRA P260 project provides an outstanding example of a long-term collaborative research project can prosper by recognising, and delivering on, the motivations of each of the involved stakeholders. The project involves researchers from the University of South Australia and major sponsors from the minerals and mining industry. In recognising the motivations of the both the academic and business project partners, a unique project structure has been developed that allows it to deliver strategic-basic research outcomes (blue sky research outcomes) as well as immediate, economy-driven results (applied and contract research outcomes) 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).

For more information go to https://ub-cooperation.eu/pdf/cases/I_Case_Study_Amira_P260.pdf

**Figure 2. Statement regarding AMIRA P260 Flotation series of projects from European Commission on University-Business Co-operation Final Report 2017.**

The AMIRA P260 Flotation series continues and is currently in its 9$^{th}$ iteration, with the 10$^{th}$ in development. The current delivered value is now estimated to have exceeded $1.6 billion with the recognition that continued value will be accrued over the life-of-mine of both past and present sponsor companies.

**References/Links.**


Go8-ATN EIA 2012 Final Report
https://www.ub-cooperation.eu/pdf/cases/I_Case_Study_Amira_P260.pdf
https://www.ub-cooperation.eu/pdf/final_report2017.pdf
The Australian "Selling Research Benefits Easy", 29 November, 2012

**Global Engagement and Profile brings benefits for South Australia**

We have been engaged with real-world processing issues on a world scale for over 30 years. Our industry engagement has been across every continent, with over 120 processing operations and supply chain companies, together with R&D collaborations with other world-leading centres. This global experience represents a vast knowledge and solutions resource at UniSA, available to the South Australian resources sector.

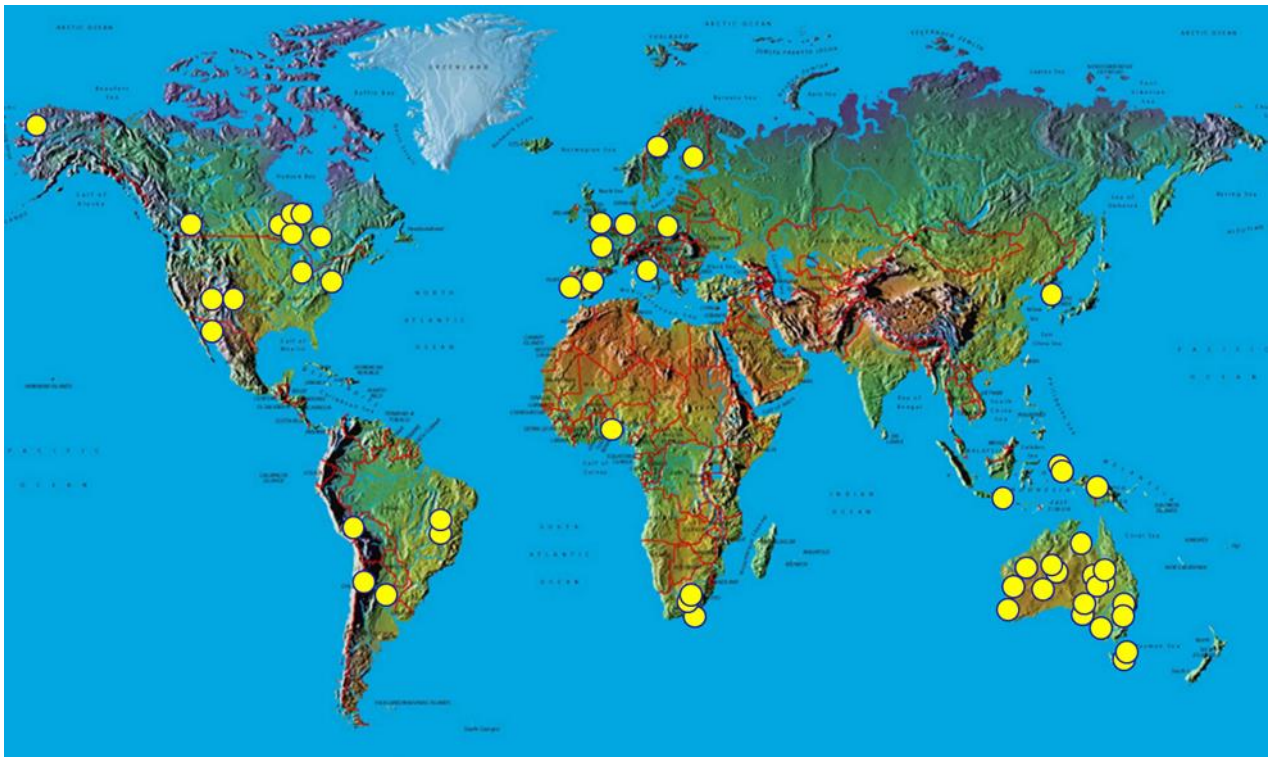


**Figure 3. Minerals processing interactions around the world.**

**Collaborations and Links within South Australia.**

University-university collaboration on resource sector initiatives has blossomed in recent years. This has developed from a long-held realisation that R&D capacity along the entire resources value chain is encompassed within the State's institutions. Two recent successful initiatives bring together UniSA's leadership in processing (comminution, flotation, hydrometallurgy, tailings), with that University of Adelaide's in mining engineering (resource definition and modelling, ore tracking and delivery, etc.). The focus of these "Consortia" built projects is real time sensing and data fusion to drive optimisation and enhancement of metal recovery.

*Unlocking Complex Resources through Lean Processing,* Premier's Research & Infrastructure Fund – Research Consortium Program, PRIF-RCP (2017-2022) UoA (HQ), UniSA. Total $5,000,000. BHP, OzMinerals + 14 technology companies.

*ARC Training Centre for Integrated Operations for Complex Resources* (2020-2024), UoA (HQ), UniSA, Curtin. Total $3,700,000. BHP, OzMinerals + 14 technology companies.

There is great potential for other State-wide initiatives spanning the Discovery-Mining-Processing-Value Add-Tailings Management spectrum, combining institutional, complementary capability.

Long association and interaction with The Department of Energy and Mining (and former departments). Notable contributions to the SA Magnetite Strategy, and Copper to the World initiatives. Provision of advice on technological landscape in processing and industry challenges.

Representation and contributions to the South Australian Chamber of Mines and Energy (SACOME) through committee membership (Mining and Extractives, Exploration, etc.)

Examples of industry partner interaction along the value chain within South Australia include – BHP, OzMinerals, Simec (formerly Arrium) Mining, Nyrstar, Magotteaux Australia, Boart-Longyear, Havilah Resources, Renascor Resources, Minotaur Exploration, Iluka, Magnetite Mines, InnovEco, Manta Controls, Maptek, IMPTEC P/L, Stoney Pinch Sands, Bureau Veritas, ALS, Toll Resources, etc. Company collaborators outside South Australia number over 100.

**The South Australian Context and Outlook – Recommendations for Future Strategy and Investment**

- The State Government facilitate and support R&D programs at UniSA in minerals processing that are key to SA resources companies' achieving investment threshold and mine development. This is especially important for commodities such as magnetite, copper, gold and critical minerals (e.g. REE, graphite, etc.)

- The State Government to support strengthening and growth, through co-investment, UniSA's leadership in resource-related R&D and its collaboration with industry. This includes attracting and retaining high-performing researchers.

- The State Government continue to support unique, national R&D infrastructure through support of NCRIS and the like.

- The success of the Future Industries Accelerator concept should be continued, potentially state-wide as a mechanism for access to key R&D infrastructure, project work and Industry-University mobility.

- The State Government promote and facilitate Industry-Funded Fellowships and Scholarships in key resource-related areas at SA's universities.

- The deep collaboration between UniSA and UoA in the resources sector is based on strong complementarity of capability and experience along the entire value chain. Clearly demonstrated in two major initiatives, the State Government should look to ways of strengthening this collaboration in R&D, for the benefit of SA resources and associated technology development.

# 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

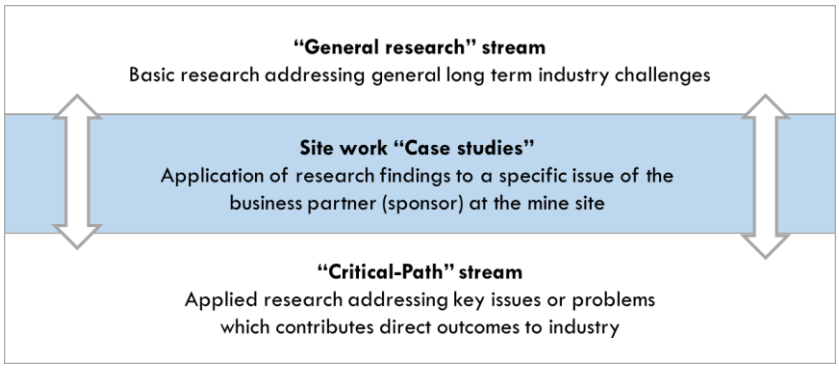
**Cooperation in R&D activities**

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].

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## 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

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# EXCELLENCE IN INNOVATION

## RESEARCH IMPACTING OUR NATION'S FUTURE – assessing the benefits

"There are compelling stories that need to be told of research impact arising from research at Australian Universities."

GROUP OF EIGHT

AUSTRALIAN TECHNOLOGY NETWORK OF UNIVERSITIES

GROUP OF EIGHT

Australian National University

CRICOS Provider: 00120C

UNSW AUSTRALIA

CRICOS Provider: 00098G

THE UNIVERSITY of ADELAIDE

CRICOS Provider: 00123M

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

CRICOS Provider: 00025B

THE UNIVERSITY OF MELBOURNE

CRICOS Provider: 00116K

THE UNIVERSITY OF WESTERN AUSTRALIA

*Achieve International Excellence*

CRICOS Provider: 00126G

MONASH University

CRICOS Provider: 00008C

THE UNIVERSITY OF SYDNEY

CRICOS Provider: 00026A

AUSTRALIAN TECHNOLOGY NETWORK OF UNIVERSITIES

Curtin University

CRICOS Provider: WA 00301J, NSW 02637B

University of South Australia

CRICOS Provider: 00121B

RMIT UNIVERSITY

CRICOS Provider: 00122A

UNIVERSITY OF TECHNOLOGY SYDNEY

CRICOS Provider: 00099F

QUT

Queensland University of Technology

CRICOS Provider: 00213J

CHARLES DARWIN UNIVERSITY

CRICOS Provider: 00300K

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

CRICOS Provider: 00109J

UTAS

CRICOS Provider: 00586B

# CONTENTS

# FOREWORD:

## MR PHILIP CLARK AM, CHAIR, EDUCATION INVESTMENT FUND (EIF)

**Excellence in Innovation for Australia (EIA) was established as a Trial with two objectives in mind.**

**Those objectives are set out in the EIA Terms of Reference:**

1. To measure the innovation dividend of research generated by Australian universities, and
2. as a precursor to a possible companion piece to Excellence in Research for Australia (ERA) in the allocation of research funding.

I come from outside the university sector and felt that the priority for the Trial should be satisfying the first objective, providing an evidence base to justify existing, and hopefully, increased research funding.

I am pleased to report that that first objective has certainly been met. The EIA Trial has clearly demonstrated that Australian universities can generate compelling case studies of impact across a wide range of disciplines and impact areas.

In Australia today, addressing the decline in national productivity growth is arguably the most significant economic challenge we face. Numerous studies have highlighted the role of research and innovation as key drivers of productivity and economic growth.

That is why good research which has significant impact is a great investment. Australia already makes a very significant investment in our world class university system, and in the research conducted by our universities. Taxpayers and governments are entitled to require evidence that research dollars are well spent.

The EIA Trial provides that evidence. I believe it goes further and provides a strong evidentiary base for the proposition that increased investment in university research is justified to drive productivity growth.

An interesting outcome from the Trial has been the fact that several high impact case studies not only profiled university researchers, but also identified and profiled the role of smart companies and organisations which have made effective use of research.

Understandably the second objective of the Trial, developing a methodology for assessing research impact which could be used for allocation of research funding, was front of mind for many in the university sector.

The EIA Trial succeeded in advancing that objective. The Trial methodology can certainly be improved and the Report which follows identifies conclusions and key learnings directed to that end. But the Trial methodology clearly has the makings of a workable system for assessing research impact.

One remarkable feature of the Trial was the spirit of cooperation and generous volunteering which made it possible and made it work so well.

DIISRTE provided a modest contribution to defray expenses but otherwise the Trial relied entirely on volunteers, including the sponsors and organisers, the participating universities, and most particularly the expert assessment panels.

I wish to acknowledge the EIA sponsors, Australian Technology Network (ATN) and the Group of Eight. Their initiative led to the Trial and the support of their Vice-Chancellors and DVCs Research kept it on track. The Trial was ably supported by members of their Secretariats including Vicki Thomson, Matthew Brown, Ian McMahon, Mark Hochman and Tracey McCormick.

I thank the members of the Development Advisory Board which I chaired, in particular David Sweeney, Director of the UK Higher Education Funding Council, whose experience and wise counsel was invaluable. David, without complaint, attended numerous teleconference meetings very early in the morning, UK time.

Credit to the twelve universities which volunteered to participate in the Trial. They made a very significant investment of time and resources, and shared some inspiring case studies of research impact.

Seven expert panels made up of 75 volunteers did the heavy lifting in assessing the case studies. About 30% of those volunteers came from the university sector. The remaining 70% were from outside the sector. They were senior representatives of industry, community organisations and government who very generously volunteered their valuable time.

The demands on their time were considerable, particularly so for Panel Chairs. Notwithstanding the workload involved, most panel members commented enthusiastically on their involvement in the Trial. I wholeheartedly endorse that sentiment. While the EIA Trial has taken more of my time than I thought it would, it has certainly been worth the effort.

**PHILIP MARCUS CLARK AM**
**Chair, Development Advisory Board**

November 2012

*"Somewhere something incredible is waiting to be known."*

– Dr Carl Sagan –

*"I believe in innovation and that the way you get innovation is you fund research and you get the basic facts."*

– Bill Gates –

# EXECUTIVE SUMMARY

**There are compelling stories that need to be told of research impact arising from research at Australian universities.**

These stories clearly articulate the value of taxpayers' investment in university research and provide direct evidence that research is bringing tangible benefits to the nation which is funding it – namely via our economy and the advancement of the society in which we live.

Australia has one of the highest percentages of its researchers in universities amongst developed economies – nearly 60%[1]. Australian universities also direct significant investment into research – over $8.2bn by Australian Bureau of Statistics (ABS) figures for 2010, representing 0.59% of GDP and 69, 199 person years of effort[2]. As such, the impact for the nation of the research undertaken in our universities is extremely relevant to its future.

This ATN/Go8 "Excellence in Innovation for Australia Research Impact Trial" was undertaken to measure the innovation dividend of research generated by Australian universities and as a precursor to a possible companion piece to the Excellence in Research for Australia (ERA).

The recent ERA exercise does not include the capability to measure the end-user benefits of research. Both excellence and innovation are crucial aspects of Australia's research efforts.

Twelve Australian universities (30% of the sector) headed by the Australian Technology Network of Universities (ATN) and the Group of Eight (Go8) and including Charles Darwin University and the Universities of Tasmania and Newcastle submitted 162 research case studies for assessment.

The participants contend, as a result of this extensive Trial, that research undertaken by our universities has wide-ranging impacts for the nation and, as such, this impact should be included for assessment in a developing national research assessment framework.

The Trial focussed on impact assessment using case studies of research as opposed to the traditional university research metrics such as how many times research has been published or cited. In other words, the Trial was to establish external impact relevance to Australia.

In focusing the study only on research impact, it was recognised that in many cases, the demonstration of impact in the wider community is often founded on fundamental research from a range of sources, and that innovation comes from myriad sources, not just applied research.

In another break with past methodologies, these case studies were assessed against Socio-economic Objectives(SEO) as outlined by the ABS[3] – Defence, Economic Development, Society and the Environment – rather than the traditional Fields of Research (FoR); again going totally to the material impact to the nation using external parameters.

Australian universities direct significant investment into research

Australia has one of the highest percentages of its researchers in Universities amongst developed economies – nearly 60%

University research can and does deliver positive impact for Australia

*"As both a former member of parliament and the academy, I'm conscious of the fact that the way research is assessed and funded in universities is based on quite a narrow set of criteria. These are important criteria but not the only ones we should consider, either from an academic or taxpayer point of view."*

– Dr Carmen Lawrence –

Seven expert Trial panels, importantly with an external 70% industry member involvement in an area usually dominated by academic experts, were established to judge the impact value of the submitted case studies, and also to demonstrate if such an assessment methodology were feasible.

The panels assessed research impact which had occurred in the period 1 January 2007 – 31 May 2012. Recognising that in some cases, impact may occur quickly, and in others it may take considerable time to be demonstrated, the impacts submitted had to relate to research which occurred either during the impact period, or in the 15-year period preceding.

The reasoning behind the Trial, and its criticality and timeframe, is directly related to the fact that Australia aims to be seen as a world leader in innovation. Research impact from a base where universities and industry work in partnership, is the foundation of an innovative society.

It is not in doubt that university research can and does deliver positive impact for Australia.

However universities have not been pro-active in articulating and communicating the impact of this research in a manner that is readily understood by the broader community. Nor have they built optimal allegiances to drive innovation with industry. This limitation has been recognised, and the benefits of research impact in demonstrating the value of universities to a smarter Australia has been a major driver of this Trial.

*"Research brings a valuable perspective to business operations but university projects are traditionally selected and graded by academics. There needs to be some method of allocating research and ensuring you get a return on your investment. I think society or taxpayers would expect that and I think it's important that you reward quality research and effective research."*

– Todd Creeger, President Conoco-Phillips –

1 The OECD Main Science Technology Indicators show that in 2008 Australia had 57.7% of researchers in the Higher Education sector.

2 http://www.abs.gov.au/ausstats/abs@.nsf/mf/8111.0

3 http://abs.gov.au/ausstats/abs@.nsf/Products/1297.0~2008~Main+Features~Chapter+4,Socioeconomic+Objective?OpenDocument#112714291310995153

# KEY LEARNINGS

## Key Learnings of the EIA are:

1. *There are compelling stories that need to be told of research impact arising from research at Australian universities.*

2. *Using a case study methodology with SEO codes to assess research impact is applicable as a way forward to a national assessment of research impact. However SEO codes would need to be managed within the process to reflect the breadth of research submitted for assessment, and the fact impact can cover more than one code. This was of particular note as it related to the Society and Economic Development code.*

3. *The use of expert Panels for the impact assessment process, with significant input from representative external panel members, is applicable for a national impact assessment process.*

4. *The range of impact ratings was wider than anticipated. The standard of case studies – both content and research – also varied greatly and this was reflected in Panel scorings. While some cases were very well written and explained, a number were poorly written and lacked defined verifiable sources to back up claims. Universities need to expand skills to better construct and present case studies for impact assessment.*

5. *Many case studies put forward cases based on prospective impact rather than demonstrated impact despite this being set out as required in the guidelines. The requirement for demonstrated impact will need further highlighting in any national research impact assessment exercise.*

6

*The link between impact and good quality research was able to be identified. However many case studies could have demonstrated this more convincingly by including information on the quality of their underpinning publications.*

7

*It was appropriate to assess impact using the industry-based grey literature that was used by many case studies in the education, policy and law areas. This use underpins the notion that impact does not result only from the published academic ERA-related journals.*

8

*Panel Chairs all commented on the time involved assessing case studies, in particular the reading. It was considered that more extensive Panel briefings would be essential should this assessment method be adopted at national level. The number of case studies assessed by each expert panel may also need to be refined to a maximum of 20.*

9

*Universities reported challenges in putting together case studies; specifically that the resources required in scaling up to a national impact assessment exercise would need to be considered. There were also logistical issues related to tracing information within the long lead time from research to impact and staff movements within those timeframes.*

## THIS TRIAL HAS DEMONSTRATED THAT:

- High quality research carried out in Australian universities has had enormous benefits for the health, security, prosperity, cultural and environmental wellbeing of Australia, the region and the world.
- Approximately 87% of the case-study assessments demonstrated at least 'considerable' impact.
- The case-study method adopted in the Trial enables these benefits to be communicated to governments, business, and the community.
- It also enables these benefits to be linked to the high-quality research that underpinned the outcomes. The combination of end-user assessment informed by expert advice has made it possible to verify that the underpinning research has contributed to the outcomes.

This Trial is seen by the universities involved as step one in an essential national conversation about research impact. However the Trial did not set out to devise measurement of research impact, rather it demonstrates by its results, that research impact can be assessed.

This Trial makes no findings regarding which body would undertake the impact assessment process should it become part of a national assessment process; and importantly this Trial makes no recommendations regarding future funding.

High quality research carried out in Australian universities has had enormous benefits for the health, security, prosperity, cultural and environmental wellbeing of Australia, the region and the world.

# CONCLUSIONS

Learnings from this Trial should be considered in conjunction with learnings from the UK REF [4] and the DIISRTE Research Impact Feasibility Study. Through the Trial process the participating universities have come to conclusions listed below.

**1. It is possible to assess research impact across a broad range of disciplines.**

- The Trial has demonstrated that universities can generate compelling case studies of impact across the whole range of disciplines and impact areas.
- The Panel Chairs concluded that impact case studies are a viable means of conducting an impact assessment exercise.
- A research assessment framework assessing both the excellence and the impact of research has the potential to ensure that the full value of university research – both excellence and impact – is assessed.
- The Trial has also revealed the resourcing issues that need to be addressed in universities should impact assessment operate at a national level.

**2. The case study approach can provide a compelling narrative of the impact of research.**

- The Trial demonstrated that when case studies are accompanied by robust validating evidence – including performance indicators where appropriate – expert review can provide a rigorous assessment of impact.
- The case-study methodology needs further development to ensure that the description of impact and the validation through evidence and indicators is robust enough for application in any broader exercise.

Universities can generate compelling case studies of impact across the whole range of disciplines and impact areas

A research assessment framework assessing both the excellence and the impact of research has the potential to ensure that the full value of university research – both excellence and impact – is assessed

**3. Research impact could be assessed against an outcomes based system of classification such as the ABS SEO codes recognising that there are some limitations to this methodology.**

- The Trial demonstrated that describing research impact by the outcomes, rather than the research discipline underpinning the impact, better articulates the impact.
- The ABS SEO code system is a nationally accepted standard for classifying the objectives of research and was shown to be broadly effective in the Trial.
- However, the use of the SEO system in the Trial had its limitations and requires fine-tuning
  - » the alignment of the Panels with the broad SEO categories of Defence, Economic Development, Society, and Environment, demanded a wide range of expertise from the panels – particularly in the case of Society.
  - » In some cases the SEO codes did not provide specific enough description for the impact – for instance within Defence and Economic Development.

**4. Expert Panels comprising a majority of end-user stakeholders are able to assess research impact. The Panels should also include an appropriate discipline mix covering the breadth of research impacts being considered.**

- The Trial demonstrated that expert Panels comprising majority end-user representation are able to assess case studies. In over 90% of the examples where a single case study was assessed by two different Panels (for the same SEO category) the ratings were identical or within one rating scale of each other.
- The Trial demonstrated that in order to make assessments Panel members required discipline-specific academic advice on the research underpinning the impacts being assessed, and to speak to the excellence of the research.

**5. Development of an impact component of any broader research assessment exercise would require further consideration of the number of case studies to be submitted.**

- The Trial imposed a practical maximum limit of 20 case studies per university across the four broad SEO categories. This was to limit the cost and workload of implementing the Trial in a short time-frame.
- Further consideration of the number of case studies to be submitted is needed to establish what number best provides an effective assessment of research impact in the university sector and the individual contribution of universities.
- To be practical an impact assessment framework must be administratively feasible and affordable by both government and universities. Further consideration of the number of case studies submitted is also necessary to ensure this is the case.
- A broader impact assessment exercise will need to be representative rather than selective.

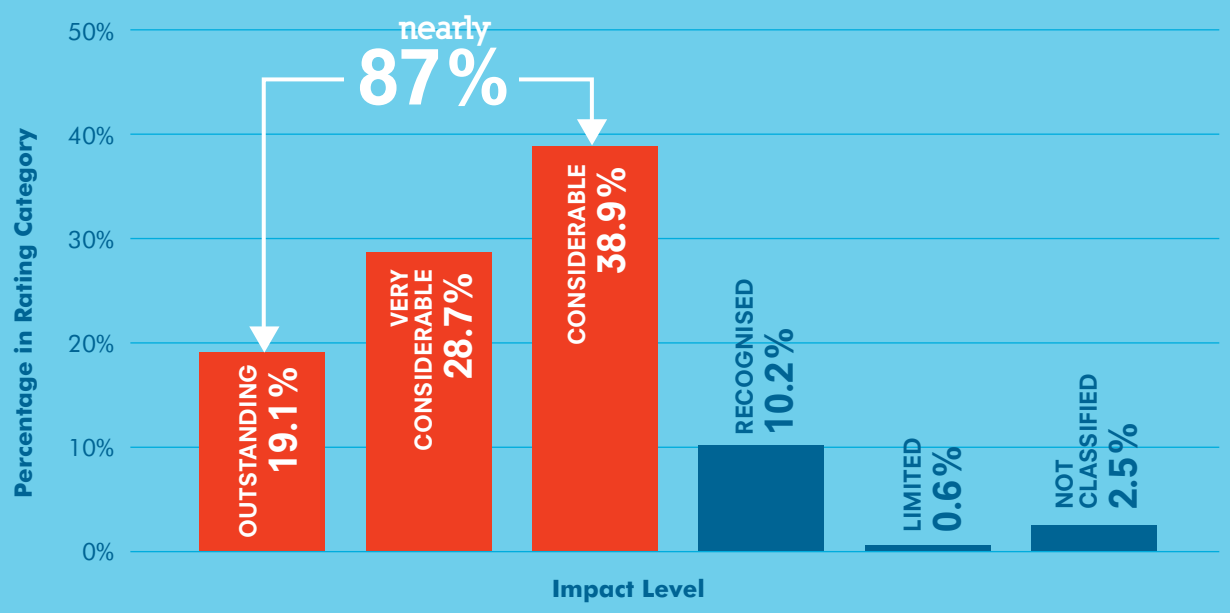
4 http://www.ref.ac.uk/

# Distribution of EIA case study ratings

Chart showing the distribution of all ratings given to case studies by panels showing that **nearly 87% of all ratings** were at the considerable, very considerable or outstanding impact level.

*The nature of the Trial resulted in universities adopting different approaches to submissions with some selecting "high end impact" case studies and others selecting case studies showing a range from early impact to mature impact. Accordingly, and given that this was a Trial, it is not helpful to publish specific university outcomes. However each universityis being provided with its own case study impact ratings and Panel feedback. With these caveats in mind, the distribution of ratings across the case studies submitted was as shown below.*

*For 12 case studies there are dual ratings where the same case study was submitted to both panels within their SEO sector. For these 12 cases, in six cases both panels assigned the same rating to the case study, in five cases the assessment was one rating apart, (i.e. A and B, B and C) and in one case the assessment was separated by two ratings, B and D.*



The Trial attracted 162 separate case studies spread across the four SEO sectors:
Defence
Economic Development
Society
Environment

## OVERVIEW OF SUBMISSIONS

The Trial attracted 162 separate case studies spread across the four SEO sectors (table right). One case study was submitted for assessment in two SEO sectors and another in three SEO sectors making a total of 165 case studies by SEO Sector.

Due to workload in the Society panels 20 case studies did not receive a rating while 12 case studies were given a rating by both panels for an SEO category. This resulted in a total of 157 ratings.

## SUBMISSIONS BY BROAD SEO SECTOR

| SEO Category | Number of submissions |
|---|---|
| Defence | 11 |
| Economic Development | 54 |
| Society | 58 |
| Environment | 42 |
| Total | 165 |

## SUBMISSIONS BY INSTITUTION AND CATEGORY

| Institution | Defence | Economic Development | Society | Environment | Total |
|---|---|---|---|---|---|
| CDU | 0 | 2 | 6 | 5 | 13 |
| Curtin | 2 | 5 | 5 | 2 | 14 |
| Newcastle | 1 | 4 | 4 | 2 | 11 |
| QUT | 1 | 5 | 5 | 3 | 14 |
| RMIT | 0 | 5 | 4 | 4 | 13 |
| U Melbourne | 0 | 5 | 5 | 5 | 15 |
| UniSA | 1 | 6 | 4 | 1 | 12 |
| UNSW | 0 | 5 | 5 | 4 | 14 |
| U Queensland | 2 | 5 | 5 | 5 | 17 |
| U Tasmania | 3 | 5 | 5 | 5 | 18 |
| UTS | 0 | 3 | 5 | 3 | 11 |
| UWA | 1 | 4 | 5 | 3 | 13 |
| Totals | 11 | 54 | 58 | 42 | 165 |

# BACKGROUND

## The value of assessing research impact is increasingly gaining International recognition.

A 2009 report by the RAND Corporation[5] (Europe) for the Higher Education Funding Council of England (HEFCE) examined international impact assessment frameworks and from a "long list" of 14 it selected four for further investigation. These were:

- The discontinued Australian Research Quality and Accessibility Framework (RQF) as an example of a case study based approach;
- The UK RAND/Arthritis Research Council Impact Scoring System (RAISS) as an example of an indicator-based approach which had been used to capture the impact of research grants;
- The US Program Assessment Rating Tool (PART) as an example of a self-evaluation approach used to assess programme performance across federal government; and
- The Dutch Evaluating Research in Context (ERiC) – a new framework to assess research impact (or 'societal quality') in the Dutch higher education system.

The report provided the basis for impact assessment development as an integral component in the UK's 2014 Research Excellence Framework (REF). The REF approach is based on the outcomes of a 2010 29-Institution pilot exercise which aimed to test the feasibility of a case study approach to impact assessment.

It was heavily modelled on work previously undertaken in this area within Australia (the 2006 ATN/Murdoch University Research Quality Framework Impact Trial).

This Trial in Australia has, in turn, drawn heavily on learnings from the REF trial, and the planned REF approach.

In addition to these international approaches there are several impact evaluation programs that have been or are currently being conducted in Australia.

These include CSIRO's Impact 2020 Project, and the 2012 Allen Consulting Group report into economic, social and environment impacts of the Co-operative Research Centres (CRC) program, and evaluation programs undertaken by several of the rural development corporations. Many of these are at project or program level, and so may not be scalable to a national impact assessment exercise.

Within the broader Australian research setting, one of the recommendations accepted by the Federal Government from the 2011 *Focusing Australia's Publicly funded Research Review* undertaken by DIISRTE, was to undertake a feasibility study into possible approaches to develop a rigorous, transparent, system-wide Australian research impact assessment mechanism, separate from ERA, to evaluate the wider benefits of publicly funded research[6]. It is expected that this Trial will play an important role in informing the feasibility study for the formulation of impact assessment policy.

## PRINCIPLES UNDERPINNING THE EIA RESEARCH IMPACT TRIAL

The Trial was designed to demonstrate and communicate the beneficial outcomes – "impact" – of research to government, business and the community by:

- Identifying good research outcomes/impact
- Justifying the claims being made by institutions of good outcomes/impact
- Identifying the research underpinning the outcomes/impact.

The Trial was underpinned by the following general principles:

1. That the development of the EIA should look to leverage the work performed in developing the UK REF where appropriate
2. That the EIA examine retrospective impact rather than prospective impact
3. That there be no explicit excellence threshold for submissions, but the impact should show a link to underpinning research
4. That the EIA take a verifiable approach to evidence in submissions (as opposed to verifying all evidence)
5. That impact will be primarily assessed by means of case-studies for all disciplines. Performance data for the underpinning research will also be included in the impact submissions, and Panels will seek to investigate any systematic links between the impact and underpinning research performance data
6. That research underpinning a submitted impact should be attributed to the university (ies) at which the research was generated, regardless of any subsequent change in affiliation of researchers involved (including where academics have retired or left academia).

These principles minimised the effort required by individual universities to participate in the Trial whilst ensuring methods employed were robust, compatible with current practice elsewhere, and able to deliver the purpose of the Trial.

This Trial used the same sectors contained within SEO Classifications maintained by the ABS.

- Sector A – Defence
- Sector B – Economic Development
- Sector C – Society
- Sector D – Environment and

The fifth broad SEO cluster is Expanding Knowledge. This was not be used for evaluation in this Trial as the expansion of knowledge is assessed through other mechanisms such as ERA.

Underneath each of these four broad sectors are a series of finer subdivisions at four and six digit breakdowns. Universities were invited to make submissions according to four digit SEO classifications contained within these four sectors.

Whilst it was expected that each submission would be encapsulated primarily within one four digit SEO classification, provision was made on the application template for multiple SEO classifications.

## THE FRAMEWORK FOR ASSESSMENT

### Time period for Assessment

Universities were asked to submit information on research impacts between 1 January 2007 – 31 May 2012. Recognising that impact may occur quickly and also that it may take considerable time to be demonstrated, the impacts submitted were required to relate to research during the impact period, or, in the 15-year period preceding claimed impact, i.e. 1 January 1992 – 31 December 2006.

### Demonstrated Impact vs Potential Impact

Whilst much research may lead to future, as yet unrecognised, or only partly recognised impact, the Trial focus was on demonstrated impact, i.e. impact that has occurred within the reference period above.

### Number of Submissions

The Trial sought a sufficient number of case studies across the four SEO sectors in order to demonstrate a range of impacts and, to assess any underlying link between quality of research and impact. It was understood that not all universities would have research or impacts in all of the four sectors. It was also understood that other factors such as size or age of university could also affect the number of impacts that may have arisen from a university's research. Therefore a maximum and minimum number of case studies was applied for each university:

- A maximum of five case studies for each of the four SEO sectors (i.e. 20 in total)
- A minimum of two case studies in three of the four SEO sectors (i.e. 6 in total)

5 Impact and the Research Excellence Framework: new challenges for universities, RAND Corporation (Europe) see http://www.rand.org/content/dam/rand/pubs/corporate_pubs/2012/RAND_CP661.pdf

6 Focussing Australia's Publically Funded Research Review – Maximising the Innovation Dividend. Review Key Findings and Future Directions. DIISRTE, October 2011. Recommendation 3, page 7

## Content of Submissions

Submissions were made on a prescribed Impact Case Study Template modelled on templates REF3a and REF5a in the UK REF assessment exercise. A copy of the template and accompanying guidelines can be found at http://www.atn.edu.au/eia/index.htm

This template sought information on the university and unit of assessment; the context of the research and claimed impact; details of the impact including the process by which the research had been adopted or used to produce benefit for end-users; the research underpinning the impact, and link between the research and the impact; research outputs from the research underpinning the impact; material which could validate or verify the claimed impact, persons involved and basic performance metrics (research and investment income).

The ATN/Go8 Trial sought to build on the considerable material and examples gathered by the UK REF which provided many possible examples and indicators that could be used as evidence of impact[7]. These examples and indicators were refined to fit within the Australian SEO classifications and provided as a guide to institutions in developing case studies.

## Scoring Index

Each case study was assessed according to the Reach and Significance of impact in keeping with the UK's REF Impact Assessment Criteria and definitions:

- Reach: The spread or breadth of influence or effect on the relevant constituencies
- Significance: the intensity of the influence or effect

The Panels assessed each case study against *overall* Reach and Significance rather than assessing each separately. Following assessment, a rating was assigned to each case study according to the following scale:

- A = Outstanding impacts in terms of reach and significance. Adoption of the research has produced an outstanding social, economic, environmental and/or cultural benefit for the wider community, regionally within Australia, nationally or internationally.
- B = Very considerable impacts in terms of reach and significance. Adoption of the research has produced a significant social, economic, environmental and/or cultural benefit for the wider community, regionally within Australia, nationally or internationally.
- C = Considerable impacts in terms of reach and significance. Adoption of the research has produced new policies, products, attitudes, behaviours and/or outlooks in the end-user community.
- D = Recognised but modest impacts in terms of reach and significance. Engagement of researchers with the end-user community to address a social, economic, environmental and/or cultural issue, regionally within Australia, nationally or internationally.
- E = Of limited reach or significance. Research has had limited or no identifiable social, economic, environmental and/or cultural outcome, regionally within Australia, nationally or internationally.
- Not classified – the impact was not underpinned by research or the link between the research and the claimed impact has not been demonstrated to the Panel's satisfaction.

In addition, and for the purpose of providing feedback to case study proponents, the Panels were asked to score three additional questions which evaluated the clarity of case study description and argument. These three questions examined:

- How the research underpinned the impact, ie whether the link between the underpinning research and the claimed impact was clearly demonstrated;
- The nature and extent of the impact, ie whether the benefit or impact on a community, constituency or organisation was clearly demonstrated, and
- Validation of impact, ie whether the references provided to validate the research impact convinced the Panel that the key impact claims had been corroborated.

Full descriptions of the scoring criteria are given in the Panel Guidelines in Appendix 6.

The ATN/Go8 Trial sought to build on the considerable material and examples gathered by the UK REF which provided many possible examples and indicators that could be used as evidence of impact

7 See REF 2014 Panel Criteria and Working Methods, Sections A3, B3, C3 and D3 http://www.hefce.ac.uk/research/ref/pubs/2012/01_12/

University of South Australia

# CASE STUDY

## MINERAL FLOTATION – SUSTAINED BENEFIT FOR MINERAL PROCESSING
## University of South Australia

For almost two decades the Ian Wark Research Institute (The Wark™) at the University of South Australia (UniSA) has been a part of finding business solutions for mining leaders such as Rio Tinto and BHP Billiton, and major corporates including Dow and Unilever.

The research in the present case study has been underpinned by the application of The Wark's strengths in physical chemistry, chemical science and resource engineering – disciplines in which UniSA has been assessed by the 2010 Excellence in Research for Australia (ERA) as 5 (*outstanding performance well above world standard*), 5 and 4 respectively.

The process of froth flotation, whereby subtle control of mineral surface chemistry influences particle interaction with bubbles, has been the mainstay of mineral processing around the world for over a century. Each ore deposit has its own unique mineralogical context and hence requires a different set of physical and chemical conditions for the optimal, selective beneficiation of the value mineral from the commercially worthless material that surrounds it (gangue).

The AMIRA International (1) project P260 has been ongoing since 1988 with the aim of improving flotation of minerals and in particular, its application in the minerals processing industry. It has focused on the influences of surface and solution chemistry, particle size, mineralogy and process hydrodynamics on the flotation process.

In order to evaluate the benefits from this series of projects, AMIRA International and The Wark commissioned RMDSTEM Ltd, a specialist management consulting group with capabilities in the evaluation of research and development, predominately in the resources sector, to carry out a study that evaluated the benefits that have been delivered to industry and the community over the life of the P260 project.

An independent study was conducted on the P260 project (1988 to 2006) by RMDSTEM Ltd (2), who engaged directly with the project sponsor companies. The report (3) shows $318M value add was delivered to the minerals industry, via successful technology transfer of research outputs, leading to measured, and verified commercial industry benefits. The report also identified $118M in expected value and $412M in future opportunity value. A second RMDSTEM Ltd study (4), to assess the additional impact of the P260 Project on industry balance sheets from 2007 to 2012, demonstrated a further expected value of $155M. Thus a total industry benefit exceeding $1billion has been derived from the P260 project.

Each Panel comprised a mix of end-user (external industry) representatives with expertise in the broad range of disciplines and academic staff with disciplinary expertise.

## ASSESSMENT PANELS

Three sectors each required two Panels. Defence with a smaller number of case studies submitted required one panel.

Each Panel comprised a mix of end-user (external industry) representatives with expertise in the broad range of disciplines and academic staff with disciplinary expertise. The end-users were in the majority in each panel and also provided the Chair for the majority of panels.

The panels were constituted to ensure, as far as possible, that membership reflected the broad range of disciplines within the sector. This was problematic for some panels as the discipline coverage proved too broad to be adequately compassed by 10–12 persons.

The Trial was fortunate to secure a wide range of highly-qualified persons to act as assessors. In particular Panel Chairs demonstrated enthusiasm for the EIA process and great skill in chairing panels of 10–12 towards moderated impact ratings. Panels also provided feedback to each case study proponent, and on the Trial process itself.

### List of Panel Chairs and association

| | | |
|---|---|---|
| **Mr Colin Beckett** | Chair, Economic Development Panel 1 | General Manager, Gorgon Project, Chevron |
| **Dr Leanna Read** | Chair, Economic Development Panel 2 | Founder and former Managing Director: TGR BioSciences |
| **Mr Chris Leptos AM** | Chair, Society Panel 1 | KPMG |
| **Professor Carmen Lawrence** | Chair, Society Panel 2 | University of Western Australia |
| **Dr Paul Vogel** | Chair, Environment Panel 1 | WA Environmental Protection Agency |
| **Mr David Parry** | Chair, Environment Panel 2 | Rio Tinto |
| **Mr Jim Walker AM** | Chair, Defence Panel | Auto Cooperative Research Centre |

The complete list of panel members is given in Appendix 3.



# CASE STUDY

## AUSTRALASIAN LEGAL INFORMATION INSTITUTE (AUSTLII) UTS & UNSW

Information is the currency of any legal system, whether in the verbal form of arguments before a court, or negotiations, or in the written form of legislation, court decisions, international treaties, or learned commentary (called both scholarship and jurisprudence).

Prior to widespread access to the Internet from the mid-1990s, such online access to legal information as did exist (from the late 1970s) was provided almost exclusively by commercial publishers, and was extremely expensive. In Australia it was very little used, either for research or practice. The advent of wider Internet usage did not appear as if it would change this, because both commercial publishers and governments sought to monetise and monopolise all provision of online legal information.

Free Internet access to the key documents of a legal jurisdiction (legislation, court decisions, treaties etc) is creating revolutionary changes to legal research and legal practice across the world. Since 1995, the Australasian Legal Information Institute (AustLII), a joint UNSW/UTS research facility, has been and is the global leader in creating and internationalising these startling impacts on research and practice, through a combination of policy research, development and advocacy for sustainable free access, and research and development into the key technologies underpinning legal information systems. AustLII is the now the dominant online legal information system in Australia, and the leader of a global consortium of free access legal information institutes.

# PANEL FINDINGS

The trial led to the panels concluding that ''there are compelling stories that need to be told of research impact arising from research at Australian universities''.

Importantly the panels found that the use of case studies was an effective means of demonstrating and communicating impact and could be used as a key component in a national research impact assessment exercise subject to modifications as outlined below.

There were some case studies where national benefit had been recognised publicly and politically for some time i.e.:

- Gardisil, University of Queensland;
- Suntech solar cells, UNSW;
- The Jameson Cell, University of Newcastle.

But there were others presented where it was concluded national impact deserved to be better recognised i.e.;

- Mineral flotation, University of South Australia
- The Australian Legal Information Institute, AustLII UTS and UNSW

Panels also concluded that the use of case studies should be supplemented by appropriate metrics, although the difficulty in establishing a set of standard metrics was recognised across the panels.

One panel summarised the relationship stating…

*"it would be preferable to start with a case study and let metrics come out of it to fit the case study rather than start with a pre-defined set of metrics and shoe-horn case studies into them".*

## GENERAL COMMENTS ON CASE STUDIES

Importantly Panels felt that there is a definite need to focus university research more on "real world" impact.

The Trial should be viewed as the start of a process that can yield exemplars of the benefits of university research, and also the pathways by which research may lead to beneficial outcomes for society.

The quality of information in case studies varied greatly. Many case studies did not express the paradigm shift in which e impact, rather than the research, is central.

Consequently many case studies were focussed on academic measures and outputs and did not adequately describe the link between the underpinning research and impact. Basically a number of case studies did not reflect what had been asked of them – that they be impact-focussed.

Similarly, Panels felt many case studies did not communicate effectively to an intended general audience, missing the central message of what was done, why it was done, what difference it made and how the research made it happen. There were, however some clear case studies which were well written and communicated clearly the research, the nature of the impact and the resultant beneficiaries. Panels identified several exemplars and recommended that these should become publically available to assist anyone writing case studies in any future national impact assessment exercise.

## DESCRIPTION AND RATING OF IMPACT

All Panels agreed that there was the need for better descriptors of the A-E rating used for impact. Comments included…

> *"it would be extremely difficult to achieve an A rating with the current EIA ratings, much harder than obtaining a 5 in ERA"* and *"it would be hard to communicate internally and externally to the university sector that a C rating still represents significant impact"*.

One Panel commented on the difficulty of using the same A-E rating system to consider a small discrete project with localised impact ie use of bakery heat, RMIT; followed immediately by a case study making claims of global significance ie ocean circulation and climate change, UTas.

It was considered that the existing rating system drawn from the UK REF was better suited to smaller scale or discrete projects than large multidisciplinary collaborations, and that it may be advisable for impacts covering integrated solutions at a regional or global level to be recognised separately in an impact rating system.

It was also recommended that for any future exercise, the current consolidated rating for Reach and Significance should be separated into two components, one for Reach (local, regional, national, global) and one for Significance (assessing extent or depth of impact). These two components could be portrayed as a matrix score or could be integrated into a single rating.

The use of impact examples and indicators as guides to assessing case study impact was supported however these will require further work. The UK REF Guidelines provide numerous examples and indicators of impact – upwards of 40 per assessment panel.

These had been condensed for the Trial and repackaged into SEO sectors. The much smaller number therefore provided for Panels was found to be too narrow. Some Panels commented on the need for a greater range of both impact examples, and indicators, to be provided in any additional exercise.

## DEMONSTRATING IMPACT – THE USE OF VERIFICATION MATERIALS

The Trial adopted a verifiable approach to claims of impact rather than a verified approach, ie claims should be capable of being verified through references and material provided in the appropriate section (Question 9 of the template).

This section was to list sources that could, if required, provide evidence to support and corroborate impact claims including reports or other material in the public domain, and/or confidential reports which could be provided by the university to the Panel; beneficiaries who could be contacted etc. Given trial time constraints no attempts were made to independently verify claims of impact.

All Panels struggled with the verification and validation of impact claims. This was evident in three main areas:

- claims which seemed inflated and for which there was little supporting evidence
- claims which did not adequately address the attribution or counterfactual ie the work of others beyond the research team, or, the case of what would have happened anyway if the research had not been undertaken
- "evidence" presented in Question 9 of the template which did not clearly lend support to the claims.

Examples of the latter included web links to large reports but without reference or context to the submitting university's claims. There were also names provided for contact yet no explanation of what supporting information they could/would provide.

The list of validating evidence was much more convincing when it was accompanied by excerpts from the evidence to indicate the specific nature of the validation, and where page numbers, references etc were provided to guide assessors to the supporting information.

Some suggestions from panels to assist any future assessment exercise were:

- the template include a textual section for case study proponents to describe how the validation material supports impact claims
- impact validation materials be examined by a secretariat prior to case studies being examined by Panels so Panel members could be confident of the verification material
- audits be undertaken of a selected percentage of case studies to authenticate verification material – this approach is used by the UK REF team.

## ASSESSMENT BY SEO CODE

There was broad support for use of output based codes (SEO codes) in organising or classifying impact assessment. These were considered more relevant than discipline based codes such as FOR codes used in ERA and grant research programs.

However in some Panels the breadth of disciplines covered by SEO sectors was considered too broad to allow knowledgeable coverage. For example, the Defence SEO is covered in one four digit SEO code. The spread of case studies ranged from international/diplomatic relations to naval engineering – this range made it difficult to get the right mix of panel expertise.

Similarly, the broad range of impacts considered by both Society Panels made it difficult to rate all case studies. The recommendation from these Panels is that consideration be given in any future exercise as to whether the SEO classification "Society" is appropriate to define a single Panel (Society 1 Panel). The Society 2 Panel further suggested that this Panel should be broken into separatePanels covering medical, health, social and education impacts.

There was a widespread assumption coming into the Trial that assessing impact would be more difficult in the humanities and social sciences than in science or engineering related disciplines. One Panel did comment that the design of the template for this Trial made it difficult to accommodate research within the creative arts however, more broadly there were a wide range of case studies from the humanities and social sciences sectors that presented convincing cases of impact.

These covered research on curricula design; collection of household data and effect on government policy, and research informing cultural understandings of convict and indigenous history. One comment arising from the Society Panels in relation to research claiming effect on government policy was that case studies often claimed the effect on policy as impact when the actual impact would be changes that arose from new policy. Evidence of the latter was rarely presented.

## LINKS BETWEEN IMPACT, RESEARCH QUALITY AND PERFORMANCE METRICS

A key design question going into the Trial was whether there should be a threshold level for quality of research claiming impact. The 2014 UK REF for example combines assessment of quality and impact in the same submission. Impact case studies can only be submitted where there is an underlying demonstrated research quality (a score of 2 on a 4* scale).

This Trial decided against this approach partly on design grounds:

- the difficulty in determining an appropriate quality indicator for research over a 20-year period
- the incompatibility of aligning quality scores from ERA which uses FOR codes with impact in this Trial which used SEO codes.

A further reason for deciding against this approach was to allow universities to submit impact claims for research which may not have been considered "high quality" according to conventional research quality indicators, but which may have had defined impact in society.

Most Panels found an implied link between research quality and impact while commenting this was more convincing when research output quality indicators were provided. Several Panels recommended that the provision of such research quality indicators be a mandatory component in any future national assessment exercise.

An interesting observation from the Society 2 Panel was *that "many case studies from the education and policy, and law areas drew from industry-focussed grey literature, and that this was appropriate to assess impact and to underpin the notion that impact does not result only from published academic ERA related journals."*

The Trial template contained a question for proponents to list research and investment income underpinning the impact (research income) or arising from the impact (investment income). In general Panels felt that it was not possible to discern a relationship between performance metrics and impact. Whilst most case studies could show a portfolio of underlying grants, there was no discernible relationship between funding and scale of impact.

UTAS

# CASE STUDY

## PROMOTING AUSTRALIA'S COLONIAL HERITAGE
## University of Tasmania

Researchers at the UTAS centre for colonialism and its aftermath (CAIA) have pioneered new ways of understanding, interpreting, and promoting Australia's colonial heritage.

Australia's colonial history has been hotly contested both within and outside the academy, in areas such as the convict system and settler-Indigenous conflict. In these scholarly and public debates Tasmania has played a key role as the second oldest colony, and site of notorious social experiments. Drawing on unique documentary holdings and a rich built environment, multidisciplinary CAIA researchers have redefined our national identity through pioneering investigations of cultural heritage.

Original research on archival records has changed perceptions of Australian colonial society. Enhanced by social, economic, and cultural analysis, this research has fundamentally re-imagined colonial lives, and thus how convict sites (in particular) are interpreted and managed by heritage site authorities and cultural institutions. Working with curators at Port Arthur Historic Site Management Authority (PAHSMA) amongst other cultural institutions. CAIA researchers have changed the way that the Australian public and international visitors engage with colonial heritage sites.

## DESIGN OF CASE STUDY TEMPLATE AND ACCOMPANYING GUIDELINES

The Trial Guidelines and template were modelled (with permission) on a consolidation of the UK REF Assessment Framework and Guidance for Submissions, the Panel Criteria and Working Methods and templates REF3a and REF5a.

The Trial Submissions guidelines can be found in Appendix 5 and the Case Study Template in Appendix 4.

While the Trial Guidelines and template were considered generally adequate for the task there were several modifications suggested for any further impact assessment exercise:

- The template Context section, was often confused with claims – instructions should clarify that this section is to provide a clear explanation of the problem being addressed
- The path to impact was not well described in many case studies. Whilst the template allowed a free text description of this pathway it was generally not clearly explained. The design of a future template could assist this by asking specific questions to guide proponents through steps to list the claims
- The Trial template asked proponents to detail impact before describing the underpinning research. This order should be reversed in a future design to assist chronological understanding of the case study claims. Allied to this point was a recommendation from the Defence Panel that the template needs to collect more information on the underpinning research to ensure that Panel members are able to assess and validate the link to impact
- The Guidelines and template will need to "tease out" the definition of impact, in particular, the nature, reach and significance. As already noted, separate scoring of Reach and Significance was deemed necessary – this will need to be reflected in guidelines
- The validation of impact in the template will benefit from a section allowing textual description of the validation material as well as a listing of the material
- Inclusion of performance metrics will require better definition or guidance as to what should be provided. In general this section was felt to be weak in the existing template;
- Appendices to the template should provide a much wider set of examples and indicators of impact appropriate to each of the Panel or Sector areas.

## ASSESSMENT PANEL WORKLOAD

The Trial was extremely fortunate to have so many well-qualified and high profile persons offer willingly to donate their time. Panel members were asked to comment on the workload involved, and what would assist future exercises. The time taken to assess individual case studies varied between 20 and 60 minutes with a median of approximately 30 minutes. Some Panels had more than 30 case studies which resulted in substantial time investment.

A concern mentioned by Panel members was the time taken understanding the Trial Guidelines, the Assessment Panel Guidelines and associated appendices. There was a consistent comment that there would have been benefit in a stronger induction process during which the Guidelines were worked through systematically and applied to a number of case studies. The requirement for adequate training of Panel members should be noted for any future national impact assessment exercise.

Notwithstanding the workload involved, most Panel members commented very enthusiastically on their involvement in this Trial, in particular on the wide range of research producing real world outcomes, and on the ATN/Go8's willingness to bring the missing yet critical component of impact assessment back on to the national research and innovation agenda.

The Trial was extremely fortunate to have so many well-qualified and high profile persons offer willingly to donate their time

The time taken to assess individual case studies varied between 20 and 60 minutes with a median of approximately 30 minutes


# CASE STUDY

## HILDA – University of Melbourne

The HILDA Survey is a nationally-representative panel survey that commenced in 2001 with a sample of around 8000 Australian households.

Members of these households, as well as any individuals who subsequently join, have been followed over time on an annual basis. In 2011 a new cohort of just over 2100 responding households was added.

The survey is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA), but responsibility for the design and administration of the survey and for the production and dissemination of data rests with the Melbourne Institute of Applied Economic and Social Research.

The unit-record data from the HILDA Survey are made available for use to researchers in academia, government and other research organisations (both in Australia and overseas). The survey has been designed with the broad objective of providing researchers and policy-makers a tool for assessing a wide range of economic, demographic, and social policy issues, including:

**i.** the incidence and dynamics of poverty;

**ii.** asset allocation, wealth accumulation, and income changes throughout the life course;

**iii.** the correlates and impact of changes in physical and mental health;

**iv.** household formation and dissolution;

**v.** social capital; and

**vi.** subjective well-being.

Research conducted by the Melbourne Institute has been instrumental in ensuring that the HILDA Survey is now numbered among the elite panel surveys in the world. Innovative survey design and extraordinary sample retention has led to the HILDA data underpinning a broad range of economic and social research projects both nationally and internationally. The outcomes of this research effort have had a substantial impact on Australian policy development, including, for example:

**i.** tax changes proposed by the Henry Review;

**ii.** the government's 2011 Paid Parental Leave policy;

**iii.** Federal minimum wage decisions; and

**iv.** informing monetary policy settings.

# FINAL CONCLUSION

That research from Australian universities delivers impact was never in doubt.

What has been an issue for Australia is the lack of priority given to assessing impact as a research outcome, and a difficulty in communicating the value of that impact to government, business, industry and the community.

This Trial has demonstrated that research impact can be assessed and, importantly, it has revealed that there are compelling stories that need to be told of research impact arising from research at Australian universities.

This Trial was unprecedented – bringing together as it did a cross section of the Australian university sector, industry and business to be part of the conversation. However this Trial and its conclusions form but a small component of what must be an ongoing national policy conversation in Australia. It is a starting point only.

It is the hope of the Trial participants that the conclusions and learnings arising out of this exercise will provide the impetus in advancing that discussion.

This Trial was unprecedented – bringing together as it did a cross section of the Australian university sector, industry and business to be part of the conversation

It is the hope of the Trial participants that the conclusions and learnings arising out of this exercise will provide the impetus in advancing that discussion

# APPENDICES

## Appendix 1 – EIA Terms of Reference

# EIA TRIAL GUIDELINES TERMS OF REFERENCE

## PURPOSE

The purpose of this document is to provide Terms of Reference for the design of the *ATN-Go8 Excellence in Innovation for Australia (EIA)*. The EIA is a trial exercise to measure the innovation dividend of research generated by Australian universities and a precursor to a possible companion piece to the Excellence in Research for Australia (ERA).

## INTRODUCTION

The transfer of knowledge between universities, industry and the community, and the impact of that knowledge on the development of new technology, new policy or economic outcomes is an important focus for many Australian universities. As such, the focus of the EIA is to implement robust and verifiable indicators that could potentially be used to assess the commercial, economic, environmental, societal or cultural benefits of university research.

The design and implementation of the EIA trial will advise and inform the ATN and Go8 and more broadly the national higher education sector and Government about how such an exercise might be introduced on a national scale.

## CONTEXT AND BACKGROUND

The recent Excellence in Research for Australia (ERA) exercise does not include the capability to measure the end-user benefits of research. Both excellence and innovation are crucial aspects of Australia's research efforts. Both the ATN and Go8 consider that an Excellence in Innovation for Australia (EIA) assessment exercise, complementary to, but separate from, ERA is required to provide a complete picture of the research performance of Australian universities.

An EIA would involve a broader data collection of innovation performance measures and the development of a deeper understanding of how best to ensure that research fuels innovation, engagement and productivity.

The ATN and Go8 will be engaging closely with both business/industry representatives and Government during 2011 in order to promote the desirability, benefits and feasibility of such an exercise. In order to support those representations, it will be important to be able to present decision makers with practical methods under which an EIA could operate.

The value of incorporating such measures is increasingly gaining recognition in an international context. In particular, the UK's new Research Excellence Framework (REF) has specifically included them in its upcoming 2014 assessment.

The REF approach is based on the outcomes of a 29-institution pilot exercise conducted in 2010 which tested aimed to test the feasibility of such assessment, and developed the method of assessment for use in the REF. It was heavily modeled on work previously undertaken in this area within Australia.

Assessment of end-user outcomes in the REF will be based on expert review of case studies submitted by higher education institutions. Case studies may include any social, economic or cultural impact or benefit beyond academia that has taken place during the assessment period, and was underpinned by excellent research produced by the submitting institution within a given timeframe. They also include information about how the unit has supported and enabled impact during the assessment period.

The outcome of the REF assessment will result in a rating for each submission on a scale from 1* to 4* and 'Unclassified'.

## TERMS OF REFERENCE

The ATN/Go8 EIA will be an exercise to measure and evaluate the innovation dividend of research, designed and implemented with respect to the following Terms of Reference below. The operational details of how the EIA will be designed and implemented are contained in the EIA Operations and Governance documents.

**1. Indicators and definitions**

- The scope of innovation outcomes for each of the main categories (economic, environmental, social and cultural);
- Quantitative metrics and supporting data which may be useful in determining innovation outcomes;
- Qualitative measures that could credibly be used to determine innovation outcomes;
- Methods to overcome difficulties in measuring outcomes in specific disciplines (e.g. arts/ humanities); and

**2. Assessment**

- Different methods of determining innovation outcomes, with specific reference to the value of case studies as proposed by the UK REF;
- Measures to reliably attribute a given outcome to a specific researcher/research group;
- Ways in which the stage of development or maturity of an outcome may be incorporated into assessment;
- Measure to delineate the effects of research and engagement in achieving innovation outcomes; and
- Assessment of innovation outcomes against Australia's National Innovation Priorities.

**3. Attribution and timeframes**

- Issues arising in the application of quantitative or qualitative measures of innovation outcomes to research outputs produced within defined time periods, such as those currently used by ERA;
- The implications of assessing short term versus long term outcomes;
- The implications of researcher mobility on measurement; and
- Whether attribution should be made at the individual or group level.

**4. Measurement scale**

- A clear justification for an innovation outcomes scale with a resolution appropriate to making informed judgement on the outcomes of a body of work, taking into account those proposed by the UK REF; and
- Issues surrounding whether measurement of outcomes should be restricted to only those research outputs identified as being of high excellence, as may be the case for the UK REF.

**5. Evaluation**

- A suggested evaluation framework for converting innovation data and indicators into a rating; and
- Identification of the primary measure(s)/indicator(s) to be used in determining an EIA rating.

# ATN-GO8 EXCELLENCE IN INNOVATION FOR AUSTRALIA (EIA)

Operations and Governance Document

## PURPOSE

The purpose of this document is to provide details of the design, operation and governance of the ATN-Go8 Excellence in Innovation for Australia (EIA) exercise.

## INTRODUCTION

The Excellence in Research for Australia (ERA) initiative run by the Australian Research Council is an exercise to measure the excellence of research produced by the Australian university sector. To measure the total value of this research, and hence the total Return on Investment to the Australian community of public money invested in the university research sector, the ATN & Go8 believe that is necessary also to measure the *innovation dividend*, or value to end-users of this research.

The ATN & Go8 are running the EIA exercise as a trial for a potential national system to measure the innovation dividend of research and to act as a companion piece to ERA.

The EIA will

- Be specified by an EIA Guidelines document to be designed with respect to the EIA Terms of Reference document,
- Operate within the parameters established by this document and be conducted in a collegial manner
- Have a Peak Governance and Decision making group comprising the Chairs of the ATN and the Go8.
- The Peak Governance Group will delegate much of its decision making to an *EIA Administrative Group* comprising the lead DVC-R ATN, lead DVC-R Go8, the ATN Directorate and the Go8 Directorate. The Peak Governance Group and consult with the non-ATN/Go8 participants of the EIA in making decisions which are outside the scope or in conflict with the content of this document.

## GENERAL FRAMEWORK OF THE EIA

While the design and implementation of the EIA will be specified in an EIA Guidelines document, it is expected that, in broad terms, the EIA will involve institutions making submissions at the discipline or research group level and that these submissions will be assessed by evaluation committees containing appropriate discipline based expertise.

## TIMING OF THE EIA

The EIA will be conducted in the period May–November 2012 (which follows the closing of the ERA 2012 submission window on 27 April 2012), with a final report on the EIA to be published on **30 November 2012.**

## EIA PARTICIPANTS

The EIA will have 12 participating institutions:

- The five ATN universities: Curtin University (Curtin), The University of South Australia (UniSA), RMIT University (RMIT), University of Technology, Sydney (UTS) and Queensland University of Technology (QUT);
- Four of the eight Go8 universities: The University of New South Wales (UNSW), The University of Western Australia (UWA), The University of Melbourne (Melbourne) and The University of Queensland (UQ)
- Charles Darwin University (CDU)
- University of Tasmania (UTas)
- Newcastle University (Newcastle)

Should an institution withdraw from the EIA the ATN/Go8 Chairs will decide, after consultation with all remaining participants, on whether it is appropriate to have a replacement institution in the EIA and which institution should be approached to join.

## EIA STAKEHOLDERS

The EIA will have a broad range of stakeholders including

- Australian universities
- Government departments
- Politicians and policy makers
- Industry
- Government research agencies
- Higher education sector
- The Australian public

## GOVERNANCE/ORGANISATIONAL FRAMEWORK FOR THE EIA

The governance/organisational structure of the EIA will comprise a *Peak Governance Group*, *Project Steering Group*, *Implementation Group* and two advisory groups the *Development Advisory Board* and a *Technical Working Group*.

The *EIA Administrative Group* will be responsible for convening these groups and arranging appropriate executive support for the operation of the groups. The executive support resources will be included as part of the EIA AG. The cost of executive support will be shared by the institutions participating in the EIA.

Resourcing of the preparation of institutional submissions for the EIA will be a matter for each institution.

*Peak Governance Group*

- ATN VCs (or nominees)
- Go8 Board (or nominees)

*Project Steering Group*

Members include the DVC-R from each of the participant institutions (or nominee).

The Project Steering Group will report to the Peak Governance Group through the Executive Director of the Go8 and the Executive Director, ATN and will

- Advise on a draft EIA Guidelines document for comment by the Development Advisory Board and approval by the Peak Governance Groups
- Liaise with the Implementation and Technical Working Groups in the design of the EIA Guidelines
- Direct the Implementation Group in implementing the EIA Guidelines
- Prepare a final report on the EIA outcomes
- Advise on a communication strategy for EIA outcomes
- Prepare any internal analysis documents/reports it deems necessary

*Implementation Group*

Members include the Research Directors of each participating institution (or nominee).

The Implementation Group will report to the Project Steering Group and will operationalise the EIA Guidelines including developing

- Documentation/proforma/instructions for participants
- Timelines
- Logistical details
- Institutional liaison

*Development Advisory Board*

Members will be high-level representatives of stake-holder sectors including industry, business, universities, government, government funded research agencies and include international member(s).

*The Development Advisory Board will*

- Provide advice to the Peak Governance Group through the Project steering group, possibly mediated by the ATN and Go8 Directorates.
- Consider a discussion paper on the EIA in their first meeting
- Review the EIA Draft Guidelines

*Technical Working Group*

Members will have particular technical expertise in measuring research performance and impact. The Technical Working Group need not necessarily have formal meetings but members will be consulted by the Project Steering Group or Implementation Group on an ad hoc basis as the need arises.

## DATA SHARING AND CONFIDENTIALITY

Institutional submissions to the EIA will be made available to all participants with the rider that this information is not to be distributed outside the EIA participant institutions without the approval of the EIA Project Steering Group, Vice Chancellors of participant universities and sign-off from the EIA Peak Governance Group.

## EIA FINAL REPORT AND COMMUNICATION STRATEGY

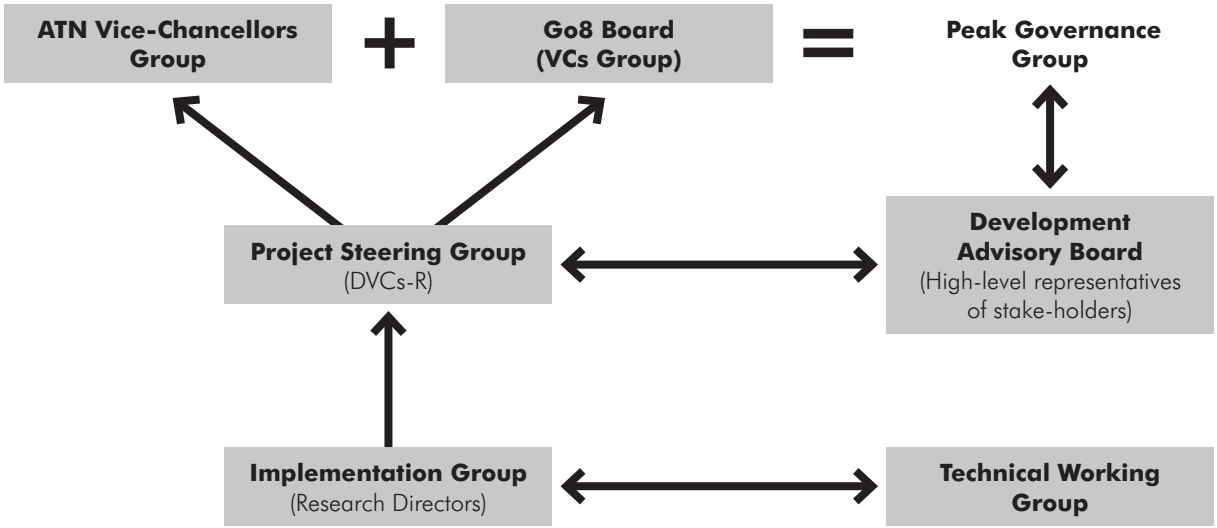
The EIA Project Steering Group, in conjunction with the EIA Administrative Group, will have responsibility for preparing the EIA final report for public distribution, any confidential internal analysis documents it warrants necessary and for devising a communication strategy for the outcomes of the EIA.

## EIA COMMUNICATION PROTOCOLS

Any formal communications from the EIA will require explicit approval from the Peak Governance Group and will, as a courtesy, be sent in advance to the Vice-Chancellors of the non ATN-Go8 participant institutions.

As a courtesy EIA participant institutions will keep the EIA Administrative Group (through either the ATN or Go8 Directorate) appraised of any significant communications or meetings that related directly to the EIA.

# EIA GOVERNANCE/ORGANISATIONAL FRAMEWORK




**Peak Governance Group**
(Vice Chancellors of ATN/Go8 Universities)

- Professor Peter Høj, University of South Australia
- Professor Margaret Gardner, RMIT University
- Professor Jeanette Hacket, Curtin University of Technology
- Professor Ross Milbourne, University of Technology, Sydney
- Professor Peter Coaldrake, Queensland University of Technology
- Professor Ian Young, Australian National University
- Professor Paul Greenfield, University of Queensland
- Professor Fred Hilmer, University of New South Wales
- Professor Michael Spence, University of Sydney
- Professor Ed Byrne, Monash University
- Professor Glyn Davis, University of Melbourne
- Professor James McWha, University of Adelaide
- Professor Alan Robson, University of Western Australia

# Appendix 2 – EIA Operations and Governance

**Development Advisory Board**

- Mr Phillip Clark AM, Chair, Education Investment Fund (EIF)
- Professor Robin Batterham, President, Australian Academy of Technological Sciences and Engineering (ATSE)
- Dr David Sweeney, Director, (Research, Innovation and Skills), Higher Education Funding Council for England (HEFCE)
- Ms Patricia Kelly, Deputy Secretary, Department of Innovation, Industry, Science and Research (DIISR)
- Dr Craig Roy, Deputy Chief Executive, Science, Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Dr Laurie Hammond, Chair, Commercialisation Australia (CA)
- Professor Mandy Thomas, PVC (Research) the Australian National University (ANU)
- Professor Margaret Harding, PVC (Research) the Australian National University (ANU)
- Professor Jill Trewhella, DVC (Research) the University of Sydney
- Professor Arun Sharma, DVC (Research) Queensland University of Technology (QUT)
- Professor Daine Alcorn, DVC (Research) RMIT University
- Ms Vicki Thomson, Executive Director ATN
- Dr Ian McMahon, Go8 Group of Universities

**Project Steering Group**
(DVC's Research of participating universities)

- Professor Daine Alcorn, RMIT University (Chair)
- Professor Robyn Owen, University of Western Australia
- Professor Graham Wright, Curtin University of Technology
- Professor Sakkie Pretorius, University of South Australia
- Professor Lyn Yates, University of Melbourne
- Professor Atilla Brungs, University of Technology, Sydney
- Professor Les Field, University of New South Wales
- Professor Alan Lawson, University of Queensland
- Professor Arun Sharma, Queensland University of Technology
- Professor Sharon Bell, Charles Darwin University
- Professor Mike Calford, University of Newcastle
- Professor Paddy Nixon, University of Tasmania

**Implementation Group**
(Directors of University Research Office or nominee)

- Mr Ian Harris, University of Queensland (Chair)
- Dr Campbell Thomson, University of Western Australia
- Dr Charlie Thorn, Curtin University of Technology
- Dr Tracey Swift/Mr Stephen Rodda, University of South Australia
- Dr Lois Fitzgerald/Mr Steve Gower, RMIT University
- Dr Shane Wood, University of Melbourne
- Mr Murray Green, University of New South Wales
- Mr Jeff Francis, University of Technology, Sydney
- Mr Michael McArdle, Queensland University of Technology
- Dr Jenny Carter, Charles Darwin University
- Ms Lyn McBriarty, University of Newcastle
- Dr Mark Hochman, University of Tasmania
- Dr Ian McMahon, Go8 Group of Universities
- Dr Matthew Brown, Senior Policy Analyst – Research, ATN

The governance framework was constructed to ensure expert input into the Trial design and clear decision making/accountability lines. Accordingly:

- The Peak Governance Group comprised Vice Chancellors of the ATN and Go8 university groupings and provided final endorsement of the processes and material used in the EIA Trial.
- The Development Advisory Board chaired by Mr Philip Clark AM provided high level input from a wide variety of stakeholders external to the Australian higher education sector into the design and conduct of the Trial.
- The Project Steering Group comprised the Deputy Vice Chancellors Research from the participating universities and advised on draft EIA Trial Guidelines and Assessor Guidelines.
- The Implementation Group of Research Office Directors developed the Trial Guidelines, Assessor Guidelines and other materials used within the Trial.
- The above groups were supported by the ATN and Go8 secretariats – Ms Vicki Thomson and Dr Matthew Brown (ATN), Dr Ian McMahon (Go8) and a program manager (Dr Mark Hochman).

# Appendix 3 – EIA Assessment Panel Chairs and Members

## LIST OF PANEL CHAIRS AND ASSOCIATION

| | | |
|---|---|---|
| **Mr Colin Beckett** | Chair, Economic Development Panel 1 | General Manager, Gorgon Project, Chevron |
| **Dr Leanna Read** | Chair, Economic Development Panel 2 | Founder and former Managing Director: TGR BioSciences |
| **Mr Chris Leptos AM** | Chair, Society Panel 1 | KPMG |
| **Professor Carmen Lawrence** | Chair, Society Panel 2 | University of Western Australia |
| **Dr Paul Vogel** | Chair, Environment Panel 1 | WA Environmental Protection Agency |
| **Mr David Parry** | Chair, Environment Panel 2 | Rio Tinto |
| **Mr Jim Walker AM** | Chair, Defence Panel | Auto Cooperative Research Centre |

## EIA DEFENCE PANEL

| | | |
|---|---|---|
| **Mr Jim Walker AM** | CEO | Auto CRC |
| **Mr Brett Biddington** | Principal | Biddington Research |
| **Dr Neil Bryans** | DSTO Fellow | DSTO |
| **Michael Clark** | Director Research and Technology | Thales |
| **Dr Chris Davis** | Research Leader, Maritime Operations Research | The Defence Science and Technology Organisation |
| **Mr Rod Drury** | | Lockheed Martin |
| **Mr Allan Gyngell AO** | Director-General | Office of National Assessments |
| **Mr Bill Horrocks** | CEO | Aviation Australia |
| **Professor Rick Middleton** | Director of Centre for Complex Dynamic Systems and Control | The University of Newcastle |
| **Professor Bill Moran** | Research Director | Defence Science Institute |
| **Dr Adi Paterson** | CEO | Australian Nuclear Science and Technology Organisation |
| **Mr Tony Quick** | Chair | Defence Materials Technology Centre |
| **Dr James Underwood** | Research Fellow | BAE Systems Centre for Intelligent Mobile Systems at Australian Centre for Field Robotics |
| **Professor Chun Wang** | Director of Sir Lawrence Wackett Aerospace Research Centre | RMIT University |

# Appendix 3 – EIA Assessment Panel Chairs and Members

## EIA ECONOMIC DEVELOPMENT PANEL 1

| | | |
|---|---|---|
| **Mr Colin Beckett** | General Manager, Greater Gorgon Area | Chevron |
| **Professor Colin Adam** | Chair | ARC Centre of Excellence in Light Metals, Monash University |
| **Professor Mark Adams** | Professor, Faculty of Agriculture and Environment | The University of Sydney |
| **Dr Amanda Caples** | A/Deputy Secretary, Innovation and Technology Division | Department of Business & Innovation |
| **Mr Peter Laver AM** | Senior Advisor | Australian Academy of Technological Sciences and Engineering |
| **Mr Anthony Lele** | Consumer and Industrial | Invetech |
| **Professor Rachel Parker** | Assistant Dean (Research) – QUT Business School | Queensland University of Technology |
| **Emeritus Professor Rob Raison** | Emeritus Professor of Immunology | University of Technology, Sydney |
| **Ms Suzanne Roche** | Director | Smartnet Pty Ltd |
| **Dr Glenn Wightwick** | Chief Technologist | IBM Australia |

## ECONOMIC DEVELOPMENT PANEL 2

| | | |
|---|---|---|
| **Dr Leanna Read** | Founder & Former Managing Director | TGR BioSciences |
| **Professor Harry Bloch** | Dean, Research & Development, Curtin Business School | Curtin University |
| **Dr Neil Byron** | Associate Commissioner | Productivity Commission |
| **Mr Todd Creeger** | President | ConocoPhillips Australia (West) |
| **Professor Kevin Galvin** | Director, Centre for Advanced Particle Processing and Transport | The University of Newcastle |
| **Dr Jurgen Michaelis** | Chief Executive Officer | BioSA |
| **Dr Simon Poole** | Director New Business Ventures | Finisar Australia |
| **Mr Gavin Rennick** | Managing Director Australasia | Schlumberger |
| **Mr Richard Sellers** | Director General | WA Department of Mines and Petroleum |
| **Mr Greg Stone** | Chief Technology Officer | Microsoft |
| **Dr Ram Vemuri** | Professor of Business Management | Charles Darwin University |
| **Mr Gerhard Vorster** | Managing Partner Consulting | Deloitte |

# APPENDICES

## EIA SOCIETY PANEL 1

| | | |
|---|---|---|
| Mr Chris Leptos AM | Partner | KPMG |
| Associate Professor John Armstrong | Philosopher in residence, Melbourne Business School | University of Melbourne |
| Dr Anne Badenhorst | Director Research, Housing | Australian Housing and Urban Research Institute |
| Ms Sally Coutts | Manager Research – Crisis Services | Salvation Army |
| Distinguished Professor Stuart Cunningham FAHA | Director ARC Centre of Excellence for Creative Industries & Innovation | Queensland University of Technology |
| Professor Michael Fraser | Director, UTS Communications Law Centre | University of Technology, Sydney |
| Dr Tracy Henderson | Manager Impact 2020 Project | CSIRO |
| Dr Mary Lincoln | Director, Performance | Office for Early Childhood Education and Care, Queensland |
| Professor Robin Mortimer AO | Executive Director | Qld Office of Health and Medical Research (OHMR) |
| Professor Andrew Podger AO | Professor of Public Policy | Australian National University |
| Mr Francis Sullivan | General Secretary | Australian Medical Association |

## EIA SOCIETY PANEL 2

| | | |
|---|---|---|
| Winthrop Professor Carmen Lawrence | Director, Centre for the Study of Social Change | The University of Western Australia |
| Dr Felicity Barr | Chair of Advisory Board for PRC for Gender, Health and Ageing | The University of Newcastle |
| Professor Lyn Beazley AO FTSE | Chief Scientist | Department of Commerce |
| Prof Carmel Diezmann | Assistant Dean (Research) – Centre for Learning Innovation | Queensland University of Technology |
| Ms Ann Hoban | Director of City Culture and Community | City of Sydney |
| Associate Professor Anita Lee Hong | Director, Oodgeroo Unit | Queensland University of Technology |
| Professor Clare Martin | Northern Institute | Charles Darwin University |
| Professor Suzanne Miller | Director | South Australian Museum |
| Mr Lindsay Rae | Advisor to Tim Costello | World Vision |
| Ms Anne-Marie Schwirtlich | Director General | National Library of Australia |
| Mr Grahame Searle | Director General | WA Department of Housing |
| Professor Sue Trinidad | Dean of Teaching & Learning, Humanities | Curtin University |

# Appendix 3 – EIA Assessment Panel Chairs and Members

## EIA ENVIRONMENT PANEL 1

| | | |
|---|---|---|
| **Dr Paul Vogel** | Chairman | EPA |
| **Mr Carl Binning** | Vice-President – Health, Safety, Environment & Community | BHP Billiton Iron Ore |
| **Dr Peter Chudleigh** | CEO | AgTrans Consulting |
| **Professor Malcom Cox** | Earth, Environmental and Biological Sciences, Earth Systems | Queensland University of Technology |
| **Dr Nora Devoe** | Coordinator, Carbon Economies | Northern Territory Government |
| **A/Professor Pauline Mooney** | Executive Director | South Australian Research and Development Institute |
| **Dr Shanti Reddy** | Director | Department of Climate Change and Energy Efficiency |
| **Dr Barry Warwick** | Senior R&D Program Leader | Environmental Protection Authority Victoria |
| **Dr Craig Williams** | School of Pharmacy & Medical Sciences | University of South Australia |
| **Dr Charlie Zammit** | Biodiversity Conservation Assistant Secretary | Department of Sustainability, Environment, Water, Population and Communities |

## EIA ENVIRONMENT PANEL 2

| | | |
|---|---|---|
| **Dr David Parry** | Principal Advisor – Environment | Rio Tinto |
| **Mr Jason Alexandra** | General Manager – Ecosystem Management Branch | Murray Darling Basin Authority |
| **Professor Andrew Campbell** | Director, Research Institute for Environment and Livelihoods | Charles Darwin University |
| **Dr Tom Hatton** | Group Executive, Energy | CSIRO |
| **Mr Mitchell Lendrum** | Policy Officer | Department of Climate Change and Energy Efficiency |
| **Professor Michael Mahony** | Head of the Discipline of Biology | The University of Newcastle |
| **Phillipa Ormandy** | Business Development Manager | CSIRO Flagships – Wealth from Oceans & Food Futures |

# EIA RESEARCH IMPACT TEMPLATE

## 1. INSTITUTION

## 2. UNIT OF ASSESSMENT

Primary SEO Code:

Secondary SEO Code (if needed):

Secondary SEO Code (if needed):

## 3. TITLE OF CASE STUDY

## 4. CONTEXT

## 5. SUMMARY OF THE CASE STUDY IMPACT (indicative maximum 100 words)

This section should briefly state what specific impact is being described in the case study and the link to the underlying research.

## 6. DETAILS OF THE IMPACT (indicative maximum 750 words)

This section should provide a narrative, with supporting evidence, to explain:

- How the research underpinned (made a distinct and material contribution to) the impact.
- The nature and extent of the impact.

The following should be provided:

- A clear explanation of the process or means through which the research led to, underpinned or made a contribution to the impact (for example, how it was disseminated, how it came to influence users or beneficiaries, or how it came to be exploited, taken up or applied).
- Where the submitted unit's research was part of a wider body of research that contributed to the impact (for example, where there has been research collaboration with other institutions), the case study should specify the particular contribution of the submitted unit's research and acknowledge other key research contributions.
- Details of the beneficiaries – who or what community, constituency or organisation has benefitted, been affected or impacted on.
- Details of the nature of the impact – how they have benefitted, been affected or impacted on.
- Evidence or indicators of the extent of the impact described, as appropriate to the case being made.
- Dates of when these impacts occurred.

## 7. RESEARCH UNDERPINNING IMPACT (indicative maximum 500 words)

This section should outline the key research insights or findings that underpinned the impact, and provide details of what research was undertaken, when, and by whom. References to specific research outputs that embody the research described in this section, and evidence of its quality, should be provided in section 8.

Details of the following should be provided in this section:

- The nature of the research insights or findings which relate to the impact claimed in the case study.
- An outline of what the underpinning research produced by the submitted unit was (this may relate to one or more research outputs, projects or programmes).
- Dates of when it was carried out.
- Any relevant key contextual information about this area of research.

## 8. RESEARCH OUTPUTS FROM RESEARCH UNDERPINNING IMPACT (maximum of ten references)

This section should provide references to key outputs from the research described in the previous section, and evidence about the quality of the research. These may also include references spanning creative works, patents etc where relevant to a case study.

Include the following details for each cited output:

- Author(s).
- Title.
- Year of publication.
- Type of output and other relevant details required to identify the output (for example journal title and issue).
- Details to enable the panel to gain access to the output, if required (for example, a DOI or URL) or can be supplied by the institution on request.

All outputs cited in this section must be capable of being made available to panels.

Evidence of the quality of the research must also be provided in this section.

## 9. ADDITIONAL INFORMATION

**a) Validation of the Impact**
(indicative maximum of 10 references)

This section should list sufficient sources that could, if audited, corroborate key claims made about the impact of the unit's research. These could include, as appropriate to the case study, the following external sources of corroboration (stating which claim each source provides corroboration for):

- Reports, reviews, web links or other documented sources of information in the public domain.
- Confidential reports or documents (if listed, these must be made available by the institution if audited).
- Individual users/beneficiaries who could be contacted by the Assessment Panel to corroborate claims.
- Factual statements already provided to the institution by key users/beneficiaries, that corroborate specific claims made in the case study and that could be made available to the Assessment Panel by the institution if audited.

**b) People**

**i.** Staff

**ii.** **Others** (including research students, end-users or beneficiaries of the research)

**c) Research and Investment Income**

This section is free format but the following should be provided for each grant or source of income used to prosecute the research or the impact:

- Who the grant was awarded to.
- The grant title.
- Sponsor.
- Period of the grant (with dates).
- Value of the grant.

This template is modelled on a combination of REF3A and REF5A templates from the 2014 UK REF. Their use for this EIA Impact Trial is acknowledged.

# GUIDELINES FOR COMPLETION OF CASE STUDIES IN ATN/GO8 EIA IMPACT ASSESSMENT TRIAL

June – August, 2012

## CONTENTS



The ATN and Go8 acknowledge that these EIA submission guidelines heavily draw on – with permission – the guidelines and supporting materials for the Research Excellence Framework (REF) to be conducted by the Higher Education Funding Council for England (HEFCE). The ATN and Go8 are grateful for the assistance of HEFCE in the preparation of the EIA and in particular to HEFCE Director (Research, Innovation and Skills), David Sweeney.

An electronic version of this document may be downloaded from either:

- the Go8 website: http://go8.edu.au/university-staff/programs-_and_-fellowships-1/atngo8-excellence-in-innovation-for-australia-trial-excellence-in-innovation-for-australia-eia
- the ATN website: http://www.atn.edu.au/eia/index.htm

# 1 OVERVIEW AND CONTEXT OF THE EIA IMPACT ASSESSMENT TRIAL

The transfer of knowledge between universities, industry and the community, and the impact of that knowledge on the development of new technology, new policy and economic, cultural, environmental or societal outcomes is an important focus for many Australian universities.

The recent Excellence in Research for Australia (ERA) exercises (2010 and 2012) included applied measures but did not include the capability to adequately capture the end-user benefits of research. Excellence in both research and innovation are crucial aspects of Australia's research efforts. Both the Australian Technology Network of Universities (ATN) and the Group of Eight (Go8) Universities consider that an Excellence in Innovation for Australia (EIA) assessment exercise, complementary to, but separate from, ERA is required to provide a complete picture of the research performance of Australian universities.

The value of assessing the innovation outcomes of research is increasingly gaining recognition in an international context. In particular, the UK's new Research Excellence Framework (REF) has explicitly included an impact component within its upcoming 2014 assessment. The REF approach is based on the outcomes of a 29 institution pilot exercise conducted in 2010 which aimed to test the feasibility of an impact assessment, and developed the method of assessment for use in the REF. It was heavily modelled on work previously undertaken in this area within Australia (the 2006 ATN/Murdoch Research Quality Framework Impact Trial). This EIA Trial in Australia will, in turn, draw heavily on learnings from the REF trial and the planned REF approach.

Within the broader Australian research setting, one of the recommendations of the *Focusing Australia's Publicly funded Research Review* undertaken by the federal Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) in 2011 and accepted by the Government is to undertake a feasibility study into possible approaches to develop a rigorous, transparent, system-wide Australian research impact assessment mechanism, separate from ERA, to evaluate the wider benefits of publicly funded research. It is expected that this EIA Impact Trial will play an important role in informing the feasibility study.

## 1.1 Purpose of the EIA Trial

The primary purpose of the EIA Trial is to identify and demonstrate the contribution that high quality research has made to the economic, social, cultural and environmental benefit of society. Implicit in this goal is the purpose to investigate the means by which these benefits may best be recognised, portrayed and assessed by institutions and government.

## 1.2 Definition of Research

For the purposes of the EIA, research is defined in the same way as for ERA, i.e. research is defined as "the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it is new and creative. This definition of research is consistent with a broad notion of research and experimental development (R&D), one that recognises research as comprising 'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise applications".

Adoption of this definition of research would normally imply that the research underpinning impact claimed in an Institution's submission has generated an ERA eligible output, or some other demonstrable and tangible research output.

## 1.3 Definition of Impact

For the purpose of the EIA, impact is defined in a similar way as for the UK REF, i.e. "an effect on, change, benefit to the economy, society, culture, public policy or services, health, the environment or quality of life beyond academia. It includes, but is not limited to, an effect on, change or benefit to:

- The activity, attitude, awareness, behaviour, capacity, opportunity, performance, policy, practice, process or understanding
- Of an audience, beneficiary, community, constituency, organisation or individuals
- In any geographic location whether locally, regionally, nationally or internationally.

It includes the reduction or prevention of negative effects including the harm, risk or cost arising from negative effects.

It does not include impact on research or the advancement of academic knowledge, nor impacts on students, teaching or other activities within the submitting institution. It may include impacts within the higher education sector, including teaching or students where they extend significantly beyond the submitting higher education institution (slightly modified from UK REF, Assessment Framework and Guidance on Submissions, Annex C, July, 2011).

### 1.4 General Principles of the EIA Trial

Following on from the purpose of the EIA Trial (Section 1.1 above) the EIA Trial aims to demonstrate and communicate the beneficial outcomes of research to government, business and the community by:

- Identifying good research outcomes;
- Justifying the claims being made by institutions of good outcomes, and
- Identifying the research underpinning the outcomes/impact.

It is recognised that this EIA Trial will operate independently of other assessment mechanisms such as ERA. ERA seeks to measure the quality of research undertaken within institutions; the EIA Trial will seek to assess the impact of research undertaken within institutions and also examine whether a link exists between demonstrated impact and the quality of underpinning research.

The Trial will be underpinned by the following general principles:

1. The development of the EIA should look to leverage the work performed in developing the UK REF where appropriate
2. The EIA will be retrospective rather than prospective
3. There be no explicit excellence threshold for submissions but the impact should show a link to underpinning research. Assessment Panels will examine the quality of underpinning research through information provided on the template in Appendix 1 and will also seek to assess any link between research quality and demonstrated impact.
4. The EIA should take a verifiable approach to evidence in submissions (as opposed to verifying all evidence)
5. Impact will be primarily assessed by means of case-studies for all disciplines. Performance data for the underpinning research will also be included in the impact submissions and Assessment Panels will seek to investigate any systematic links between the impact and underpinning research performance data.
6. Research underpinning a submitted impact should be attributed to the institution(s) at which the research was generated regardless of any subsequent change in affiliation of researchers involved (including where academics have retired or left academia). It is important to note that the focus of this Trial is to demonstrate the assessment of impact through case studies and not the assessment of individual institution's impact.

These principles are aimed at minimising the effort required by individual institutions to participate in the Trial whilst ensuring that the methodologies employed are robust, compatible with current practice elsewhere and able to deliver the purpose of the EIA Trial.

### 1.5 Disciplines for Evaluation

This EIA Trial will use the same cluster groupings contained within Socio-Economic Objective (SEO) Classifications maintained by the Australian Bureau of Statistics (ABS).

The four broad SEO clusters for evaluation in this Trial are:

- Sector A – Defence
- Sector B – Economic Development
- Sector C – Society
- Sector D – Environment

Each Sector contains multiple additional classifications at two digit SEO divisions with two digit divisions being further split into multiple four digit classifications. Some are further divided to six digit classifications.

The fifth broad SEO cluster is Sector E – Expanding Knowledge. This will not be used for evaluation in this Trial as the expansion of knowledge is assessed through other mechanisms such as ERA. The assessment in the EIA Trial will be of the impact, not the research in underlying fields. Thus, it is important to note that all disciplines included within Sector E are eligible to be submitted in this Trial if their impact occurs in areas listed under Sectors A-D. For example, 970114, Expanding Knowledge in Economics could have a resultant impact claimed under several SEO Codes in Sectors A-D including, 91, Economic Frameworks, 9204, Public Health amongst many possibilities.

Institutions are invited to make submissions according to four digit SEO classifications contained within these four Sectors. It is expected that each submission will be encapsulated primarily within one four digit SEO classification however provision is made on the application form for up to three SEO classifications. A list of the four digit SEO classifications may be found at http://www.abs.gov.au/Ausstats/abs@.nsf/Latestproducts/CF7ADB06FA2DFD69CA2574180004CB82?opendocument.

### 1.6 The Framework for Assessment

#### *1.6.1 Time period for Assessment*

Institutions should submit, on the template provided in Appendix 1, information on research impacts which have occurred in the period 1st January, 2007 – date of submission (ie, roughly five and a half years). Recognising that in some cases, impact may occur quickly and in others that it may take considerable time for impacts of research to be demonstrated, the impacts submitted should relate to research which occurred during the impact period, or in the 15 year period preceding the claimed impact, i.e. 1st January, 1992 – 31st December, 2006.

Exceptions to this time frame may still be allowed if justified in the application.

*1.6.2 Demonstrated Impact vs Potential Impact*

Whilst much research may lead to future, as yet unrecognised, or only partly recognised impact, the focus for this Trial is on demonstrated impact, i.e. impact that has occurred within the reference period above.

Examples of what may constitute demonstrated impact are contained in Appendix 2. These lists are not comprehensive and are provided only as examples. Applicants are free to use other examples or explanations which they consider may demonstrate research impact.

*1.6.3 Excellence threshold*

There is no excellence threshold for submissions to the EIA. The differing timing of ERA vs the EIA Trial, the likelihood that that staff may have moved institutions within the 20 year assessment period and the differing units of assessment for ERA and the EIA Trial, all combine to render impossible any ERA derived quality threshold for claimed EIA Trial impacts. However the Assessment Panels will be keen to examine whether, on the information provided to them, it is possible to discern any connection between research quality and impact for the case studies submitted.

The EIA Trial template in Appendix 1 contains a section requiring applicants to describe the quality of the research underpinning the claimed impact. This section will be used by Assessment Panels to assess whether there is high impact research which is not underpinned by research excellence.

### 1.7 Timetable for the EIA Trial

Final EIA Trial Guidelines will be released in May, 2012 and institutions will be given till 31st August, 2012 to prepare submissions. Note that individual institutions may set an earlier closing date for submissions, i.e. prior to 31st August. Assessment of submissions will occur through September, 2012. Results are expected to be released to institutions in November, 2012.

### 1.8 Use of Information

Following assessment, results will be used in three ways:

1. A consolidated assessment report will be prepared for each institution on results for those units submitted from their own institution;
2. A summary report of results spanning all institutions will be made available to each participating institution, and
3. A summary EIA Trial report will be prepared for the peak EIA Governance Group and released to the public following endorsement. This report will evaluate the process of the EIA Trial and make recommendations concerning its potential more widespread adoption.

In addition to these uses, the Assessment Panels, the Project Steering Group and the Development Advisory Board for the EIA will be seeking to identify issues which may need to be considered in any future widespread impact assessment through the Higher Education sector, including the feasibility study likely to be undertaken by DIISRTE as mentioned in Section 1.

## 2 SUBMISSIONS

### 2.1 Eligibility of Impact Case Studies for Submission

The basic element of submission for the EIA Trial is the case study of research impact. The impact must be related to underpinning research. Consequently institutions should submit case study examples for assessment where they can demonstrate that the research underpinning the impact was undertaken at their institution.

In cases where the research underpinning the claimed impact was undertaken by staff at two different institutions (i.e. staff involved in the underpinning research changed employing institutions through the 20 year reference period) then both institutions may claim a proportion of the impact. The template in Appendix 1 provides for an apportioning of impact. In such cases it would be incumbent on each submitting institution to clearly demonstrate the link between the research undertaken at their institution and the claimed impact.

### 2.2 Units of Evaluation

Unlike ERA where the primary Unit of Evaluation is the research discipline in the institution, in the EIA Trial the Unit of Evaluation is the impact as represented by the case study. The attribution of the outcome is for the institution to determine – this may be School, Research Centre or Institute, or some combination of researchers working across institutional boundaries.

As noted in Section 1.5, each submission may be assigned up to three four digit SEO codes, with one being assigned as the primary SEO code. Note that it is not necessary for all case studies to be assigned three SEO Codes. It is expected that in many cases, impact may occur in one SEO code only.

### 2.3 Number of Submissions

As noted above in Section 1.5 there are four Sectors for evaluation. The EIA Trial is seeking a sufficient number of case studies across the four SEO Sectors in order to demonstrate a range of impacts and to assess any underlying link between quality of research and impact. Ideally each institution would submit a maximum of five case studies in each of the four Sectors, i.e. 20 case studies. However, it is understood that not all institutions will have research or impacts in all of the four Sectors, e.g., Defence. Other factors such as size or age of institution may also affect the number of impacts that may have arisen from an institution's research. Therefore a maximum and minimum number of case studies will apply for each institution:

- A maximum of five case studies for each of the four SEO Sectors (i.e. 20 in total)
- A minimum of two case studies in three of the four SEO Sectors (i.e. 6 in total).

### 2.4 Content of Submission

Submissions should consist of research impact case studies made on the template in Appendix 1. The information contained in this template should be sufficient to allow the Assessment Panel to make a judgement on the research impact – no further reading should be required.

The template is provided as a Word document and contains headings as described in 2.4.1 below. Within each heading are suggestions as to points which submitting institutions may wish to emphasise in completing each section. These are in no way prescriptive and are provided as examples which may assist institutions in considering how to portray high value research impact. The Assessment Panels recognise that high value impact may arise in a variety of settings and via differing pathways – each submission will be evaluated on the basis of information provided and the quality of the case made.

Note that it is possible for an individual case study to have multiple impacts. For example, a new medicine may have impact in both health and economic outcomes; a new environmental assessment standard may have economic, environmental and cultural impacts. In such cases the multiple impacts should be described within the single case study, not submitted as separate case studies.

#### *2.4.1 Impact Case Study Template*

*Question 1: Institution* – This is the name of the submitting institution within the EIA Trial.

*Question 2: Unit of Assessment* – This is the four digit SEO code which best classifies the research impact in the case study presented. There is provision for one primary and two secondary SEO codes. These codes will be used to determine which Assessment Panel considers the research impact case study.

*Question 3: Title of Case Study* – This is the title describing the research impact case study. As far as is possible this should be in layperson's language and free from jargon or language which may be understood only by those within the unit being evaluated. The title may be used in further promotion of the EIA Trial and thus should be understandable to a wide range of persons.

*Question 4: – Context* – This question provides for inclusion of background or contextual information that may assist Assessment Panels understand the significance of the research impact, i.e. how the problem to be solved was identified, the nature of contact with end-users or beneficiaries etc. It should not be more than 200 words; neither should it repeat any information given elsewhere in the template.

*Question 5: Summary of the Case Study Impact* – This section should be a brief statement of the specific impact described in the case study and the link to the underlying research. It should not repeat information contained elsewhere in the submission.

*Question 6: – Details of the Impact* – This section should provide a discussion of the how the research in the following Questions (7 and 8) led to the claimed impact. As well as drawing the link between the research and the impact this discussion should also explain the process whereby the research was adopted, incorporated or otherwise used to produce impact for the claimed beneficiaries. The discussion should further outline the reach and significance of the impact.

It should also describe the impact within the wider body of research leading to the impact showing the research groupings specific contribution.

Further detail of information that should be included in this section is included on the template in Appendix 1.

*Question 7: Research underpinning Impact: –* This section should outline the key research findings that underpinned the impact. It should provide details of what research was undertaken, over what time period and l the people involved – other than the primary contributors listed in question 9(b). Whilst a timeline of the research undertaken can be included, this section should not be simply a chronology of events but should detail key research findings and progress of ideas that resulted in the impact.

*Question 8: – Research outputs from research underpinning impact* – This section should provide full references to the key outputs arising from the research outlined in Question 7. Up to 10 references may be included. These may include references spanning the full range of ERA eligible outputs including creative works, patents etc. where relevant to a case study. The references will be a key factor enabling the Assessment Panels to assess the quality of research underpinning the impact. All outputs

must be capable of being sourced by the Assessment Panel, or if difficult to access, must be available to the Panels on request.

*Question 9: – Additional information*

*(a) Validation of the impact* – The EIA Trial will take a "verifiable approach" to validating claimed impact, rather than a "verified" approach; that is, claims should be capable of being verified through references and material provided in this section. This section should therefore list sources that could, if required, provide evidence to support the impact claims. These could include beneficiaries who could be contacted by Assessment Panels to corroborate claims, reports or other material in the public domain which would support impact claims and/or confidential reports which could be provided by the institution to the Assessment Panel to corroborate impact claims.

*(b) People* – This section should contain the names and positions of the staff who have made a primary contribution to the research impact case study. A primary contribution may come from employed staff, adjunct staff, HDR students and end-users or beneficiaries of the research. It is not meant to be an exhaustive list but sufficient to validate their link to the institution and the claim to impact. It should include details of their years of employment at the institution during the 20 year assessment period on the project underpinning the case study. Where it is possible to outline the contribution of each person to the research impact case study (their part in the research rather than percentage of contribution) this should also be included.

Higher Degree by Research (HDR) students should be listed at this question with similar details as for staff above.

*(c) Research and Investment Income* – Research income obtained to prosecute the research or the research impact should be listed at this question as should any further investment income used to realise the impact, e.g. university or external investment associated with technology development or transfer, patent and Intellectual Property costs. Recognising that income may have been received over the 20 year period of assessment, a standard table has not been provided for income received. This should be listed in free format, i.e. table, series of dot points, but in a manner which makes it clear to the Assessment Panel what income has been received to support the research and its impact.

The template in Appendix 1 contains word limits for each question. Whilst these are to be taken as a guide, each case study should be no more than 15 pages including the additional material contained in question 9.

**The underlying purpose of these questions is for the submitting institution to provide the Assessment Panels with sufficient, self-contained information to enable a reasonable assessment of the reach and significance of the claimed impact, the link to underlying research conducted by the research grouping and the research grouping's contribution to the claimed impact within the wider body of research.**

If further clarification is required concerning completion of the template in Appendix 1 it should be sought in the first instance from the institutional contact listed in Section 4.2 of these Guidelines.

### 2.5 Process for Submission and Closing Date

Completed submissions should be provided to each institution's Research Office. Internal processes for submissions, including internal deadlines and names of receiving officers for submissions will be determined by each institution.

Each institution will send their submissions to the ATN Office by 5.00pm Eastern Standard time, 31st August, 2012. Submissions should be a zip file comprising pdf documents for each case study submitted.

Each institution's EIA Submission should be accompanied by a signed Statement from the Vice Chancellor (or delegate) certifying (a) that all reasonable efforts have been made to verify that the information submitted as part of the submission is correct, accurate, and sufficiently comprehensive, (b) that the Submission has been prepared in accordance with the EIA Trial Guidelines and (c) granting permission for the Submission material to be used by relevant parties for the purpose of the EIA Trial.

The Certification Statement is contained in Appendix 3.

### 2.6 Verification of Impact Claims

The Assessment Panels realise that providing data to conclusively verify each claim of high value research impact would impose a large administrative overhead for institutions and could result in submissions which are excessively lengthy. The emphasis in Submissions for this EIA trial will therefore be on data and claims which *are verifiable* rather than data or claims which *are verified* in the Submission text.

The Certification Statement in Appendix 3 includes a statement to the effect that institutions have the data, testimonies, material or other information as relevant, to verify claims made in Submissions and would be able to produce such information should they be so required to do.

The ATN/Go8 EIA trial will seek to build on the considerable material and examples gathered by the UK REF providing possible evidence of impact[1]. Examples of impact for many of the disciplines within this trial are contained in Appendix 2. Note that these examples are provided as a guide to the range of potential impacts which may be used in case studies. The lists are not exhaustive or exclusive and do not imply rank order. Submissions are not expected to be aligned with these examples and it may be possible for a case study to demonstrate more than one type of impact from, or in addition to those examples provided.

Institutions should also satisfy themselves that they have obtained all necessary consents for the use of information contained in the submissions.

# 3 EVALUATION

## 3.1 The Process for Evaluating Submissions

There will be two Assessment Panels for each of the four broad Sectors. Each Panel will comprise a mix of end-user representatives with expertise in the broad range of disciplines represented by the cluster and academic staff with disciplinary expertise. The end-users will constitute the majority of the Assessment Panel and shall also provide the Chair for each Assessment Panel. The Assessment Panels will be constituted to ensure, as far as possible, that the membership reflects the broad range of disciplines covered within the Sector – particular attention will be paid to Sectors B and C (Economic Development and Society) which cover a larger number of disparate disciplines.

Following receipt of Submissions, the ATN and Go8 Offices will distribute them to each Assessment Panel along with guidelines on evaluation research impact submissions. These guidelines will point Assessment Panel members to the range of possible impacts as provided in Appendix 2.

## 3.2 Scoring Index

Each Case Study will be assessed according to the Reach and Significance of the impact. This is in keeping with the UK's REF Impact Assessment Criteria with the following definitions:

- Reach: The spread or breadth of influence or effect on the relevant constituencies;
- Significance: the intensity of the influence or effect.

The Assessment Panel will assess each Case Study against overall Reach and Significance rather than assessing each component separately. Following assessment, a rating will be assigned to each Case Study according to the following scale:

- A = Outstanding impacts in terms of reach and significance. Adoption of the research has produced an outstanding social, economic, environmental and/or cultural benefit for the wider community, regionally within Australia, nationally or internationally.
- B = Very considerable impacts in terms of their reach and significance. Adoption of the research has produced a significant social, economic, environmental and/or cultural benefit for the wider community, regionally within Australia, nationally or internationally.
- C = Considerable impacts in terms of their reach and significance. Adoption of the research has produced new policies, products, attitudes, behaviours and/or outlooks in the end-user community.
- D = Recognised but modest impacts in terms of their reach and significance. There has been engagement of researchers with the end-user community to address a social, economic, environmental and/or cultural issue, regionally within Australia, nationally or internationally.
- E = The research impact is of limited reach or significance. Research has had limited or no identifiable social, economic, environmental and/or cultural outcome, regionally within Australia, nationally or internationally.
- Not classified – The impact was not underpinned by research or the link between the research and the claimed impact has not been demonstrated to the Assessment Panel's satisfaction.

## 3.3 Multi-Disciplinary Research

The structuring of submissions around SEO Codes (as opposed to more disciplinary focussed FOR Codes) is expected to assist the assessment of research which is inter-disciplinary and multidisciplinary. However, in cases where Assessment Panels do not consider that they have the breadth of expertise to adequately assess submissions and where they feel the submission may be more accurately assessed in another panel they may refer it to a different Assessment Panel for consideration. In cases where the submission spans the expertise of more than one Assessment Panel it will be referred to a meeting of the Chairs of Assessment Panels for evaluation.

1 See REF 2014 Panel Criteria and Working Methods, Sections A3, B3, C3 and D3 http://www.hefce.ac.uk/research/ref/pubs/2012/01_12/

# 4 FURTHER INFORMATION

## 4.1 Confidentiality of Information

Given that some material contained in Impact Case Studies may be commercial in confidence to the submitting unit or may contain intellectual property or other sensitive information, members of Assessment Panels will be required to sign a Confidentiality Agreement as a condition of panel membership. This will include an undertaking that information contained in submissions may be used by Assessment Panel members only for the purpose of the EIA Trial.

Submissions shall not be disclosed during the assessment period to any other person except Assessment Panel members and the EIA Trial project team. All reasonable steps shall be taken to ensure that other people do not have access to the submissions.

## 4.2 Contact officers

Whilst information on the Trial will be maintained on the EIA Trial website, each participating institution has a designated contact officer from whom further information can be obtained (listed below).

Charles Darwin University:
Jenny Carter
Director, Office of Research & Innovation
Jenny.Carter@cdu.edu.au
08 8946 6708

Curtin University:
Charlie Thorn
Director, Office of Research and Development
C.Thorn@curtin.edu.au
08 9266 9062

Queensland University of Technology:
Michael McArdle
Director, Office of Research
m.mcardle@qut.edu.au
07 3138 5376

RMIT University:
Lois Fitz-Gerald
Executive Director, Office for Research
lois.fitz-gerald@rmit.edu.au
03 9925 4603

University of Melbourne:
Shane Wood
Manager, ERA Project Team
woos@unimelb.edu.au
03 8344 2072

University of New South Wales:
Murray Green
Deputy Director & Senior Data Analyst, ERA Office
murray.green@unsw.edu.au
02 9385 8035

University of Newcastle:
Lyn McBriarty
Director, Research Services
lyn.mcbriarty@newcastle.edu.au
02 4921 5300

University of Queensland:
Ian Harris
Director, Research Partnerships
i.harris@research.uq.edu.au
07 3365 3559

University of South Australia:
Tracey Swift
Director, Research and Innovation Services
tracey.swift@unisa.edu.au
08 8302 3471

University of Tasmania:
Mark Hochman
Senior Advisor, Research Policy and Strategy
mark.hochman@utas.edu.au
03 6226 6371

University of Technology, Sydney:
Jeffrey Francis
Director, Research and Innovation Office
Jeffrey.Francis@uts.edu.au
02 9514 1253

University of Western Australia:
Elizabeth Przywolnik
Senior Project Officer, Research Assessment Unit
elizabeth.przywolnik@uwa.edu.au
08 6488 4714

In addition to individual institution contact officers, further information can also be sought from:

ATN Directorate:
Matthew Brown
Senior Policy Analyst – Research
matt.brown@atn.edu.au
08 8302 7610

Group of Eight Secretariat:
Ian McMahon
Director Research
ian.mcmahon@go8.edu.au
02 6239 5488

EIA Trial Program Manager:
Mark Hochman
mark.hochman@atn.edu.au
0408 843 325

# APPENDIX 1 – EIA RESEARCH IMPACT TEMPLATE

## 1. INSTITUTION

## 2. UNIT OF ASSESSMENT

Primary SEO Code:

Secondary SEO Code (if needed):

Secondary SEO Code (if needed):

## 3. TITLE OF CASE STUDY

## 4. CONTEXT

## 5. SUMMARY OF THE CASE STUDY IMPACT (indicative maximum 100 words)

This section should briefly state what specific impact is being described in the case study and the link to the underlying research.

## 6. DETAILS OF THE IMPACT (indicative maximum 750 words)

This section should provide a narrative, with supporting evidence, to explain:

- How the research underpinned (made a distinct and material contribution to) the impact.
- The nature and extent of the impact.

The following should be provided:

- A clear explanation of the process or means through which the research led to, underpinned or made a contribution to the impact (for example, how it was disseminated, how it came to influence users or beneficiaries, or how it came to be exploited, taken up or applied).
- Where the submitted unit's research was part of a wider body of research that contributed to the impact (for example, where there has been research collaboration with other institutions), the case study should specify the particular contribution of the submitted unit's research and acknowledge other key research contributions.
- Details of the beneficiaries – who or what community, constituency or organisation has benefitted, been affected or impacted on.
- Details of the nature of the impact – how they have benefitted, been affected or impacted on.
- Evidence or indicators of the extent of the impact described, as appropriate to the case being made.
- Dates of when these impacts occurred.

## 7. RESEARCH UNDERPINNING IMPACT (indicative maximum 500 words)

This section should outline the key research insights or findings that underpinned the impact, and provide details of what research was undertaken, when, and by whom. References to specific research outputs that embody the research described in this section, and evidence of its quality, should be provided in section 8.

Details of the following should be provided in this section:

- The nature of the research insights or findings which relate to the impact claimed in the case study.
- An outline of what the underpinning research produced by the submitted unit was (this may relate to one or more research outputs, projects or programmes).
- Dates of when it was carried out.
- Any relevant key contextual information about this area of research.

## 8. RESEARCH OUTPUTS FROM RESEARCH UNDERPINNING IMPACT (maximum of ten references)

This section should provide references to key outputs from the research described in the previous section, and evidence about the quality of the research. These may also include references spanning creative works, patents etc where relevant to a case study.

Include the following details for each cited output:

- Author(s).
- Title.
- Year of publication.
- Type of output and other relevant details required to identify the output (for example journal title and issue).
- Details to enable the panel to gain access to the output, if required (for example, a DOI or URL) or can be supplied by the institution on request.

All outputs cited in this section must be capable of being made available to panels.

Evidence of the quality of the research must also be provided in this section.

## 9. ADDITIONAL INFORMATION

**a) Validation of the Impact**
(indicative maximum of 10 references)

This section should list sufficient sources that could, if audited, corroborate key claims made about the impact of the unit's research. These could include, as appropriate to the case study, the following external sources of corroboration (stating which claim each source provides corroboration for):

- Reports, reviews, web links or other documented sources of information in the public domain.
- Confidential reports or documents (if listed, these must be made available by the institution if audited).
- Individual users/beneficiaries who could be contacted by the Assessment Panel to corroborate claims.
- Factual statements already provided to the institution by key users/beneficiaries, that corroborate specific claims made in the case study and that could be made available to the Assessment Panel by the institution if audited.

**b) People**

**i. Staff**

**ii. Others** (including research students, end-users or beneficiaries of the research)

**c) Research and Investment Income**

This section is free format but the following should be provided for each grant or source of income used to prosecute the research or the impact:

- Who the grant was awarded to.
- The grant title.
- Sponsor.
- Period of the grant (with dates).
- Value of the grant.

This template is modelled on a combination of REF3A and REF5A templates from the 2014 UK REF. Their use for this EIA Impact Trial is acknowledged.

# APPENDIX 2 – EXAMPLES OF OUTCOMES WHICH MAY CONSTITUTE RESEARCH IMPACT

The template of examples in Appendix 2 draws heavily on examples of research impact drawn from the UK REF, Panel Criteria and Working Methods (REF 01.2012) at http://www.ref.ac.uk/pubs/2012-01/ In particular these examples are taken from Sections A3, B3, C3 and D3 of the referenced document and consolidated under the broad SEO Sectors to be used in the EIA Trial.

Any researchers wishing further information on impact assessment within the 2014 UK REF are referred to the above referenced document and also to the Assessment Framework and Guidance on Submissions (REF 02.2011) http://www.ref.ac.uk/pubs/2011-02/

In considering the examples in Appendix 2 the following points should be borne in mind.

These examples are:

- A guide to the range of potential impacts that may be eligible in case studies;
- Illustrative rather than prescriptive;
- A set of examples rather than a comprehensive listing;
- An attempt to "best fit" examples given for the four panels of the UK REF into the EIA's four SEO sectors.

These examples are not:

- An exhaustive or exclusive list;
- Mutually incompatible, i.e. one case study may result in a range of impacts – included in this list or additional to this list;
- Indicative of a rank order of impact.

The Assessment Panels recognise that research impact(s) can occur in a variety of ways and a variety of settings, and may have single or multiple beneficiaries. Impact can take many forms and the Assessment Panel encourages case studies that describe impacts of a societal, cultural, economic or environmental nature whether they follow the examples given or not.

Institutions should submit their strongest case studies for assessment rather than provide a range of case studies of varying impact.

## SECTOR A: DEFENCE

Impacts where the beneficiaries are the government, industries or other organisations or agencies connected with national security. Examples of impacts may include:

- Technologies or products which are used in defence related industries.
- Software or algorithms which enable detection or interception of malware or hostile signals.
- Development of technical standards which influence policies, designs or protocols.
- Understandings of international relationships, including historical analysis, which enhance diplomatic relationships.
- Development of communications technologies or protocol s or standards which find broader application within the wider community.
- Health outcomes that have broader application in the wider community.
- Waste management and contaminant remediation that have broader application in the wider community.

**Further specific examples may be found in many other particular sectors and the above sectors are chosen only with the intention of demonstrating some specific examples of impact.**

## SECTOR B: ECONOMIC DEVELOPMENT

Impacts where the beneficiaries are usually industries or industry sectors, either new or established, or other types of organisation which undertake activity that creates wealth. Examples of research impact may include:

- The performance of an existing business has been improved through the introduction of new, or the improvement of existing, products, processes or services; the adoption of new, updated or enhanced technical standards and/or protocols.
- The strategy, operations or management practices of a business have improved.
- Jobs have been created or protected.
- Improved business performance measures, for example, sales, turnover, profits or employment associated with new or improved products, processes or services.
- Improved effectiveness of workplace practices.
- A new business sector or activity has been created.
- Performance has been improved, or new or changed technologies or processes adopted, in companies or other organisations through highly skilled people having taken up specialist roles that draw on their research, or through the provision of consultancy or training that draws on their research.
- Potential future losses have been mitigated by improved methods of risk assessment and management in safety or security critical situations.

**The examples above are general in nature and relate to many industry sectors. More specific examples in particular industry sectors may include the following:**

*In agriculture*

- Production, yields or quality have increased or level of waste has been reduced.
- Decisions by regulatory authorities have been positively influenced.
- Costs of production, including food, have been reduced.
- Husbandry methods have improved.
- Management practices in production businesses have resulted in improved efficiency or animal welfare.

*In the health sector*

- Policies have been introduced which have had a positive impact on economic growth or incentivising productivity.
- The costs of treatment or healthcare have reduced as a result of evidence based changes in practice.
- Gains in productivity have been realised as a result of evidence based changes in practice.
- The roles and/or incentives for health professionals and organisations have changed, resulting in improved service delivery.

*In the professional services sector*

- Professional standards, guidelines or training have been influenced by research.
- Practitioners/professionals have used research findings in conducting their work.
- The quality or efficiency of a professional service has improved.

**Further specific examples may be found in many other particular sectors and the above three sectors are chosen only with the intention of demonstrating some specific examples of impact.**

## SECTOR C: SOCIETY

**Impacts on society may be many and varied in nature. Some impacts in selected areas of society are given below as examples or guides of what may constitute impact in Sector B, Society.**

*Impacts on health and welfare*

Impacts where the beneficiaries are individuals and groups whose quality of life has been enhanced (or potential harm mitigated)

- Public health and well-being has improved.
- A new clinical or lifestyle intervention (for example, drug, diet, treatment or therapy) has been developed, trialled with patients, related or other groups (for example, prisoners, community samples), and definitive (positive or negative) outcome demonstrated.
- A new diagnostic or clinical technology has been adopted.
- Disease prevention or markers of health have been enhanced by research.
- Care and educational practices have improved.
- Clinical, dietary or healthcare guidelines have improved.
- The control of diseases has been improved.
- The costs of treatment or healthcare have reduced.

*Impacts on society, culture and creativity*

Impacts where the beneficiaries are individuals, groups of individuals, organisations or communities whose knowledge, behaviours have been influenced

- Beneficial changes to social policy or practice have been informed by research.
- Enhancements to heritage preservation, conservation and presentation; the latter including museum and gallery exhibitions.
- Production of cultural artefacts, including for example, films, novels and TV programmes.
- Public or political debate has been shaped or informed; this may include activity that has challenged established norms, modes of thought or practices.
- Enhanced cultural understanding of issues and phenomena; shaping or informing public attitudes and values.
- Developing stimuli to tourism and contributing to the quality of the tourist experience.
- Contributing to processes of commemoration, memorialisation and reconciliation.
- The awareness, attitudes or understanding of (sections of) the influenced public have been informed, and their ability to make informed decisions on issues improved, by engaging them with research.

*Impacts on public policy and services*

Impacts where the beneficiaries are usually government, public sector, and charitable organisations and societies, either as a whole or groups of individuals in society, through the implementation of policies

- Policy decisions or changes to legislation, regulations or guidelines have been informed by research evidence.
- The implementation of a policy (for example, health, environment or agricultural policy) or the delivery of a public service has been enhanced.
- The quality, accessibility, acceptability or cost-effectiveness of a public service has been improved.
- The public has benefitted from public service improvements.

*Impacts on practitioners and services*

Impacts where beneficiaries are organisations or individuals, including service users involved in the development of and delivery of professional services

- Professional standards, guidelines or training have been influenced by research.
- Practitioners/professionals have used research findings in conducting their work.
- The quality or efficiency of a professional service has improved.
- New or modified professional or technical standards and codes of practice.
- There has been a positive influence on professional standards, guidelines or training.
- Expert and legal work have been informed by research.

**Further specific examples may be found in many other particular sectors and the above sectors are chosen only with the intention of demonstrating some specific examples of impact.**

## SECTOR D: ENVIRONMENT

*Impacts on the environment*

Impacts where the key beneficiary is the natural or built environment

- The environment has been improved through the introduction of new product(s), process(es) or service(s); the improvement of existing product(s), process(es) or services; or the enhancement of strategy, operations or management practices.
- New methods, models, monitoring or techniques have been developed that have led to changes or benefits.
- Policy debate on the environment, environmental policy decisions or planning decisions have been informed or changed by research evidence.
- The management or conservation of natural resources, including energy, water and food, has been positively influenced or improved.
- Planning decisions have been informed by research.
- Sales of new products or improvements in existing products that bring quantifiable environmental benefits.

**Further specific examples may be found in many other particular sectors and the above sectors are chosen only with the intention of demonstrating some specific examples of impact.**

# APPENDIX 3 – CERTIFICATION STATEMENT

(modified from ERA 2012 Certification requirements, ARC, 2012)

This Certification Statement must be signed Deputy Vice-Chancellor (Research) or equivalent of each participating institution certifying that:

**1.** The person signing the Certification Statement has made all reasonable efforts to verify that the information submitted as part of the submission is correct, accurate, and sufficiently comprehensive.

**2.** The submission complies with the ATN/Go8 EIA Trial Guidelines

**3.** In compiling its submission, the institution has complied with relevant privacy requirements and taken reasonable steps to ensure awareness of the inclusion in the submission of relevant information and of its use in the EIA Trial process on the part of:

**a.** all eligible researchers referred to in the submission who maintain any continuing affiliation with the institution; and

**b.** to the maximum extent feasible, all eligible researchers referred to in the submission who no longer maintain an affiliation with the institution.

**4.** The institution grants to the ATN/Go8 Peak Governance Group a permanent, irrevocable, non-exclusive licence to use the material submitted as part of the EIA Trial, for the purposes of Trial and for any subsequent policy or program development.

**5.** The institution acknowledges and agrees that outcomes of the EIA Trial evaluation will be distributed and published in the manner described in the EIA Guidelines.

**6.** The institution has in its possession such material as may be required to verify claims of impact as contained in the institution's Submission(s) to the EIA Trial.

.....

Signature of DVC (Research) or equivalent

.....

Name of DVC (Research) or equivalent

# GUIDELINES FOR ASSESSMENT PANELS

ATN/Go8 Excellence in Innovation for Australia (EIA) TRIAL

## 1. BACKGROUND

The Excellence in Innovation for Australia (EIA) Trial is a study being undertaken by the Go8 and ATN groups of universities, the University of Newcastle, Charles Darwin University and the University of Tasmania to demonstrate and communicate the beneficial outcomes of research to government, business and the community.

The Trial aims to identify and demonstrate the contribution that high quality research has made to the economic, social, cultural and environmental benefit of society. Implicit in this goal is the purpose to investigate the means by which these benefits may best be recognised, portrayed and assessed by institutions and government.

## 2. GENERAL PRINCIPLES OF THE EIA TRIAL

The EIA Trial aims to demonstrate and communicate the beneficial outcomes of research to government, business and the community by:

- Identifying good research outcomes;
- Justifying the claims being made by institutions of good outcomes, and
- Identifying the research underpinning the outcomes/impact.

It is recognised that this EIA Trial will operate independently of other assessment mechanisms such as ERA. ERA seeks to measure the quality of research undertaken within institutions; the EIA Trial will seek to assess the impact of research undertaken within institutions and also examine whether a link exists between demonstrated impact and the quality of underpinning research.

The Trial will be underpinned by the following general principles:

1. The development of the EIA will look to leverage the work performed in developing the UK REF where appropriate
2. The EIA will be retrospective rather than prospective
3. There be no explicit excellence threshold for submissions but the impact should show a link to underpinning research. Assessment Panels will examine the quality of underpinning research through information provided on the template in Appendix 1 of the Submission Guidelines and will also seek to assess any link between research quality and demonstrated impact.
4. The EIA should take a verifiable approach to evidence in submissions (as opposed to verifying all evidence)
5. Impact will be primarily assessed by means of case-studies for all disciplines. Performance data for the underpinning research will also be included in the impact submissions and Assessment Panels will seek to investigate any systematic links between the impact and underpinning research performance data.
6. Research underpinning a submitted impact should be attributed to the institution(s) at which the research was generated regardless of any subsequent change in affiliation of researchers involved (including where academics have retired or left academia). It is important to note that the focus of this Trial is to demonstrate the assessment of impact through case studies and not the assessment of individual institution's impact.

These principles are aimed at minimising the effort required by individual institutions to participate in the Trial whilst ensuring that the methodologies employed are robust, compatible with current practice elsewhere and able to deliver the purpose of the EIA Trial.

## 3. ROLES AND RESPONSIBILITIES OF ASSESSMENT PANELS

### 3.1 Main role – assessment of case studies

This EIA Trial will use the same cluster groupings contained within Socio-Economic Objective (SEO) Classifications maintained by the Australian Bureau of Statistics (ABS). The four broad SEO clusters for evaluation in this Trial are:

- Sector A – Defence
- Sector B – Economic Development
- Sector C – Society
- Sector D – Environment

Research impact in this Trial will be primarily assessed by means of case-studies for all disciplines. Guidelines governing completion and submission of case studies may be found at both the Go8 website http://go8.edu.au/university-staff/programs-_and_-fellowships-1/atngo8-excellence-in-innovation-for-australia-trial-excellence-in-innovation-for-australia-eia and the ATN website http://www.atn.edu.au/eia/index.htm It is recommended that members of Assessment Panels read these Assessment Panel Guidelines in conjunction with the Submission Guidelines from the above web pages.

There are 12 institutions participating in the EIA Trial. In recognition of the varying ages, sizes and academic profiles of participating institutions, maximum and minimum thresholds have been set for submission of case studies. These are:

- A maximum of five case studies for each of the four SEO Sectors (i.e. 20 in total)
- A minimum of two case studies in three of the four SEO Sectors (i.e. 6 in total).

Consequently it is expected that there will approximately 120–150 case studies in total, spread across the four broad SEO sectors above.

The EIA Trial will be a process of expert review and thus panel members will be required to read the case studies allocated to their panel and assess them according to the definition of impact and the criteria outlined below. Examples of impact are given in Appendix 1 and examples of impact indicators are in Appendix 2 – note that these are examples only rather than comprehensive listings and Panels are free to add or expand the range of examples and impact indicators as they consider case study submissions.

The Trial will assess research impacts which have occurred in the period 1st January, 2007 – date of submission (ie, roughly five and a half years). Recognising that in some cases, impact may occur quickly and in others that it may take considerable time for impacts of research to be demonstrated, the impacts submitted should relate to research which occurred during the impact period, or in the 15 year period preceding the claimed impact, i.e. 1st January, 1992 – 31st December, 2006.

Exceptions to this time frame may still be allowed if justified in the application.

### *3.1.1 Definition of impact*

For the purpose of the EIA, impact is defined in a similar way as for the UK REF, i.e. "an effect on, change, benefit to the economy, society, culture, public policy or services, health, the environment or quality of life beyond academia. It includes, but is not limited to, an effect on, change or benefit to:

- The activity, attitude, awareness, behaviour, capacity, opportunity, performance, policy, practice, process or understanding
- Of an audience, beneficiary, community, constituency, organisation or individuals
- In any geographic location whether locally, regionally, nationally or internationally.

It includes the reduction or prevention of negative effects including the harm, risk or cost arising from negative effects.

It does not include impact on research or the advancement of academic knowledge, nor impacts on students, teaching or other activities within the submitting institution. It may include impacts within the higher education sector, including teaching or students where they extend significantly beyond the submitting higher education institution (slightly modified from UK REF, Assessment Framework and Guidance on Submissions, Annex C, July, 2011).

### *3.1.2 Impact Assessment Criteria*

Each Case Study will be assessed according to the Reach and Significance of the impact. This is in keeping with the UK's REF Impact Assessment Criteria with the following definitions:

- Reach: The spread or breadth of influence or effect on the relevant constituencies;
- Significance: the intensity of the influence or effect.

The Assessment Panel will assess each Case Study against overall Reach and Significance rather than assessing each component separately. A scoring system for relevant questions in the submission template is described below and may assist Assessment Panel members in determining an overall ranking for Reach and Significance. Following assessment, a rating will be assigned to each Case Study according to the following scale:

- A = Outstanding impacts in terms of reach and significance. Adoption of the research has produced an outstanding social, economic, environmental and/or cultural benefit for the wider community, regionally within Australia, nationally or internationally.
- B = Very considerable impacts in terms of their reach and significance. Adoption of the research has produced a significant social, economic, environmental and/or cultural benefit for the wider community, regionally within Australia, nationally or internationally.
- C = Considerable impacts in terms of their reach and significance. Adoption of the research has produced new policies, products, attitudes, behaviours and/or outlooks in the end-user community.

- D = Recognised but modest impacts in terms of their reach and significance. There has been engagement of researchers with the end-user community to address a social, economic, environmental and/or cultural issue, regionally within Australia, nationally or internationally.
- E = The research impact is of limited reach or significance. Research has had limited or no identifiable social, economic, environmental and/or cultural outcome, regionally within Australia, nationally or internationally.
- Not classified – The impact was not underpinned by research or the link between the research and the claimed impact has not been demonstrated to the Assessment Panel's satisfaction.

### *3.1.3 Scoring index for rankings*

In determining the above rankings, Assessment Panels may find it helpful to use a scoring system for relevant criteria within the case study template. Questions 6 and 9 lend themselves to scoring criteria as below.

*Question 6 – Details of the Impact*

This question asks for information on two elements of the impact:

*i. How the research underpinned (made a distinct and material contribution to) the impact, and*

*ii. The nature and extent of the impact.*

The following scoring scale will apply to each element:

*i. How the research underpinned (made a distinct and material contribution to) the impact*

*5 – the link between the underpinning research and the claimed impact is clearly demonstrated.*

*4 – the link between the underpinning research and the claimed impact is discernible from the information provided.*

*3 – the link between the underpinning research and the claimed impact can be inferred from the material presented but is not clearly demonstrated.*

*2 – there is a possible link between the underpinning research and the claimed impact but it is not clear.*

*1 – there is no discernible link between the underpinning research and the claimed research.*

*ii. The nature and extent of the impact.*

*5 – the benefit or impact on a community, constituency or organisation is clearly demonstrated.*

*4 – the benefit or impact on a community, constituency or organisation is discernible from the information provided.*

*3 – the benefit or impact on a community, constituency or organisation can be inferred from the material presented but is not clearly demonstrated.*

*2 – there is a possible benefit or impact on a community, constituency or organisation but it is not clear.*

*1 – There is no discernible benefit or impact on a community, constituency or organisation.*

*Question 9 – Validation of impact*

*5 – The references provided to validate the research impact have convinced the Assessment Panel that the key impact claims have been corroborated.*

*4 – The references provided to validate the research impact have convinced the Assessment Panel that the key impact claims are probably corroborated.*

*3 – The references provided to validate the research impact have convinced the Assessment Panel that the key impact claims are possibly corroborated.*

*2 – The references provided have not convinced the Assessment Panel that the key impact claims have been corroborated but further information could provide a more convincing corroboration.*

*1 – The references provided have not convinced the Assessment Panel that the key impact claims have been corroborated and it is unlikely that further information could provide a more convincing corroboration.*

A scoring template covering these questions and questions 7 and 8, (research underpinning impact and research outputs from research underpinning impact) will be provided to members of the Assessment Panel.

There will be eight Assessment Panels for the EIA Trial, two for each of the four broad SEO sectors. Each assessment panel will comprise approximately 12 members – 8 or 9 end-users from sectors represented in each of the broad SEO codes and 3–4 researchers from academic disciplines whose research may lead to outcomes in the broad SEO code. Each Assessment Panel will be chaired by an end-user panel member. End-users will be senior individuals from the private or public sector with experience in commissioning, applying or otherwise benefitting from research in one or several of the disciplines covered by the broad SEO sector.

*3.1.4 Consideration of Multi-Disciplinary Research*

The structuring of submissions around SEO Codes (as opposed to more disciplinary focussed FOR Codes) is expected to assist the assessment of research which is inter-disciplinary and multidisciplinary. However, in cases where Assessment Panels do not consider that they have the breadth of expertise to adequately assess submissions and where they feel the submission may be more accurately assessed in another panel they may refer it to a different Assessment Panel for consideration. In cases where the submission spans the expertise of more than one Assessment Panel it will be referred to a meeting of the Chairs of Assessment Panels for evaluation.

*3.1.5 Assessment Briefing Sessions*

The assessment of impact is a process of expert review; however the assessment criteria are broad and may give opportunity for a variety of interpretations. To assist consistency in application of the assessment criteria, each Assessment Panel will undertake briefing sessions at an early stage of the assessment process. These sessions will involve Assessment Panel members examining a range of sample impact case studies with the purpose of developing a common understanding of the application of impact descriptors to case studies. A secondary purpose of these exercises will be for the Assessment Panel to suggest any panel specific indicators of impact in addition to those provided in Appendix 2.

*3.1.6 Panel decisions*

Decisions concerning judgement in the assessment of impact against these criteria will remain the responsibility of the Assessment Panels and each Panel will be required to reach a consensus decision concerning the rating of each case study submitted to their Assessment Panel. The decision of the Assessment Panel will be final and not subject to ratification by any other body within the EIA governance structure.

Near the conclusion of the assessment process there will be a meeting of Assessment Panel chairs to

- discuss/resolve any issues with submissions crossing panel boundaries, e.g. multi-sector or disputed sector submissions
- debrief on the operation of the panels and the assessment process

### 3.2 Additional role

In addition to the assessment of research impact case studies, the Assessment Panels will be asked to comment on three other matters:

1. Whether there is a discernible link between the research impact outlined in the case study and the quality of the underpinning research. Quality may be deduced from several sections of the completed template but principally questions 8 and 9c;
2. Whether there is any discernible link between the research impact outlined in the case study and any underlying research performance metrics. These may be drawn from several sections of the completed template but principally question 9, and
3. Any general observations on the assessment process, including changes to Guidelines or Instructions to Assessment Panel Members that may improve the operation of a future EIA exercise.

### 3.3 Timetable for Assessment Panel workings

| Date | Event/Action |
|---|---|
| June/July/August 2012 | Institutions: collect trial data |
| 27 June TBC | Project Steering Group meeting |
| 28 June 2012 | Development Advisory Board meeting Canberra |
| 2 July 2012 | Letters go out to prospective panel members |
| 9 July – 20 July | Responses received and/or followed up |
| Week commencing July 23 or 30 | Project Steering Group review panel memberships and Assessment guidelines |
| 10 August 2012 | Briefing materials forwarded to panel members<br>Polite declines to any panel members not required |
| 16–31 August 2012 | Briefings of panel members (multiple sessions, including DAB Chair) |
| 31 August 2012 | EIA submissions finalised at Research Offices |
| 3 September 2012 | EIA submissions forwarded to ATN |
| 3–7 September 2012 | Materials organised and collated for panels |
| 7 September 2012 | Materials forwarded to individual panel members (hard copies?) |
| 7–21 September 2012 | Reading time for panel members |
| 24 September – 5 October 2012 | 8 x 1 day panel sessions |
| 8–22 October 2012 | Implementation Group: Review of assessments and input to draft EIA report.<br>Draft report written (Mark H)and submitted to ATN and Go8 |
| 24 October 2012 | Draft report forwarded to Project Steering Group |
| **31 October 2012** | **Project Steering Group: comment/consider draft EIA report** |
| 7 November 2012 | Development Advisory Board: comment/advice on draft EIA report |
| Virtual industry panel: review and comment on draft EIA report | |
| 14 November 2012 | ATN VCs/Go8 Board (possibly out of session): considers/approves EIA report |
| **28 November 2012** | **Symposium and public release of EIA report** |

### 3.4 Confidentiality of information and conflicts of interest

All members of Assessment Panels including those providing secretariat support must keep confidential all material and information provided as part of the EIA assessment process. To this end all panel members will be asked to sign confidentiality agreements.

Where members of Assessment Panels have a conflict of interest in assessing specific case studies, i.e. case studies describing take up of research by a rival company to one of the end-user panel members, then this conflict must be declared to the panel chair as soon as the individual becomes aware of the potential conflict. The panel chair will decide the appropriate action on a case by case basis.

# NOTES TO ACCOMPANY APPENDICES 1 AND 2 – EXAMPLES AND INDICATORS OF OUTCOMES WHICH MAY CONSTITUTE RESEARCH IMPACT

The template of examples in Appendix 1, and indicators of impact in Appendix 2 draw heavily on examples of research impact drawn from the UK REF, Panel Criteria and Working Methods (REF 01.2012) at http://www.ref.ac.uk/pubs/2012-01/ In particular these examples are taken from Sections A3, B3, C3 and D3 of the referenced document and consolidated under the broad SEO Sectors to be used in the EIA Trial.

Any researchers wishing further information on impact assessment within the 2014 UK REF are referred to the above referenced document and also to the Assessment Framework and Guidance on Submissions (REF 02.2011) http://www.ref.ac.uk/pubs/2011-02/

In considering the examples of impact in Appendix 1 and indicators in Appendix 2, the following points should be borne in mind.

These are:

- A guide to the range of potential impacts that may be eligible in case studies and/or indicators that may demonstrate impact;
- Illustrative rather than prescriptive;
- A set of examples rather than a comprehensive listing;
- An attempt to "best fit" examples and indicators given for the four panels of the UK REF into the EIA's four SEO sectors.

These examples are not:

- An exhaustive or exclusive list;
- Mutually incompatible, i.e. one case study may result in a range of impacts – included in this list or additional to this list;
- Indicative of a rank order of impact.

# APPENDIX 1 – EXAMPLES OF IMPACT BY SEO SECTOR

## SECTOR A: DEFENCE

Impacts where the beneficiaries are the government, industries or other organisations or agencies connected with national security. Examples of impacts may include:

- Technologies or products which are used in defence related industries.
- Software or algorithms which enable detection or interception of malware or hostile signals.
- Development of technical standards which influence policies, designs or protocols.
- Understandings of international relationships, including historical analysis, which enhance diplomatic relationships.
- Development of communications technologies or protocols or standards which find broader application within the wider community.
- Health outcomes that have broader application in the wider community.
- Waste management and contaminant remediation that have broader application in the wider community.

**Further specific examples may be found in many other particular sectors and the above sectors are chosen only with the intention of demonstrating some specific examples of impact.**

## SECTOR B: ECONOMIC DEVELOPMENT

Impacts where the beneficiaries are usually industries or industry sectors, either new or established, or other types of organisation which undertake activity that creates wealth. Examples of research impact may include:

- The performance of an existing business has been improved through the introduction of new, or the improvement of existing, products, processes or services; the adoption of new, updated or enhanced technical standards and/or protocols.
- The strategy, operations or management practices of a business have improved.
- Jobs have been created or protected.

- Improved business performance measures, for example, sales, turnover, profits or employment associated with new or improved products, processes or services.
- Improved effectiveness of workplace practices.
- A new business sector or activity has been created.
- Performance has been improved, or new or changed technologies or processes adopted, in companies or other organisations through highly skilled people having taken up specialist roles that draw on their research, or through the provision of consultancy or training that draws on their research.
- Potential future losses have been mitigated by improved methods of risk assessment and management in safety or security critical situations.

**The examples above are general in nature and relate to many industry sectors. More specific examples in particular industry sectors may include the following:**

*In agriculture*

- Production, yields or quality have increased or level of waste has been reduced.
- Decisions by regulatory authorities have been positively influenced
- Costs of production, including food, have been reduced.
- Husbandry methods have improved.
- Management practices in production businesses have resulted in improved efficiency or animal welfare.
- There are improvements in food and/or water security for a region, State or nation.

*In the health sector*

- Policies have been introduced which have had a positive impact on economic growth or incentivising productivity.
- The costs of treatment or healthcare have reduced as a result of evidence based changes in practice.
- Gains in productivity have been realised as a result of evidence based changes in practice.
- The roles and/or incentives for health professionals and organisations have changed, resulting in improved service delivery.

*In the professional services sector*

- Professional standards, guidelines or training have been influenced by research.
- Practitioners/professionals have used research findings in conducting their work.
- The quality or efficiency of a professional service has improved.

**Further specific examples may be found in many other particular sectors and the above three sectors are chosen only with the intention of demonstrating some specific examples of impact.**

## SECTOR C: SOCIETY

**Impacts on society may be many and varied in nature. Some impacts in selected areas of society are given below as examples or guides of what may constitute impact in Sector B, Society.**

*Impacts on health and welfare*

Impacts where the beneficiaries are individuals and groups whose quality of life has been enhanced (or potential harm mitigated)

- Public health and well-being has improved.
- A new clinical or lifestyle intervention (for example, drug, diet, treatment or therapy) has been developed, trialled with patients, related or other groups (for example, prisoners, community samples), and definitive (positive or negative) outcome demonstrated.
- A new diagnostic or clinical technology has been adopted.
- Disease prevention or markers of health have been enhanced by research.
- Care and educational practices have improved.
- Clinical, dietary or healthcare guidelines have improved.
- The control of diseases has been improved.
- The costs of treatment or healthcare have reduced.

*Impacts on society, culture and creativity*

Impacts where the beneficiaries are individuals, groups of individuals, organisations or communities whose knowledge, behaviours have been influenced

- Beneficial changes to social policy or practice have been informed by research.
- Enhancements to heritage preservation, conservation and presentation; the latter including museum and gallery exhibitions.
- Production of cultural artefacts, including for example, films, novels and TV programmes.
- Public or political debate has been shaped or informed; this may include activity that has challenged established norms, modes of thought or practices.
- Enhanced cultural understanding of issues and phenomena; shaping or informing public attitudes and values.

- Developing stimuli to tourism and contributing to the quality of the tourist experience.
- Contributing to processes of commemoration, memorialisation and reconciliation.
- The awareness, attitudes or understanding of (sections of) the influenced public have been informed, and their ability to make informed decisions on issues improved, by engaging them with research.
- Improvements in quality of life, well-being or happiness for individuals or organisations.
- Greater fairness and/or equity outcomes for individuals within organisations or at an organisational level.

*Impacts on public policy and services*

Impacts where the beneficiaries are usually government, public sector, and charitable organisations and societies, either as a whole or groups of individuals in society, through the implementation of policies

- Policy decisions or changes to legislation, regulations or guidelines have been informed by research evidence.
- The implementation of a policy (for example, health, environment or agricultural policy) or the delivery of a public service has been enhanced.
- The quality, accessibility, acceptability or cost-effectiveness of a public service has been improved.
- The public has benefitted from public service improvements.

*Impacts on practitioners and services*

Impacts where beneficiaries are organisations or individuals, including service users involved in the development of and delivery of professional services

- Professional standards, guidelines or training have been influenced by research.
- Practitioners/professionals have used research findings in conducting their work.
- The quality or efficiency of a professional service has improved.
- New or modified professional or technical standards and codes of practice.
- There has been a positive influence on professional standards, guidelines or training.
- Expert and legal work have been informed by research.

**Further specific examples may be found in many other particular sectors and the above sectors are chosen only with the intention of demonstrating some specific examples of impact.**

## SECTOR D: ENVIRONMENT

*Impacts on the environment*

Impacts where the key beneficiary is the natural or built environment

- The environment has been improved through the introduction of new product(s), process(es) or service(s); the improvement of existing product(s), process(es) or services; or the enhancement of strategy, operations or management practices.
- New methods, models, monitoring or techniques have been developed that have led to changes or benefits.
- Policy debate on the environment, environmental policy decisions or planning decisions have been informed or changed by research evidence.
- The management or conservation of natural resources, including energy, water and food, has been positively influenced or improved.
- Planning decisions have been informed by research.
- Sales of new products or improvements in existing products that bring quantifiable environmental benefits.

**Further specific examples may be found in many other particular sectors and the above sectors are chosen only with the intention of demonstrating some specific examples of impact.**

# APPENDIX 2 – INDICTORS OF IMPACT BY SEO SECTOR

## SECTOR A: DEFENCE

Indicators of impacts where the beneficiaries are the government, industries or other organisations or agencies connected with national security. Examples of indicators may include:

- Sales of products used by government, industries or other agencies connected with national security
- Adoption of technical standards which influence policies, designs or protocols.
- Traceable reference to research outcomes which have lead to enhanced diplomatic relationships.
- Adoption of communications technologies or protocols or standards which find broader application within the wider community
- Traceable references to research outcomes leading to improved training outcomes in defence forces
- Traceable references to research outcomes leading to improved cultural understandings in defence forces.

## SECTOR B: ECONOMIC DEVELOPMENT

Impacts where the beneficiaries are usually industries or industry sectors, either new or established, or other types of organisation which undertake activity that creates wealth. Example indicators of research impact may include:

- Sales of new products/services
- Other business performance measures including improved profitability, employment outcomes, take up of new products/services
- Evidence of improved cost effectiveness
- Evidence of service change
- Measures of improved business productivity, including improved processes, technology use, asset usage, customer satisfaction etc

**The examples above are general in nature and relate to many industry sectors. More specific example indicators in particular industry sectors may include the following:**

*In agriculture*

- New plant breeds
- Improved production, yields or quantities
- Reduced costs of production, including food or other agriculture
- Reduced levels of waste
- Changed codes, regulations or standards relating to production
- Stability of food production, availability of food/water, usage of food/water

*In the health sector*

- Measures of improved population health outcomes (clinical outcomes, public health outcomes)
- Measures of improved patient outcomes
- Measures of improved well-being
- Evidence of an enhanced patient experience
- Documented changes to clinical guidelines

*In the professional services sector*

- Verifiable references to inclusion of research outcomes in professional standards or guidelines
- New or modified professional standards or codes of practice
- New or modified technical standards of protocols

## SECTOR C: SOCIETY

**Impacts on society may be many and varied in nature. Some impact indicators in selected areas of society are given below as examples or guides of what may constitute impact in Sector C, Society.**

*Impacts on health and welfare*

- Measures of improved population health outcomes (clinical outcomes, public health outcomes)
- Measures of improved patient outcomes
- Measures of improved well-being
- Evidence of an enhanced patient experience
- Documented changes to clinical guidelines

*Impacts on society, culture and creativity*

Indicators of impact where the beneficiaries are individuals, groups of individuals, organisations or communities whose knowledge and/or behaviours have been influenced.

- Documented evidence of changes to social policy with traceable reference to research outcomes
- Documented changes of shifts in social attitudes with traceable reference to research outcomes
- Measures of improved social and organisational equity, welfare or inclusion related to research outcomes
- Measures of improved educational attainment with traceable reference to research outcomes
- Citation by journalists, broadcasters or social media
- Participation data showing tourism numbers, audience figures and/or visitor numbers at destinations, events, performances
- Creation or growth of small businesses in the creative industries.
- Happiness and/or well-being indicators including life, health, work, relationship, mood and economic satisfaction

*Impacts on public policy and services*

Indicators of impacts where the beneficiaries are usually government, public sector, and charity organisations and societies, either as a whole or groups of individuals in society, through the implementation of policies.

- Documented evidence of changes to public policy, legislation, regulations, guidelines or codes
- Measures of improved public services including, where appropriate, quantitative data on quality, accessibility or cost-effectiveness of public services
- Documented evidence of an influence by research outcomes on public policy debates
- Incorporation of research outcomes, or their influence on training or continuing professional development materials

*Impacts on practitioners and services*

Indicators of impacts where beneficiaries are organisations or individuals, including service users involved in the development of and delivery of professional services

- Traceable references of inclusion of research into professional standards or codes of practice
- Incorporation of research outcomes into training or continuing professional development materials
- Evidence of adoption of best practice by professional workers, organisations or societies

Customer satisfaction measures with services.

## SECTOR D: ENVIRONMENT

*Impacts on the environment*

Impacts where the key beneficiary is the natural or built environment. Indicators may include:

- Reduction of wastes, emissions or harmful products into the environment;
- Sales of new products or improvements to existing products that bring quantifiable environmental benefits
- Evidence of generic environmental impact across a sector confirmed by independent authoritative sources
- Traceable reference to outcomes of research affecting planning decisions
- Traceable reference to inclusion of research outcomes into policy, legislation or codes of practice.

# Appendix 7 – 20 of the best EIA Case Studies

A summary of twenty of the best EIA case studies – each receiving an outstanding or very considerable impact rating – is included below. Note that the listing does not imply an order of merit for the case studies.

## 1. CHARLES DARWIN UNIVERSITY – Reducing Morbidity and Mortality from Malaria

### Context

More than 700 million cases of malaria occur each year, causing one million deaths. Infants and pregnant women are at greatest risk.

Plasmodium falciparum, the cause of most deaths, has been the major target for malaria elimination, yet the other major species – P. vivax – comprises approximately 50% of the malaria burden in the Asia-Pacific. Until recently, P. vivax was thought to cause a non-severe febrile illness and was therefore seen as relatively unimportant.

Antimalarial drug-resistance has undermined the treatment of both these species. Patients presenting late with severe disease are at risk of death, even when treated with quinine.

The Menzies Malaria team, in collaboration with the Ministry of Health, has established a research and training unit in Indonesian Papua and Sabah, Malaysia.

The unit has had four clear aims:

**i.** To determine the burden of both species of malaria

**ii.** To identify the best treatments for multidrug-resistant malaria

**iii.** To test whether artesunate, a new drug that kills parasites faster, could reduce mortality in severe malaria

**iv.** And to determine the pathophysiological mechanisms by which patients with malaria die and use this information to design new adjunctive treatments.

The ultimate goal of these studies is to facilitate deployment of new treatments and evaluate their impact on malaria burden.

### Summary of the Case Study Impact

The major impacts of the research undertaken by the Menzies Malaria Team and its collaborators are:

**i.** The incorporation of P. vivax-specific strategies into the malaria-control and elimination strategies of WHO, The Bill & Melinda Gates Foundation and AusAid

**ii.** The implementation of dihydroartemisinin-piperaquine (DHP) as a highly effective treatment of multidrug-resistant malaria in Indonesia (resulting in a 30% reduction in incidence of falciparum malaria, and a 31% reduction in neonatal mortality)

**iii.** A global (The World Health Organisation), Indonesian and Australian policy change from quinine to artesunate for the treatment of severe malaria

**iv.** The translation into clinical trials of adjunctive L-arginine in severe malaria.

## 2. CHARLES DARWIN UNIVERSITY – Savanna Burning: Emerging Carbon Economies and Indigenous Social and Economic Development

### Context

Over the past three decades, Traditional Owners (led by Lofty Bardayal Nadjamerrek) and scientists have expressed concern over the effects of fire on the cultural and natural values of two of Australia's most significant biodiversity hotspots:

- The Arnhem Land Plateau
- And Kakadu National Park.

Collaborative research undertaken by CDU, Bushfires NT and the CSIRO (under the umbrella of the CDU-hosted CRC for Tropical Savannas Management) has provided vital inputs to a groundswell for better fire management, driven by strong Indigenous leadership from the Northern Land Council, NAILSMA and Traditional Owners.

As a direct result of this leadership, land management practices have been developed, including fire regimes based on a combination of traditional knowledge and western science. These fire regimes have a clear objective: to restore Indigenous management regimes and minimise destructive fires in the late dry season.

The role of the collaborative research described in this case study was to set up the scientific basis for better fire management that reduces greenhouse gas emissions. This, in turn, has helped to create an economic base for fire management in Australia's tropical savannas and to provide for Indigenous social and economic development.

**Summary of the Case Study Impact**

This case study has helped to open up a new land use option for Australia's tropical savannas above the 1,000mm rainfall isohyet.

The newly developed land management practices and, in particular, the new fire regimes that reduce emissions have widespread potential benefits – socially, environmentally and economically. They enable Indigenous communities, pastoralists and public land management agencies to:

- Reduce greenhouse gas emissions
- Improve wildlife habitat
- Strengthen Indigenous connections to country and build Indigenous management capacity
- And to earn sustainable income streams from land that is currently mostly unproductive commercially.

To date, only a few projects in the voluntary carbon market have delivered real returns, but the advent of a carbon price from 1 July 2012 has now opened up the potential for far greater impact arising from the research described here.

## 3. CURTIN UNIVERSITY – Building knowledge and influencing policy to reduce harm from alcohol and other drugs

**Context**

The National Drug Research Institute's (NDRI) mission is to conduct and disseminate high quality research that contributes to the primary prevention of harmful drug use and the reduction of drug-related harm in Australia. Since its inception in 1986, the Institute has grown to employ about 30 research staff, making it one of the largest centres of drug research and public health expertise in Australia. It is a designated World Health Organization (WHO) Collaborating Centre for Alcohol and Drug Abuse and a Curtin University Tier 1 Research Centre.

Staff at the Tier 1 Research Centre have completed more than 500 research projects, resulting in a range of positive outcomes for policy, practice and the community.

**Summary of the Case Study Impact**

- informed and contributed to policy and evidence-based practice such as the National Drug Strategy, National Alcohol Strategy and the National Amphetamine Type Stimulants Strategy
- contributed to Australia's involvement in international strategies (e.g. WHO Global and Regional Strategy to Reduce Harmful Use of Alcohol)
- directly contributed to Australian and State government alcohol and other drug (AOD) policy
- informed liquor licensing decisions
- contributed to strategies to reduce pharmaceutical drug harm
- informed government debate regarding cannabis policy
- significantly contributed to international evidence-based school interventions
- influenced standard drink label adoption and National Health and Medical Research Council (NHMRC) guidelines to reduce alcohol health risks
- contributed to evidence-informed briefings to the Inter-Governmental Committee on Drugs, the Australian National Preventative Health Agency and Australian National Council on Drugs
- contributed to the establishment of the first peer naloxone distribution program in Australia
- been cited in development of policy documents for Indigenous Australians (e.g. Complementary Action Plan, Northern Territory Alcohol Framework).

NDRI is also regularly requested to facilitate Australian and state government consultations regarding policy/responses to AOD problems.

## 4. CURTIN UNIVERSITY – Scanalyse: MillMapper and CrusherMapper reduce energy use and downtime in ore processing

**Context**

In mineral processing, mineral extraction is facilitated by crushing the raw ore into progressively smaller pieces and finally grinding it into a powder. Rock crushers and grinding mills are commonly used to achieve this.

Crushers operate by a shearing mechanism, where rocks fall into a concave cavity which has a conical spindle rotating inside it. As the rocks fall they are progressively crushed by the rotation of the spindle against the cavity wall.

A typical grinding mill comprises a large hollow rotating barrel, into which the crushed ore is introduced, and often includes grinding media, which are harder objects such as pebbles, metal balls or metal rods, which assist the process. The mill rotates to tumble the ore, which then falls and impacts on the rough internal structure of the liner and the grinding media to effect a reduction in rock particle size.

**Summary of the Case Study Impact**

Scanalyse Pty Ltd provides mineral processing operations with sophisticated wear and performance management tools, particularly for their crushing and grinding circuits. The company significantly improves the productivity and profitability of these operations by providing detailed, high quality condition monitoring information about the equipment.

Scanalyse services, particularly MillMapper and CrusherMapper, are used to:

- minimise energy use
- reduce costly downtime
- dramatically reduce losses due to catastrophic failure
- increase the usable lifetime of a mill liner and maximise the financial efficiency of replacing liners
- increase safety by removing the need for dangerous manual inspections.

## 5. UNIVERSITY OF NEWCASTLE – Impact of the Reflux Classifier in Enhancing the Recovery of Resources

### Context

According to the productivity commission Australia has seen a 40% decrease in yield from mining over the past 30 years. Thus the separation of the valuable components from the waste forms a critical part of the mining industry. In particular, it is increasingly important to achieve efficient beneficiation of fine particles given these are the most liberated, and therefore the most valuable.

This case study is concerned with a major advance in the gravity separation of these fine particles, the development of the Reflux Classifier. Here the particles are separated in water on the basis of their density. This technology, developed by the University of Newcastle, is now being used worldwide to achieve efficient separations of fine particles in a broad range of commodities. One key area concerns metallurgical coal used as a reducing agent in iron and steel making, which attracts a premium price in the market place.

Naturally producers have been interested in maximizing their production into this market however the existing technology applied to fine particles has proven ineffective in separating the low density metallurgical coal from the higher density coal. The Reflux Classifier has solved this previously intractable problem, and has also proven to be remarkably effective in mineral processing, achieving very high grade product.

### Summary of the Case Study Impact

This case study is concerned with the world-wide impact of the Reflux Classifier, in providing a solution to the recovery and concentration of fine metallurgical coal, iron ore and chromate. It is estimated that this technology has been used in the processing of ~ $6 Billion (AUD) worth of resources, delivering an estimated $381M of benefit to end users via increased yield. The Reflux Classifier is the invention of Professor Kevin Galvin. He has led the research over the past 12 years, with $4.8M of funding from national competitive schemes, and worked closely with the collaborating partner, Ludowici Australia, to insure rapid and effective adoption of the research findings.

## 6. THE UNIVERSITY OF NEWCASTLE – Improved Outcomes for Postmenopausal Women with Hormone Receptor Positive Early Breast Cancer

### Context

Breast cancer is the most common type of cancer in women and the most frequent cause of cancer related deaths. In developed countries about 75% of all breast cancers occur in postmenopausal women of which about 80% are hormone receptor positive. The current standard of care for both pre- and post-menopausal women with hormone receptor positive breast cancer at the time of the ATAC (Arimidex (anastrozole), Tamoxifen, Alone or in Combination) trial was tamoxifen (an antioestrogen).

Tamoxifen increases the risk of endometrial cancer and blood clotting disorders so an alternative type of antioestrogen (an aromatase inhibitor or AI) was investigated under the ATAC trial. The rationale for ATAC was based on the proven efficacy of anastrozole (an AI) in advanced breast cancer, its favourable side effect profile, and different mechanism of action in comparison to tamoxifen.

Until recently, tamoxifen has been the endocrine treatment of choice for post-menopausal women with hormone receptor positive early breast cancer resulting in a 47% reduction in tumour recurrence and mortality reduction of 26% following the use of five years of adjuvant tamoxifen. Clinical trials comparing aromatase AIs with tamoxifen have confirmed that AIs offer significant efficacy and tolerability advantages over tamoxifen during the treatment phase and are now recommended as adjuvant treatment for postmenopausal women with hormone receptor positive early breast cancer.

### Summary of the Case Study Impact

Results from the ATAC study were pivotal in establishing AIs, in particular anastrozole, as an adjuvant endocrine therapy for postmenopausal women with hormone receptor positive early breast cancer. Women on the ATAC study who received anastrozole for five years after surgery had a 24% lower risk of cancer recurrence than those women who received five years of tamoxifen. These results led to the registration of anastrozole for the treatment of early breast cancer in most countries.

In Australia, anastrozole is approved (registered and PBS subsidised) for the treatment of early hormone sensitive early breast cancer in post-menopausal women. With AIs now the standard of care for postmenopausal women with hormone sensitive early breast cancer, in excess of one million women are impacted.

## 7. QUEENSLAND UNIVERSITY OF TECHNOLOGY (QUT) –

**VitroGro®ECM: Modern wound care technology helping people with chronic wounds**

### Context

The incidence of chronic wounds, such as diabetic, venous and pressure ulcers, is on the increase due to association with the increasingly ageing population and the sharp rise in diabetes and vascular disease. With few cost-effective and viable chronic wound treatments available to clinicians, patient outcomes have been poor, placing additional financial pressures on the healthcare system.

Recent statistics indicate chronic wounds in the Australian elderly population consume $2.6 billion of the health care budget while diabetic wound treatment makes up 30% of the treatment costs for diabetes, a disease that is increasingly affecting those in middle age. In western countries the economic cost of a diabetic foot ulcer is thought to be between $7,000 and $10,000. If healing is complicated and amputation is required, this cost can increase to $65,000 per person. There are more than 3,500 limb amputations a year in Australia, one every 20 seconds globally.

Innovative, cost-effective and safe therapies that can be used in primary care settings are urgently needed, as current treatments for chronic wounds tend to be only moderately effective. This is often due to a lack of good basic science to underpin the product.

### Summary of the Case Study Impact

VitroGro®ECM is an innovative wound care technology developed from ground-breaking research by tissue engineering and protein experts at the Institute of Health and Biomedical Innovation (IHBI) at QUT. This new liquid technology restores the normal wound healing process by creating a scaffold over the wound that allows normal skin cell attachment, and subsequent cell proliferation and migration. VitroGro®ECM is a safe, ease-of-use treatment that improves chronic wound healing, reducing treatment time and cost.

Following successful large-scale cGMP manufacturing and recent clinical trial, VitroGro®ECM will be available for sale once CE Mark is granted by the British Standards Institute.

## 8. RMIT UNIVERSITY –

**Bushfire community safety**

### Context

With the impact of climate change and often unpredictable, extreme Australian weather, the risk of bushfire is a constant and deadly threat. However, until 2003, limited research had been done into bushfire prevention and management, and policies for this area, specifically those related to bushfire community safety, were inadequate.

Professor John Handmer saw significant gaps in knowledge and policies related to community bushfire safety. To address this, in 2003, he started the first known major Australian research project specifically on community bushfire safety. This project focussed on Australia's approach to community bushfire safety, known as 'Prepare, stay and defend or leave early'. It resulted in the publication of an internationally lauded book, articles in peer-reviewed journals and commissioned reports, as well as invitations to advise various national and international audiences on bushfire community safety.

The findings and recommendations from this research have informed and changed the response to bushfires in Australia and around the world. In Australia, this research influenced local, state and federal government bushfire policies and procedures, particularly after the 2009 Black Saturday bushfires, and shaped the new fire index and warnings systems. Bushfire-prone countries around the world, including the US and Greece, have also looked to Professor Handmer's research and knowledge when reviewing their bushfire safety policies and procedures.

### Summary of the Case Study Impact

Until 2003, bushfire community safety policies were inadequate and lacked an appropriate evidence base due to the lack of available research data. Professor Handmer recognised this problem and started an interdisciplinary research project looking at community bushfire safety. The findings and recommendations from this research directly influenced and changed government policies across Australia and around the world.

In Australia, this research has provided a strong evidence base that governments use to shape and support their bushfire prevention and management policies and procedures, including those on sharing responsibility, vulnerabilities, and the new fire index and warnings systems. It also formed a core part of the evidence during the Victorian Bushfire Royal Commission.

Internationally, this research has been used by numerous international bodies, including the UN Global Fire Monitoring Centre, UN University in Bonn, IPCC, European Environment Agency and University of California, Berkley, to influence their bushfire-related policies.

## 9. RMIT UNIVERSITY –

**Improving weather forecasting and climate modelling for the Australian Region using GPS Radio Occultation**

### Context

Global Positions Systems (GPS) and next generation Global Navigation Satellite Systems (GNSS) are platform technologies which can be exploited for a myriad of novel applications to benefit society and the environment. Prior to this research, Australia had not begun to explore the use of GPS and GNSS data for meteorology, weather forecasting and climate monitoring applications.

Over the past 10 years RMIT University and the Bureau of Meteorology (BoM) have worked together to develop practical applications of GPS RO and GNSS technologies for Australian meteorology. They have worked collectively with the US Joint Centre for Satellite Data Assimilation (A combined NOAA, NASA and DoD research unit), the University of New South Wales and Wuhan University to significantly advance the accuracy of Australian weather forecasting and climate monitoring.

This research has been supported through several funding initiatives including the Bureau of Meteorology's Strategic Investment Fund, Australian Research Council's Linkage grant (ARC-L), Department of Industry, Innovation, Science and Research (DIISR)'s Australian Space Research Program (ASRP) and the DIISR International Science Linkage (ISL) funding scheme.

**Summary of the Case Study Impact**

In 2006, RMIT applied GPS RO data to meteorological research into weather forecasting and climate trends. This research demonstrated the potential to significantly increase the accuracy of weather forecasts. In 2012, GPS RO data was assimilated into BoM's operational weather forecasting system. This improved the accuracy threshold of weather forecasts in the Australian region by up to 10 hours. Over 22 million Australians have benefitted through access to timely and more accurate weather forecasting information. Innovative meteorological applications of GPS and GNSS will continue to deliver far reaching benefits for Australian industries, including tourism, mining, emergency services and environmental management.

## 10. THE UNIVERSITY OF MELBOURNE –

### Development and application of low carbon emissions geopolymer concrete

**Context**

The production of concrete for construction is a major contributor to greenhouse gas emissions worldwide. Emissions from the construction industry can form nearly half of a nation's total emissions, with emissions from concrete construction second only to transport-based emissions. The single largest component of greenhouse gas emissions from concrete (70%+) comes from the production of Ordinary Portland Cement (OPC), which utilises a high-temperature process than emits a very significant amount of CO2 as a by-product: 0.6 tonne of CO2 per tonne of OPC through calcination alone or one tonne of CO2 per tonne of OPC including the fossil fuel required for the reaction. More than 2.5 billion tonnes of cement is manufactured each year.

The desire of Australian users to reduce CO2 emissions has been the key driver to the commercialisation of geopolymer concrete by Zeobond Pty Ltd and its partners. Research at the University of Melbourne in collaboration with Zeobond and key specifiers like VicRoads continues to be crucial in overcoming technical hurdles, establishing product confidence and developing new testing protocols as part of international standardisation.

**Summary of the Case Study Impact**

Research at the University of Melbourne, led by Professor Jannie van Deventer, in collaboration with Zeobond and partners has led to the world's first commercial scale adoption and regulatory acceptance of geopolymer concrete.

Geopolymer concrete is a cost-competitive, environmentally friendly concrete made by replacing the OPC component of concrete with readily available, safe industrial wastes like fly ash (a by-product of burning coal) and slag (from steel manufacturing).

OPC is made primarily from calcium and silicone, with the calcium principally sourced from quarried limestone. Using a manufacturing process that imparts high potential energy via calcination allows the activated OPC material to react easily with a low energy material such as water. The production of geopolymer cement replaces the calcium used in OPC with low-energy aluminium from recycled industrial waste and only a small amount of high chemical energy materials (alkali hydroxides) which cause a reaction only at the surfaces of particles to act like a glue. Using aluminium and silicone – rather than calcium and silicone – prevents the release of vast quantities of CO2 and makes use of industrial by-products rather than quarried virgin materials.

Geopolymer concrete has been proven to offer better fire and chemical resistance than OPC, utilises industrial waste, can match any OPC compressive strengths and reduces the carbon footprint of concrete by 80%.

This geopolymer cement is now in commercial supply. Users currently include VicRoads, the Queensland Department of Transport and Main Roads, local councils and large housing developers.

## 11. THE UNIVERSITY OF MELBOURNE –

### The National Indigenous Eye Health Survey and the Indigenous Eye Health Unit, Melbourne School of Population Health, The University of Melbourne

**Context**

The infectious bacterial disease trachoma was eliminated from mainstream Australia early last century, however Australia is the only developed country in the world where trachoma is still endemic. The high rate of this disease in remote communities is a major cause of blindness in adults and children, although the disease is preventable and almost 95% of vision loss in Aboriginal communities can be avoided through early detection.

Under the leadership of Melbourne Laureate Professor Hugh R. Taylor AC, the Indigenous Eye Health Unit (IEHU) was established at The University of Melbourne in 2008 to support trachoma elimination and conduct research and policy development by exploring barriers and enablers for Indigenous people accessing eye health services.

Their work on screening techniques and proactive health initiatives in areas with endemic trachoma has led to dramatic improvements with lower rates of the disease.

The National Indigenous Eye Health Survey (2009) provided the first national data on Indigenous eye health since the Fred Hollows led National Trachoma and Eye Health program (RACO 1980) in the 1970s.

This survey outlines the extent of the eye health gap and needs across the country from the most remote areas to the major cities. Its findings provided the basis for the Indigenous Eye Health Unit to ascertain the extent of the problem, assess the services available and work on ways to reduce the gaps and fix problems in the system.

The Roadmap to Close the Gap for Vision launched jointly by the Hon Warren Snowdon MP, Minister for Indigenous Health and Justin Mohammed, Chair of the National Aboriginal Community Controlled Health Organisation (NACCHO) in February 2012 outlines 42 policy recommendations to improve the quality and access to eye health services in order the close the gap for vision.

The IEHU has a focus on trachoma elimination and supports the Government funded trachoma screening and treatment programs with a range of health promotion materials and social marketing.

### Summary of the Case Study Impact

The Indigenous Eye Health Unit provides a unique, dedicated team who with donor funds have been able to contribute positively to Indigenous eye health policy. The range of experience and perspectives of the team members together with collaborators and their focus on consulting widely with key players means a thorough and supported approach to improving access to quality eye care.

Professor Taylor's involvement at senior levels of the eye care sector and with government combined with other staff of the IEHU who interact and support the work of people on the ground providing services including those working on trachoma creates a unique perspective and ability to provide technical support and provide a continued push to improve the availability of eye care and close the gap for vision.

The prevalence of trachoma in screened communities decreased significantly in Western Australia and the Northern Territory between 2008 and 2011, with an increase in the number of communities screened. There has been a drop of 40% in trachoma cases in Western Australia in the past year.

## 12. THE UNIVERSITY OF SOUTH AUSTRALIA –

**A world first plastic automotive mirror – from fundamental research to commercial OEM product**

### Context

Traditional manufacturing in high wage western countries such as Australia is in serious decline. Over the past decade, much of this capability has been lost to countries such as China and India. Whilst the mining boom has brought Australia considerable wealth, traditional manufacturing jobs still outnumber mining jobs 5 to 1*. As such, the challenge for the Australian manufacturing industry is to shift to the production of high value add, high technology products. This case study is one example of an Australian company partnering with an academic institution to transform part of its manufacturing base in this new direction.

The business opportunity in plastic rear view mirrors is multidimensional, and extends across criteria ranging from reduced greenhouse gas emissions per kilometre travelled, a simplified product assembly process and improved safety to innovation in product design. There have been many unsuccessful attempts in the past decade to introduce plastic alternatives for automotive mirrors and windows. These products have fundamentally failed due to either uncompetitive pricing or technical limitations rendering the final product inferior to the conventional glass alternative. In particular, plastic rear view mirrors must demonstrate resistance to UV damage, abrasion damage, corrosion resistance and extreme variations in temperature.

This case study describes the development and impact of the world's first light-weight, plastic, robust automotive mirror based on research conducted by project teams at the University of South Australia's Mawson Institute and Ian Wark Research Institute (MI/IWRI). The work was undertaken as a joint project with industry partner SMR Automotive, one of the largest manufacturers of rearview mirrors for passenger cars in the world) and the CRC for Advanced Automotive Technology (AutoCRC)

*http://www.innovation.gov.au/Industry/ReportsandStudies/Documents/KeyFactsAustralianIndustry.pdf

### Summary of the Case Study Impact

This project has delivered a first-to-market light-weight, plastic automotive mirror, with an engineered multi-layer thin film coating system on the front surface to deliver performance attributes superior to that of glass. This multi-million dollar research and development project has progressed through to industry scale-up and commercialisation. Plastic mirrors are now being manufactured at SMR's new Adelaide facility on a 3 shift per day, 5 day a week basis and are being exported to the world as an exemplar of Australian research and engineering collaboration and innovation. The production

facility is capable of producing 3 million parts per annum. Positive impacts on manufacturing, the automotive car industry, the state economy and the environment have been identified.

## 13. THE UNIVERSITY OF NEW SOUTH WALES – Development of Silicone Hydrogel Contact Lenses (SEE3 project)

### Context

Involving a multidisciplinary approach to research, the Cooperative Research Centre for Eye Research and Technology (CRCERT) resulted in the co-development of a highly permeable silicone hydrogel lens (NIGHT & DAY™) which has revolutionized the contact lens market worldwide. This product could not have been achieved without collaboration of core participants (which included researchers at the Cornea and Contact Lens Research Unit and the Graduate School of Biomedical Engineering at UNSW) in an innovative approach to solving the problem of hypoxia (lack of oxygen) to the eye due to wearing hydrogel lenses.

### Summary of the Case Study Impact

Prior to this innovation, practically all of the 125 million contact lens wearers worldwide demonstrated one or more clinical signs of hypoxia. This problem was precipitated by the inability of traditional contact lenses to deliver sufficient oxygen to the ocular surface. The research undertaken during the SEE3 project resulted in the development of silicone hydrogel materials, whose substantially improved oxygen transmissibility eliminates the hypoxia problem while maintaining the comfort, movement and wettability of conventional hydrogel contact lenses. As of 2011, 47% of contact lenses fitted globally are manufactured from silicone hydrogel materials and this number continues to increase annually.

## 14. THE UNIVERSITY OF NEW SOUTH WALES – Green Steelmaking: Taking Polymer Injection Technology to the international markets from concept to commercialization within a decade

### Context

UNSW's world-first patented "green steel" making process, Polymer Injection Technology (PIT), is optomising electric arc furnace steelmaking in Australia and overseas with significant environmental benefits and cost savings. The process, invented by Professor Veena Sahajwalla, emerged from the novel proposition that waste plastics, or polymers, and used tyres – significant global waste burdens – could be absorbed in EAF steel production. Research demonstrated that by burning these carbon-based waste streams at very high temperatures in electric arc furnaces the waste undergoes a complete transformation, reacting with slag to dissolve into liquid steel. The reaction produces none of the toxic by-products usually associated with incineration at lower temperatures, so effectively realises zero-waste recycling. At the same time the waste "mix-in" – calibrated by the PIT – increases the volume and "foaminess" of the slag, the key to furnace efficiency, therefore reducing electricity usage. A productive partnership with the Australian steel manufacturer, OneSteel, enabled UNSW to take PIT through pilot trials and industrial testing to commericalisation and licensing. Because the production of "green steel" using PIT completely transforms the molecular structure of carbon sources, it does not just give waste a facelift; it fundamentally changes its internal structures to maximise environmental and economic benefits.

### Summary of the Case Study Impact

The impacts of a commercially-viable "green steel" making process are significant given the constant growth in global demand for steel, the huge amounts of non-renewable coke and electricity needed for furnaces and their problematic emissions (4–5% of global greenhouse gases). The incorporation of PIT into OneSteel's commercial furnaces over the last four years has achieved a 10–20 percent reduction in coke consumption, saved millions of Kwhs of power, absorbed large amounts of waste and reduced production costs by 15–35 per cent. The new knowledge underpinning PIT can be applied beyond steel-making to facilitate industrial scale recycling in other manufacturing processes.

## 15. THE UNIVERSITY OF QUEENSLAND – A human papilloma virus (HPV) vaccine for the prevention of cervical cancer

### Context

Research undertaken by Prof Ian Frazer and Dr Jian Zhou led to the discovery of HPV virus-like particles. The technology was patented in 1991, and licensed to CSL in 1995. The patents were subsequently licensed to Merck and GlaxoSmithKline (GSK) for the development of HPV vaccines against cervical cancer.

### Summary of the Case Study Impact

Research conducted by Prof Ian Frazer and Dr Jian Zhou on virus-like particles led to the development of the HPV vaccines, Gardasil and Cervarix, for the prevention of cervical cancer and other HPV related cancers. Cervical cancer is the second most common cancer in women globally and kills 275,000 women annually. HPV infection is also a common cause of head and neck cancer, and the vaccine is also effective against genital warts. The vaccines

are now available in 120 countries and more than 100 million doses of Gardasil and Cervarix have been distributed worldwide. In addition to developed countries, the vaccine has been made available at low cost to developing nations where cervical cancer has the greatest mortality rate. It is estimated that the vaccines have the potential to save 250,000 lives annually (Alliance for Cervical Cancer Prevention).

## 16. THE UNIVERSITY OF QUEENSLAND – Titanium fabrication for aerospace materials

### Context

Titanium is an attractive element for metal component manufacture as it is light, high strength and corrosion resistant. Unfortunately, titanium alloys are expensive and difficult to manufacture into useful components. Cost factors have always limited the use of titanium to niche applications, for example, the biomedical, petrochemical and aerospace industries. However, it is in these particular markets that demand for titanium is rapidly growing. Researchers at the University of Queensland, who are part of the CAST CRC (headquartered at UQ) and UQ's Defence Materials Technology Centre, have developed significant technical capability, reducing manufacturing costs.

### Summary of the Case Study Impact

A CAST CRC and Ferra Engineering partnership has been highly successful in developing techniques to manufacture titanium components for the F-35 Joint Strike Fighter (JSF), a defence force combat aircraft being developed by the United States, Australia and eight other partner nations.

The JSF is the centrepiece of a $300 billion program with 6,000 aircraft expected to be produced. The light metals technology developed with CAST helped Ferra to secure seven out of the 21 contracts in Australia for the JSF Project. These long term, high precision metal component supply contracts will result in significant growth for Ferra, and over the life of the project will be worth an estimated $1 billion to the company.

## 17. UNIVERSITY OF TASMANIA – Oceans and Global Climate

### Context

ACE CRC based at the University of Tasmania is Australia's largest centre of Antarctic and Southern Ocean climate change research. Antarctica and the Southern Ocean influence both the regional and global climate in profound ways. Many of the impacts of climate change will be seen in the Southern Ocean and Antarctica before anywhere else on Earth so the ACE CRC is well positioned to advance the world's understanding of how climate change is evolving.

Southern Ocean science is necessarily collaborative – it relies on complex logistics and is expensive. ACE CRC is a unique partnership and provides the 'glue' for Australian and international research collaborations on the role of the Southern Ocean in global climate and climate change.

Much of the ACE CRC's research impact is only able to be identified when viewed with the whole body of work. That is, the value of this work is in building proof of man-made climate change and a case for changing behaviours as a whole. The ACE CRC research adds to this body of work and this collective work has had enormous effect on all levels of society. The contribution of Southern Ocean data has been of particular importance to these global understandings.

### Summary of the Case Study Impact

ACE CRC research feeds directly into the Intergovernmental Panel on Climate Change (IPCC) Working Group 1 (the Physical Science Basis). The IPCC remains the single most important avenue by which science informs climate change policy at all levels of government worldwide and is a central contributor to the public's understanding of climate change and human influence on that change.

Through its contribution to the IPCC and other consciously broad educational activities, ACE CRC played an important role in creating the political mandate for government action on climate change and paving the way for environmentally conscious behaviour change by the community.

## 18. UNIVERSITY OF TECHNOLOGY SYDNEY – Evaluating the impact of the Extended Medicare Safety Net

### Context

Growth in out-of-pocket costs associated with medical services provided to the community through Medicare has been an increasing concern since 2000. In 2004, the government introduced the Extended Medicare Safety Net (EMSN) to address these concerns. The policy was designed to provide additional financial relief to patients with high out-of-pocket costs, particularly those with complex and chronic conditions. This case study outlines research undertaken by the Centre for Health Economics Research and Evaluation (CHERE) to investigate the impact of the EMSN, and the subsequent policy responses by government.

CHERE has developed and applied advanced theory and methods in health economics to analyse financing, organisation and delivery of health services. Australia has a unique combination of public and private sources of finance for health care, and public and private sector providers. CHERE has developed a program of research investigating the impact of these, particularly around public and private health insurance. There are substantial

data sets, collected for administrative purposes and surveys, which have been under-used for research. The research described here demonstrates how these data, in this case, data on utilisation and expenditure on medical services, both individual out of pocket costs and government subsidy, can be used to analyse how changes in the policy setting shape decisions and affect outcomes for patients and providers, and ultimately the taxpayer.

**Summary of the Case Study Impact**

In 2009, CHERE published the first analysis of the impact of changes to the EMSN. The research report was tabled in both houses of the Australian Parliament, and directly influenced 2009–2010 Federal budget measures to cap EMSN benefits for a number of high expenditure items. A further review was commissioned and also tabled in Parliament.

Both reviews received extensive media coverage, have been widely cited in academic and policy settings, and critically appraised by stakeholders in Australian health care policy. They have shaped policy outcomes and directly benefited many Australians through controls on EMSN expenditure resulting from the EMSN caps.

## 19. THE UNIVERSITY OF WESTERN AUSTRALIA –

### Investment Framework for Environmental Resources (INFFER): Improving Australia's record of delivering successful environmental programs

**Context**

In most countries, including Australia, funding for public environmental programs is very small relative to the number and scale of environmental problems. To deliver the most valuable environmental outcomes requires careful targeting of funds to the 'best' projects, however, identifying the best projects is very challenging. It requires decision makers to integrate biological, physical, economic, social and policy information in a rigorous decision-making framework. In practice, few programs succeed in this difficult task. In many cases, managers lack the skills and knowledge to do so. As a result, outstanding projects fail to be identified and funded, and too many of the projects that are funded have minimal impact. In some programs, funds are spread so thinly across many projects that they are too small to deliver worthwhile outcomes. Environmental programs are also criticised for being unclear about their objectives, for failing to use science sufficiently, for using inappropriate policy mechanisms, and for being unable to demonstrate environmental benefits (e.g. Auditor General, 2008). Starting with work on salinity, and later broadening the work to cover environmental issues in general, the researchers set out to provide knowledge, tools, training and broad communication to address these problems.

**Summary of the Case Study Impact**

This project has led to $8.5 million for projects delivering greater environmental value. It is being used to develop projects in four states with staff from 21 of Australia's 56 regional environmental bodies and government agencies in three states trained in using this framework.

It has influenced the design and rollout of government programs, including criteria for selecting projects. New decision-making tools and conceptual frameworks from the research are being used by managers and policy agencies around Australia and internationally. It is changing the thinking of environmental managers and influencing the culture of decision-making to focus more on environmental outcomes.

## 20. THE UNIVERSITY OF WESTERN AUSTRALIA –

### Mandatory addition of folic acid to flour to prevent serious birth defects

**Context**

Neural tube defects are serious birth defects resulting in early death or lifelong disability. Research in the early 1980s suggested a possible protective effect from taking vitamin supplements before conception and into early pregnancy. This was confirmed by further studies (including a case-control study in WA by UWA researchers and published in 1989, the first to show a protective effect of dietary folate) and randomised controlled trials published in the early 1990s. These studies confirmed that 70% of neural tube defects were preventable by sufficient maternal folic acid intake during that early period. The neural tube closes very early in pregnancy (by the end of the sixth week after the last menstrual period, often before a woman knows for sure she is pregnant) and around 40% of pregnancies are unplanned, so the challenge is to ensure sufficient folate levels from the time of conception. Starting supplements once pregnancy is confirmed may be too late to provide the necessary protection. Having folic acid added to a staple food through fortification means that all women consuming that food would have a reliable source of folic acid, regardless of whether their pregnancy was planned.

**Summary of the Case Study Impact**

This research made a major contribution to the decision of State Food Ministers in June 2007 to introduce, by September 2009, mandatory fortification of flour in Australia with the vitamin folic acid to prevent neural tube defects.

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