

AUSTRALIAN INSTITUTE FOR SOCIAL RESEARCH

Connecting Ideas: Collaborative Innovation for a Complex World

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The key to South Australia's future prosperity and sustainability may lie in improving our ability to build disciplinary bridges that span intellectual divides and enable a converged set of knowledge and skills to create innovative solutions to the social, economic and environmental challenges that we face. By connecting ideas across disciplines a self-reinforcing process of collaborative innovation can emerge, offering more robust solutions to complex problems and challenges.

There has been a growing recognition of the need for **multidisciplinary** perspectives and **collaborative** approaches to help solve complex, globally shared problems. Indeed the key to tackling the major social, economic and environmental challenges that face is likely to be the development of deeply embedded partnerships between STEM and HASS researchers. As discussed in *Section 2.3*, collaboration is increasingly recognised as a means of fostering innovation, and of implementing new technologies in a given social, cultural or ethical context (*Section 3.3*). Together they are more likely to develop innovative solutions to tackling: –

- Population ageing and rising dependency rates;
- Workforce ageing and the need to support higher rates of labour force participation;
- Health inequalities and healthy ageing;
- Poverty and social exclusion;
- Climate change and water scarcity.

Engaging researchers from the sciences, humanities, arts and social sciences (HASS) in collaborative approaches to problem solving is strategically vital to South Australia's future development. Understanding why the nexus between the physical sciences and the HASS is of such importance and why collaborations across disciplinary boundaries are central to innovation processes is the focus of *Connecting Ideas – collaborative innovation for a complex world*.

For a number of decades the science, technology, engineering and mathematics (STEM) disciplines have been regarded as the primary source of innovation with the contribution of the HASS disciplines being regarded as secondary. There has been a major reappraisal of this view over the last few years with HASS and STEM researchers coming together more frequently to collaborate in joint problem solving. This has been driven in large part by researchers from the humanities, arts and social sciences who have argued that innovation is inherently multi-disciplinary. Meanwhile policymakers have increasingly acknowledged the crucial role of these disciplines in understanding, shaping and generating innovation.

While the idea that innovation in the development of new technologies takes place in a social, cultural and ethical context is not a new one, the view that this necessitates fully engaging the HASS sector in innovation processes has only recently found policy traction in Australia. To respond sensitively and appropriately to human needs requires sophisticated collaboration between STEM and HASS disciplines. This is crucial for developing a better understanding of the social implications of technological innovations which is ultimately vital to their successful implementation. Examples of technological innovation where there is a compelling case for such collaboration include nanotechnology, genetic modification and nuclear energy generation which are the subject of considerable community debate.

The HASS disciplines play an important role in anticipating the consequences of significant technological change and assist in designing policies in response to these changes. Knowledge generated by them can have a profound impact on the shape, design and uptake of particular technologies. Large scale and complex problems (such as, population ageing and climate change) necessitate collaboration and interdisciplinary problem solving, in order to achieve innovative solutions. HASS disciplines bring critical knowledge about the causes and management of such problems.

If we think about innovation as solely the product of scientific and technological endeavour we risk placing limits on the quantity and quality of innovation and our capacity to fully understand and respond to the challenges that face us. This implies the need to adopt a balanced conception of innovation, that is, one that views innovation as a process underpinned by the dynamic interaction of scientific, technological, social, political, economic, environmental and cultural knowledge and skills.

We can no longer afford to confine thinking and practice around innovation to the development of technological solutions. We must focus greater attention on policy, institutional and behavioural innovations where the humanities, arts and social sciences are the main intellectual wellspring of innovation. It is also important to acknowledge the role of technology in the HASS domain and the innovative outcomes generated by this – as illustrated in the Case Study ‘Paradesic’ in Section 3.8.1 and the Case Study ‘Fish-Bird Project’ in Section 3.8.2.

In *Connecting Ideas* the case for establishing deeply embedded collaborations between scientists, HASS researchers and policy makers is set out. To build durable disciplinary bridges requires an appreciation of the multi-faceted character of the challenges that we face and the contributions that all disciplines can make to innovation processes and outcomes.

Connecting Ideas distils the perspectives of a number of industry leaders, policy makers and academics on the role of HASS in innovation. It also provides a snapshot of the considerable scale of the HASS research base in Australia and South Australia indicating that –

- ⇒ The HASS disciplines in South Australia employ **1,166** teachers and researchers across the three major universities, representing **39 per cent** of the total South Australian university workforce of teachers and researchers (see *Table 1*). They have 42 per cent of Higher Degree students and hold 11 per cent of research income (PSRC 2009, Tables 4 and 5).
- ⇒ In 2009 HASS disciplines across Australia attracted \$166,614,551 in ARC funding (29.5% of all ARC funding) – a steady growth being evident since 2002 (see *Figure 2*). With the exception of 2007, South Australia has shown a similar pattern of growth in HASS research funding, which in 2009 stood at **\$8,363,531** (25.3%, see *Figure 3*).

There is an impressive foundation of diverse innovations in South Australia that have been inspired and informed by HASS disciplines. A number of these are highlighted in *Connecting Ideas*.

We also review changes in Australian Government policy, noting a growing acknowledgement of the contribution that HASS disciplines make to innovation in Australia. Most recently, Minister Carr identified the importance of understanding the human dimensions of complex systems and the need

to develop multi-disciplinary and collaborative solutions to the major policy challenges the nation faces.

South Australia is well positioned to be a leader in this. It has a long history of innovation in many fields, often led by ambitious reforming State governments. This is embodied in the *South Australian Strategic Plan* which provides a foundation for multi-disciplinary problem solving.

A multi-disciplinary approach is likely to yield significant benefits to the South Australian community by harnessing knowledge and skills from the STEM disciplines and the humanities, arts and social sciences. Solving the challenges we face as a community requires a commitment to a 'collaborative innovation agenda' which explicitly acknowledges and actively engages expertise from the sciences and the social sciences. This has important implications for government and industry support for innovation. The challenge for government policymakers, researchers and industry is to build a more solid foundation for innovation by fostering and resourcing long term collaborations.

2 FOUNDATIONS FOR INNOVATION

2.1 Introduction

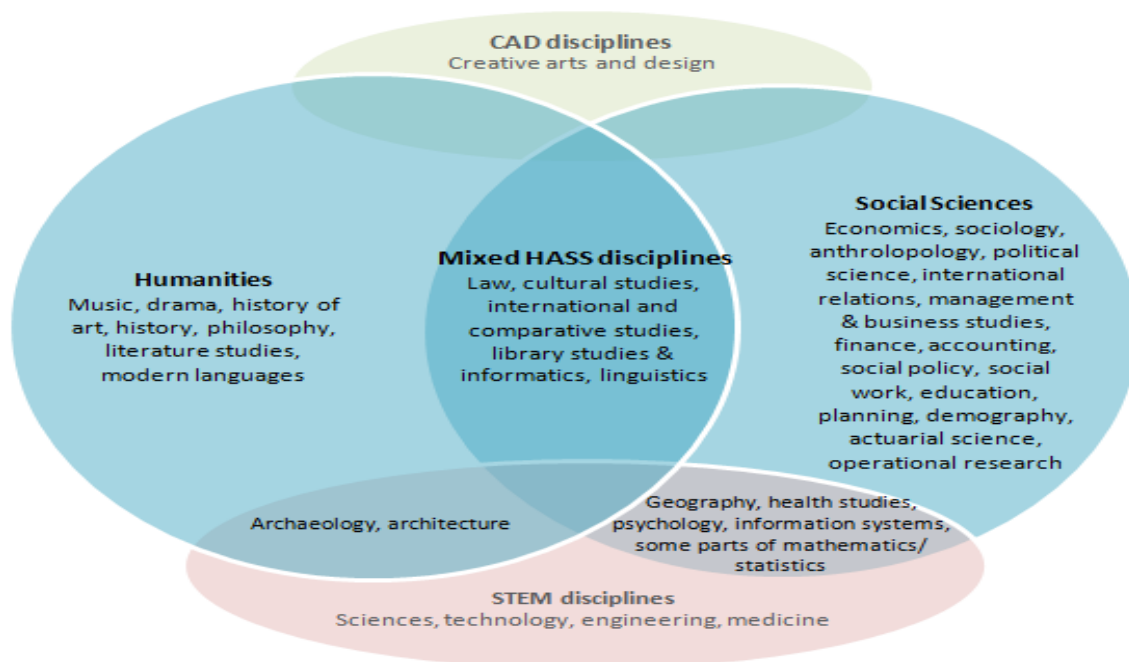
The complex social, economic and environmental challenges confronting Australia requires a fundamental shift in the way we approach problem solving and innovation, one that values the contributions of all disciplines whether they be from the science, technology, engineering and mathematics (STEM) sector or the humanities, arts and social sciences (HASS) sector. The attention of researchers and policymakers has been largely focused on the contribution of STEM research to innovation, leaving HASS on the margins of the innovation debate. A growing need for more complex problem solving that bridges disciplinary boundaries is now required. This requires that we place HASS at the centre of innovation debate and explore how we can lay the foundations for new forms of collaborative innovation for a complex world.

Connecting Ideas aims to make a contribution to the innovation debate by examining the contribution that the HASS disciplines make to innovation and why it is important that this contribution be regarded as strategic imperative as we enter the 21st century.

2.1.1 Defining the humanities, arts and social sciences

The humanities, arts and social sciences (HASS) are a broad group of academic disciplines dedicated to the study of society, the economy, business, governance, history and culture (LSE: 2008) – see Figure 1.

Figure 1: What are the Humanities, Arts and Social Sciences Disciplines?



Source: LSE (2008): 16

HASS exhibits considerable disciplinary breadth, contributing to the generation of an extensive body of knowledge and skills that help us to better understand and engage with the world we live in. The social sciences alone encompasses the diverse disciplines of anthropology, archaeology, sociology, demography, social geography, linguistics, law, economics, history, political science, psychology, education, and social medicine (Deutsch, Markovits and Platt, 1986). The humanities combine philosophy, literature, music and drama and are a disciplinary umbrella for the arts, including the performing arts, visual arts and crafts, new media arts and creative writing. However, the arts overlap with other domains in the cultural sector, such as design, media and digital content, cultural institutions such as libraries and museums, and much scholarship from the humanities (Haseman and Jaaniste: 2008).

The breadth of disciplines is not necessarily reflected in the design of the DEEWR higher education academic data base whose categories lack the detail required to provide an accurate depiction of HASS researchers – leading to an under-estimate of the total numbers. This is evident in *Section 3.4* which focuses on the number of HASS researchers in South Australia.

2.2 Exploring the concept of innovation in the context of HASS


The history of human progress is also a history of innovation Innovation transforms an idea into a new, improved product, process or service (Angel Gurrià, OECD Secretary-General, Towards an Innovation Strategy, 2007).¹

Innovation can be described simply as new undertakings and using new methods of doing things, a means of generating, applying and expanding our knowledge (Commonwealth of Australia; 2009). However, the concept of innovation has many layers which are explored in this section.

Innovation should also be understood not just in terms of outputs and outcomes, but also as a **process** and as a **way of thinking** that brings benefits for individuals and the community as a whole (Howard 2008a: 6).

Innovation is seen as **adding value** and therefore, as an **inherently positive** characteristic of human endeavor. It is a deliberative process that enhances society and the economy by using knowledge to improve products, services, processes and organizations (Productivity Commission, 2007: 7).

The OECD definition of innovation distinguishes four types: *product innovation* (involving new or significantly improved goods and services); *process innovation* (involving new or significantly improved delivery methods); *marketing innovation* (involving significant changes in product design



Innovation is about thinking about change. ... It's the implementation of new ideas into an organisation.

Professor Andrew Beer, Flinders University of South Australia

¹ OECD Observer No. 263, October 2007 -

http://www.oecdobserver.org/news/fullstory.php/aid/2322/Towards_an_innovation_strategy_.html

or packaging, product placement, product promotion or pricing) and *organisational innovation* (involving the introduction of a new organisational method in the firm's business practices, workplace organisation or external relations.² Similarly, the UK's National Endowment for Science Technology and the Arts (NESTA) defines innovation in terms of the development and application of new ideas, typically in the form of products, processes, organisational forms or services (2006).

Innovation can also be understood as a **'system'** that represents the collective of people, organizations, structures, processes, tools and incentives that enable the development and application of creative and often new solutions to issues and problems (Footitt & Gerrard, 2009: 1,13; Keighley-James: 2008).

[it is important] ... to acknowledge and understand the influence that the network of actors, systems, instruments, incentives, barriers and other factors have in facilitating the innovation 'process' (or otherwise) (Footitt & Gerrard, 2009:13).

Critical to the development of innovation systems is the building of a broader **'culture'** of innovation (Haseman & Jaaniste, 2008: 9), which in turn, is linked to innovation being a way of thinking, as well as a commitment to innovation – such as can be enshrined in government policy.

Over time the way in which innovation is understood has shifted, from its early origins in science policy linked to the R& D and defence investment agendas of governments in the 1940s and 1950s. Later innovation came to be viewed as an economic instrument essential to the realisation of national competitiveness and export orientation. Over time, there has been a broadening of the concept of innovation to encompass concepts like creativity, collaboration and problem solving (Keighley-James: 2008). This has fuelled a debate about an expanded role for HASS in innovation involving a partnership with STEM disciplines that seeks to inform the development of a more holistic innovation policy agenda that is human centred rather than technologically deterministic. In other words the prospects of solving the great challenges we face in the 21st century will be greatly improved by the insights and the contributions that HASS can provide as a key player in a modernised innovation agenda.

2.2.1 Social innovation

One expression of a modernised innovation agenda has been the emergence of the concept of 'social innovation' which was popularised in South Australia by the appointment by the South Australian Government of Geoff Mulgan as a Thinker in Residence.

'Social innovation', according to Mulgan (2008: 36) refers to " *how communities and societies innovate new ways of meeting their needs*" through the development of new programs, institutions, and activities that seek to improve quality of life and meet unmet *social* needs. Social innovation as a specific field of inquiry has received less attention than technical innovation (Mumford: 2002; Considine and Lewis: 2007). As a relatively recent entrant into the innovation lexicon conceptual clarity and operationalisation of the concept of social innovation remains a work in progress. Just

² http://www.oecd.org/document/10/0,3343,en_2649_33723_40898954_1_1_1_1,00.html

how this is resolved will have a profound influence over the role that HASS plays in innovation agendas more generally.

As with other forms of innovation, interpretations of what social innovation implies vary greatly. On the one hand, the development of new ideas about social organisations, or social relationships, might involve the creation of new kinds of social institutions, the formation of new ideas about government, or the development of new social movements. On the other hand, social innovation might involve the creation of new processes and procedures for structuring collaborative work, the introduction of new social practices in a group, or the development of new business practices (Mumford: 2002).

Taken as broadly as this, social innovation can be regarded as transformative of existing practices and processes. It focuses attention on the human dimensions of change, offering us insights into the factors that foster or impede the resolution of complex problems while also playing a key role in the resolution of these problems.

The contribution of the HASS disciplines to innovation processes is likely to be greatly accentuated by a broadly defined social innovation agenda that seeks to mainstream principles of social innovation into the wider innovation and problem solving agenda. This is an approach that is consistent with that envisaged by Geoff Mulgan, avoiding the emergence of an overly welfarist conception of social innovation that is preoccupied with specific program responses to social disadvantage that tend to address the symptoms of the problems we face rather than offer their resolution.

Not surprisingly social science knowledge and skills are the foundation for social innovation, enabling policy makers to ask the right questions and determine what works and why, and what types of policy and program interventions are likely to be the most effective in meeting particular needs.

Social innovation takes many forms. Very often the answer to a problem lies not in introducing new technologies, but in developing smarter policies and more effective ways of meeting people's needs. An effective innovation system can do more than churn out new gadgets; it can show us better ways to live (Commonwealth of Australia 2009: 14).

The challenge for policymakers and HASS researchers is to ensure that social innovation is central to the wider innovation agenda, offering a human dimension to an agenda that has been dominated by technological and scientific considerations.

2.3 The collaboration-innovation relationship

Collaboration provides the opportunity to learn from others, share resources and create new opportunities. Consequently it is at the heart of most innovations (NESTA: 2007).

Insights from HASS disciplines have greatly expanded our understanding of the dynamics of innovation and in particular the benefits of networking and collaboration. Economists, sociologists, political scientists, organizational psychologists and industrial geographers have generated an extensive body of knowledge that underpins industrial networking policies throughout the world. These policies are central to the innovation agendas of governments. More broadly

collaboration between STEM and HASS researchers is viewed as essential to the resolution of complex problems requiring innovative solutions (Riedlinger M *et al*, 2006: 53; Howard, 2008: 7). Collaboration between disciplines is well suited to complex problem solving as Howard (2008:7) argues:

Interdisciplinary research tends to be problem-oriented and quite often ... end-user focused It builds 'theories' that seek to identify and explain the causes of problems and suggests actions and results that will be achieved through particular interventions.

Regularly in my work, I come across the need for multidisciplinary action to be able to provide really innovative solutions. I come across fabulous disciplinary work, of depth and significance, but for it to drive an innovative solution, invariably I think you need a multidisciplinary capacity because you don't always have all the tools around that are going to help you go with the journey to get to the solution at the end of the day. Professor Caroline McMillen, University of South Australia

The OECD regards innovation as requiring **global collaboration** in order to achieve solutions to global problems and in recognition of the global nature of human existence. It recently argued that governments need to do more to foster collaboration between universities and businesses, reflecting the growing trend for co-operation across borders and sectors (OECD: 2007).

Collaboration between the education system, government and the private sector is often viewed as a foundation for innovation (Kaufmann and Todtling, 2001). There are numerous examples of successful government and university collaborations with the private sector that provide the foundation for innovation and transformative change. This is evident in the field of information and communications technology where government investments, university knowledge and private interests have

Collaborative links stimulate innovation by facilitating cross-cutting interactions and a free flow of ideas and knowledge.

Australia Research Council 2003, Submission to the House Of Representatives Standing Committee on Science And Innovation Inquiry into Pathways to Technological Innovation.

combined to create and develop the revolutionary technology of the Internet, giving rise to one of the fastest growing industries in history. Government has and continues to be a major generator of the growth of the ICT industry. Silicon Valley, to a large extent, was founded on one key customer, the US Department of Defence (Berlin, 2005: 131). It is also clear that the success of Silicon Valley is in large measure attributable to the proximity and engagement of the University of Stanford and the University of California, Berkeley. Research into innovation processes over the past 25 years has shown that technologically dynamic firms depend heavily on the close proximity of publicly funded academic research and related training (Pavvitt, 1998:794).

Through research on the inter-relationships between companies and the public sector, social scientists working in the fields of economic geography, sociology and economics have had a profound impact on our understanding of the drivers of industrial competitiveness and economic growth. Numerous studies have quantified the positive impact of collaboration on business performance (Commonwealth of Australia 2009; Hubbard 2008; Frost and Sullivan 2006; OECD 2004). Analysis by the Commonwealth Department of Industry Tourism and Resources (2006) has

identified that Australian manufacturers who collaborate are more likely to produce innovative products (nationally and internationally) than those who do not collaborate.

Collaboration is a central component of Australia's *Innovation Agenda* (Commonwealth of Australia: 2009). Innovation is identified as a means of extending knowledge, creativity and the development of new skills as well as a means of maximising resource usage, spreading risks and extending global influence. Collaboration across the disciplinary spectrum is seen to be one of the principal drivers of innovation.

Innovation occurs at the intersection of disciplines.

Tim Zak,
Carnegie Mellon
University

Collaboration increases innovators' capacity to absorb new knowledge, recruit new people, and develop new skills. It enables them to reduce costs by eliminating duplication, achieving economies of scale, and democratising access to expensive infrastructure. It spreads the risks and maximises the rewards associated with innovation. International collaboration builds capacity in this country and beyond, facilitates access to new knowledge (most of which is created outside this country), attracts foreign investment, and extends Australia's global influence (Commonwealth of Australia 2009: 60-61).

2.3.1 International recognition of the importance of collaboration for innovation

There has been strong international support for cross sectoral and cross disciplinary research with numerous countries and international organisations asserting that collaboration is at the heart of sound innovation policies (Riedlinger *et al* 2006: 49; Cunningham 2005: 121-122; NESTA: 2007, 2008). A review of the policies and funding programs of the European Union, UNESCO, the Council of Europe and the OECD involving the arts and culture working in partnership with the health, youth, community, education and social services sectors (Centre for Creative Communities: 2006) found that all acknowledge the need to create structures and processes that support cross-sector collaboration, and call for new models of innovation systems that encourage such integration (Riedlinger *et al* 2006: 49).

The National Endowment for Science Technology and the Arts (NESTA: 2007) has explored the relationship between collaboration and innovation, arguing that innovation cannot occur without collaboration because of the opportunity provided to share resources and knowledge. It points to a number of collaborative initiatives that have supported innovation -for example, the Swiss wristwatch, the transistor, Wikipedia and Toyota's networked approach to innovation which has generated a 14 per cent increase in worker output, and a 50 per cent reduction in defects.

Collaboration can also produce new disciplines that involve merging existing disciplines, for example, bioinformatics (which applies computer science to help solve problems at the molecular level) and entirely new disciplines, for example, nanotechnology (which is based mainly on chemistry, physics and materials sciences). New technologies enable widespread collaboration that was not previously possible, for example, *MySpace*, *YouTube* and *Facebook*, which in turn will support new forms of innovation. As a problem solving tool, collaboration is of critical importance, and in the face of new and complex challenges, NESTA argues, requires new forms of collaboration.

Collaboration has always been at the heart of innovation, but meeting the economic and social challenges of the 21st century will require more extreme partnerships – ones that cross previously sacrosanct organisational, geographical and disciplinary boundaries (NESTA 2007: 1).

In other examples of international recognition of the importance of cross disciplinary and collaborative approaches to research -

- The Research Councils UK announced a new protocol in August 2006 that was designed to promote cross disciplinary research, using the strategy of peer review based on the range of relevant domains.
- Finland's innovation policy is now characterised by cross-sectoral activity that includes international clusters to foster learning, experimentation and integration.
- The Canada Foundation for Innovation uses project-based, rather than discipline-based or sector-based, funding (Metcalfe *et al*, 2006: 17).

2.4 The Elephant in the Room - Undervaluing of the HASS disciplines

... the social sciences do not enjoy the same status as that of the natural sciences in the eyes of both the scientific community and the general public. This has serious consequences on public funding and public legitimisation (Van Langenhove 2001: 4-5).

Numerous writers, many of them cited in this report, have argued strongly about the importance of the HASS disciplines, but few acknowledge that HASS disciplines do not enjoy the high status afforded to STEM disciplines in the innovation debate. It is important that the reasons for this are understood before making a case for their significance.

The British Academy's (2004) report, *That Full Complement of Riches: the contributions of the arts, humanities and social sciences to the nation's wealth* (chaired by Professor Paul Langford), argued that government policy needed to move away from a narrowly-defined but historically entrenched concern with the 'science base' (construed in physical science or technology terms) and towards a broader view of the 'research base' needed for an advanced industrial society. Most observers agree that the role of the social sciences, arts and humanities disciplines will tend to increase over coming years, particularly in the face of complex globally experienced issues that require multi-disciplinary solutions (LSE Public Policy Group 2008: 18). Australia's Council for the Humanities and Social Sciences argues that the once recognised link between 'science and art' has diverged over the past century but is now re-forming, as creative inventions are increasingly recognised for their economic contribution, and as industrial innovation, research and teaching reintegrate into the '*domain of technology and creative practices*' (Howard, 2008a: 7). A key driver for the emergence of the 'creative industries'³ has been the development of digital technologies which assist creative output to achieve commercial outcomes (Howard, 2008a: 16).

³ Identified by the ARC Centre of Excellence for Creative Industries and Innovation (CCI) as having these 6 components – advertising and marketing; architecture, design and visual arts; film, television and radio; music and performing arts;

Prior to the Rudd Government taking office, Australian Government initiatives like *Backing Australia's Ability* (2001), *Knowledge Nation* (2001), and the process for developing National Research Priorities during 2002 and 2003 (which originally failed to include a role for the HASS), all exemplified a trend to promote the STEM disciplines and to minimise the role of the HASS in developing a competitive Australia (Cunningham: 2004; Mann: 2003; Haseman & Jaaniste: 2008). Following the announcement in 2002 of the four national research priorities⁴, the then Minister for Education Science and Training, Dr Brendan Nelson made clear where the governments research priorities lay when he commented –

The four national research priorities set a clear and coherent direction for Australian research. Science is now at the centre of government policy making, acknowledging the vital contribution that scientific achievements can make to the quality of all or lives (cited in Mann, 2003: 3).

Of course all four priorities are areas where the HASS can contribute significantly but the fact that they were not seen to be critical is evidence of their perceived value at the time. In March 2003, the Social Sciences and Humanities Conference, sponsored by the then Department of Education Science and Training, was a key initiative for HASS representatives to refine and assist in the implementation of the priorities (Mann 2003: 3). Four papers – one for each priority area – were produced by the Academy of the Social Sciences in Australia to highlight the contribution that could be made by the social sciences to each.

In one of those papers, Professor Fiona Stanley explored how HASS adds value to the biomedical and health sciences and are 'pivotal to their success'. Professor Stanley argued strongly for collaborative research to develop the evidence base required for the 'complex, multidimensional and cross disciplinary' nature of pathways to health and wellbeing (Stanley 2003: 13). She pointed to the model present in the *Australian Research Alliance for Children and Youth*, which brings together a variety of HASS disciplines to address the problems affecting Australian children and young people. One of the Alliance's projects is the *Longitudinal Study of Australian Children* that enables a focus on prevention and early intervention. It also involves –

....a national data network, multidisciplinary research nodes working on an agreed national agenda, with effective communication to translate the research into action (Stanley 2003: 17).

In relation to 'frontier technologies', another National Research Priority, Mann (2003: 19) identified four ways in which the social sciences can make a contribution in this area –

- through their active research role in identifying the conditions leading to creativity and innovation, and in the conditions affecting the uptake and transfer of new ideas and technologies;

software development and interactive content; writing, publishing and print media – all involving cross disciplinary input from the STEM and HASS disciplines (Higgs P *et al*, 2007)

⁴ 'Environmentally sustainable Australia', 'Promoting and maintaining good health', 'Frontier technologies for building and transforming Australian industries' and 'Safeguarding Australia'

- as partners in multidisciplinary research in new hybrid areas like biogenetics, biotechnology, and nanotechnology, with a major contributing role based on knowledge of human behaviour and capability, and the impact of new technologies on behaviour;
- by analysing the potential costs and returns on investment of new technologies, and by modelling the dynamic interactions between new technologies and social and behavioural changes produced by them;
- by undertaking public policy analyses of key issues, including the consequences of new technologies and analysis of the ethical issues associated with equity of access to new technologies.

In their analysis of the National Research Priority ‘Safeguarding Australia’ Graycar and Beaton (2003: 24 -27) identified a range of ways in which the HASS disciplines’ understanding of human behaviour is critical to national security, with specific reference to the protection of critical infrastructure (eg computing and transport systems), protection from invasive diseases and pests, protection from terrorism and crime and transformational defence technologies.

For each technological innovation and proposed methods of operation there will follow the necessary adaptations and/or wholly new strategies for making best use of them. Here again is the challenge to understand how humans will approach and execute tasks while coping with new technologies. ...

A secure Australia will do well to engage in the kinds of research that will provide the wisdom to choose among alternatives that seek to minimise all kinds of risk and to respond with effect when incidents occur. The social sciences have the intellectual tools and the research methodologies to contribute significantly to this challenge (Graycar & Beaton 2003: 27).

More recently, Cunningham (2008) described the HASS-STEM relationship in terms of ‘parallel universes’, with innovation being widely perceived as more strongly associated with STEM based research. However, he cites a number of factors as leading to their convergence, including the following –

- collaboration between researchers from both groups of disciplines has generated significant evidence for the ‘interdependence of knowledge production, knowledge management and knowledge transfer’;
- the services-based emphasis of modern advanced economies demands innovation which is not dependent on scientific breakthroughs but on inputs that are driven by user needs (2008: 2-3). In 2007-08, the services sector accounted for more than 65 per cent of GDP, and over the last 20 years, the services sector value added with an average increased annual rate of 3.9 per cent. The services sector holds the largest share of Australia’s employment (nearly 86 per cent of the total Australian workforce) (DIISR 2009c).

2.4.1 Measuring innovation

Apart from the directions set by government, one of the reasons for the under-valuing of the HASS disciplines’ role in innovation could lie in the way innovation is measured. The National Endowment for Science Technology and the Arts (NESTA: 2008) argues that traditional metrics fail to adequately capture the innovation that occurs in services, the public sector and the creative industries, or in user-

led and open innovation. NESTA also notes that the traditional, now outdated, conception of innovation was based on a linear model that began with scientific discovery and basic research, moved to applied research, engineering and manufacturing activities, resulting in a new commercialised product. NESTA concludes that:

This linear model of innovation is no longer universally applicable. Innovation is now understood as a multidirectional process involving multiple actors, which is strengthened by repetition. It encompasses not only the development of new components and products but new services, technical standards, business models and processes. It is as much a feature of developments in the public and non-profit sectors as in the private sector (NESTA: 2008).

This limited understanding of innovation was reflected in the mechanisms developed to measure innovation, exemplified in internationally agreed indicators like R&D expenditure, patent production and numbers of science and technology graduates. NESTA argues that these indicators fail to keep pace with change, including the shift taking place in many economies from manufacturing to service industry development.

Consequently, there is a need for new metrics that can measure innovation outcomes across diverse sectors. NESTA was commissioned to develop an *'Innovation Index'* to track and measure the United Kingdom's innovation performance. The Innovation Index website (<http://www.innovationindex.org.uk/>) aims to provide a focal point where materials, ideas and suggestions can be shared, and potential solutions critiqued.

In other international developments, the OECD and European Commission have worked on new innovation metrics, as have a number of countries including Canada, the USA and Australia. The development of more relevant indicators to measure non-technological innovation is a critical element of the OECD's *'Innovation Strategy'*, while the *European Innovation Scoreboard* benchmarks the innovation performance of EU countries and regions with recent versions being designed to capture new forms of innovation (other than technological). The *Oslo Manual* (OECD: 2005) prepared under the joint aegis of the OECD and the European Commission (Eurostat), was developed in recognition of the need for constant improvement of innovation metrics, in response to the changing context for innovation. Its first edition appeared in 1992 while its most recent and third edition in 2005 was expanded to include non-technological innovation.

Measurement brings a range of methodological challenges, including designs that can adapt to diverse industries and sectors, that include apparent failures which nevertheless contribute to future thinking, and that capture the application of innovation in a variety of settings (NESTA: 2008).

In Australia, the IBM-Melbourne Institute *Innovation Index of Australian Industry* (2007) provides an industry-specific multi-indicator approach to measuring the rate of innovative activity in Australia. It encompasses six different dimensions of innovation and adjusts the measure for the level of economic activity and enables the measuring of the proportion of total activity involving innovative endeavours.

2.5 The changing perception of the contribution of the HASS disciplines

Interest in the role and contribution of HASS is probably as old as the many disciplines that comprise it. In recent years, key international bodies like the OECD, and a growing number of governments around the world have focused attention on the contribution of HASS disciplines to the resolution of a wide range of questions and related public policy challenges.

There is a growing recognition of the contribution made by HASS research in its own right, along with an increasing awareness of the importance of cross-disciplinary research in the search for innovative solutions to complex global issues (CHASS, 2005: 13).

2.5.1 Changes in the OECD's focus on the social sciences

It is important to recognise the influence of the OECD on individual governments, including the Australian Government (Haseman & Jaaniste, 2008: 12). While the OECD has a long tradition of examining the role and contribution of the social sciences it has taken considerable time for this to be translated into detailed analysis at the country level. Ten years after the 1966 report *The social sciences and the policies of governments* was presented to the 2nd Ministerial Meeting on Science, the OECD Committee for Scientific and Technological Policy (CSTP) examined the social sciences policies of France, Japan and Finland and produced a number of recommendations that remain relevant today. These included integrating social science research findings into major decision making processes and enhancing communication between social science researchers and government. In 1997 the CSTP began another study, culminating in a 1999 report that recommended a series of workshops to continue the focus on the social sciences. Four important workshops that can be seen as returning the social sciences to the OECD agenda followed:

- i. **Ottawa 1999**, *The Social Sciences for a Digital World: building infrastructure for the future* – focused on the challenge of digitisation and the need to invest in digital infrastructure. This workshop also found that innovations in the information and communications technology sector held the potential for new research opportunities for the social sciences.
- ii. **Bruges 2000**, *The Contribution of the Social Sciences to Knowledge and Decision Making*. This workshop foreshadowed a new perspective for social sciences research involving a process of continuous and collaborative learning, between disciplines and between governments and researchers.
- iii. **Tokyo 2000**, *Social Sciences and Innovation* – focused on the contribution to be made by the social sciences to technological and social innovations.
- iv. **Lisbon 2001**, *Restructuring the Social Sciences* - which brought together the findings of the three previous workshops and focused on interdisciplinary research. It produced the *Declaration on Strengthening the Role of the Social Sciences in Society* (Van Langenhove, 2002: 24; OECD Directorate for Science Technology and Industry: 2004).

Adopted on November 8th 2001, the *Lisbon Declaration* was designed to address the changing demand for social sciences input into policy making in government, and the need for a re-assessment by both social scientists and government decision makers about strategies to realise this. The OECD remains a powerful advocate for the contribution of the social sciences to the understanding and resolution of complex problems.

Social science knowledge is a powerful resource for understanding and coping with the growing complexities, uncertainties and risks in our world. Governments, as well as social and economic actors, should therefore make a more systematic and extensive use of social science as a source of expertise on societal issues as well as of citizens' participation in governance (OECD 2004: 70).

The social sciences have remained on the UNESCO agenda for many years (Van Langenhove, 2002: 25). In 1994, UNESCO established the *Management of Social Transformations* program to foster

Achieving our innovation goals will require quality work across the entire research spectrum – including the humanities, arts and social sciences. The physical sciences my underpin the development of new technologies, but those technologies will go nowhere if they are not tailored to the real world, if they don't meet concrete needs, and if people don't have the skills to use them.

Senator Kim Carr
in his address to the Deans of Arts,
Social Sciences and Humanities

1 October 2008

international policy relevant social sciences research, and in 1999 published the first *World Social Science Report* which documented developments across different disciplines. UNESCO and its *Management of Social Transformations* program have collaborated with the OECD social science workshop series and will play a lead role in the follow up of that series. In 2002, the International Social Sciences Council, a non government organisation in formal association with UNESCO presented a major conference on the *Social Sciences in the 21st Century* (Van Langenhove, 2002: 25-26).

The European Union's (EU) research funding introduced socioeconomic research for the first time in its history through its '*Fourth Framework Program*' (FP4) while its '*Seventh Framework Program*' – FP7 - (running from 2007 to 2013) dedicated, for the first time, an entire theme to the HASS sector. Theme 8 is also linked to the *Lisbon Agenda* through which the EU aims to address Europe's current and future challenges – namely, growth, employment and competitiveness; social cohesion and sustainability; quality of life; and global interdependence. Research under the umbrella of Theme 8 is also intended to be collaborative, working across disciplines and across countries (Howard 2008: 6).

2.5.2 Changes in Australian Government Policy Focus on the HASS disciplines

The Rudd Government took office on 3 December 2007 and enhancing innovative capacity was one of its many identified areas of reform. One indicator of Australia's uneven 'innovation performance' was our drop from fifth to eighteenth in the World Economic Forum's Global Competitiveness Index. This was attributed to a number of factors, including a 22 per cent fall in Commonwealth spending on science and innovation as a share of GDP since 1993-94. Business spending on research and development had reduced in the late 1990s, with the proportion of Australian firms introducing innovations remaining at one in three for years (Commonwealth of Australia: 2009; DIISR: 2009a). Australia spends 2 per cent of GDP on research and development, while other countries spend much more. Australia also ranks last among OECD countries in collaboration for innovation between firms and universities (Commonwealth of Australia 2009: 3, 20).

Comparative international data further highlight a gap in funding designed to foster innovation. For example, China's R&D spending has grown by 22 per cent a year since 1996, compared to 8 per cent a year in Australia. Where Australia spends 2 per cent of GDP on research and development, Austria, Denmark, Germany, Iceland, Switzerland, Taiwan, and the United States spend more than 2.5 per cent; Finland, Japan, South Korea, and Sweden spend more than 3 per cent; and Israel spends more than 4 per cent (Commonwealth of Australia 2009).

In response to this situation, the Rudd Government commissioned a review of the National Innovation System in early 2008. Chaired by Dr Terry Cutler it identified a number of weaknesses in that system and its recommendations were responded to in the Australian Government's *Innovation Agenda for the 21st Century* (Commonwealth of Australia: 2009). The Agenda also drew on a number of other national reviews, including that of the Cooperative Research Centres Program (Commonwealth of Australia: 2008), and the review of the higher education system (Commonwealth of Australia: 2008a).

Innovation is very much about people and processes; the social sciences has played a key role in understanding how people work together.

Ian Chessel, Chief Scientist

The Strategic Roadmap for Australian Research Infrastructure, released in September 2008, recognised for the first time in Australian Government innovation-related policy, the importance of the HASS disciplines (DIISR: 2008). This turned the policy focus that had been evident during the Howard Government years of linking innovation with the STEM disciplines while minimising the contribution of the HASS disciplines. Informing the *Roadmap*, the Cutler review of the innovation system in Australia recommended that HASS be included in the successor to the National Collaborative Research Infrastructure Scheme and emphasised the importance of the creative arts, humanities and social sciences to the innovation process. The Cutler report also argued against separating the HASS disciplines from the physical sciences, noting that innovation is about interpretation and solution seeking as well as analytical problem solving (Carr: 2008).

Building on the Strategic Roadmap that had been released in 2006, the 2008 *Strategic Roadmap for Australian Research Infrastructure* reaffirmed the 12 capabilities of the 2006 document, but added the new capability of 'Humanities Arts and Social Sciences (HASS)', in recognition of '... *the wide ranging contributions these disciplines make to the national interest* (DIISR 2008: viii, 9). The 2008 Roadmap emphasised the importance of cross-discipline, collaborative research effort and networks, and the need to enhance these (2008: 17).

Responding to today's global, social, cultural and economic challenges requires specialist knowledge of the people, societies and cultures that underpin, fuel or react to these challenges. Humanities, arts and social sciences (HASS) research is integral to achieving this fine-tuned understanding (DIISR 2008: 39).

In order to build on the contribution of the HASS, the 2008 *Strategic Roadmap for Australian Research Infrastructure* argued that a ‘transformative step is needed on how it approaches research’, and that in line with trends in North America, Europe and the United Kingdom, this required an investment in a purpose built, dedicated HASS e-Research infrastructure, tailored to the HASS disciplines and providing the technical capacity for electronic analysis of texts and the construction of virtual environments that use advanced design technologies. This is seen as generating efficiencies, facilitating innovation, enabling HASS-STEM collaborations, supporting the effective dissemination of HASS research findings, and fostering international collaboration (DIISR 2008: 39). This strategy is seen as enabling more awareness of the impact of the HASS disciplines, arguing that –

The physical sciences may underpin the development of new technologies, but those technologies will go nowhere if they are not tailored to the real world, if they don't meet concrete needs, and if people don't have the skills to use them. That's where the humanities, arts and social sciences come in – and why we are seeing much closer collaboration between the STEM and HASS disciplines on everything from public health to robotics.

Senator Kim Carr, Minister for Innovation, Industry, Science and Research, Presentation to the Deans of Arts, Social Sciences and Humanities, October 1st 2008, Melbourne.

The capability will transform the impact and international standing of HASS research from fields as critical and diverse as history, sociology, economics, international relations, visual arts, literary studies, design, demography, anthropology, archaeology, cultural geography, and cultural studies. In key areas of social and economic policy, such as international relations or indigenous policy, more accurate predictive modelling of social, cultural and economic behaviours and the linkage of HASS data across large scale databases can be used to examine the long term impacts of government policy and interventions. ...

In an increasingly connected world, research infrastructure that both enables the research and makes it widely accessible is vital (DIISR 2008: 39).

The Australian Government's science and innovation budget was increased by 5 per cent in the 2008-09 Budget and a further increase of 25 per cent is expected in the 2009-10 Budget. This direct investment in Australian innovation was further supported by investments in infrastructure to sustain the innovation process — including the National Broadband Network — and in the ‘Education Revolution’, which is described by the Australian Government as transforming every stage of the learning journey from pre-school to post-doctorate level (Commonwealth of Australia: 2009).

Budget changes meant that in 2009-10, the Australian Government was spending \$8.58 billion on science and innovation, an increase of 25 per cent from the previous year. One quarter of Commonwealth spending on innovation is now directed to encourage business investment in innovation (including research and development tax incentives) and the remainder is directed to the higher education sector, research agencies and cross sector initiatives like the Cooperative Research Centres Program (Commonwealth of Australia 2009: 18 citing 2009 data from the Department of Innovation Industry Science and Research, Canberra).

Funding of \$17 million has been allocated to establish a *Creative Industries Innovation Centre* in the *Enterprise Connect* network, and the Department of Innovation, Industry, Science and Research re-focused its *International Science Linkages Program* to include the HASS disciplines.

Through the *National Collaborative Research Infrastructure Strategy* (NCRIS), the Australian Government has allocated \$542 million over 2005-2011 to provide researchers with major research facilities, supporting infrastructure and networks necessary for world-class research. Rather than seeking proposals through a competitive grants program, the NCRIS Committee commissioned independent external facilitators to develop national investment plans for priority capabilities identified in the *Strategic Roadmap for Australian Research Infrastructure* (DIISR 2008). In developing the investment plans, facilitators worked with researchers, research managers, research funders and users, to define the infrastructure requirements and the collaborative arrangements for managing the operation and accessibility to facilities and equipment. Importantly, funding and eligibility have been designed to encourage collaboration and co-investment. The Strategy also seeks greater participation by Australian researchers in the international research system, and supports involvement of a broad range of researchers – from higher education institutions; Australian Government and State and Territory research agencies and institutions; independent research institutions; private sector research organisations; and industry⁵.

Until recently, the HASS disciplines were considered largely out-of-scope in the NCRIS process, partly because of the way NCRIS had defined infrastructure. However, an NCRIS working group was established to examine HASS infrastructure needs (for example, laboratories and fabrication facilities in the creative arts, new technical and digital capabilities that support HASS research) has identified the need for this gap to be addressed, noting that despite international precedents to support such infrastructure, Australia has few examples (Keighley-James: 2008).

Consequently, the Australian Government argues that it is important to expand the capacity of public research institutions in order to enhance economic and social returns and to ensure that their research findings are widely accessible. Citing international evidence that indicates up to three quarters of private sector patents draw on public sector research, the *Innovation Agenda* argues that a strong public research sector reduces the cost of innovation to industry, can stimulate the development of new clusters of activity, can make Australia more attractive to foreign investment and generates a knowledge base that brings widespread benefits including for population health, community resilience, cultural enrichment and environmental protection (Commonwealth of Australia 2009: 32).

In summary research generated by HASS is widely recognised among policy makers as having a critical role to play in improving community, cultural and environmental strength as well as providing a foundation for understanding the human dimensions of science and technology. While this growing recognition of the role and contribution of HASS is translating into changes in funding programs the challenge of full integrating HASS into the innovation agenda remains substantial.

⁵ Source: <http://ncris.innovation.gov.au/Pages/default.aspx>

2.5.3 Changes to the Cooperative Research Centres Program

The Cooperative Research Centres (CRC) Program was established in 1990 to provide closer linkages between research and development providers and end-users, including industry. However, the HASS sector's involvement in CRCs has been limited, and only one of the 18 members of the CRC Appraisal Panel in 2006 was a HASS researcher (Metcalfe *et al*, 2006: 21; Howard 2008: 21). A wider and more cross-disciplinary focus has been identified as needed, especially for resolving major public policy issues (Howard 2008: 16). When interviewed for the CHASS study, the Deputy Chair of the CRC Association foreshadowed a change in this trend –

... as the CRC Program places more emphasis on outcomes providing economic, lifestyle or environmental benefits for Australia, it will have to take a conscious policy effort to bring HASS into the relationship (Metcalfe et al, 2006: 21).

The recent Review of the CRC Program (Commonwealth of Australia: 2008) also reflects these views. A key criticism of the Program, identified by the Review, was its emphasis on commercialisation and an accompanying shift away from its original purpose of pursuing outcomes aimed at the 'public good'. Endorsing the Productivity Commission's finding in its study of science and innovation, and Minister Carr's February 2008 statement on the need to move away from the focus on short term commercialisation that had characterised the previous decade, the Review also concluded that there had been an unbalanced emphasis on the science and engineering fields while neglecting the humanities, arts and social sciences. The Review report argued that HASS input was vital to developing multidisciplinary and collaborative solutions to major challenges facing Australia and other countries. It noted that:

At the moment the CRC Program only funds applications that are from predominantly science and engineering fields. However as the boundaries between sciences and the social sciences are increasingly blurred in multidisciplinary areas and as most real-world problems require collaborative, multidisciplinary solutions, for which humanities and social sciences input is vital, this distinction is rapidly becoming out of date.

Extending eligibility to researchers in the fields of humanities and social sciences would enable the services sector to participate in the CRC Program more fully. Given that a substantial proportion of innovation comes from process innovation, it would be foolish to exclude opportunities for collaboration and research in these fields. These are also fields that can contribute to resolving major public good problems, particularly in areas of social justice and social services (Commonwealth of Australia 2008: 65).

In conclusion, it is evident there is widespread agreement that –

- a) large scale problems require collaboration and interdisciplinary effort,
- b) collaboration is important for innovation, and
- c) the HASS disciplines have a critical role to play in developing solutions to large scale and complex problems.

This recognition is relatively recent and growing as a result of changing international and national government policy directions. For a number of decades the STEM disciplines were regarded as

central to innovation while the contribution of the HASS disciplines was seen as secondary. In the last decade in particular, there has been a re-thinking and broadening of the concept of innovation and the contribution which the HASS disciplines make. Better understanding the contribution of HASS disciplines to innovation will help to more fully engage HASS in the innovation agenda and debate.

3 THE CONTRIBUTION OF THE HASS DISCIPLINES TO INNOVATION

The contribution of the humanities, arts and social sciences to innovation needs to be the subject of an ongoing national conversation. While many researchers working in HASS disciplines appreciate the role and contribution of HASS to innovation, this appreciation is not widely shared in the research community as a whole. It is important in this context that considerable effort be devoted to clearly articulating the contribution of HASS to innovation.

HASS has intrinsic value, as well as directly fostering innovation. It helps us to understand the social, cultural and ethical context in which scientific and technological change occurs, providing skilled personnel whose expertise is transferable to a range of sectors, and contributing to innovation through cross-disciplinary and cross-sector collaborations. Large scale and complex problems (such as, population ageing and climate change) require collaboration and interdisciplinary effort, in order to achieve innovative solutions, and the HASS disciplines bring critical knowledge about the causes and management of such problems.

3.1 The intrinsic value of the humanities, arts and social sciences

Apart from their important contribution to cross-disciplinary research, HASS disciplines are valuable in themselves. The Council for the Humanities and Social Sciences (CHASS) recently summarised the intrinsic value of the HASS disciplines in this way –

The humanities ask us to account for ourselves, our history, our stories and our human values. The social sciences draw on rigorous investigations to help us make informed choices about the sort of society we wish to live in – how we organise education, health, wealth and security. The arts ask the same questions in different ways, providing not scientific knowledge but insight – the flashes of inspiration that illuminate, and encapsulate our place in the world (CHASS, 2005: 13).

CHASS recently undertook a major national study commissioned by the then Department of Education Science and Training to quantify the contribution of HASS research using a new assessment process in place of the university sector's conventional approach involving the number of publications/research grants/research students. The new approach involved seven representative academic departments compiling a 'case for excellence' that provided evidence about the quality and impact of their departments' research and of the research capability of their organisation as a whole. Apart from developing a useful model with application across all disciplines, the report identified the difficulty in quantifying the impact of HASS research, beyond that conducted within universities and publicly funded research agencies, to its broader application and impact in the community. For HASS researchers, society itself is the subject of their research and CHASS distinguishes three levels of its impact which are – within the research setting, as it is practised by professionals working in the social, cultural and artistic professions, and in the everyday lives of the community (CHASS, 2005: 15).

Previous CHASS research (Gascoigne & Metcalfe: 2005) had identified a huge range of social benefits derived from HASS research, many leading to economic outcomes. It identified numerous projects that involved professional consultancies to government, drawing on HASS disciplines' research, and leading to new jobs and new industries. That report also identified savings and resource efficiencies arising from HASS research that changes public attitudes (eg to water usage) and provides improved approaches to teaching and administration.

Ireland's Minister for Education and Science has also argued for recognition of the HASS disciplines for their intrinsic value as well as for their direct or indirect economic benefit –

The intrinsic value of the arts, humanities and social sciences ... outweighs direct or indirect economic benefit.... The ... humanities and social sciences ... can provide not simply knowledge, but the wisdom that allows us to lead enlightened lives, to negotiate our way around the complexities of everyday living ... and to live fulfilled and contented lives. ...

... there is also a separate and very compelling case to be made for their value in purely economic terms.... the importance of our science, engineering and technology to economic success is very direct in the modern knowledge age.... We cannot fulfil the promise of those developments in the absence of a deeper understanding of our ideals and objectives as a society and the highly complex issues that surround those. The humanities and social sciences enable us to address those ... [and] play a very direct, but often underestimated, role in our national innovation system. The skills imparted by the humanities and social sciences are central to the creation and transmission of new knowledge and underpin the development of our society (Hanafin: 2006).

3.2 Fostering innovation

The HASS sector also fosters creativity and innovation. The *Strategy for Science Technology and Innovation* (Government of Ireland 2006: 30-31) identifies this and other roles for HASS disciplines –

- enhancing our understanding of the rapid changes occurring social and economically;
- better informing public policy making;
- developing creative and analytical skills in the context of a global economy that is increasingly dominated by knowledge based services.

The Strategy emphasises the importance of HASS research in fostering a 'climate of innovation' and commits to investments designed to provide a 'world class research system in humanities and social sciences' (Hanafin: 2006).

The role of the arts in innovation processes has been the subject of considerable attention over the last five years. Hassemann and Jaaniste (2008: 5) argue that the arts sector — particularly the performing arts, visual arts and crafts, new media arts and creative writing — should be included in Australian Government innovation policy

People think innovation should be spontaneous if it's real ... Rather innovation requires a lot of hard work that you systematically plan for, allocate resources to and develop.

Chris Robinson, Department of Education and Children's Services

development because of their significant role in national innovation. In advancing this proposition they present six arguments exploring the place of the arts in Australia's national innovation system; all of these arguments have direct and critical relevance for understanding the role of the social sciences in innovation:

- *the cultural argument*: the arts create and promote an atmosphere of innovation;
- *the skills argument*: a rich arts education builds the skills required of a future innovative workforce;
- *the knowledge argument*: the arts create new knowledge for innovation through creative production and processes, including collaborations with other disciplines, such as science, within and beyond universities;
- *the commercialisation argument*: the arts can convert new knowledge and research into profits through entrepreneurial activity;
- *the economic argument*: the arts, as part of the creative industries, occupy a substantial, growing, enabling and innovative part of the economy;
- *the systems argument*: the cultural sector is an innovation system within which various institutions and organisations behave as innovation hubs.

3.3 Understanding the social, cultural and ethical context of technological change

Innovation in the development of new technologies takes place in a social, cultural and ethical context. Technology both shapes and is shaped by context. For example, the technological changes associated with the Internet have significant implications for daily life, service provision, education, work practices, media industries, the arts and popular culture. To respond sensitively and appropriately to human needs requires sophisticated collaboration between STEM and HASS disciplines. This is crucial for the development of a better understanding of the social implications and responsiveness of technological innovations as well as the successful implementation of these in differing social contexts. Examples of technological innovation where there is a compelling case for such collaboration include nanotechnology and genetic modification.

The HASS disciplines assist in understanding concepts like social inclusion and exclusion, equity and poverty, and the potential role of information and communication technologies as further entrenching inequities in the absence of social policy interventions. While the important innovation of the Internet is not disputed, it is the social sciences in particular, that undertake the research which identifies the implications of poverty and low levels of education restricting access to the Internet. It is the social sciences that are usually responsible for developing services and other interventions that compensate for inequitable access to advances in information and communication technologies. Social scientists have worked for years on developing strategies to reduce poverty, with little success. It is possible that if the HASS and STEM disciplines were to work

collaboratively on issues like poverty, more innovative responses to social exclusion and disadvantage could be developed.

The HASS disciplines play an important role in anticipating the consequences of significant technological change and assist in designing policies in response to these changes. Knowledge generated by them can have a profound impact on the shape, design and uptake of particular technologies. For example, electronic or remote forms of ‘telecare’ in health, that apply IT-based monitoring and reporting technologies to patient care delivery, now have a long history. Literature

The most radical transformation within our society and our technology over the last 20 to 30 years have actually come from the social sciences and humanities, in terms of the way we organise to do things, we structure government relations, we organise our economy.

Professor Andrew Beer, Flinders University of South Australia

surveys have found more than 8,600 published journal reports (mainly in medical journals) on telecare or e-health experimentation. The vast majority of these studies concerned innovations that were developed by technology companies and piloted by health and social services professionals (LSE 2008: 60). Countries like Japan, with one of the world’s largest proportions of older people needing care, are leading the field in developing robots to become carers of old people. However, their integration into the aged care system will require significant collaboration.

Since the mid 1990s there has been considerable attention devoted to research related to the ‘the social shaping of technology’ (SST) (Williams and Edge: 1996).

This has gained increasing recognition in recent years, particularly in the UK and Europe where SST research is seen to play a positive role in integrating natural and social science knowledge, in offering a greater understanding of the relationship between scientific excellence, technological innovation and economic and social well-being, and in broadening the policy agenda, for example in the promotion and management of technological change (European Science Foundation/Economic and Social Research Council: 1991). SST studies show that technology is a social product, patterned by the conditions of its creation and use. Every stage in the generation and implementation of new technologies involves a set of choices between different technical options which are mediated by social considerations and implications. SST research thus goes beyond traditional approaches, concerned merely with the assessment of the ‘social impacts’ of technology, to examine what shapes technology and the adoption or rejection of technology.

3.4 Provision of skilled personnel, and personnel with transferable skills

HASS disciplines also foster economic growth by providing skilled personnel – every year more than 150,000 HASS graduates enter the labour market in the UK, with more than two-thirds entering the private sector (LSE 2008: 21). There was a trend for businesses and government representatives interviewed by the LSE Public Policy Group to perceive the HASS disciplines as producing graduates

with transferable skills, an understanding of the complexities of organisational processes and their management and an understanding of how political and social factors affect business projects, with a capacity to think creatively and contributing to firms' understanding of emerging trends (LSE 2008: 23).

In Australia, 64 per cent of all undergraduate and postgraduate course work students were in the HASS sector in 2004, with STEM sector students comprising the remaining 36 per cent. Research based doctorates in the same year had a higher proportion in the STEM disciplines – 55 per cent compared with the 45 per cent in the HASS disciplines. In terms of employment, most STEM researchers work in universities or publicly funded research organisations while the opposite applies to those from the HASS disciplines. (CHASS, 2005: 15-16).

The HASS disciplines in South Australia employ **1,166** teachers and researchers across the three major universities, representing **39 per cent** of the total South Australian university workforce of teachers and researchers (see *Table 1*). They have 42 per cent of Higher Degree students and hold 11 per cent of research income (PSRC, 2009, Tables 4 and 5).

Table 1: Academic staff by HASS discipline and by University, South Australia, 2007 & 2008

| Discipline | Flinders Univ (2007) | Univ of Adelaide (2008) | Univ of SA (2008) | Total |
|---|-------------------------|----------------------------|----------------------|--------------|
| Education | 42 | 30 | 100 | 172 |
| Economics | 32 | 28 | 9 | 275 |
| Commerce, Management, Tourism and Services | | | | |
| Studies in Human Society | 86 | 52 | 97 | 235 |
| Psychology | 27 | 25 | 38 | 90 |
| Law and Legal Studies | 32 | 29 | 18 | 79 |
| Studies in Creative Arts and Writing | 82 | 59 | 38 | 315 |
| Language, Communication and Culture | | 38 | 48 | |
| History and Archaeology | | 25 | 3 | |
| Philosophy and Religious Studies | | 11 | 11 | |
| Total | 301 | 366 | 499 | 1,166 |
| <i>% of University total</i> | <i>40%</i> | <i>32%</i> | <i>45%</i> | 39% |
| University total | 745 | 1,136 | 1,108 | 2,989 |

Source: Premiers Science and Research Council, 2009

3.5 HASS disciplines and funding for research

Industry undertakes three-fifths of Australia's research, most of it involving applied research and experimental development and a miniscule proportion involving the humanities, arts and social sciences (HASS). When research is undertaken in the HASS, it is most likely to occur in the public sector (most being undertaken by universities and the balance by publicly funded research agencies like CSIRO and a small amount directly by government agencies) which is responsible for 89 per cent of research in these fields (Commonwealth of Australia 2009: 31).

By comparison, in the United Kingdom, HASS disciplines receive 8 per cent of research council funding, which is less than one-tenth of the amount that STEM disciplines receive (although it is recognised that higher costs are usually involved for STEM research) (LSE 2008: 15). In relation to funding from government for university research in the UK, 18 per cent goes to HASS disciplines, equating to £3,400 per head annually across all academic personnel compared to an average of £24,800 per head for those in STEM disciplines (LSE 2008: 16).

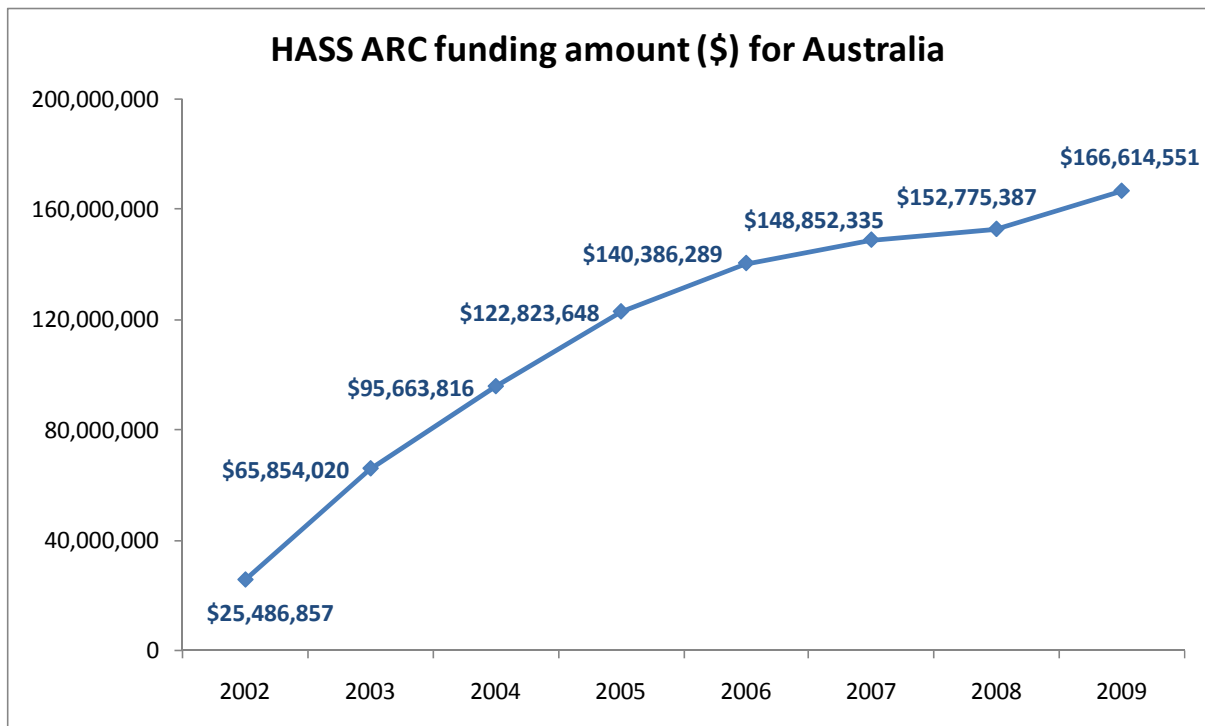
In calculating Australian and South Australian HASS disciplines' share of ARC funding, it was evident that an agreed definition could not be found regarding which disciplines are regarded as 'HASS'. Even the website for the Council of the Humanities and Social Sciences (CHASS) does not define its member disciplines. Consequently, the AISR has reviewed the information which is available and developed a list of disciplines (*see Appendix 3*) and used these to filter a search of the ARC website.⁶

As *Figure 2* indicates, in 2009 HASS disciplines across Australia attracted \$166,614,551 in ARC funding – a steady growth being evident since 2002. With the exception of 2007, South Australia has shown a similar pattern of growth in HASS research funding, which in 2009 stood at \$8,363,531 – see *Figure 3*.

It is important to note that these figures only reflect projects where HASS researchers are the first named investigator. There are a growing number of multi-disciplinary projects in which HASS researchers are involved but are not the first named investigator. In addition further research is necessary to quantify the full value of other sources of research income secured by HASS. For example the Australian Institute for Social Research at the University earns around \$2m in contract research income per annum.

⁶ Part 1: Projects and fellowships. New and ongoing - http://www.arc.gov.au/general/searchable_data.htm

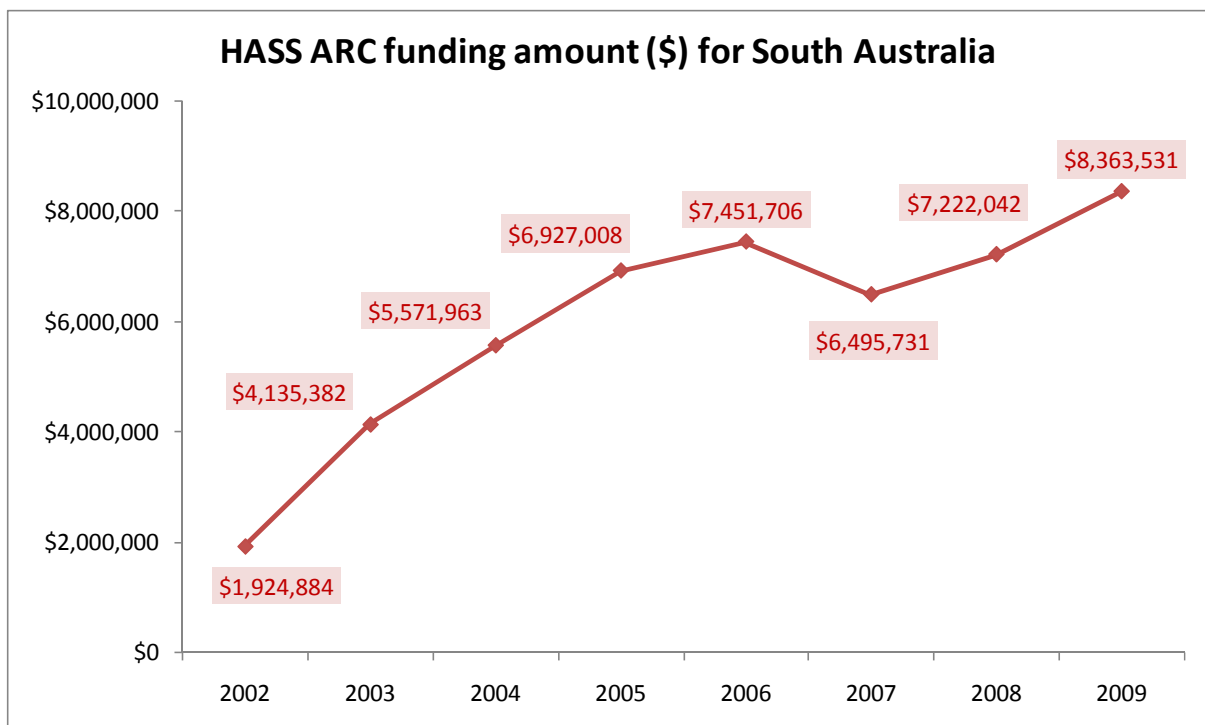
Figure 2: HASS* ARC funding amount (\$) for Australia



* Disciplines included as HASS in this calculation are shown in Appendix 3.

Source: Data extracted on 30 March 2010 from National Competitive Grants Program (NCGP) Dataset: Completed projects, and New and ongoing Projects www.arc.gov.au/general/searchable_data.htm

Figure 3: HASS* ARC funding amount (\$) for South Australia

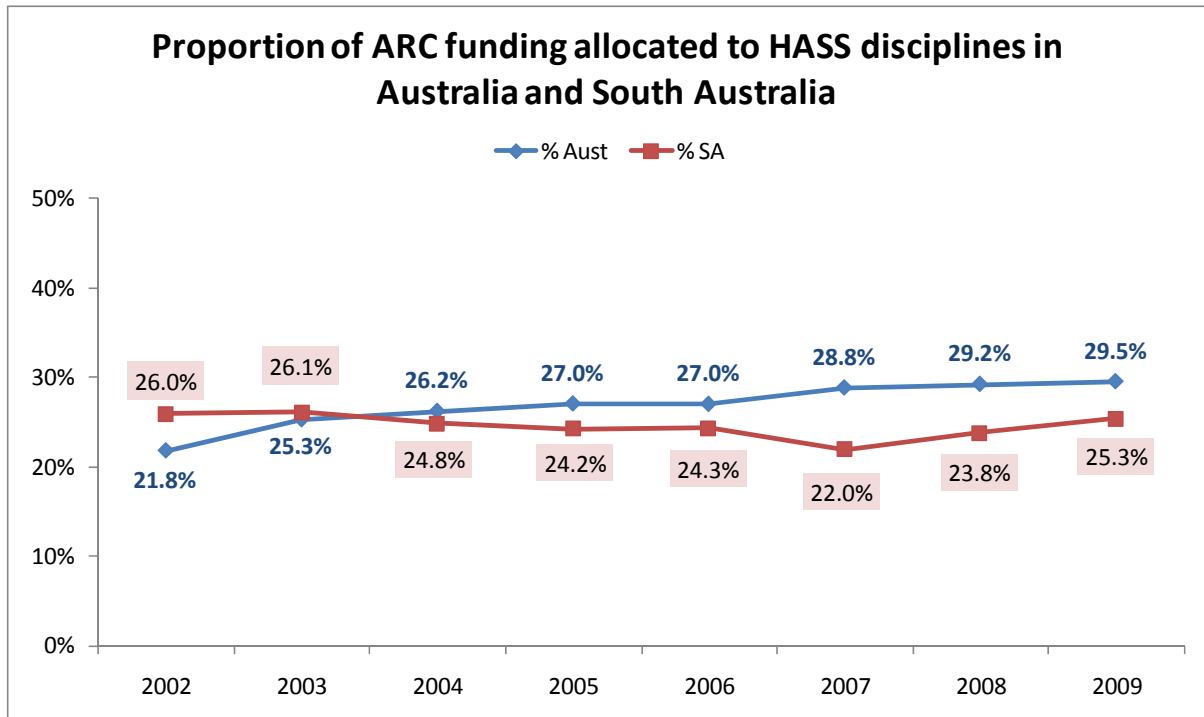


* Disciplines included as HASS in this calculation are shown in Appendix 3.

Source: Data extracted on 30 March 2010 from National Competitive Grants Program (NCGP) Dataset: Completed projects, and New and ongoing Projects www.arc.gov.au/general/searchable_data.htm

As *Figure 4* indicates, the proportion of ARC funding allocated to HASS disciplines in South Australia exceeded the national level in 2002, with South Australian HASS researchers attracting 26.0% of funding compared to the 21.8% share by HASS researchers nationally. However, in 2004 this trend began to change with South Australian HASS researchers receiving less funding than their peers across Australia as a whole. By 2007 the gap widened with HASS disciplines nationally attracting 28.8% of ARC funding while those in South Australia attracted 22.0%. There has been a slight upward trend since, climbing to 25.3% in 2009, compared with the national proportion of 29.5%.

Figure 4: Proportion of ARC funding allocated to HASS* disciplines in Australia and South Australia



* Disciplines included as HASS in this calculation are shown in Appendix 3.

Source: Data extracted on 30 March 2010 from *National Competitive Grants Program (NCGP) Dataset: Completed projects, and New and ongoing Projects* www.arc.gov.au/general/searchable_data.htm

3.6 The impact of the HASS disciplines – from the perspective of HASS researchers

The Public Policy Group of the London School of Economics recently presented a report to the British Academy on the findings from a six month research project that examined reasons why contributions of HASS to a knowledge society were constrained and under-valued (LSE 2008). The study involved interviews with some 100 senior representatives of business, government, civil society organisations, the media and universities, together with a systematic literature reviews and a survey of 340 HASS academics.

On a scale of 1 (little impact) to 7 (high impact) academics surveyed rated the actual and potential impact of their discipline in five domains. Findings are summarised in *Table 2*. In all domains, those surveyed believe that their disciplines' potential impact is greater than their actual impact. The lowest level of impact was seen to relate to the science and technology arena, followed by economy

and business and public policy – all of which received relatively low ratings. The highest impact was ascribed to public and culture, followed by civil society.

Table 2: HASS researchers’ rating of the actual and potential impact of their discipline

| Domain | Actual Impact | Potential Impact |
|-------------------------------|---------------|------------------|
| Public and culture | 4.6 | 5.6 |
| Civil society | 4.1 | 5.1 |
| Public policy | 3.4 | 5.1 |
| Economy and business | 3.0 | 3.8 |
| Science and technology | 2.9 | 3.9 |

Source: London School of Economics (LSE) Public Policy Group, 2008

The LSE Public Policy Group identified a range of reasons for their findings about perceived impact and value attributed to HASS (LSE 2008: 8-14). These involve –

- **Measuring and valuing impacts** - the need to better record how HASS achieves impacts, including disaggregation of higher education statistics to separate HASS, STEM and other key discipline groupings and to involve HASS in that recording process; separate estimation by disciplines of economic impacts (this issue is discussed in *Section 2.4.1*).
- **Boosting impacts on economic development** – increasing working relationships between HASS and business; more sharing of information on good practice in university and business working relationships.
- **Boosting impacts on government and public policy making** – HASS disciplines need to train students in ways that better fit contemporary government need, including cross disciplinary and group learning; radical improvement is needed of current methods of communicating research findings and their usefulness and applicability to external audiences; HASS disciplines need to improve their capacity to exploit new forms of digital research data so that they can access government held data for research purposes and better train their students for using that data and understanding its capabilities. There is also a need for more cooperative work between universities and public sector organisations to improve the relevance of post graduate studies to an environment demanding innovation in evidence based policy making.
- **Further boosting impacts on civil society, culture and public** – this includes better dissemination and explanation of research results.
- **Improving linkages with science and technology research** – there is a need for research funding bodies to review the support they provide for joint HASS and STEM research to address key policy issues, such as, climate change, population ageing and the introduction of new technologies. It is also seen as likely that more joined up work within HASS disciplines could engage the attention of STEM researchers.

It would seem prudent to review the implications of these findings for research development in the Australian context. A survey on the contribution of HASS researchers to innovation in South Australia would be timely in this regard.

3.7 Quantifying the role of the HASS disciplines in cross-sector collaboration

It is important that we better understand the role that HASS researchers are playing in multi-disciplinary collaborations, particularly with STEM researchers. One way of doing this is to examine the authorship of papers. More than 90 per cent of research papers published by Australian scientists have more than one author, and one-third of all published Australian research has an international co-author (Barlow 2006: 37). The extent to which this represents multi-disciplinary collaboration is worthy of close examination.

Analysis of Australian cross-disciplinary research patterns identifies the fields most likely to collaborate are environmental science, ecology and evolution while the least likely are cognitive science and media studies (Grigg *et al* : 2003). However, there is a general lack of information that quantifies cross-sector collaboration, and a significant proportion of such interaction is not documented (Riedlinger M *et al*, 2006: 52). Some progress has been made in the Australian context as the following case study demonstrates.

Case Study: The Council for Humanities Arts and Social Sciences (CHASS) study of STEM-HASS Collaboration in Australia (Metcalf *et al* 2006)

The Council for Humanities Arts and Social Sciences (CHASS) is a relatively recent peak body, having been established in 2004. A research study commissioned by the then Department of Education Science and Training (DEST) explored the relationships between the humanities, arts and social sciences (HASS) and the science, technology, engineering and medical (STEM) sectors. This has not only added significantly to the knowledge base on collaboration across disciplines, but is a case study in itself on cross sectoral collaboration.

One of the drivers for the CHASS study was the call for innovative solutions, based on new forms of cross-sector collaboration, to find solutions to major challenges including water conservation, national and global security in the face of terrorism and climate change. The study delineated the extent of HASS-STEM collaboration in Australia - using case studies exemplifying this and surveys to quantify patterns, identified key success factors and barriers affecting collaboration and best practice strategies for effective collaboration.

The first of two surveys drew 606 responses (330 from HASS, 159 from STEM and 108 from both, and 9 from 'other' disciplines). It was designed to scope the extent of cross-sector collaboration in Australia, who conducts such projects and the reasons for doing so, as well as to identify factors that support or hinder collaboration and lessons learned. Among its findings were the following –

- 75 per cent of all respondents had participated in cross-sector collaboration.
- The disciplines identified most frequently were social sciences with arts, and from the STEM sector, health and medicine. Least frequently identified collaborations were from policy, political science, philosophy, religion and chemical sciences disciplines.

The second survey was designed to test key learnings and information from the literature review, from the first survey, the case studies, interviews and other components of project methodology. It drew 688 responses, of whom 60 per cent had participated in cross-sector collaboration. Its findings included –

- Those involved tended to be more advanced in their careers, and cross-sector collaboration appeared to be an indicator of career maturity.
- The two top areas of collaborative activity were 'Promoting and maintaining good health' and 'Appreciation of cultural and historical heritage'.
- The five top outcomes identified as a result of cross-sector collaboration were gathering knowledge and understanding, improving current strategies, publications, education and developing guidelines and models (Metcalf *et al*, 2006: 23-24).

The CHASS study identified a number of benefits arising from cross-sector collaboration, including –

- Managing the increasing amount of knowledge generated by research.
- Creating new knowledge at the intersections between disciplines.
- Provision to industry of new and more appropriate responses to their markets, including the development of new commercial products.
- Enhanced problem solving capacity.
- Development of new services and programs for the community.
- Training of staff and volunteers for new services developed.
- Enables more effective engagement of the public or industry in research projects and outcomes.
- Enhanced creativity and innovation. Although difficult concepts to measure, these were identified as cross-sector collaboration outcomes.
- Development of wider professional and social networks (Metcalf *et al*, 2006: 25-29).

At the same time, cross-sector collaboration has high transaction costs which are likely to increase when team members –

- are widely geographically dispersed;
- are inexperienced in collaboration;
- have limited or no experience in working with each other;
- have a high degree of personal connection to their own discipline or work site;
- have other priorities or commitments that take precedence over the collaboration;
- belong to organisations with inflexible administrative and reporting requirements (Metcalf *et al*, 2006: 30).

The CHASS study has provided, in great detail, findings relating to the incentives and impediments to cross-sector collaboration and mapped these against the following seven factors – structure and team management, power distribution, resources and support, commonalities and differences, communication, personal traits of team members, and status and recognition (Metcalf *et al*, 2006: 33-34).

In their review of the literature, the CHASS researchers identified both a focus on science as the key to future economic and social prosperity and a growing tendency to recognise the humanities for their commercial potential. The main example cited was the report from the Prime Minister's Science, Engineering and Innovation Council (PMSEIC: 2005), which acknowledged the need to –

... include the cultural sectors as powerful engines of sustainable economic growth, and recognise the contribution the HASS sector makes to Australia's research and economy (Riedlinger et al 2006: 49).

The PMSEIC report also supports a whole-of-government approach to coordinate and improve existing innovation policy (PMSEIC 2005: 18).

Other CHASS research (2005: 14-15) illustrates the impact of HASS-STEM research collaborations, with examples that include investigations of major causes of avoidable mortality, like road deaths, obesity and diabetes 2. In this context HASS disciplines make a critical contribution to better understanding how human thinking and behaviour influences healthy eating and lifestyles, and risk taking when driving. While water availability and energy use will be enhanced through a range of scientific and technological innovations, changes in water and energy users' behaviours will play an equally important role. HASS based knowledge is essential for building and maintaining cohesive governments, legal systems, businesses, economies and societies.

The world's problems have scant respect for disciplines or knowledge sectors. Key issues now confronting us – global warming, energy insecurities, terrorism – require solutions that harness the talents of all ...

Malcolm Gillies, President, Council for the Humanities Arts and Social Sciences, September 2006, Preface to CHASS Occasional Paper 3 prepared by Metcalfe et al., 2006

3.8 Role of HASS in addressing complex problems

Complex problems require multidisciplinary perspectives and collaborative approaches to problem solving (Metcalfe et al, 2006: 26; Keighley-James: 2008). It is difficult to imagine that we will successfully tackle the major social, economic and environmental challenges that face us without the development of strong partnerships between STEM and HASS researchers. Together they are more likely to develop innovative solutions to tackling: –

- Population ageing and rising dependency rates;
- Workforce ageing and the need to support higher rates of labour force participation
- Health inequalities and healthy ageing
- Poverty and social exclusion
- Climate change and water scarcity.

This role is recognised in recent Australian Government policy statements. Minister Carr has identified the importance of understanding the human component of complex systems and in developing solutions to major issues and challenges. For this to occur, collaboration across disciplines is essential (Kim Carr 2008).

If we want to understand complex systems that have people in them, you need to understand the social component. It's a dynamic part of these systems. For example, how much water we should secure from the Murray River. The issues are environmental, legitimacy and fairness

issues around this research. These issues highlight collaboration as a crucial and integral part of the whole research agenda (CSIRO interviewee cited by CHASS study, Metcalfe et al, 2006: 15-16).

The humanities and social sciences have a powerful influence in shaping the way we see our society and evaluate changes and developments in it. By permeating our understanding of issues ... the humanities and social sciences achieve broad changes to people's views of the world. They have a strong ethical component which, when fused with analytical techniques, gives them great strength in tackling complex social questions.

ASTEC 1993, Bridging the gap: the social sciences, humanities, science and technology in economic development, Australian Science and Technology Council, Canberra.

Research on the role of innovation in economic and social change has proliferated in recent years, particularly in the social sciences (Fagerberg: 2003). This tendency is likely to accelerate over coming years as the pressure intensifies to develop effective solutions to pressing environmental, economic and social problems. This will be accompanied by increasing recognition of the importance of cross disciplinary research and problem solving (Verlaeckt & Vitorino, 2002: 10-11). Increasingly, the demands of the global community require integrated research that transcends location (Van Langenhove, 2002: 22).

Examples follow in *Sections 3.8.1, 3.8.2 and 3.8.3.*

3.8.1 Enhancing Indigenous culture health and well being

The *Strategic Roadmap for Australian Research Infrastructure* (DIISR 2008) identifies the untapped potential contribution of HASS disciplines to enhancing national and international understanding of Indigenous culture. Research on this issue brings together most disciplines in the humanities, arts and social sciences and research undertaken will be more accessible and able to be shared because of the PARADISEC digital initiative (see Case Study below).

CASE STUDY: PARADISEC- HASS linkages to other areas of research

The Pacific and Regional Archive for Digital Sources in Endangered Cultures (PARADISEC) has achieved international recognition for its development of low cost techniques for recording, cataloguing and digitising in digital media research resources on endangered cultural heritage in Indigenous Australia, the Pacific Island nations and East and Southeast Asia. These are then able to be accessed internationally as this knowledge base continues to develop.

PARADISEC is regarded as model for other disciplines, and as having immense potential for National Research Priorities both in relation to digitising and sharing research findings, and in providing critical information on linguistic and cultural determinants affecting all four research priority areas. It provides significant opportunity for research collaboration and can promote economically valuable outcomes like growing cultural tourism.

Source: DIISR (2008: 42).

Critical to this research is the collaboration of HASS researchers with STEM researchers. Many important data sources cannot be accessed without culturally sensitive protocols and negotiations, and a huge amount of research material has not been digitised. Capturing the substantial knowledge that exists, and enabling collaboration among researchers requires the creation of infrastructure and eResearch tools to resolve digitisation priorities, linkage of collections and data bases, efficient searching and downloading mechanisms and specialised tools and software (DIISR 2008: 42). This in turn requires a 'national collaborative research platform' that supports whole-of-government policy development, but the DIISR believes that such an investment will bring important policy returns.

Alongside the research motivation for developing a highly sophisticated platform is an equally compelling case for the HASS sector to deliver the research and evidence that will enable a broad range of public policies to be developed to ameliorate and advance the economic, social and cultural conditions of our Aboriginal and Torres Strait Islander communities (DIISR 2008: 42).

3.8.2 Addressing the consequences and benefits of population ageing

There are a range of products and services that determine the quality of life of very old people and these include health, housing and aged care services, financial services, services that enable access to electronic communication and a range of policies that promote the continued participation of older people in their communities. Of particular relevance is –

- a) the way in which different sectors can combine their knowledge and the outcomes of that knowledge – one example being the development of robots specifically to support older people in their homes, and
- b) the capacity for cross sector policy, program and service provision in order to address older people's needs as holistically as possible. This principle is applicable to all groups with particular needs from the very young to the very old, from one cultural background to another, and from one location to another.

The well known current and projected growth of the proportion and number of people over the age of 65 means that a significant market exists for the development of services and products that address the impact of the ageing process, and innovation will be critical to their development, and to their uptake.

Case Study - The Fish-Bird Project: Robotic wheelchairs interact with humans

Based on collaboration between a media artist and a team of robotics designers, this project developed robotic wheelchairs that interact dynamically with people. Funded by an ARC Linkage grant and by the Synapse initiative of the Australia Council, it offers advances in wheelchair technology and monitoring systems that can be applied in a range of hospital, disability care and aged care environments.

'Fish' and 'Bird', the two robots in the exhibit, read and react to human body language by moving about and writing text. The project is also designed to promote a positive social view of wheelchairs in the community.

<http://www.araa.asn.au/acra/acra2005/papers/rye.pdf> Source: Metcalfe et al (2006:14)

The knowledge, the interest, the willingness, the cultural change that is brought about by some of the hard physical sciences, like technical type innovation, it is not only enriched, it probably doesn't actually happen unless the social sciences are part of the mix.

Craig Fowler, SA Department of Further Education, Employment, Science and Technology

A study undertaken for NESTA in the United Kingdom, (Deloitte 2009) mapped the innovation system across the public, private and voluntary sectors and assessed the capacity of five sectors⁷ with specific impact on the quality of life of older people to address their needs. The study is one of a series commissioned by NESTA to address some of society's most complex challenges and to assess the use of innovative responses to those challenges.

Innovation, whether social, financial or technological will play a fundamental part in helping key markets adapt to the changing needs of the ageing population. Without innovation, the effectiveness of policy or market solutions used to address ageing will deteriorate as problems around them intensify. To confront the challenges of ageing in a preventative way, universal recognition of the value of innovation as an agent of change and improvement will be important, together with a need to ensure that opportunities to develop, scale-up and embed innovations across each dimension of older people's lives are taken (Deloitte 2009: 8).

⁷ The five sectors were housing, Health and Aged Care, Social Participation, Local Environment and Transport, and Financial Services

While specific innovations and gaps in innovation within each sector were identified (for example, housing that adapts to users' changing needs, technological, physical and environmental changes that enable continued living at home, accessible services and information that supports that access, reliable and accessible public transport, telecare of various kinds, changes that enable prolonged participation in the workforce and innovative pension models), the study also identified the importance of collaborative design and delivery of ageing-focused innovations, and collaborative funding models that cut across government agencies (Deloitte, 2009: 39).

Policymaking is only beginning to recognise the need to arrange public services around the needs of older people, not departmental silos (Deloitte 2009: 37).

Another key gap identified related to inadequate transmission of information about innovative outcomes that enable their universal take up and adoption across a short time frame (Deloitte, 2009: 39).

One of NESTA's main conclusions was that part of the solution to challenges faced by older citizens derives from the way in which services link to each other and are configured. It identified a series of structural problems that constrain innovation in the United Kingdom – cost pressures that restrict the resourcing of innovative effort, inadequate networks that prevent knowledge exchange across sectors and regions, inflexible policies, planning and regulation, underdeveloped incentives to encourage innovative thinking and behaviour, and inadequate market data linking older people's needs to product and service provision (Deloitte 2009: 3-4).

A number of conclusions on fostering collaboration arise from the NESTA report including the need for –

- Integrated funding arranged around common challenges, rather than funding that is aligned to departmental budgets. The example given involves the establishment of a dedicated 'Innovation Fund' to which government departments are required to contribute an agreed percentage of their total funding.
- Improved knowledge exchange and communication processes that support the sharing of successful innovations and best practice across sectors, organisations, regions and markets.

3.8.3 Addressing climate change

One of the world's most pressing problems relates to climate change, and addressing the role played in this by human beings. The NESTA (National Endowment for Science Technology and the Arts) has the role of transforming the United Kingdom's capacity for innovation in order to better manage major social and economic challenges. NESTA recently implemented a new research area called 'innovation that matters', with climate change being one of three major social challenges it will concentrate upon.

The report from this research highlights the importance of marrying the development of technologies that can reduce carbon emissions with changes in human thinking and behaviour. For example, cars can be designed to use biofuel and other innovative methods of transport but people can be encouraged to use teleconferencing to replace travelling to and from meetings (Footitt &

Gerrard 2009: 13). The report argues the need for better understanding how ‘innovation systems’ can be developed that integrate new technologies, new solutions, new behaviours and new approaches (Footitt & Gerrard 2009: 14). This of course, requires collaboration across sectors and disciplines, as opposed to parallel approaches to finding solutions to climate change. The role of the HASS working with the STEM disciplines is clear. The report attributes current failure to resolve global warming to a reliance on a ‘small subset of measures’ to address the range of issues involved.

There is very little emphasis on the ... broader social innovation that would allow a transition towards ‘doing things differently’. As such, the system does not reflect the role that behavioural and social change through radical innovation can, and needs to, play in delivering ... enduring emissions cuts. Here, the nature of the problems and the scale of the targets are such that technological innovation and its deployment is, in itself, unlikely to deliver the necessary reductions within the necessary (short) timescales. ... there is also a need for much more radical and rapid innovation to promote sustained behavioural and lifestyle changes (Footitt & Gerrard 2009: iii).

Case Study - Integrating HASS and STEM: Recycled water acceptable to society

A major collaborative project involving social psychologists, engineers, water researchers, hydrologists and the water industry is investigating water reuse in Western Australia. It is being undertaken by CSIRO National Flagship – Water for a Healthy Country and integrates information on water reuse technology, social acceptability, capital and operating costs, water quality, opportunities to link with waste energy, potential scale, human health risk, environmental impact, and water discharge and management.

Source: Metcalfe et al (2006:14)

3.8.4 Providing innovative solutions to housing issues

Every day, Australians with disabilities face the challenges of high unemployment rates, low incomes, high living costs, difficulties with public transport, and a lack of affordable and appropriate housing.

A group of researchers at the Australian Housing, Urban and Regional Research Institute (AHURI) based at Flinders University, has been assisting the community and governments by researching the experiences of people with disabilities in the housing market. The Flinders University research has provided concrete evidence of the nature and the extent of the disadvantage facing disabled people in the housing market. The research team, acting in an advocacy role for those members of the community affected by disabilities, has also developed several policy options for governments (IRUA 2008). The research project will contribute to housing policy development by:

- making explicit the contribution housing assistance – including public housing – makes to the social inclusion aspirations of governments;

- providing a greater depth of understanding of the ways housing assistance programs contribute to social inclusion for persons with a disability;
- identifying those aspects of housing assistance that have social inclusion impacts in order to produce policies which produce stronger social inclusion outcomes in the future;
- documenting the ways in which social inclusion amongst persons with a disability varies by location (metropolitan/non metropolitan; inner versus outer urban) and type of disability, as well as the role housing assistance plays in contributing to better outcomes;
- examining the housing transitions of persons who have moved from institutional to more independent forms of housing and how this has affected their level of social inclusion;
- considering ways in which housing assistance and support services could be integrated to maximize social inclusion outcomes (AHURI 2009).

3.8.5 Addressing social and community disadvantage

Social scientists researching social and community disadvantage recognise that clients often present with multiple problems that require a co-ordinated solution from a range of agencies. This has led policymakers and practitioners to develop joined up problem solving processes like Innovative Community Action Networks in South Australia. These organisational forms involve multi-disciplinary and multi-sectoral partnerships.

Case Study: Innovative Community Action Networks

Innovative Community Action Networks (ICANS) are a social innovation created by the South Australian Social Inclusion Unit designed to address school retention. Through these networks, government, business and community organisations work together to collectively reshape learning and employment pathways for young people aged 12 to 19 years) at risk. Rather than a 'one size fits all' approach, ICANS operate from a 'one size fits one' approach. This includes providing individual case management to address specific barriers to young people successfully learning, such as family problems or alcohol and drug abuse. In effect ICANS constitute community directed projects that provide innovative learning opportunities for young people who have dropped out of school early or are at risk of doing so. Through this social innovation, government, business and community organisations are working together to collectively reshape learning and employment pathways for young people at risk. Since 2004, ICANS have succeeded in connecting and re-connecting nearly 80% of participants with education, training and employment (Government of South Australia: 2009).

Allied to this approach have been innovative applications of spatial information systems designed to inform place based decisions and evaluate the effectiveness of specific policy/program interventions. The two case studies below provide Australian examples of collaboration across disciplines and sectors to enhance community well-being.

Case Study - An emerging field: spatial and information architecture

The way we understand space is emerging as a new field – spatial and information architecture.

The *Suburban Communities* project aims to develop tools to help households, community groups and neighbourhood to use information and communication technologies to design better community spaces in urban areas. The project is supported by the Spatial Information Architecture Laboratory based at the Royal Melbourne Institute of Technology.

The Laboratory is a transdisciplinary education and research centre that brings together artists, architects, designers, computer scientists, geospatial scientists, social theorists and philosophers – among others – to research strategies for viewing and managing information. See <http://www.sial.rmit.edu.au>

Source: Metcalfe *et al* (2006:14)

Case Study – Accessibility and Remoteness Index of Australia

ARIA was developed by the National Centre for Social Applications of Geographical Information Systems at the University of Adelaide as a joint project with the Australian Department of Health and Ageing in 1999. ARIA is an unambiguously geographical approach to defining remoteness. ARIA+ is a continuous varying index with values ranging from 0 (high accessibility) to 15 (high remoteness), and is based on road distance measurements from 11,879 populated localities to the nearest service centres in five size categories based on population size.

As a comparable index of remoteness that covers the whole of Australia, ARIA+ provides a measure of remoteness that is suitable for a broad range of applications including assisting in service planning, demographic analysis and resource allocation

ARIA is now widely accepted as Australia's most authoritative geographic measure of remoteness informing policy decisions about the location of a wide range of health and other services in Australia.

. See <http://www.gisca.adelaide.edu.au>

Source: GISCA 2009

3.8.6 Australian research funding that supports cross-disciplinary collaboration

The importance of cross disciplinary collaboration is reflected in a number of Australian research funding schemes. In addition to the Cooperative Research Centres program, several funding initiatives support cross disciplinary and/or cross sector research collaboration. These include funding programs offered by the Australian Research Council (ARC), the National Health and Medical Research Council (NHMRC), and the Australia Council.

The *ARC Research Networks* program is designed to foster collaboration in interdisciplinary settings. Interviewed for the CHASS research, an ARC representative noted the increasing proportion of research proposals in major ARC schemes that are cross-disciplinary, that their success rate equated that of single discipline proposals, and that much cutting-edge research is likely to cross traditional disciplinary boundaries, including the HASS-STEM boundaries (Metcalfe et al, 2006: 19).

The ARC Linkage Scheme fosters collaborative and multi-disciplinary research. HASS researchers in South Australia are increasingly taking advantage of this scheme, often working with STEM researchers on multi-year projects, particularly in the health sciences.

The *National Health and Medical Research Council* (NHMRC) has a Collaborative Research Centre that funds collaborative projects, and multidisciplinary work is considered a high priority. A new NHMRC program, the *Preventive Healthcare and Strengthening Australia's Social and Economic Fabric Award*, involves collaborative social sciences, humanities, arts, health and medical research (Metcalfe et al, 2006: 20).

Synapse is an Australia Council initiative that encourages innovation by enabling artists and scientists to work collaboratively. It includes placement of artists in scientific institutions and has developed a database for linking artists and scientists.

CSIRO National Flagships provide funding for large scale collaborative research partnerships that reflect the National Research Priorities. Three of the six National Flagships have substantial collaboration that involves social sciences – *Water for a Healthy Country*, *Wealth from Oceans*, and *Energy Transformed* (Metcalfe et al 2006: 15).

4 GOVERNMENT AND INNOVATION

Governments play a key role in innovation (for example, through research and development funding/tax concessions for the private sector) and in direct provision (through public sector research facilities). They are also concerned about fostering innovation within the public sector through reforms to public institutions, policies, legislation and processes. More recently governments like the South Australian government have sought to explicitly recognise the human dimensions of innovation through the establishment of bodies like the Australian Centre for Social Innovation.

The main focus of government over the last few decades however, has been upon innovation as a foundation for economic and productivity growth, viewing it as a powerful determinant of differences in the economic performance of firms, regions and countries (Fagerberg: 2003). The pursuit of innovation has been among the highest priorities of developed countries over the last decade. This view has been reinforced by the OECD which advocates the adoption of national innovation strategies by governments. The OECD Innovation Strategy argues that innovation is a crucial determinant of competitiveness, productivity and national progress, and an important key to addressing global challenges such as climate change and sustainable development.⁸

4.1 Australian Government

The Australian Government has taken up the innovation challenge posed by the OECD through the development of its own *Innovation Agenda* which identifies a 'national innovation system' as-

...the system we use to harness the creativity of our people. It is the system we rely on to transform great ideas into great results for the community, the economy and the environment. Genius is wasted if you can't capture it and apply it to the real world. That's what the national innovation system does (Commonwealth of Australia 2009: 1).

The notion of a 'system' may seem counter-intuitive to the creativity associated with innovation. However, while individual researchers, entrepreneurs, policy makers and consumers may innovate separately, they also collectively form components of an overall 'system'. Government has a critical role to play in linking individual stakeholders, in strengthening those linkages and enabling the system to function as a coherent role. This includes investing in infrastructure that sustains the innovative process, with education and training systems and national broadband systems being two obvious examples of this investment.

⁸The OECD [Innovation Strategy](http://www.oecd.org/document/56/0,3343,en_2649_33723_42380088_1_1_1_1,00.html) is an evidence-based cross-government policy approach designed to help countries capture the economic benefits of innovation. Reporting in 2010, a key part of this strategy is a focus on human resources, education and training to promote innovation. The Strategy will provide a framework for dialogue and review, new indicators on the innovation-economic performance link, initiatives for innovation-friendly business environments, and the development of best practices and policy recommendations.

http://www.oecd.org/document/56/0,3343,en_2649_33723_42380088_1_1_1_1,00.html

An innovation system seeks to ensure seamless development from the origin of an innovation to its implementation and distribution. When the market is unable to provide this outcome, it is now widely accepted that governments should intervene by ‘... *plugging gaps in the system through which ideas might be lost*’ (Commonwealth of Australia 2009: 3). This view also resonates in South Australia where the Economic Development Board asserts that the public sector has a vital role to play in regulating market activity or behaviour, to achieve a social or other objective, or to correct for market failure (EDB 2009).

The experience of the world’s most successful knowledge-based economies tells us that innovation is most likely to occur in a supportive public policy environment (Commonwealth of Australia 2009: 23).

4.2 South Australian Government

One of the key challenges which Australia’s *Innovation Agenda* is designed to address is our country’s ‘fragmentation, duplication and a lack of coordination’ and poor levels of collaboration between business and universities (having the lowest ranking in 2007 against other OECD countries on this measure) and ‘inadequate’ connections to international research and business networks (Commonwealth of Australia 2009: 69). Both Commonwealth and State governments are seen as needing to develop research programs based on interdisciplinary principles and with appropriate resourcing to ensure quality outcomes (Howard, 2008: 26).

South Australia’s history is full of innovative discoveries – from the invention of the stump jump plough, the discovery of penicillin, the Hills Hoist, discoveries in molecular biology and diagnostic x-rays, to major civic participation, with South Australia being one of the first places in the world to give women the vote.

Government of South Australia, 2004

4.2.1 Key South Australian government achievements in fostering and supporting innovation

South Australia is recognised nationally as having an established and recognised history of innovation in many fields, often led by ambitious reforming State governments (Mulgan: 2008). This is embodied in the *South Australian Strategic Plan* (Government of South Australia 2007) which is committed to the objective of ‘Fostering Creativity and Innovation’. The objective includes 12 key targets, all of which are pivotal in realising this aim but are revealing in identifying the State government’s understanding of innovation as both a process and an outcome. – see *Appendix 1: Creativity and Innovation in the SA Strategic Plan*.

At a state level **South Australia’s Strategic Plan (SASP)** is a foundation for multi-disciplinary problem solving. The social sciences are critical to most if not all of the SASP targets. For example the objective of ‘Attaining sustainability’ requires a deep understanding of how communities think, behave and function. One of the most critical aspects of the Strategic Plan is its emphasis on the importance of “key interactions” – an acknowledgement that none of the objectives or targets is self-supporting, but that are all interrelated. It is a recognition that economic development must take account of the objectives of environmental sustainability, that employment growth depends

upon increasing the participation of those not presently engaged, and that research and development and innovation are vital to all economic, social and environmental progress (EDB, 2009: 5).

Premier Rann recently overviewed the State's history of innovation, drawing attention to the role played by the very successful ICANs, the *Festival of Ideas* and *Thinkers in Residence* initiatives, the Social Inclusion Unit (the model for which has since been adopted nationally) and the *Common Ground* social housing facility, itself a Thinkers in Residence output. He noted that the SASP

South Australia has a rich history of outstanding achievement in generating and applying innovative ideas. We need to build on this capacity and embrace innovation as a central feature of our State's economy and future identity. We need to become – and to become internationally known as – a dynamic hub of science and technology innovation.

Government of SA, STI 10 Year Vision for Science Technology and Innovation in South Australia

demonstrates that it is possible to successfully combine '*... economic growth, environmental responsibility, cultural ambition and social innovation*' (Rann: 2008).

One of the key outcomes of the Thinkers in Residence program has been the establishment of the Australian Centre for Social Innovation (TACSI) by the State Government. TACSI responds to Geoff Mulgan's final Thinkers in Residence report which outlines a range of directions for the pursuit of social innovation in South Australia (Mulgan: 2008). One of the Centre's early aims is to –

'... take the policies, research and ideas from innovators around Australia and link them to the most appropriate social services in order to turn them into action that makes a tangible difference (Rann: 2008).

Geoff Mulgan envisaged that TACSI would play a key role in tackling pressing challenges like population ageing, healthy ageing, workforce development, urban regeneration and

hardship and inequities experienced by Aboriginal people. Mulgan also stressed the importance of fostering innovation in the public sector through leadership development, investment in creative ideas, creating an environment for social innovation through facilitative policies, budgets, legislation and people (Mulgan 2008: 23-26). Additionally Mulgan advocates the need to develop systems of evaluation to measure success and learn from failure. Finally he urges the need to overcome tendencies towards risk aversion as experimentation is central to innovation.

The Centre's method of operation is intended to be collaborative, building partnerships between governments and with higher education, not for profit organisations and non government organisations, in recognition of the critical role of collaboration in innovation. The Economic Development Board in South Australia (2009: 89) has noted that effective innovation is typically highly networked and interactive: business-to-business and business-to-public sector. Innovation networks and precincts have proven effective because they bring together and co-locate different players in the innovation space and supply chain. There is considerable potential through ACSI to build strategic problem solving alliances between government agencies, universities, industry and the community sector. In the process, it could increase awareness of the contribution made by HASS to innovation.

South Australia has been active in fostering collaboration and industry networking. This has included support from the South Australian Government for the development of a number of industry clusters. These brought together key stakeholders from a range of organisations, and across different sectors, with the common goal of sharing expertise and business networks for a combined benefit. The formation of the very successful **Water Industry Alliance** and the **Defence Industry Alliance** to cultivate clusters of companies and research organisations focused on innovative technology and export opportunities has been a significant factor in the growth of South Australia’s water management industry and its defence industry. **BioInnovation SA** plays a similar role in the bioscience sector. South Australia has two commercially focused innovation precincts, established to forge geographical concentrations of businesses, research institutions, education institutions and industry innovation: **The Thebarton Bioscience Precinct & The Mawson Innovation Precinct**. Another successful initiative has been the **Wine Innovation Cluster** – see Case Study below.

Case Study: SA Wine Innovation Cluster

The Wine Innovation Cluster brings together five leading research agencies that address the needs of the grape and wine sector: The Australian Wine Research Institute; CSIRO Plant Industry ; Provisor Pty Ltd ; South Australian Research & Development Institute and The University of Adelaide. Research and the innovation that these organisations have delivered in practice have helped the Australian wine sector achieve much of its success over past decades. Between them, the partners possess the major share of Australian research, development, extension and education capabilities over the whole of the grape and wine value chain from “climate, soil and water” to the consumer. Areas of expertise include wine science, chemistry and microbiology, wine making technology, and wine consumer behaviour and preferences and illustrating the wide range of disciplinary collaboration. Opened in late 2008, the cluster establishes the Waite Institute at The University of Adelaide as an R&D hub to support the next phase of growth in the Australian wine industry, and includes a purpose built research facility.

The Premier’s Research and Science Fund incorporating the Sustainable Energy Research Grants Program (formerly known as SENRAC), was established to facilitate investment in key science and research initiatives of strategic and sustainable value to the State. It aims to make transformational investments that have a demonstrable potential to generate significant and sustainable economic, social and/or environmental benefits for the State. The fund can inject a total of up to \$4.2 million per annum into new and continuing strategic R&D initiatives.

The **STI¹⁰ - 10-Year Vision for Science, Technology and Innovation in South Australia** (Government of South Australia: 2004) outlines the Government’s key aspirations, strategies and performance targets relating to the development of science, technology and innovation in South Australia for the ten years to 2014.⁹ It documents what South Australia does well, identifies challenges for the State,

⁹ The STI¹⁰ vision included implementation through the Adelaide Innovation Constellation (now known as [Constellation SA](#)), linking five physical precincts in a virtual collaborative environment. Constellation SA has evolved directly from STI¹⁰ and is now the overarching program for its implementation.

and proposes strategies for improvement. These include building capability and infrastructure, strategic leadership by the State Government and developing people and communities. A key strategy involves collaboration across disciplines, including a specific focus on supporting social sciences and innovation, for example, by linking HASS and STEM researchers.

The social sciences can be and have been influential but not in a linear way... More often than not, it's an idea or even a slogan that's picked up that relates and is associated with other notions and ideas that seem to have relevance in the institutional and policy and political context.

Lance Worrall, Public Sector Performance Commission

Since the launch of STI¹⁰ a new organisational framework called **Constellation SA** has been developed to strengthen collaboration between researchers, within and across disciplines, and improve the interface between the research community and end-users so that research findings are taken up and used for practical purposes. The initiative has been promoted as a vehicle to enhance the effectiveness of public sector research in contributing to innovation in industry and to provide the framework for Government funding of research. Seven alliances collectively make up the overarching framework. The alliances themselves comprise research clusters, which reflect the specific themes and research strengths of the State within that particular area. Constellation SA is supporting collaborations in a range of areas including agriculture, food and wine; defence and advanced manufacturing; health and medical sciences; minerals and energy; natural resource management and climate change, the arts and society and the citizen. The CSA framework is supported by State government investment designed to build a critical mass of capabilities in the priority areas, drawing upon the \$100m plus devoted to R&D/innovation per annum (Keighley-James: 2008). The challenge in developing these collaborations is to embed multi-disciplinary processes within them and between them.

In order to foster collaborative approaches to tackling pressing social problems, the State government established **The Social Inclusion Initiative**. Launched in March 2002, the initiative supports the development of whole of government approaches, policies and programs in a number of priority areas including Aboriginal health, disability, homelessness, mental health, school retention and young offenders. The Social Inclusion Initiative is supported by the Social Inclusion Unit based in the Department of Premier and Cabinet. The work of the Unit is informed by the Social Inclusion Board which is chaired by the Commissioner for Social Inclusion. The Social Inclusion Unit partners with South Australia's universities in research projects focusing on specific areas of interest to the Social Inclusion Agenda. For example, it worked with the Australian Institute for Social Research in the design of a research tool to measure social inclusion, social exclusion and community capacity and applied this to communities in Adelaide's Northern Region (Spoehr, Wilson, Barnett, Watson-Tran and Toth 2007).

The **Thinkers in Residence** program makes an important contribution to fostering innovation in South Australia. Each year the Premier of South Australia invites two or three world-class thinkers to Adelaide to assist in the State's strategic development. Appointment as an Adelaide Thinker in Residence is a prestigious award which recognises both exceptional talent and outstanding leadership. The Thinkers undertake residencies of 2 - 6 months, in which they assist South Australia to build on its climate of creativity, innovation and excellence. They provide the State with strategies for future development in the arts and sciences, social policy, environmental sustainability and

economic development. Each of the Thinkers has engaged in a tailored program of activities, involving research, master-classes, public lectures, mentoring, writing and publishing. Their impact has been evident in numerous areas, having led to the development of a number of initiatives and changes in policy directions.

In 2008 the State Government focused attention on public sector innovation and performance through the establishment of the **Public Sector Performance Commission**. One of the key initiatives of the Commission has been the establishment of high level cross government action teams working in the areas of Leadership Development, Productivity and Performance Improvement, Innovation, Citizen Centric Government and Stronger Families. Close collaboration between the Commission and the Australian Centre for Social Innovation has the potential to generate significant policy, program and organisational innovations that better position South Australia to meet key objectives outlined in South Australia's Strategic Plan.

Constellation SA, The Social Inclusion Initiative, the Public Sector Performance Commission and the Australian Centre for Social Innovation variously recognise the importance of collaborative approaches to the development of the State. The challenge ahead is to build on this foundation for fostering innovation and collaboration through the development of a partnership between Constellation SA the Social Inclusion Initiative, TACSI and the Public Sector Performance Commission.

These initiatives enable South Australia to be a national leader in multi-disciplinary approaches to innovation. To build on this strength there is a need to consider practical strategies that foster and support collaboration across a wide range of disciplines, sectors and institutions.

4.2.2 State of Innovation

In terms of innovation performance, the State has performed better on process improvement than on new goods and services or marketing (EDB, 2009: 87). Between 2000-01 and 2006-07 the South Australian Government invested \$1 billion in R&D, representing some \$160 million per annum. However, the level of business expenditure on R&D in South Australia has traditionally been lower than the national average and well below the OECD average, though the most recent figures show a slight improvement. The apparent reluctance of the State's business sector to engage with new technology and scientific ideas required for development of new innovative products and services reflects the State's business structure. More than 90 per cent of companies in South Australia turn over less than \$2 million a year – typical of the overall Australian landscape – and small firms tend to lack the capacity for high-risk R&D. The fact that larger corporations are often headquartered elsewhere means that much product development and marketing innovation is undertaken in other locations (EDB: 2009).

The Economic Development Board (2009) has focused attention on the importance of innovation to the State's development and growth, arguing that South Australia has a brief window of opportunity to build on its unique natural advantages in generating solar, wind, wave and geothermal electricity and establish itself as Australia's leading clean energy State. To achieve this, the EDB argues, the South Australian Government should implement strategies to promote technological innovation.

The EDB has further indicated that (renewable technology) innovation will be driven by the private sector, but there are strong reasons for public support for research and development. These relate to the strong economic spillover benefits from these new technologies, as well as the potential to deliver broader public benefits through faster emissions reductions and the creation of new industries (ibid: 6). However, as discussed in *Section 3.7*, it is not just technological innovation that is required in managing key challenges, the HASS have an equally important role to play in changing human thinking and behaviour to reduce environmental pressures, and to apply new technologies appropriately.

The EDB (2009) points to a number of weaknesses in the State's innovation system including the lack of linkages between industry and the State's public sector research base, reflecting poor alignment of R&D focus between the two sectors. Health, other life sciences and agriculture are key research strengths in the State's universities and public sector research agencies.

Approximately 50 per cent of the State Government's R&D funding is allocated to Primary Industries and Resources (PIRSA) and 25 per cent to Health. By contrast, business expenditure on R&D is targeted mainly at manufacturing (41 per cent) and mining (29 per cent). Manufacturing accounts for over 50 cents in every dollar business spends on R&D (2005-06 figures), with mining being the next most significant area (12 per cent of business R&D spend). This profile is reasonably consistent with the composition of exports of goods and services from South Australia (EDB 2009: 95).

A multi-disciplinary approach is likely to yield significant social as well as economic benefits to the South Australian community by harnessing knowledge and skills from both the physical and social sciences. Solving the challenges we face as a community requires a commitment to a 'collaborative innovation agenda' which explicitly acknowledges and actively engages expertise from the sciences and the social sciences. This has important implications for government and industry support for innovation. The challenge for government policymakers is to build a more solid foundation for innovation by fostering and resourcing long term collaborations.

Apart from relying on collaboration that brings together diverse skills and experience, innovation also demands a skilled workforce (now recognised as the foundation of a knowledge-based economy) and workplaces that promote and support creativity. It also requires an investment of resources designed to build the capacity

We have a culture that respects and values the diversity of views but that means that we don't get a single message to go in an ocean, or processes in an ocean. I think that's a significant failing as far as social sciences as a discipline. We present difference, we present polarity and we shouldn't be doing that if we want to secure funding and recognition for our role.

Professor Andrew Beer speaking about the social sciences, Flinders University of South Australia

Certainly there's lots of things that South Australia could and should be doing, a more practical edge across each of the technology spaces and capturing social science inputs into that.

Dr Ian Chessell, Chief Scientist

for innovation. The national Innovation Agenda identifies the challenge facing Australia of moving beyond the skills required for the present and developing the skills required for the future, of which innovation skills will be increasingly prominent (Commonwealth of Australia 2009: 13, 40).

4.3 The role of the HASS disciplines in promoting their role in innovation

The HASS disciplines need to be more active in promoting their role and contribution, particularly at a time when recognition of that contribution is growing. Just as any innovative product, process or service needs to be marketed in order to be used, so too does the contribution made by disciplines. This challenge has been recognised both locally and internationally (CHASS, 2005: 17) and internationally (Van Langenhove, 2002: 22).

The humanities, arts and social sciences have a strong case, but they have not made this case with strength and conviction. It is important to identify and make widely known the real impacts and benefits of HASS research, not just its quality as measured against scholarly standards. The community needs to be reminded that HASS research has social value, commercial worth, and community and cultural benefits – and people working in the HASS community are the ones to make these arguments.

Until this argument is articulated clearly and convincingly, HASS research remains in danger of being inadequately valued, despite the fact that it deals with ‘the most important questions’ (CHASS, 2005: 17).

More than a decade ago, the Gulbenkian Commission on the Restructuring of the Social Sciences (Wallerstein 1996) analysed the role of the social sciences and identified a number of changes needed to strengthen the disciplinary groupings position relative to other groupings. A key finding of its report was the need to establish integrated research programs cutting across disciplines, and bringing researchers together around specific themes and problems that reflect high priority issues. According to Van Langenhove, this important report was the catalyst for placing the social sciences on the OECD’s agenda (2002: 25). A high priority identified at this time was the need to reconsider the appropriateness of disciplinary structures that impede multidisciplinary problem solving (Langenhove, 2002: 22).

In recognition of the need for cross disciplinary collaboration within the HASS sector the Council for Humanities and the Social Sciences (CHASS) was inaugurated in Australia in June 2004. The objectives of CHASS include promoting the contribution of the sector to government, industry and the public, providing a forum for discussion between the humanities, arts and social sciences sectors in Australia and building the innovative capacity of Australia, through better linkages between this sector, and science, engineering and industry (Cunningham: 2008).

The HASS sector needs to better articulate the contribution that it makes to social, economic, environmental and cultural development generally and as part of this highlight the central role that the sector plays in both understanding, fostering and generating innovation. Like the STEM sector, HASS will need to overcome tendencies towards disciplinary isolationism and embrace multi-disciplinary engagement as foundation for innovation. This does not imply that researchers working in relative isolation from other disciplines are not making important contributions as they clearly are.

There is a need however for more disciplinary bridge builders than we currently have. To ensure this outcome there will need to be changes to the institutional environment in which researchers operate, particularly to funding schemes and the measurement of academic performance which need to foster greater multi-disciplinary collaboration and problem solving.

Few would dispute the potential benefits that can arise from a multi-disciplinary approach to problem solving in the face of complexity and uncertainty. Innovative solutions can often be found in the spaces where disciplines intersect and knowledge and skills are creatively combined.

Tackling climate change, financial crises, unemployment, population ageing, political instability, inequality and rapid technological change, beg a collaborative and multi-disciplinary approach to conceptualising and operationalising innovation. While technological innovation will play an important role in helping us to address many of the challenges that we face, it will need to be informed by and grounded in social, political, cultural, environmental and economic considerations.

Understanding the motivations and behaviours of individuals and groups within local national and international socio-economic systems is indispensable in forming responses to complex problems. Changes in attitudes and behaviour will be as important as changes in technology. Even more pragmatically, changes in attitude and behaviour may be far less expensive to implement and may be far more cost-effective than technological solutions.

For example, the benefits of changing attitudes to water and energy use are likely to be considerable and may reduce the need for the construction of additional capacity in water and energy networks. There is increasing recognition that social scientists, working closely with engineering and technology specialists, have generated a great deal of evidence for the interdependence of knowledge production, knowledge management and knowledge transfer, giving rise to claims in the literature for fifth generation or ecological approaches to innovation systems. This research and scholarship has demonstrated the benefits of interdependence between STEM and the social sciences, arts and humanities (Cunningham 2008).

I often think that researchers and academics and policy people often talk together well ... but to actually bring the three together is where I think they have then been able to discover things and shift policy ...

Jan Patterson, Social Inclusion Unit

Considerable momentum is being generated internationally in fostering multi-disciplinary approaches to problem solving. For example, social and behavioural scientists have well established working relationships facilitated by the *International Human Dimensions Programme* in Bonn, Germany. Additionally the British Governments' *Science and Innovation Investment Framework 2004-2014* outlines five major priority areas for future government-sponsored research that appear to be grounded in a multi-disciplinary approach to problem solving. These are:

- 1) demographic and socio-economic change;
- 2) globalization;
- 3) climate and environment;

4) global uncertainty; and - technology change (LSE 2008: 59).

It would be helpful to view the priority areas for government supported innovation outlined in the Cutler report in a similar light. They include: climate change mitigation and adaptation; water; resource and marine industries; agricultural and food security; and population health (Venturous Australia 2008).

To develop effective solutions to complex problems like climate change and population ageing there is a need to strengthen and deepen the intellectual foundations for innovation. Collaborative and multi-disciplinary approaches to problem solving can help us realise this objective. Greater conceptual and practical interaction between the sciences, social sciences, arts and humanities is vital to this.

To foster and sustain a dynamic multi-disciplinary national innovation system will require government, universities, and industry to review how existing structures, processes and funding arrangements facilitate or impede collaboration with HASS disciplines. While some of the foundations for this exist in South Australia there are likely to be considerable opportunities to strengthen our innovation system through relatively minor reforms.

The focus of these reforms should be to embed a multi-disciplinary approach to problem solving in decision making processes, research funding guidelines and institutions. Broadly this involves building on the 'joined up' approach to policy making that had been adopted by the State Government. This involves a long term commitment to developing collaborative research and development institutions and processes within and between government, universities, industry and civil society. The objective of this is to nurture a dynamic culture of productive collaboration where self-reinforcing linkages underpin innovation processes that sustain prosperous communities.

This is a shared responsibility. In a recent study on maximising the social, policy and economic impacts of research in the humanities, arts and social sciences the London School of Economics (LSE) found that *"...disciplines cannot strengthen their impacts in isolation or in a one-sided way. Both government and the civil service on the one hand and business on the other also need to change their perceptions and behaviours in significant ways if the welfare benefits to the UK economy and society of humanities and social sciences research are to be fully realized and further developed"* (LSE 2008). Equally the LSE concludes that the HASS face the imperative of radically improving *"... the ways in which higher degree students are trained, to better fit the contemporary needs of government - especially by cutting across discipline boundaries, incorporating more group working and group-assessment, and improving quantitative skills"* (LSE 2008, p. 11). Finally the LSE point to a *"... pressing need to better record how the humanities and social sciences currently achieve impacts, as the first step to systematically trying to expand those impacts in future"* (LSE 2008:8).

The LSE has also drawn attention in its study *"...to the need for disciplines to radically improve their own organization and communications, particularly for informing and lobbying government and policy-makers and communicating research findings"* (LSE 2008, p. 12). There are important policy implications for Australia and South Australia flowing from these conclusions, including the need to:

- increase awareness of the contribution of the role of the humanities, arts and social sciences to innovation;

- broaden disciplinary engagement in innovation policy development and decision making regarding the allocation of R&D funds;
- foster multi-disciplinary collaborations in research project design and implementation;
- broaden multi-disciplinary engagement in research clusters and institutes;
- provide funding for shared research infrastructure to facilitate multi-disciplinary engagement in innovation processes;
- reform academic performance measurement and funding systems to acknowledge multi-disciplinary commitments to problem solving.

In relation to this final point the Economic Development Board recently recommended that a “... thorough review of State Government expenditure on R&D and innovation”, be undertaken, “...to determine whether current allocations remain appropriate and whether there is scope to improve coordination between the various delivery arms of government”. Furthermore it concluded that the “The future funding priority must be to improve linkages between government, industry and research institutions” (EDB 2009:6). A review of this nature could well be the vehicle for cementing stronger collaborative linkages between HASS and STEM researchers.

By more systematically enabling the intersection of HASS and STEM disciplines in research and complex problem solving we deepen our capacity to innovate and meet the major challenges that we face. This is the essence of connecting ideas – creating a state of collaborative innovation.

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APPENDIX 1: CREATIVITY AND INNOVATION IN THE SA STRATEGIC PLAN

| AREA | Target | Description |
|--|---|--|
| CREATIVITY | T4.1 Creative industries | Increase the number of South Australians undertaking work in the creative industries by 20% by 2014. |
| | T4.2 Film industry | Double the number of feature films produced in South Australia by 2014. |
| | T4.3 Cultural engagement – institution | Increase the number of attendances at South Australia’s cultural institutions by 20% by 2014. |
| | T4.4 Cultural engagement – arts activities | Increase the number of attendances at selected arts activities by 40% by 2014. |
| | T4.5 Understanding of Aboriginal culture | Aboriginal cultural studies included in school curriculum by 2014 with involvement of Aboriginal people in design and delivery. |
| INNOVATION | T4.6 Commercialisation of research | Increase gross revenues received by South Australian-based research institutions from licences, options, royalty agreements, assignments, licensed technology and patents by 2010. |
| | T4.7 Business innovation | The proportion of South Australian businesses innovating to exceed 50% in 2010 and 60% in 2014. |
| | T4.8 Broadband usage | Broadband usage in South Australia to exceed the Australian national average by 2010, and be maintained thereafter. |
| INVESTMENT IN SCIENCE, RESEARCH AND INNOVATION | T4.9 Public expenditure: | By 2010, public expenditure on research and development, as a proportion of GSP, to match or exceed average investment compared to other Australian states. |
| | T4.10 Australian Government resources | Secure Australian government research and development resources to 10% above South Australia's per capita share by 2010 and increase this share to 25% by 2014, for both public and private spheres. |
| | T4.11 Business expenditure | Increase business expenditure on research and development to 1.5% of GSP in 2010 and increase to 1.9% by 2014. |
| VENTURE CAPITAL | T4.12 Venture capital | South Australia’s share of Australian Government-administered venture capital program funds to reach 7% by 2010, and be maintained thereafter. |

APPENDIX 2: LIST OF INTERVIEWEES

Professor Andrew Beer, Pro vice Chancellor of Research, Flinders University of South Australia (5th August 2009)

Dr Ian Chessel, Chief Scientist, South Australia (13th July 2009)

Dr Craig Fowler, Deputy Chief Executive, Planning, Policy and Innovation, Department of Further Education, Employment, Science and Technology (DFEEST) (22nd June 2009)

Mr David King Jones, Senior Partner Woodhead International Architectural and Design Firm (17th June 2009)

Professor Caroline McMillen, Deputy Vice Chancellor & Vice President: Research & Innovation, University of South Australia (13th July 2009)

Professor James McWha, Vice Chancellor, University of Adelaide (15th July 2009)

Dr Jan Patterson, Principal Policy Advisor, Social Inclusion Unit, Government of South Australia (10th June 2009)

Dr Chris Robinson, Chief Executive, Department of Education and Children's Services (DECS) (8th July 2009)

Dr Tony Sherbon, Chief Executive, SA Health (2nd June 2009)

Mr Lance Worrall, Chief Executive, Public Sector Performance Commission (10th June 2009)

Mr Tim Zak, Executive Director of Carnegie-Mellon University's Heinz School of Public Policy and Management Branc. (3rd June 2009)

APPENDIX 3: HASS DISCIPLINES

The following list contains all disciplines identified in *Figure 2, Figure 3 and Figure 4*, as engaged substantially with HASS discourses and methodologies.

| | |
|--|--|
| Anthropology | Applied Economics |
| Archaeology | Archaeology and Prehistory |
| Architecture | Architecture and Urban Environment |
| Art theory and criticism | Business and Management |
| Cinema, Electronic Arts and Multimedia | Cognitive Science |
| Communication and media studies | Communication Technologies |
| Cultural Studies | Curratorial and related studies |
| Curratorial studies | Curriculum and pedagogy |
| Curriculum Studies | Demography |
| Design studies | Econometrics |
| Economic history and history of economic thought | Economic theory |
| Education Studies | Education systems |
| Environmental engineering | Environmental Studies |
| Environmental Science and Management | Environmental Sciences |
| Film, television and digital media | Historical Studies |
| History and the philosophy of science and medicine | Human geography |
| Journalism, Communication and Media | Justice and Legal Studies |
| Language studies | Law |
| Law Enforcement | Linguistics |
| Literary studies | Literature studies |
| Other architecture, urban environment and building | Other arts |
| Other Behavioural and Cognitive Sciences | Other economics |
| Other education | Other journalism, librarianship and curatorial studies |
| Other language, communication and culture | Other law and legal studies |
| Other law, justice and law enforcement | Other Policy and Political Science |
| Other Studies in Human Society | Performing Arts |
| Performing Arts and Creative Writing | Philosophy |
| Policy and Administration | Political Science |
| Professional development of teachers | Psychology |
| Public health and health services | Religion and religious traditions |
| Social sciences, humanities and arts - general | Social Work |
| Sociology | Special studies in education |
| Tourism | Urban and Regional Planning |
| Visual arts and crafts | |