

**Submission to Senate Standing Committee on Economics
The challenges to Australian industries and jobs posed by increasing global competition in
innovation, science, engineering, research and education**

**Submission from Australian Research Council Centre of Excellence for Creative Industries
and Innovation (CCI)**

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About the CCI

The ARC Centre of Excellence for Creative Industries and Innovation (CCI) was established in 2005 to focus research and development on the contribution that the creative industries and their contributing disciplines can make to a more dynamic and inclusive innovation system. Block funded by the Australian Research Council from 2005-13, it is acknowledged as a global leader in this emerging field. It is a broadly-based, cross-disciplinary, internationally focused centre embracing both fundamental theoretical and highly applied research in media, cultural and communication studies, law, education, economics and business and information technology, addressing key problems and opportunities arising for Australia, the Asian region, and for the wider world, from innovation in both the creative economy and the broader service economy. The Centre plays a significant role in theoretical and strategic debates with academic, policy, and industry interlocutors, as well as working extensively on new empirical and technical methodologies, including, for example, the creation of new statistical approaches to measuring the creative economy, social media 'big data' analytics, and ethnographic action research.

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This submission focuses on the contribution which the creative sector makes to Australian innovation. The creative sector is defined, following the Australian Bureau of Statistics,¹ as the cultural and creative activity conducted by the creative workforce and found in the creative industries, which include media, arts, heritage, design, fashion, and information technology.

The ABS, adopting methodologies in part indebted to CCI research, released the first Satellite Account for Cultural and Creative Activity in February 2014. It showed that ‘Culture is big business’,² contributing an estimated \$86 billion (6.9%) to Australia’s Gross Domestic Product on a national accounts basis in 2008-09 and \$65.8 billion (5.6%) to Australia’s Gross Value Added in same year (see Attachment 1). To put this into context, this contribution was similar to the GVA contribution of Health Care and Social Assistance. There were almost 1,000,000 people during that same year whose main employment was in a cultural or creative industry or occupation.

The data in this Satellite Account is the first official account of the true size and shape of the Creative Sector (or Creative Economy) and is the combination of my centre’s, and others’, efforts to develop fundamental evidence for the importance of this emerging sector.

But what does this have to do with the Committee’s Terms of Reference?

The ABS’ Satellite Account provides a snapshot in time from six years ago. The CCI’s research, though closely aligned with the ABS’s findings, goes further in showing consistent growth in the creative sector over four census periods (1996-2011) at levels well above the growth of the general economy.³

We developed the so-called Trident methodology (see Attachment 2) which can track the input value of ‘creative occupations’ to the economy as a whole. This has provided a robust tool for sector and workforce skill analysis, which generates previously unknown insights into the wider economic significance of creative activities and skills. For example, countermanding the usual perception of cultural and creative labour, we showed that all creative employment attracted above-average wages and salaries except for music and the performing arts.

In a second iteration of the Trident, we broke down the broad categories of creative economy and creative employment, and identified significant variations in growth, demonstrating that significantly higher growth was occurring in creative services (B2B) rather than cultural production (B2C) and growth was also significant in embedded creative employment. (See Attachment 3.) Examples of the contributions of embedded creative workers could include interface designers who contributed to revolutions in the finance industry; technical writers in online education export industries; or simulation and games experts who make training

¹ ABS 2014, 5271.0 - Australian National Accounts: Cultural and Creative Activity Satellite Accounts, Experimental, 2008-09, <http://www.abs.gov.au/AusStats/ABS@.nsf/MF/5271.0>

² <http://www.abs.gov.au/ausstats/abs@.nsf/latestProducts/5271.0Media%20Release12008-09>

³ The CCI’s Creative Economy research is summarised most conveniently in Stuart Cunningham 2013, *Hidden Innovation: Policy, Industry and the Creative Sector* (University of Queensland Press), chapter 4, and Stuart Cunningham 2014, ‘Creative labour and its discontents: a reappraisal’, in Greg Hearn et al, *Creative Work beyond the Creative Industries: Innovation, Employment, and Education* (Edward Elgar), chapter 2.

environments for mining operations or defence departments. These long-run, above-average growth trends are indicators of innovation insofar as this demonstrates a specific call on these particular attributes and skills as the general economy evolves. New locations of creative labour are co-evolving with new needs and opportunities across the economy.

This perspective on Australian innovation addresses several of the Committee's Terms of Reference (TOR).

As an illustration of TOR (a) and (d), consider an outstanding example of creative services attracting investment in innovation to secure high skill, high wage jobs and industries in Australia: the post, digital and visual effects production sector. An innovation perspective on the sector would see it as sharing many of the characteristics of Australia's advanced manufacturing sector. It is a small, high tech, high skill sector attracting foreign direct investment, producing niche, short run, product which is locked into global supply and value chains, must constantly innovate to compete in highly innovative global markets, and is almost completely 'trade exposed'—in other words, is highly vulnerable to the value of the Australian dollar. Working often in combination with international (or 'offshore') productions attracted to Australia, but also very much able to attract foreign direct investment based on internationally competitive post, digital and visual effects standalone skills, this high tech, globally networked, component of the screen industries have often contributed a quarter of the total economic activity the screen production sector in Australia. Recommendations arising from the consideration of post, digital and visual effects production sector as a key innovation sector include:

- **ensuring that this sector is able to take full advantage of current innovation support mechanisms such as the R&D tax regime and treating such support mechanisms as the Export Market Development Grant scheme has integral to the Australian innovation system**
- **considering the importance for Australian innovation of the value of the current Post, Digital and Visual Effects Production (PDV) Offset, and the need to raise the Location Offset to 30% to keep key components of this sector in synergy.**

As an illustration addressing TOR (a) culture of innovation and healthy innovation ecosystem, (d) relationship between advanced manufacturing and a dynamic innovation culture, and (h) training and retaining a healthy research and innovation workforce, I submit a research paper I prepared for the Australian Council of Learned Academies' Securing Australia's Future project (Project 4 'The role of science, research and technology in lifting Australian productivity') (see Attachment 4).

While a great deal is known about Australia's science capability to contribute to Australian innovation, what we don't know very much about is the on-the-ground, actual mix of knowledge and discipline input into our most innovative and productive companies, and how disciplinary and domain knowledges are forged and interact in leading, high performance, high tech, firms across many industry sectors.

My research paper shows that, across high skill, high wage, high performance, high tech firms and sectors in Australia there is always mixing of humanities, arts and social sciences (HASS) and science, technology, engineering and maths (STEM) in their workforces.

This has a number of implications for innovation policy. In keeping with the overall thrust of this submission, these findings remind us

- **that services (including creative services) need to be treated equally with primary industries and manufacturing as critical generators of high skill, high wage jobs, export performance, and innovation**
- **that education and training at school, vocational and higher education levels need to take account of the necessity in all facets of high-performance, innovative workplaces for cross disciplinary communication and collaboration and complex problem solving skills, and the opportunities that ‘T-shaped’ people have to flourish in such environments.**

With regard to TOR (j) policy options to create a seamless innovation pipeline, including support for emerging industries, with a view to identifying key areas of future competitive advantage, my research⁴ shows that there is growing evidence for innovation policies in numerous jurisdictions taking into consideration the role of the creative sector. This has been driven by the evident contributions which especially design and digital content are making to contemporary industrial activity across both manufacturing and services.

However, Australian policy making in relation to the contribution which the creative sector can make to innovation has been intermittent and often half-hearted.⁵ There is some minor recognition of the role which the creative sector plays through a few case studies and profiles of design as an industry sector and design thinking in the Commonwealth's *Australian Innovation System Report*.⁶ Two important initiatives have been the establishment of the Creative Industries Innovation Centre and the awarding of the ARC Centre of Excellence for Creative Industries and Innovation. The Creative Industries Innovation Centre, a component of Enterprise Connect, demonstrated that business services targeted specifically at the sector and delivered by those with specific expertise in the sector were highly prized by recipients of those services, particularly in comparison to highly generic business service provision. **Restructuring of government-provided business services needs to be mindful of the evidence that previously marginalised business sectors, such as the creative sector, may well become marginalised again in the genericisation of business service provision.**

Concrete policy and program commitments have been made at the state level, including preeminently support for design as a value adding input into industry which was developed both in Victoria and Queensland.⁷ I have conducted case studies of the Queensland example, and of a number of other ‘demand-side’ programs to support design as a value adding input into manufacturing and services, as well as a case study of experimental R&D in arts and culture, in *Hidden Innovation*, chapter 6. There are a number of still highly pertinent policy strategies for industry development in the areas of investment, exports, skills and training, and research and

⁴ *Hidden Innovation*, chapter 1.

⁵ See *Hidden Innovation*, pp. 56-64 for a case study of Australian policy-making.

⁶ See eg *Australian Innovation System Report 2012*, p. 47, and *Australian Innovation System Report 2013*, p. 67.

⁷ A case study of the Queensland example is provided in *Hidden Innovation*, pp. 187-192.

development which have not been acted on arising from the last major national report in 2006, *Unlocking the Potential: Digital Content Industry Action Agenda*.⁸

Policy initiatives arising from the much more intense focus on the creative sector in the UK have produced a great deal of practical traction, as well as strategic, forward looking manifesto-style recommendations. (See Attachment 5).⁹ Many of these should also be considered for Australia. This suite of broad recommendations draw on this manifesto as well as adding to, and adapting, it for Australian conditions:

- **the adoption of contemporary definitions of the creative sector/creative economy, as outlined in this submission. This would include supporting the ability of the Australian Bureau of Statistics to continue to iterate the Cultural and Creative Activity Satellite Account**
- **to articulate revisions to the Australian Innovation System framework which integrates the creative sector**
- **government policies on R&D tax regimes, public procurement, and business support especially for SMEs should be reviewed for their applicability to and accessibility by the creative sector**
- **arts and cultural policies can be reviewed to consider the development of a rigorous experimental approach to digital R&D in these sectors**
- **increased and more efficient rights licensing transaction transactions should be supported through mechanisms such as the UK Copyright Exchange**
- **school and university curricula should be encouraged to bring together art, design, technology and computer science to better prepare the workforce of the future for high growth, cutting edge business opportunities which thoroughly mix and match these disciplinary knowledges**
- **school and university curricula should teach and promote entrepreneurship**
- **the contemporary nature, scope and growth potential of 'creative careers' should be integrated into school and university curricula.**

In conclusion, I quote from an op-ed in this week's *Australian Financial Review*,¹⁰ which states 'There is a big prize waiting for the country and the education system that can draw a more deliberate connection between the humanities and the world of STEM and business. ... A new partnership between the humanities and the sciences would be a great foundation for Australia's future'.

⁸ *Unlocking the potential: Strategic Industry Leaders Group report to the Australian Government*, <http://catalogue.nla.gov.au/Record/4349599>. This report appears to have been removed from web access.

⁹ Hasan Bakhshi, Ian Hargreaves, Juan Mateos Garcia 2013, *A Manifesto for the Creative Economy*, NESTA. <http://www.nesta.org.uk/sites/default/files/a-manifesto-for-the-creative-economy-april13.pdf>

¹⁰ Tom Golsby-Smith 2014, 'Humanities will inspire good business', *Australian Financial Review* 28 July, p12.

Attachment 1

Culture is big business

<http://www.abs.gov.au/AusStats/ABS@.nsf/MF/5271.0>

The Australian Bureau of Statistics (ABS) today released its first experimental measures of the economic contribution of cultural and creative activity in Australia.

Cultural and creative activity is estimated to have contributed \$86.0 billion (6.9%) to Australia's Gross Domestic Product in 2008-09.

"This new ABS release shows cultural and creative activity is a significant component of the Australian economy, in addition to playing an important role in the wellbeing and quality of life of the community" said ABS Director of Culture, Recreation and Migrant Statistics, Andrew Middleton.

Volunteer services to arts and heritage organisations are estimated to have been worth a further \$756 million in 2008-09.

The number of persons whose main employment was in a cultural or creative industry or occupation averaged 972,200 in 2008-09.

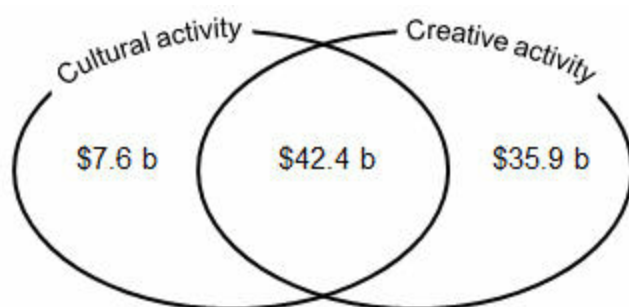
There were 164,730 entities actively trading as a business or non-profit institution within the cultural and creative industries at the end of June 2009.

The ABS' estimates were prepared following strong interest in the economic role of these activities, such as highlighted by Australia's National Cultural Policy *Creative Australia*.

Estimates for cultural and creative activities have previously been published in other countries such as Canada, Finland, Spain, the United Kingdom and the United States of America.

Further information can be found in [Australian National Accounts: Cultural and Creative Activity Satellite Accounts](http://www.abs.gov.au/AusStats/ABS@.nsf/MF/5271.0) (cat. no. 5271.0), available for free download from the ABS website (www.abs.gov.au).

CULTURAL AND CREATIVE ACTIVITY GDP - NATIONAL ACCOUNTS BASIS, 2008-09

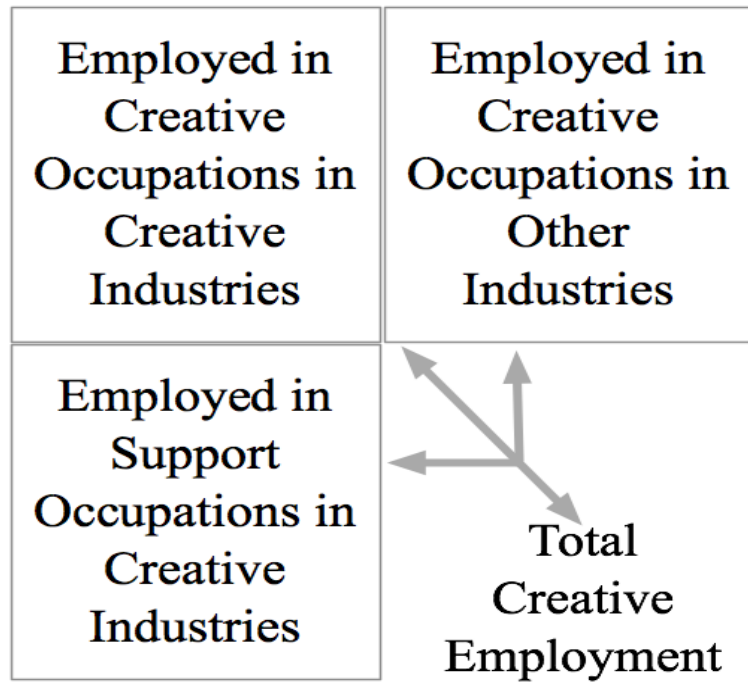


Cultural activity is estimated to have contributed \$50.1 billion (4.0%) to GDP in 2008-09, while creative activity contributed \$78.3 billion (6.3%). The industries and occupations common to these two segments accounted for \$42.4 billion (3.4%) - this common activity is counted only once in the combined account for cultural and creative activity.

The Creative Trident

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Attachment 2



Attachment 3

		Average annual Growth, 2006-11
Cultural Production	film, TV & radio; publishing; music, performing & visual arts	0.6%
Creative Services	architecture & design; advertising & marketing; digital content & software	3.8%
TOTAL CREATIVE ECONOMY		2.8%

Attachment 4

HASS-STEM mixing in Australian advanced manufacturing and high-tech, high performance services

Paper prepared addressing 'An innovative workforce to meet Australia's future needs' for

Securing Australia's Future, ACoLA Project 4:

The role of science, research and technology in lifting Australian productivity

Stuart Cunningham

'I always thought of myself as a humanities person as a kid, but I liked electronics. ... Then I read something that one of my heroes, Edwin Land of Polaroid, said about the importance of people who could stand at the intersection of humanities and sciences, and I decided that is what I wanted to do' Steve Jobs

*That intersection 'will be a key to creating innovative economies in the twenty-first century'
Walter Isaacson, Steve Jobs, xvii*

Executive Summary

A great deal is known about Australia's science capability to contribute to Australian innovation. What we don't know very much about is the on-the-ground, actual mix of knowledge and discipline input into our most innovative and productive companies, and how disciplinary and domain knowledges are forged and interact in leading, high performance, high tech, firms across many industry sectors. This paper surveys some key literature, introduces a suite of six companies which have agreed to be interviewed, and makes some initial observations which arise from the study so far. The six firms and their industry sectors are: Resmed (medical devices), Cochlear (medical devices), Invetech (high tech design for manufacturing solutions), Halfbrick Studios (games, mobile applications), MBD Energy Limited (waste management), and Westpac (financial services). This project seeks to address at least two of the key questions which Project Four 'The role of science, research and technology in lifting Australia's productivity' addresses: 'what are the attributes of an innovative workforce?' and 'what of the future workforce needs of Australian industries?'

Background

Because of the excellent work done in, for example, the Chief Scientist's Health of Australian Science report and work of this nature going all the way back to the monumental West report Mapping Australia's Science and Innovation System in 2003, we know a great deal about Australia's science capability to contribute to Australian innovation. What we don't know very much about is the on-the-ground, actual mix of knowledge (and discipline) input into Australia's most innovative and productive enterprises, companies and sectors. Further, we don't know enough empirically about how disciplinary knowledges interact in complex contemporary industry situations. Most studies concentrate on the supply-side and our understanding of graduate/career outcomes at the granular, disciplinary level is very poor. We need more demand-side studies.

Good new empirical research in this area can give us a whole set of new stories to tell decision-makers and complement that small set of research and innovation hero companies and individuals we have heard much about. We are particularly interested in the multi-disciplinary links that we are likely to see in empirical settings in complex, research and information rich industry settings across the board.

We are particularly interested in the interaction of the STEM and HASS sectors in addressing 'An innovative workforce to meet Australia's future needs'. Indeed, the guiding hypothesis is that 'An Innovative Workforce that Meet Australia's Future Needs' requires a mix of STEM and HASS expertise. We may find great data in considering those at the forefront of using social media technologies to build businesses highly responsive to massively empowered consumers; related 'big data' businesses; mining and exploration sectors drawing on the knowledge of anthropologists; the construction industry interacting with design; preventative health strategies for Indigenous and non-Indigenous communities relying on cross-cultural engagement as well as epidemiology; and so on.

Themes from Existing Research

We begin with summaries of five key documents relating to the concept of interdisciplinary expertise mixing: *The Social Sciences and the Humanities – Use It, Don't Lose It*¹¹, a 2011 position paper from The Danish Business Research Academy (DEA); the DEA's 2007 industry survey, *When Social Sciences and Humanities Research Generates Profit*¹²; the study of Swedish interdisciplinarity in various industries, *Mix to Max: an ethnographic study of skills mixing*¹³; *Collaborating across the sectors: the relationship between the HASS and STEM sectors*¹⁴, a 2009 Occasional Paper from the Council for Humanities, Arts and Social Sciences (CHASS); and *Inside the Matrix: Finding the Hidden Human Dimensions*¹⁵, a 2008 collection edited by the Australian Business Foundation.

The Danish Business Research Academy (DEA) advises its government and the wider European Union, particularly since the EU began funding research that contributes to policy development regarding the region's *Grand Societal Changes*—thus far defined as global warming; energy, water and food supply; an ageing society; public health; the likelihood of pandemics; and inclusive, innovative and secure societies.

In *The Social Sciences and the Humanities – use it don't lose it* (2011), the DEA argues that until recently the Social Sciences and Humanities (SSH, or HASS in Australia) have been under-appreciated in their potential for making a meaningful contribution to the EU addressing its Grand Societal Changes. Where once the HASS might have been relegated to minor or token roles in response to these challenges, the report contends that with their ability to offer alternative, possibly unconsidered viewpoints and creative solutions, the DEA contends that the HASS can participate in interdisciplinary collaborations that involve more than solely the traditional physical sciences – Science, Technology, Engineering and Mathematics/Medicine (STEM).

In such a collaborative, interdisciplinary arrangement, the HASS would be represented in advisory and expert groups, where evaluators understand and appreciate their contribution. While not advocating a move away from policy development, the DEA recommends that the HASS also should be actively involved in “driving innovation, that is in the entire process of addressing the Grand Social Challenges, from problem formulation to project evaluation and project implementation”¹⁶.

In making these recommendations, the DEA drew on research collated in its 2007 paper, *When Social Sciences and Humanities Research Generates Profit*, in which 100 Danish companies were ask to identify the challenges and needs that might be solved with the help of the HASS. Findings relevant to our own research include discussions of the benefits of interdisciplinary

¹¹ <http://dea.nu/sites/default/files/DEA.eu-visionspapir.enkelt.pdf>

¹² <http://fuhu.dk/filer/DEA/Publikationer/2007/When%20SSH%20research%20generates%20profit.pdf>

¹³ http://lnu.se/polopoly_fs/1.19299!Mixa_for_att%20Maxa_Slutrapport.pdf

¹⁴ <http://www.chass.org.au/papers/PAP20061101EA.php>

¹⁵ <http://trove.nla.gov.au/work/33864700>

¹⁶ <http://dea.nu/sites/default/files/DEA.eu-visionspapir.enkelt.pdf>

collaborations with the HASS toward *creativity and innovation*, and the *dynamics of organisational change*.

A significant number of the companies surveyed by the DEA noted the need for research that identifies the ways in which creative processes can be maximised through an interdisciplinary perspective, and which interdisciplinary fields might facilitate increased value for various types of companies. The paper noted the need for firms to recognise that interdisciplinary teams invariably stimulate creativity (while also acknowledging that firms have warned that the actual cost of establishing such productive teams can be prohibitive). Firms also observed that HASS research and development offers the advantage of regarding user-driven innovation as not just simply technological development, but also as contributing to the ability to link and synthesise the varying types of understanding of customers, the market, and the firms themselves.

Finally, the paper concluded that the knowledge desired by the surveyed companies could only be accessed and organised through macro- and micro-level studies in order to offer useful theoretical, practical, and philosophical solutions to challenges presented across the wider industrial landscape¹⁷.

The combined findings of these two papers suggest that the Humanities and Social Sciences can offer a two-pronged strategy to government and industry: firstly on a macroeconomic scale, conducting research and participating in policy formulation and implementation; and secondly at a microeconomic level in the firms themselves, where HASS practitioners can work in an interdisciplinary context alongside their industry colleagues to find innovative and creative solutions that might otherwise have been left unconsidered.

Where the DEA papers offered useful macro-level recommendations about the potential of HASS involvement in interdisciplinary research, development and workplace teamwork, the Swedish report *Mix to Max: and ethnographic study of skills mixing* (2009)¹⁸ – compiled by the creative union DIK and the [Sveriges Ingenjörer](#) (Swedish Association of Graduate Engineers) – offers a practical analysis of the value of interdisciplinary expertise-mixing in a range of local industries of varying sizes.

Arguably an example of HASS/STEM interdisciplinary collaboration in action, DIK and the Sveriges Ingenjörer commissioned Stockholm consulting agency Trendethnography AB to conduct intimate case studies into the interdisciplinary practices of successful Swedish companies, with a view to collecting the following data: the keys to successful skills mixing; strategies and leadership; opportunities and organizational structures; if and how skills mixing works; and understanding various skills, including the importance of creativity.

¹⁷

<http://fuhu.dk/filer/DEA/Publikationer/2007/When%20SSH%20research%20generates%20profit.pdf>

¹⁸ http://lnu.se/polopoly_fs/1.19299!Mixa_for_att%20Maxa_Slutrappport.pdf - an English translation is available on request

Incorporating 400 hours in the field, 20 ethnographic interviews, 25 written interviews, Trendethnography AB consulted four firms: a design company; a concert promoter; a web agency; and a telecommunications company. Similarly to the DEA research, researchers found that on the ground there are arguments both for and against skills mixing, with some large firms claiming that the resources involved can be prohibitively expensive, while other smaller firms argued that there was an imperative to include the practice in their processes in order to deliver innovative and effective products.

The *Mix to Max* research's coverage of a large telecommunications company, as well as smaller organisations like the concert promoter or design agency took on greater relevance given the subjects of our own case studies are a selection of Australia's leading small, medium and large companies incorporating interdisciplinary teams. This is particularly so in the extended extracts of interviews with team members and team leaders, who offered detailed explanations of their practice, environment, and speculation regarding the effectiveness of their interdisciplinarity. But in its overall findings, Trendethnography AB identified four broad strategies that typify companies that embrace interdisciplinarity in their workplace:

Mix everything – companies considering mixing skills should also consider mixing other aspects, including gender, ethnicity or age,

Meet new customer needs – successful interdisciplinary teams have a better understanding of the customer, and in recruiting from different educational backgrounds, recognise that globalisation plays a role in their formation,

Attract the young – interdisciplinary teams should comprise young people gathered from the global workforce, and

Identifying a new mission – such broad recruitment practices require close analysis of a company's purpose, and transparency of its *raison d'être*.

More specifically, *Mix to Max* identified ten aspects of organisational reality that were common across the four firms:

The teams were actively aware of their interdisciplinarity

Interdisciplinarity is more than just one or two different individuals in an otherwise homogenous group – all team members mixed thoroughly and enthusiastically

All four teams drew great benefit from the higher purpose of the company

Successful interdisciplinary teams had a company-level narrative informing their process

The teams included strong individuals who saw themselves as important parts of an even greater whole

Each team had clearly defined business goals that were transparently incorporated into their practice

Three of the four teams operated under careful and considered time management

All teams used multiple methods of communicating with each other

The four teams were offered varied and custom working environments that provided different levels of sound, light, warmth, privacy and more

Three of the teams had been formed according to a structure and methodology that was appropriate to their company's circumstances

The report finishes with a three-stage, fourteen-point checklist outlining the various steps a firm should consider in establishing an interdisciplinary team. While it could be argued that some of the specific goals of the *Mix to Max* research eluded the authors – particularly in terms of detailed outlines of organisational strategy and structure – it cannot be denied that the findings offer encouragement to policy-makers and firms looking to inspire and incorporate interdisciplinary teams in both research facilities and industrial contexts.

*Collaborating across the sectors: the relationship between the HASS and STEM sectors*¹⁹, a 2009 Occasional Paper from the Council for Humanities, Arts and Social Sciences (CHASS) focuses on 'cross-sectoral collaborations' that combine HASS and STEM expertise. Focusing on Australian and international examples, the authors examined the actual and potential benefits of such collaboration, and identified the characteristics – including the policies, attitudes, and funding – that typified a successful collaboration.

The researchers found that among the benefits of cross-sectoral collaboration are innovative solutions to problems, development of commercial products, collaboration with community services, more diverse education opportunities, and a more engaged public and end-users. Teams and individuals involved in these collaborations gain from the process, which promotes creativity and innovation, broadens social and professional networks, and in some cases offers wider recognition to the participants.

The disadvantages of cross-sectoral collaboration include higher transaction costs than those evident in other forms of collaboration, such as between institutions, as well as increased amounts of times and resources needed to connect with and appreciate other disciplines, develop common goals and approaches, and even just to communicate. Also, at a discipline level, some practitioners experience disadvantage in the context of their field's focus on publications, or reward mechanisms like academic recognition and promotion.

But chief among the findings were the observations that "cross-sectoral collaborations will not flourish in Australia without positive actions by government, funding institutions, researchers and industry" and that given the high transaction costs of collaboration – in particular cross-sectoral collaboration – the practice is "most likely to be profitable when the issues or problems being tackled cannot be dealt with by one sector alone".

The authors finish with five recommendations:

¹⁹ <http://www.chass.org.au/papers/PAP20061101EA.php>

Promote a new mindset – explore cross-sectoral opportunities, fund education & dissemination, adopt European model of defining ‘science’ as including HASS,

Change research behaviour – remove institutional impediments, and fund cross-sectoral research,

Educate for greater collaboration (secondary & tertiary),

Train ‘boundary spanners’ – encourage postgraduate students working with a foot in both camps, to attend a semester program in communication, team management, and the different approaches of different disciplines, and

Coordinate and advocate cross-sectoral collaboration – establish an institute for collaboration through short-courses, seminars and events.

*Inside the Matrix: Finding the Hidden Human Dimensions*²⁰ is a 2008 Australian Business Foundation publication. ‘How Intangible Networks can Boost the Innovation Odds’ charts the story of the Australian company Radiata Communications, which achieved success over foreign competitors by developing an effective new wireless local area network. In establishing a symbiotic relationship between the radio astronomy, telecommunications, and microchip design fields, Radiata brought significant scientific and technological skills into their team. Through strategic planning, Radiata nurtured valuable multi-sector experience in its staff that would be critical in developing sophisticated skill-sets. ‘How Deloitte Embedded Innovation in its DNA’ looks at Deloitte’s development of business strategies, in particular those focusing on encouraging innovation in their individuals and teams. The study emphasises the importance of understanding the composite skills and talents of individuals and teams, rather than simply what they “do”. The study also warned of the temptation – in the face of ambiguity – to “devolve rather than evolve unique combinations of skills”. ‘Factors behind Successful Creative Project-based Teams’ examines the factors that contribute to real innovation and lasting change. They advocate the benefits of cross-pollinating ideas by building teams that incorporate different operating styles, professional backgrounds, and viewpoints, and balance creative and non-creative team members in order to capitalise on the skill-sets of both.

Approach

The following approach was suggested to identify and approach companies who meet with the following criteria:

That have adapted over the lifespan of the company to foster multi-disciplinary collaboration to meet new challenges e.g. the creation of skill mixes, dealing with the ups and downs that occur with change, the outsourcing or insourcing of skills.

²⁰ <http://trove.nla.gov.au/work/33864700>

There would be a mix of small, medium and large companies, and be of a reasonable size and longevity.

Balance between science-based R&D companies and other companies across the Australian economy, for example services, mining, manufacturing, construction/architecture. The point being to illustrate how STEM and HASS knowledge and skills are being mixed or linked in order to address complex problems in the context of productivity challenges.

Noting product life-cycle within a company. (e.g. IT products run around a one year cycle whereas mining could run around a 25 year cycle).

Dealing with both STEM-driven and HASS-driven companies.

Companies and industry sectors identified

Resmed (medical devices)

Cochlear (medical devices)

Invetech (high tech design for manufacturing solutions)

Halfbrick Studios (games, mobile applications)

MBD Energy Limited (waste management)

Westpac (financial services).

The companies in brief

Resmed

ResMed, a medical innovation company created in 1989, specializes in commercialising devices for sleep breathing disorders such as obstructive sleep apnea (OSA). The company employs over 3000 staff with core skills of systems thinking, communications and team work. In addition to technical prowess, emotional intelligence is also of value to ResMed. This helps the company create cross-functional teams who can interact across the organisation- even with the international employees, which allows cross pollination of knowledge.

Eighty five percent of the company's R&D and manufacturing base are located at the Sydney site where 60% of the 1,200 employees are engineers and the others are of a non-technical background, such as marketing, sales or design. International branches of the company hire locals who are brought out to Australia on a secondment for 3-5 years to immerse themselves in product knowledge directly and return back to their country to relate the knowledge back to the

science community and consumers. Local employees also provide an intimate understanding of the country's regulations and protocols.

ResMed run an "ACHIEVE" program which ensures that all their employees have an understanding of ResMed's history, the range of products they produce as well as what occurs in other divisions of the business. Through this career portal employees can observe how different departments connect and what key characteristics they are looking for so they can enhance their skill set should they choose to change positions within the company.

Cochlear

Cochlear is an Australian founded company which develops electro-acoustic implants to restore hearing to the deaf. The company aims to provide a lifelong commitment in upgrading and servicing the technology as well as support communities.

The building of cochlear communities, utilising volunteer networks, social media and events assist the company in establishing their brand integrity, in particular with new potential clients, and retain their hold on the market. Cochlear has established a 'rest of life' brand commitment that creates loyalty amongst the recipients.

Since its establishment in 1978, Cochlear has expanded to 70% of the market share, with operations extending to all over the world including in the US, Europe, Korea and Japan. Through innovation and internationalisation, the company has also given autonomy to regional operations, creating local engagement programs through an understanding of cultural diversity.

Technological innovation is at the core of the company and technical skills are of key importance. However, a range of disciplines and collaborations are keys to the success of the company- for example, design thinking, social science (studies on social isolation), communication, understanding cultural diversity, marketing and community engagement. To foster interdisciplinary collaboration and gain access to a wider range of skills and expertise; Cochlear has recently moved to Macquarie University in order to form part of a precinct.

Invetech (<http://www.invetech.com.au/>)

Invetech specialises in the "idea to product" technological journey, working with major global companies to achieve business success. The mixing of technical and non-technical skills is critical to the company's achievements. While Invetech has a mission focusing on the path from idea to product, their separate company Capstone Partners offers clients an "IP to IPO" pathway to build their business.

Founded thirty years ago, Invetech quickly evolved from a contract R&D company to an innovation solutions company, rapidly differentiating itself from other research organisations through a focus on creativity, entrepreneurialism and commercial understanding. Underpinned by strong technical expertise, Invetech enables its clients to make the next significant step in their innovation journey. This requires a core team of 200 full-time staff who possess high quality technical skills and a diverse range of non-technical skills.

Strong technical skills are at the centre of Invetech's achievements, with many of the staff having a background in engineering (from mechanical to biomedical) and industrial design. Also critical to Invetech's success are a wide variety of skills not traditionally associated with science and engineering, from entrepreneurship, creativity and product development, to market understanding and business acumen (marketing, communications and project management). These complementary disciplines are instilled in staff through a variety of methods, including in-house training and mentorship by senior staff. Such skill mixes are further enhanced through a matrix structure, which fosters a culture of creativity and a formalised ideation process that encourages business units and technical experts to engage each other and exchange ideas.

In 2004, recognising that many technical industries lacked effective consultancy services for commercialisation and business practices, Invetech formed Capstone Partners, a separate company that facilitates the "IP to IPO" journey by blending executive and consulting consultancy services from the technological and commercial realms. Drawing on the collective senior level managerial expertise of a dozen full-time consultants from a variety of industries and backgrounds, Capstone Partners specialises in maximising the business pathway of its clients. Capstone Partners' key business offering is a core value for emerging businesses: building a staff with the right mix of expertise to build a successful business.

Where Invetech uses in-house training, mentorship, and a formalised matrix structure to endow its staff with an appropriate mix of technical and non-technical skills, Capstone Partners work with their clients to build effective teams with a diverse mix of technical and non-technical skills.

Halfbrick Studios

Halfbrick is one of Australia's most successful games companies. Profiled in *Australia in the Asian Century*, winner of industry and innovation awards, Halfbrick responded to rapid shifts in the games industry which impacted at the same time as the onset of the GFC with a strong move into mobile applications (apps). During a period of crisis in the games industry, HalfBrick not only survived, but has grown strongly. More than two years after its first release in 2010, its main success, Fruit Ninja, was still in second place on the Top Paid iPhone Apps list. The company's success has been used as a model by the Australian government as an indicator of opportunity for local game developers to reclaim their competitive advantage.

Formed in 2001, Halfbrick, like most Australian games companies, was originally a developer of licensed titles for platforms such as Game Boy Advance, Nintendo DS games handheld console, and Playstation portable. In recent years, however, Halfbrick has transformed its business model to become an independent games developer and publisher of its own titles for mobile devices. Halfbrick's principle business model depends upon high-volume sales of games titles via micro-purchased App downloads, principally from Apple's iTunes store and merchandising sales from branded T-shirts, posters, mugs and the like (with characters/iconography from Halfbrick games). The viability of this business model depends on the radical disintermediation pioneered by the iStore. The developer receives an unprecedentedly high 70 per cent return on every download.

Over 13 years, since the inception of the company, the skill base which was mostly engineering has grown into a broad mix of software engineering, creative design, user-centred design, art design, storytelling, community relations management, basic business skills, together with cutting-edge technical skills around cloud computing and cutting-edge business skills around social media analytics. Recruitment in the area of these latter forms of cutting-edge business skills is much trickier than in the other areas.

It is possible that no other industry sector exhibits the same complex range and balance of STEM-HASS inputs. What allows this mix to work, and what Halfbrick seeks to target in recruitment, is a shared background in and passion for games. Even the accountant loves games! Halfbrick has 75 staff, based in Brisbane, with a new office set up in Sydney in the last few years, and plans to establish a San Francisco office. 40% of staff are from engineering background, about 20% art, 10-15% design, plus sound specialists, quality assurance, community managers, etc.

Recruitment, particularly in the cutting-edge social media analytics domain, has meant that over time and especially in recent years, Halfbrick has needed to go much wider than the usual recruitment pool, recruiting on the US west coast where such expertise is a much deeper and years ahead of Australia. 'Cloud services' innovation in this fast-cycle global entertainment sector requires new mixes of skill sets, as games – playing their typical role in the creative industries – play a leading role in the movement from entertainment as a product to a service. The new challenges are 'how to build economies around our games', how to profit from 'virtual economies', recruiting 'people who love numbers'. Some European companies, for instance, have recruited staff from the European Central Bank. There are tensions – creatives question the need for this bolstering of social media analytics capability.

MBD Energy Limited

MBD Energy is a company that specialises in researching new industrial waste management solutions. One current example is a macro algae fuel project worth \$11 million to be done in collaboration with James Cook University and the Advanced Manufacturing Cooperative Research Centre looking into its use as carbon capture storage²¹.

MBD Energy is a small/medium enterprise (SME) whose aim is to drive innovation in sustainability. This aim attracts high calibre individuals worldwide with the same dedication which was recently confirmed via a survey of the employees whose results were also utilised to develop a personal development plan for each individual.

The company currently has three projects running in Thailand (Ratchaburi Project), South Africa (Khanyisa Project) and Canada (Peace River Project), with a total of 75 staff in Australia located across the head office, research & development (R&D) and project sites. There R&D centre is located within James Cook University where 10 doctoral candidates are currently performing research.

²¹ MBD Energy Limited welcomes new \$11 million macro algae fuel project, <http://amcrc.com.au/mbd-welcomes-11m-macro-algae-fuel-project>, accessed 19th November 2012.

The board of the company plays an important role by strategically utilising the team's skills across multiple areas within the company to achieve project outcomes. These outcomes are also the result of the board determining how the results from R&D link towards business ventures. For example, the R&D team are routinely taken out of their comfort zone and taken onsite to interact with the process and design team. R&D is crucial to maintain the company's innovative and competitive edge, which overall places great demand for the businesses unique skill sets.

Westpac

Westpac are one of the few companies that have a team dedicated to utilising a "customer-design" approach. The team consist of 20 people from varying backgrounds who are supplemented by external contractors depending on workload or specialist skill sets required. One of the major projects they have worked on has been the website which is where they first learned and developed the concept of "customer-design" approach. The project involved emulating the customer's journey and understanding what people needed- efficiency for example.

The Westpac team have recently developed relationships with academic institutions in pursuit of completing the triangle- bridging between business and design thinking with teaching in universities. Currently the team have collaborated with Roy Green at the University of Technology Sydney and University of Newcastle to create a new design discipline which aims to fulfil this need. As it stands the customer and service centred design industry is fragmented within Australia and consists predominantly of SME's who rely on the contracting ability of larger companies for work, who in turn rely on their specialist services.

Overarching themes

This project focuses on at least two of the key questions which Project Four 'The role of science, research and technology in lifting Australia's productivity' addresses: 'what are the attributes of an innovative workforce?' and 'what are the future workforce needs of Australian industries?'

The key theme is: what does industry *do* with its human capital inputs in the context of high-performance, high-tech, high R&D-based firms? Considered over time, as companies grow, face obstacles in the external environment and/or as a consequence of increased organisational complexity, there is a stabilisation of the relationship of HASS-STEM skill sets – that is, an increased and embedded recognition of the centrality of the relationship, if not of their equal contribution. It follows that, while good data on qualifications and backgrounds in Australian business enterprises will tell us a good deal about HASS-STEM relationship, exploring quantitatively the evolution within companies and individuals of that relationship will tell us even more about performance, innovation, efficiency and productivity.

At a superficial level, the mix may seem self-evident and obvious: at Resmed and Cochlear, most of the foundation science R&D and industrial/product design is done in Sydney, while the great majority of the sales and marketing, and client interface, is conducted in the dozens of

foreign markets in which they operate. But looked at more closely, this simple spatial and functional distinction can blur for various purposes. For other companies, the nature of the mix is more of a fundamental and open question. For Halfbrick, the mix between creatives (storytellers, designers, animators), technologists and business can change – particularly as social media marketing and community engagement in the games apps space depends on analytics as much as on traditional marketing.

The STEM-driven companies – Invetech (design), Resmed (biotechnology), Cochlear (biotechnology), MBD Energy (energy) – all recruit initially for scientific and technical competency and then provide additional training in non-technical skills such as communication, design thinking, understanding cultural diversity, marketing and community engagement. Organisations approach the further training of non-technical skills in different ways. Invetech for example perform formalised in-house training and mentorship with senior staff. Resmed on the other hand achieve this through the creation of cross-functional teams. Each is tailored to the company's needs and strategic aims. The extent to which technically-based companies are prepared to go to shape human capital was evidenced by MBD Energy who hired a psychologist to interview the employees and determine why they chose to work for the company. The most common answer was their desire/commitment to innovate in sustainability. The interview however had a twofold purpose in that it also assisted the company in determining personalised personal development programs to ensure their employees would have long and fulfilled careers within the company.

Westpac and Halfbrick are somewhat different examples as they are stories about fundamental changes in market and client/user demand and the need to innovate to respond to such changes. As we have seen, Halfbrick has a more varied mix of staff: 40% of staff are from engineering background, about 20% art, 10-15% design, plus sound specialists, quality assurance, community managers, etc, and its recruitment strategies are in the midst of significant change due to the rapidly morphing nature of the gameplay environment. The ability to work effectively in multidisciplinary teams from the outset is a critical factor.

The Westpac case study is about a small unit within a very large company led by Ian Muir, an engineer by training and a long-term Westpac employee, who was tasked in 1995 with building the bank's website. From there, over almost 20 years, an approach of customer-centred design for the numerous iterations of online and now mobile customer interfaces has kept Westpac at the forefront of the financial services innovation. The key in this case, well prior to, and continually in parallel with recruitment, has been reshaping of the skill set of the leader – from engineer to customer-centred design advocate and manager/coordinator of creative design and software inputs in a 'very conservative' industry rightly focused on security and stability of product offering. A key recruitment, in this context, was Stephen Cox, an anthropologist and archaeologist by training, who consulted to the Westpac group for 13 years before coming inside the company three years ago. He leads the application of a variety of ethnographic methods which delve in depth into customer apprehension, expectation and aspiration.

This points to another overarching theme. It is a truism that a sustainable business is dependent on paying great attention to its client, customer or user base. What these case studies illustrate

is that such attention gives rise to successive waves of innovation and, again, the stabilisation of the STEM-HASS knowledge base and dynamic within the organisation.

Even though it commands a 70% share of the market, Cochlear has competitors for hearing implants. Effectively, to win a client for a Cochlear implant is to win them for life. In a sense, your choice of brand defines an identity. A device is implanted inside the skull which is rarely 'de-implanted', while a client will typically require, or desire, upgrades to the external part of the device as product innovation occurs. A similar long term commitment is taken by the implanting surgeon who will typically need to choose between competing devices to specialise in. In these circumstances, the relationship between product quality and reputation, and marketing, is critical. In addition, Cochlear must deal with dramatically different client cultures across the numerous markets in which they operate. Some are very 'top down' – what the doctor recommends is definitive. Decision-making in others is much more family- and community-centred. Teachers are extremely important intermediaries in decision-making regarding implants. In the US, developing a 'Cochlear community' involves large biannual celebrations at which founder Graeme Clark appears, where 10% of US Cochlear implant recipients are happy to volunteer to raise awareness, and the employment in the Colorado R&D node of social media development experts.

At possibly the other extreme of customer relations, Halfbrick operates in an environment of extreme volatility. Harvard economist Richard Caves makes the point that demand in the creative industries is so radically uncertain that 'it is not quite – but almost – appropriate to say that innovation in creative activities need involve nothing more than consumers changing their minds about what they like'.²² The decision to engage social analytics expertise drawn from well outside the creative sector in order to gain objective insight into revealed preferences of gamers (in addition to the more traditional 'gut feeling' and 'relatives as taste intermediaries') has been controversial but necessary. Sitting somewhere between these two extremes might be Westpac. Despite a long history of path dependency creating a 'sticky' customer base for the traditional banks, regulation that makes it easier to change and the erosion of traditions of lifetime brand loyalty have given rise to greater substitutability in financial services.

A third overarching theme is that getting the HASS-STEM relationship right is a critical factor in efficiency and productivity at the firm level. Efficiency and productivity in this context means getting alignment between production inputs, the production process and uptake in the market. In 2004, recognising that many technical industries lacked effective consultancy services for commercialisation and business practices, Invetech formed Capstone Partners, a separate company that facilitates the "IP to IPO" journey by blending executive and consulting consultancy services from the technological and commercial realms. Drawing on the collective senior level managerial expertise of a dozen full-time consultants from a variety of industries and backgrounds, Capstone Partners specialises in maximising the business pathway of its clients.

Another overarching theme is facing up to the not inconsiderable challenges of building effective and productive multidisciplinary teams. There is regular stress in the literature of the costs as

²² Richard Caves, *Creative Industries*, p 202

well as the benefits, the obstacles as well as the opportunities, of 'mixing and matching'. Economic sociologist David Stark's (2009) thesis, in *The Sense of Dissonance: Accounts of Worth in Economic Life*, is that firms confronting rapidly changing and uncertain environments are better served by allowing multiple logics of worth and not discouraging the resulting exploration of uncertainty. Successful firms explore new ways to organise innovation processes and to combine incommensurate knowledges. Stark describes these organisational forms as heterarchic (multiple rather than linear power relations) and 'maintain[ed] an ongoing ambiguity among the co-existing principles' (2009, pp. xiii-xiv). The frictions generated should not be avoided or shut-down, as they generate a 'resourceful dissonance'. Similarly, in 'Factors behind Successful Creative Project-based Teams', Leslie Butterfield and Dafydd Wyn Owen examine the factors that contribute to real innovation and lasting change. They advocate the benefits of cross-pollinating ideas by building teams that incorporate different operating styles, professional backgrounds, and viewpoints, and balance creative and non-creative team members in order to capitalise on the skill-sets of both. ResMed stresses cross functional team development and the building of emotional intelligence across all staff, the better to deal with conceptual challenge and incommensurability.

Expanded case studies (these have been published in Bell, J, Frater, B, Butterfield, L, Cunningham, S, Dodgson, M, Fox, K, Spurling, T and Webster, E (2014). The role of science, research and technology in lifting Australian productivity. Report for the Australian Council of learned Academies, www.acola.org.au, pp. 162-7.

Halfbrick

Since its inception in the early-2000s, Brisbane-based games developer Halfbrick has come to be regarded by some as a metaphorical canary down the mine for Australian games companies, if not globally. Excelling in an industry that experiences radical changes almost weekly – from shifts in the global economy to the growing sophistication in customer needs – Halfbrick has garnered multiple industry and innovation awards and been lauded by the Australian government – in its white paper *Australia in the Asian Century* – as an exemplar for other growing companies. More than two years after its first release in 2010, their game *Fruit Ninja* was still in 2nd-place on the Top Paid iPhone Apps list.

Originally, Halfbrick – like most Australian games developers at the time – was a developer of licensed titles for platforms like GameBoy Advance, Nintendo DS, and PlayStation portable. Recently, though, the company has transformed its business model to become an independent games developer and publisher of its own titles for mobile devices. Halfbrick's principal business model depends on high-volume sales of games via micro-purchased App downloads – principally from Apple's iTunes store – and merchandising sales from branded T-shirts, posters, mugs and other products featuring characters and iconography from the games. The viability of this business model depends on the radical disintermediation pioneered by the iTunes store, and Halfbrick earns an unprecedented 70 per cent return on every download.

But there are consequences for such growth, as CEO Shaniel Deo notes, "As we've evolved and moved more into publishing, we've had to move into the marketing and business side. When we started out, we just had the engineering and artwork design – we didn't even do the audio back then." This growth from a predominantly engineering background into software engineering, creative design, user-centred design, art design, storytelling, community relations management and advanced technical skills in cloud computing and social media analytics has required an evolution in recruiting and a cultural shift in what is expected of new staff and their peers.

Arguably, no other industry sector exhibits quite the same complex range but roughly equal balance of STEM-HASS inputs. For this mix to work, new staff members need to demonstrate a shared background

in and passion for games, and this is a key plank in the Halfbrick recruiting platform. As an export-oriented company working into a global market, Deo explains that Halfbrick has few misgivings about maintaining their headquarters in Australia, “There are specific roles that are easier for us to hire from overseas and bring them back to Australia. But the bulk of what we do will be done here, and we’ll continue to look for sharp young people who have a passion for making great entertainment.” And besides, their target market is almost truly global: “It’s pretty much world-wide – if they have electricity and the Internet, they like our games! The glue that ties us all together here at Halfbrick is games – that’s a very important trait that we test for, regardless of the actual job ... We wouldn’t hire someone who didn’t have that because we need to have that common thread. It’s very important to bring everyone together and to be able to make something that requires all those different skills, *and* to have a shared knowledge. Even if they are an accountant, that’s fine – my cousin works here and he’s the CFO; for all intents and purposes he’s an accountant, but he still has that love of games, that passion for games – not as deep as everyone here, but he has that shared history and knowledge.”

Halfbrick has 75 staff based in Brisbane, with a new office recently established in Sydney, and there are plans to establish a San Francisco office. Forty per cent of staff have an engineering background, while 20 per cent having training in art, and 10-15 per cent in design, with the remainder a mix of sound specialists, quality assurance, community managers and administration. In recent years, however, the company has been forced to cast its recruiting net wider in response to the social media phenomenon, which has transformed the way games are used. *Cloud services* innovation in this fast-cycle global entertainment sector requires new skills mixes, as games lead the way in the creative industries moving from entertainment *products* to a *service*. In a ‘games as service’ model, new classics like *Fruit Ninja* need to maintain longevity, and this is only possible when the game can be integrated into new platforms and social media, and offer real-time virtual feedback.

Providing such qualities in the games industry requires the input of specialised skills in cloud services, virtual economies, and social media analytics, skills that while rare in the relatively new electronics entertainment industries in Australia, have been well-established in places like the US West Coast for more than a decade – hence the plans to build a foothold in San Francisco. As Deo notes, “We need to look outside our own industry – we’re going to move to *free-to-play* business models, premium models, and we need to build economies around our games. We’re already bringing in data analysts to look at what’s going on in the games and within the economy, and we want to bring in more people with backgrounds in economics.”

While internationally renowned economists like Hal Varian have been recruited by global corporations like Google, sourcing economics-literates for the games industry is a challenge says Deo, “These are people who love numbers and crunch numbers, and look at trends and figure out what’s going on. They might go to university and get an economics degree, but the last place they’ll think they might end up is

in the games industry.” Despite this, lateral-thinking executives in European and US-based games companies have recruited well-known economists from places like the European Central Bank.

Ongoing challenges for Deo and his colleagues include “building economies around our games”, extracting profit from “virtual economies”, and recruiting those people “who love numbers”. In creative industries like Halfbrick, however, such recruiting can generate tension, particularly among the foundation creative cohort, which questions the need for this bolstering of economics and social media analytics capacity. Says Deo, “As we align our strategy and say this is really about embracing our users and capturing them, and helping to increase retention and engagement with them, the creatives are starting to see why we’re doing this. But initially there definitely was some pushback – they wanted to be left alone to create games and not have to worry about this stuff. Part of the overall process is definitely educating and showing these guys the cool things we can do with this stuff to enhance and amplify the work they do.”

Cochlear

Cochlear is an Australian-founded company that develops electro-acoustic implants to restore hearing to the deaf, and offers a lifelong commitment to upgrade and service its technology, and support the local communities of their clients. While the story of the company is primarily about technological innovation, CEO Chris Roberts is quick to point out that in the context of the medical story of Cochlear, the technology came before the science, “We develop new technologies, new ways of doing things. But it’s not until you put it the hands of the surgeon or the audiologist and they go out and use it clinically that you really understand what you have. Then you understand which aspects need to change.”

In 2013, Cochlear celebrated their thirtieth anniversary of the manufacture and implant of their first device. While founder Professor Graeme Clarke is credited with the invention, the first successful implant operation occurred over fifty years ago in 1961, and is a wonderful example of the power of iteration, miniaturisation and advances in technology. Chris Roberts also credits Cochlear as a visionary and collaborative company, “that by and large has been able to make sensible decisions for the long term, have invested technological innovation and R&D, and worked with the key opinion leaders around the world to develop these products and innovations.”

With their permanent implants and upgradeable external components, Cochlear has established a ‘rest of life’ brand commitment that encourages client loyalty. Says Roberts, “The value proposition of Cochlear’s product involves a two-part system: the implant lasts a lifetime, but a great deal of intelligence sits external to the ear and essentially sends power and sound data to the implant. We don’t have anything in the implant to wear out, but as the technology advances patients can replace the external piece.” But the company has encountered and survived controversy. Roberts notes that although the early years of the company saw protest from deafness advocates over offering hearing where it was not wanted, “in countries like Australia and the US, the majority of new recipients getting Cochlear implants are not children. More people over the age of 65 are getting an implant than children. Increasingly, there is an order of magnitude of deafness in adults than there is in children – the adults actually had speech and language; they heard, and then they went deaf.”

Cochlear maintains their brand integrity – in particular, with potential clients – and retains their market share by building communities, and using volunteer networks, social media and events. In the US – and to a smaller extent in other regions around the world – the company coordinates ‘Celebration’, an event that allows implant recipients and those considering the process to gather and exchange stories and experiences. This ‘Cochlear Community’ and Cochlear’s associated volunteer networks offer a living example of the value of *peer-to-peer* consultation in marketing a product, rather than relying solely on

the *expert-to-user* experience. Roberts notes, however, that these methods are chosen on a “country to country” basis – a technique that might be successful in Germany may not work in China. A key example of the success of peer-to-peer (and even *user-to-expert*) marketing can be found in the work of Mike Noble, who received an implant as a child after going deaf. He won a Graeme Clark Scholarship as an adult, and now works with clinicians, implant recipients and new clients to promote and disseminate the positive message of Cochlear. As a *digital native* and having a lifetime of experience with the company’s products, Noble acts as a powerful social media ambassador for Cochlear.

Since its establishment in 1978, Cochlear has gained more than 70 per cent of the global market, with operations extending to the United States, Europe, India, Korea and Japan. Through innovation, internationalisation, and an appreciation of cultural diversity, the company offers autonomy to regional operations, and encourages locally developed engagement programs. Each region has dedicated country managers who address cultural and regulatory diversity, and coordinate multi-disciplinary teams that can handle local issues. At the clinical coalface, Cochlear works closely with surgeons and clinicians who have self-selected a very specific career in managing hearing disability. Through careful clinical and patient diplomacy and management, the company has established a powerful and loyal lobby that allows it to maintain its market share. Cochlear currently employs more than 2600 staff globally, with 75 per cent of its AU\$120-million R&D program based in Australia, and the balance in Belgium, Gothenburg and Colorado.

Technological innovation is at the core of Cochlear, which prizes technical expertise. Roberts believes that with the quantum of medical knowledge doubling every two to three years, the role of the company “is on the side of technological innovation, to scan the horizon for what technologies can be applied in combination with developing trends in clinical and medical knowledge so that innovation may change intervention.” However, a diverse range of disciplines and collaborations are vital to Cochlear’s success. For example, key non-technical skill sets include design thinking, social science (studies on social isolation), communication, understanding cultural diversity, marketing and community engagement. To foster interdisciplinary collaboration and gain access to a wider range of skills and expertise, Cochlear recently relocated to Macquarie University to form part of the world’s first precinct dedicated to hearing and related speech and language disorders. A key element of this collaboration focuses on trend analysis and prediction, but the scope for innovation is widened by nurturing relationships with all faculties, regardless of their ‘technical’ status.

Westpac

Westpac are one of the few companies globally that have a team dedicated to using a *customer-centred design* approach. The company's Digital Customer Experience Team consists of 20 people from varying and remarkably eclectic backgrounds – including fashion designer, anthropology, pure web design, product and technology design, and French philosophy – and is supplemented by external contractors depending on workload or project-specific specialist skill sets requirements. The team's Chief Experience Officer is Ian Muir, formerly a mechanical engineer, who initially was employed by Westpac in the mid-1990s to design and market one of Australia's first Internet banking programs using Windows diskettes mailed to customers, before being reassigned to develop Australia's first banking website. Muir explains, "We followed a customer-centred design approach, which essentially involved customers in helping to resolve some of the fundamental flaws in the web design. There was a very tight correlation between that customer perspective – the business perspective of what we're trying to achieve –and the technological capability that we had at the time." Given the significant evolution in customer expectations over the following decades, Muir observes that the team's practice and methodology, "has evolved into *collaborative design*, *customer experience design* and a more *service design* approach, which asks, 'What are the services that customers might be wanting to achieve? How do we look at this from an end-to-end perspective? And, What is the journey that they might go on?'"

Like all of the 'Big Four' Australian banks, Westpac presented the Digital Customer Experience Team with many "conservative, complex and legacy-based systems and processes" associated with customers and the manner in which they needed service. But the team soon established that a style of *open innovation* was the most effective strategy in addressing fundamental issues and targeting the appropriate audience. One of Muir's first innovative acts was to engage the services of Stephen Cox, a *design anthropologist* who initially consulted to Westpac in 2000, but now works full-time with the team. Cox's background in anthropology and archaeology informed a radical new line of enquiry that sought to find the right solution for customers by identifying what they actually 'needed'. The accolades and awards showered on Westpac's team by consumer groups led to subsequent research into business – and eventually corporate – Internet banking. This dedicated internal design practice has seen Westpac become the leading institution in the field, a feat maintained for more than a decade – for example, where its competitors might sign up a thousand clients a month, Westpac was achieving the same result on a daily basis using methodologies designed by the team. While Westpac's competitors undoubtedly use similar techniques in small, distributed pockets of their banking practice, and invariably rely on externally sourced practitioners, Westpac remains one of the few financial institutions nurturing a dedicated creative team that can service such a magnitude of customer experience design practice.

In addition to customer-focused design practice, Muir's team has tailored a *design principles group* that specialises in disseminating successful initiatives throughout the organisation. Muir credits Cox and his colleagues with being able to, "identify and learn best practice, keep pace with appropriate levels of

technique, and establish best practice in applying these techniques.” For example, the group trains more than 500 people annually in developing a “more customer-centred approach”, encouraging an understanding of customer mind-set in a variety of ways, including the development of competencies in data analysis and synthesis, prototype development, and app design. The design group has been lauded for its ability to use reflexive practices to inform and develop techniques and tools that can be used across the organisation. The Digital Customer Experience Team also conducts R&D that incorporates the use of ethnographic approaches that include cultural probes, contextual enquiry and observational research. While the team’s core researchers come from such diverse fields as archaeology, mechanical engineering and philosophy, the rapid pace of technical change often means that state-of-the-art technical capabilities like app development and HTML5 programming are outsourced on a project-specific basis.

The Westpac team have recently liaised with academic institutions – in particular, collaborating with Roy Green at the University of Technology Sydney and University of Newcastle – to create a new, triangular design discipline that incorporates business and design thinking with university teaching. Muir explains, “There is a higher order interest as to how we can complete this triangle back to the institutions and bridge back to the educational level. Language, philosophies and other disciplines may help bridge the divide that seems to exist between business thinking and design thinking.” Currently, the customer- and service-centred design industry is fragmented within Australia, and predominantly involves SMEs that have a symbiotic relationship with larger companies, parlaying specialist services in exchange for the contracting abilities of the latter.

Westpac’s Internet and mobile banking team is arguably unique among Australian companies in that its in-house development and cross-disciplinary composition – supplemented externally where necessary – has attracted favourable comparisons with the global design units of corporations like Google.

Resmed

ResMed – a medical innovation company created in 1989 – specialises in commercialising devices for sleep breathing disorders such as *obstructive sleep apnoea* (OSA), and services a global market: 50 per cent of sales are in the US; 40 per cent in Europe; and 10 per cent in Asia. The company employs over 3000 staff with core skills of systems thinking, communications and teamwork. In addition to technical prowess, ResMed values emotional intelligence and actively nurtures cross-functional teams that interact domestically and globally across the organisation. These strategies ensure cross-pollination of knowledge, and an appreciation of each other's expertise.

Senior Vice-President of Global Supply Operations & Manufacturing, Anthony Claridge attributes the global success of ResMed in part to the competitive advantage the company has gained through careful cultivation of its key resource – people – “We’re anxious to learn, and that’s part of where we think our success is as an organisation – we wish to not stay where we are. We want to learn more; we want to be better. We think that this provides a competitive advantage, an agility of mind, and an ability to meet changing market trends – to be constantly on the lookout for change, to be part of it, or leading it, or weathering it. We also have an acute awareness of what we don’t know, and so when people come in with backgrounds from other industries, we’re delighted to have a different perspective.”

Eighty five per cent of the company’s R&D and manufacturing base are located at the Sydney site, where 60 per cent of the 1,200 employees are engineers; the others are of a non-technical background, including administration, marketing, sales and design. International branches of the company hire locals who are seconded to Australia for 3-5 years to immerse themselves in product knowledge directly, and return to their country to relate the knowledge back to the science community and consumers. Local employees also provide an intimate understanding of their country’s regulations and protocols. Claridge explains that, “Where there is a recognised need for more local knowledge, effective management acknowledges that you don’t pretend that you can do that from afar – if you can’t do it well the way you’re set up, then you need to adjust to make sure you do it well. Our cross-functional thinking, the fact of being born global, and also that we are a learning organization – all stem from Dr Farrell’s desire to be looking for what we need to be next. We try and get ahead of the problem rather than ignore it and have to do a bigger fix.”

Founder and CEO of ResMed, Dr Peter Farrell came from a background in chemical engineering before working in the mechanical engineering department at the University of New South Wales, where he first began to foster what would become ResMed’s intimate links with the tertiary sector. Director of Global Talent & Succession Management, Pearl Daly explains the complex skill sets required of ResMed’s engineers, “Our applied research group is typically looking at blue skies, five to ten to fifteen years out – skills composition typically focus on algorithms engineering, because that is what is at the heart of our

CPAP devices. They must have that strong understanding, but they also must have an understanding of physiology –for example, algorithms engineers who have done a Masters in biomedical science, or biomedical clinicians with a Masters in signal processing. It's a very small subset, but that's where the research happens on the CPAP side of things."

ResMed's largest business unit manages the patient interface – or the mask that the patient wears – which requires a significant amount of applied research. Daly explains the various skills involved, "It can be mechanical or mechatronic or product design for the conceptual thinkers, and then from the applied research into mechanical engineering, software and electrical engineering. Within mechanical, we have more of a bent towards very strongly analytical engineers coupled with industrial designers and those mechanical engineers who like the conceptual, front-end side. It's extremely important to get a good balance in the design engineering team. Depending on where they're at in the product development life-cycle, we might change that mix accordingly." Claridge adds here that ResMed's product development is achieved using cross-functional teams, "The project leader is responsible for all of the engineering disciplines, the logistics, the manufacturing, the marketing, the quality, and the clinical factors – the whole spectrum." Overseeing the entire operation is the Sydney Leadership Team, which meets weekly and is aware of all aspects of design and production. As Claridge explains, "This is one of the areas which differentiates us from other organisations – we want to use the power of the organisation to achieve success, not the power of individuals, or a single silo's function."

Daly says that ResMed's *ACHIEVE* program, "ensures that everyone, irrespective of whether they have a science background or otherwise will know about the history of ResMed, the range of products that we make, the algorithms that make up our IP – these briefings are offered on a regular basis, and people are encouraged to up-skill."

Through this career portal, employees planning to change their position in the company can enhance their skill set by observing the overall organisational structure and key characteristics of different departments. She explains that ResMed is proactive in responding to feedback from managers about the skill sets they need, "Over the past twenty years, ResMed has continued to hire very smart people – so IQ is always very highly regarded, and these things are very important to us. We're now seeing more of an evolution where we still want smart people, but we also want our engineers to have better emotional intelligence, and we are recruiting equally for that. One of the requests from our Learning Centre saw one of our vice presidents of development wanting our engineers to be up-skilled in the art of influencing negotiations, self-awareness, being able to read a room. Also, we want our engineers and our high potential talent to be thinking about how we commercialise; at the end of the day, we are a business. We've had a very strong push towards people truly understanding that one of our key values is value consciousness and value from a financial perspective. We need our engineers to be more balanced from an emotional perspective as well as that commercial acumen."

Attachment 5

A Manifesto for the Creative Economy: Summary

The UK's creative economy is one of its great national strengths, historically deeply rooted, contributing at least 9.7 per cent of value added in the economy and providing jobs for 2.5 million people. The creative workforce has in recent years grown four times faster than the workforce as a whole.

Behind these headline figures, however, lies a picture of considerable disruption and business uncertainty associated with digital technologies. Previously profitable business models have been swept away, young companies from outside the UK have quickly dominated new Internet markets, and some creative businesses have struggled to develop new capabilities needed to compete. All this has generated sharp challenges in areas such as the provision of skills and the defence of intellectual property. (Chapter one)

The result has been polarisation between the interests of (native UK) content and service companies on the one side and (mostly native American) technology businesses on the other. Creative industries policy which, in the late 1990s was groundbreaking and internationally influential, increasingly looks out of date in its failure to fully engage with innovation and digital technologies. (Chapter two)

These problems have been exacerbated by the manner in which UK policymakers and statisticians define and measure the creative economy. The government's current methodology understates the importance of digital technologies to the success of the creative industries, and underplays the significance of creative work in the wider economy. Without reform in this area, it will be impossible to design or evaluate policy in a way that meets the strategic needs of the creative economy. (Chapter three)

Proposal one: We urge Government to adopt and build upon our new definitions for the creative industries and for the wider creative economy. These definitions are simple, robust and recognise the central role that digital technologies play in the creative economy.

It is not too late to refresh tired policies which bear upon the success of the creative economy. On many fronts, technology continues to evolve rapidly and radically, guaranteeing further disturbance to

established players and opportunities for innovators and newcomers. Big Data, the Internet of Things, Wearable Computers, Assisted Creativity and the Maker Movement provide examples of this continued dynamic. (Chapter four)

The policy agenda itself requires co-ordination across a range of issues: research and development (R&D); access to finance; arts funding; competition and market regulation; copyright; education and digital infrastructure. (Chapter five)

Proposal two: we commend to policymakers our Creative Innovation System framework within which these strategic priorities can be addressed in a coherent and effective manner.

Creative businesses do significant amounts of what should be recognised as research and development. But because the government's definition of R&D for tax purposes pays little or no regard to the characteristics of the creative economy, creative businesses cannot avail themselves of the support that innovative firms in other sectors enjoy. (Chapter six)

Proposal three: Government should revise its guidelines on eligibility for R&D tax relief to make it more accessible to creative businesses. Technology Strategy Board programmes should also be further broadened to address the needs of the creative economy. Public procurement rules should be changed to open up opportunities for smaller technology firms. Cross-disciplinary Research Council knowledge transfer initiatives should be rigorously evaluated and the lessons applied in a further round of investment. More international collaborations with leading research centres should be encouraged.

Like other innovative businesses, creative companies have a natural tendency to cluster, which further reinforces their innovativeness. No government can create clusters from scratch, but the right policies can help, including smart use of data, investments in human as well as physical capital and leveraging universities and other anchor institutions. (Chapter six)

Proposal four: Local policymakers should follow our seven-point guide for developing creative clusters.

There are also structural reasons why creative businesses – and in particular content companies – face barriers to loan and risk finance. (Chapter seven)

Proposal five: Government should ensure that its generic business finance schemes do not discriminate against creative businesses, and that regulations help the development of Internet platforms such as crowdfunding sites. Absent hard evidence on their efficacy, government should resist introducing new sector-specific finance programmes. A higher priority is to coordinate the collection and publication of investor-friendly data through the Creative Industries Council, thus supporting the development of a

thicker market for risk finance.

The UK's longstanding commitment to the public funding of arts and culture is an important strength in the country's creative economy, though currently under strain in the light of 'austerity' measures. (Chapter eight) A more ambitious effort is needed however, to ensure that we understand the broader value of these investments. Meanwhile, arts and cultural organizations have more to do to take advantage of the creative and business opportunities afforded by digital technologies.

Proposal six: The Treasury and DCMS should work with the AHRC and its Cultural Value Project to undertake a broad-based assessment of the value of public arts and cultural spending in the UK, drawing upon similar work on the natural environment. Funding decisions should be justified in the light of criteria that emerge from this work.

Proposal seven: Funders should incentivise experimentation with digital technologies by arts and cultural organizations and allocate a sustained percentage of their resources to digital R&D, ensuring that the evidence arising from this work is openly shared. Under its new leadership, the BBC should publish in 2013 a strategy to reflect its Digital Public Purpose in the period to 2018, including through the ambitious vehicle of its Digital Public Space project.

A healthy creative economy requires open and contestable markets, well supervised by competition authorities which have the information and the authority to act speedily and effectively when problems arise in fast-moving digital markets. (Chapter nine)

Proposal eight: Ofcom should be given the powers to gather information in all Internet markets in order to maximize the chances of sound and timely judgments about the emergence of potentially abusive market power as well as best practice in curbing online breaches of copyright and addressing other market concerns. Ofcom should contribute a regularly updated strategic overview of these issues, working closely with the Information Commissioner, the Intellectual Property Office, the Competition and Markets Authority and other agencies. Ofcom's remit should be broadened to advise Government on the actions needed to ensure the UK enjoys a flourishing, open internet, balancing the interests of consumers and citizens and committed to supporting innovation and growth. These changes should be a central feature in the Communications Bill planned for 2013/14.

Ofcom's current work in helping to design and implement a well-evidenced framework to deal with online copyright infringement is welcome, as is the Government's commitment to widening exceptions to copyright and other reforms which will promote innovation without harming the essential interests of rights holders. We support these moves to make paid licensing easier and rights infringement less attractive. (Chapter ten)

Proposal nine: UK Copyright rules and exceptions should be re-balanced, along the lines proposed by the UK Government, and also at the European level as part of the drive for a European Digital Single Market. A new mechanism for enabling vastly increased and more efficient rights licensing transactions (through the proposed Copyright Hub) should be put in place during 2013, again with potential European replication ('Licensing Europe').

The creative economy depends on a fusion of different skills, including technology, art, design and entrepreneurship. But there is abundant evidence that schools lack the resources and the incentives to provide this mix of learning. The Education Secretary's belated decision to include Computer Science in the English Baccalaureate is welcome, but the exclusion of art, design and technology replicates this error. (Chapter eleven)

Proposal ten: Government should ensure that the school curriculum, including its representation in the English Baccalaureate, brings together art, design, technology and computer science and that young people should enjoy greater opportunities to work creatively with technologies, both in and out of school. There is a disconnect between what UK creative businesses need from graduates and what universities are teaching them. Measures to improve the quality of graduate employment data made available to prospective applicants for creative courses (including industry-approved course kitemarks) should be extended.