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Senate Standing Committees on Economics
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Dear Committee Secretariat,

RE: UTS SUBMISSION TO THE INNOVATION ENQUIRY

The economics of technical change are in general shaped by two alternative perspectives of innovation. On the one hand, the technology-push perspective highlights the significant role that science and technology play in developing technological innovations. On the other hand, a demand-pull approach identifies a broader set of market features that affects the performance of innovation. Overall, science and technology underpin the vast majority of technological innovations and user demand is the best guide to drive innovation in the right economic and social direction. Another similar line of thought is that design-led innovation complements technology-driven innovation, and together they can create significant differentiation in international markets.

The creative industries contribute more than \$90 billion to the Australian economy annually in turnover, and NSW is home to more than 40% of these businesses with the highest concentrations in the Sydney CBD and inner city around UTS. However, changes in technology and the increasing use of the Internet for business have potentially led to decline in these sectors, with growth occurring in software development and interactive content (CIIC 2013).

Recently, the government has indicated that industry can leverage more of the nation's innovative strengths to confront challenges, as Australia improved its ranking in one of the world's most closely watched measures to 17th on the annual Global Innovation Index 2014, up from 19 last year. Australia's major strengths are in tertiary education (7th), research and development (8th), ICTs (9th), general infrastructure (9th), and trade and competition (1st). Due to its premier location and its embedded innovation ethos, UTS has a great deal to offer to its local communities, particularly working with small business, and provides expertise and support in the transformation toward new enterprises.

Successful innovation rests on a foundation of education and skills, and as the Global Innovation Index demonstrates, increasing the educational achievement of young people is crucial to Australia's ability to generate new knowledge and innovate.

This year, UTS has two new major landmark buildings in Sydney – the Faculty of Engineering and IT (FEIT) Broadway Building which was opened in June and the Frank Gehry designed Dr Chau Chak Wing Business School which will be open in November. These form a part of UTS' investment in our future campus. In particular, the new Broadway Building will be home to industry pods, an immersive 3D visualisation facility, known as the Data Arena, Disruptive Design Labs and a Software Development Studio. These facilities, along with resources and purpose-design spaces across campus, will allow UTS to help students incubate their technology-enabled business ideas, commercialise and take them to market. Working across all Faculties, UTS joins the business community in this innovation ecosystem, offering collaborative services to our partners.

The essence of this submission is that, in order to maintain its distinctiveness, competitive advantage and ultimately its position in ranking exercises such as the Global Innovation Index, Australia must continue to focus on and improve what it does well in the innovation space. Collectively the Government, industry, and research and education providers need to build a knowledge infrastructure that benefits the future prosperity of all Australians.

Quoting directly from the preface to the ITIF report (Atkinson, 2014) Understanding the US National Innovation System:

"...innovation in any nation is best understood as being embedded in a national innovation system (NIS). Just as innovation is more than science and technology, an innovation system is more than those elements directly related to the promotion of science and technology. Rather, it also includes all economic, political and other social institutions affecting innovation (e.g., a nation's financial system; organization of private firms; the pre-university educational system; labor markets; culture, regulatory policies and institutions, etc.)."

The commercial viability of innovation systems depends on the establishment of designed environments that are attractive to entrepreneurs and funders. Innovation flourishes in ecosystems which build on an entrepreneurial culture that enables the flow of people, ideas and funding.

(a) The need to attract new investment in innovation to secure high skill, high wage jobs and industries in Australia, as well as the role of public policy in nurturing a culture of innovation and a healthy innovation ecosystem;

One of the indicators of success identified in *Venturous Australia* (Cutler, 2008) is that "Australia's innovation system is properly coordinated and integrated with our national innovation priorities." Equally as important as setting national innovation priorities is the need to strategically assess and identify our existing and emerging national strengths in a meaningful, evidence-based way, such as the technology/ knowledge foresight exercise conducted by PMSEIC on China.

Also, it is important to determine appropriate investment strategies for these strengths. We would advocate through its strategic industry investment that Government consider seeding or growing new industries beyond those that are almost "obvious": (mining & mineral processing, oil & gas, food, agriculture, medical technologies). Such investment strategies should have an international outlook, to allow closer collaborative connections with our major trade partners.

The role of public policy in nurturing a culture of innovation is to facilitate interactions between universities and industry and to create conducive environments for commercialisation and translation. These are addressed more throughout this submission, as is the need for further investment in education, in particular to train graduates to be able to create or recognise innovation opportunities.

(b) The Australian Government's approach to innovation, especially with respect to the funding of education and research, the allocation of investment in industries, and the maintenance of capabilities across the economy;

It is important for the government to support innovation, through a bipartisan approach, and to provide long-term certainty for key innovation programs. It is also important to continue to provide substantial support to our major innovation strengths such as education and research, ICTs and general infrastructure to keep Australia ahead of close competitors.

(c) The importance of translating research output into social and economic benefits for Australians, and mechanisms by which it can be promoted;

The importance of research translation cannot be overstated, in particular in the intersection between ICT, creative industries and health. Significant efforts have been made through a number of processes (RQF, ERA, and EIA) to define impact and to develop appropriate assessment tools.

Impact, however defined, is essential as a philosophy and encouraging planning for impact as part of future funding application processes would help to shift behaviour. We note that both the ARC and NHMRC funding and practice is starting to emphasise translation/translatable health, which is encouraging.

The following case study highlights UTS capabilities in the translation of research into benefits for all Australians are highlighted below, providing a typical example of a new generation of products that showcase the interdisciplinary interplay of health, ICT and creative industries:

The UTS Centre for Health Technologies has developed smart wheelchair technology, using assistive robotics, to overcome the issue of people with physical disabilities being unable to use a powered wheelchair. The 'Aviator' intelligent technology directs and controls the chair's navigation by reading the user's head movements and brainwaves. The research looked at human mechanical interaction robot sensing and perception of human cues. The research is significant in that the same technological approach can be applied to other disability aids. The Aviator was listed third in the Australian Anthill SMART 100 index (which identifies and ranks the 100 most innovative products in Australia each year) in 2011.

(d) The relationship between advanced manufacturing and a dynamic innovation culture;

We know that the Australian economy is experiencing a rapid shift from a low cost economy to a high cost economy that has significantly impacted on the terms of trade and competitiveness of firms. There has been significant reliance on the resources boom and its effect on the economy, and we have a high proportion of SMEs in our business make up. We have by-and-large also fared poorly in the productivity stakes, with Australian productivity gains stalling and many of our trading partners still feeling the effects of the Global Financial crisis.

On the innovation front, much of Australia's response has been a reliance on supporting technological solutions because traditionally the answer to the question of what drives productivity in advanced economies has been technological innovation. However, more recent evidence suggests that non-technological innovation such as business models and customer experience is just as, if not more important; which requires the development of high performance work organisation leadership and management capabilities. Support for both technological and non-technological (business process) innovation needs to be provided to firms and this proposal provides the foundation to focus on renewing the managing capability of firms to drive competitiveness.

Australia has a strong history of technological and product innovation, although it is not endemic across the economy. Companies such as Cochlear, ResMed and Hills have been able to combine their technological expertise with world class product design to compete on a global scale. These firms and others like them have been able to remain competitive within a changing economic environment by transferring their process of innovation from a product focus to an organisational or business model focus. They have applied their rigorous design process and tools to their entire organisation. This step change in the role and value of design - or Design Led Innovation - will be a future management capability which all firms need to adopt to remain competitive. Design Led Innovation is a process that goes beyond technological innovation and combines soft skills, new business models, high performance work organisation and management capabilities to boost a company's competitiveness.

There is evidence of the positive correlation between design and competitiveness. Businesses that employ design as a management capability outperform their peers and enhance their competitiveness.

For example, countries such as Finland, Ireland, Spain, Denmark, the UK and South Korea have all developed national design policies as a key driver of national competitiveness. Also, following on from the seminal UK Design Council report on the value of Design to the UK economy(2005), the Design Management Institute more recently (2014) found that companies that were design centric (i.e. deployed design as an integrated function across the entire enterprise) outperformed the Standard & Poor's by 228% over the past 10 years.

We need to move from pilot to scale. To raise awareness of the benefits of design for competitiveness we must build on the multiple pilots and small scale Design Integration programmes that have been delivered to industry at Federal (through Enterprise Connect) and State levels (Queensland South Australia and Victoria). We are now starting to see strong economic outcomes from firms who have participated in these programmes.

Over the past two years UTS, with its long term collaborator CSIRO, has focused on understanding how design can strengthen technological innovation through the "Design for Manufacturing Competitiveness" report and the soon to be completed "Capturing the value of S&T through Design Led Innovation" research project. These activities have highlighted the potential that a design-led approach can have to improve industry competitiveness.

Building on the proven pilot and modest scale Design Integration Programmes referred to above, now is the time to scale this to all businesses. This is fundamentally a re-skilling and capability building activity for business. This gap in knowledge has been clearly highlighted in the 'Management Matters' study undertaken by Professor Roy Green. From our pilot studies, we have found that such an approach will improve the absorptive capacity of companies in building new management/leadership skills. To ensure we leverage the technology investments made, it requires a whole of innovation ecosystem redesign and grounded in continuous learning and evidence based research. We have learnt from the international Silicon Valley model success stories – the integration of many disciplines in a connected ecosystem which brings about major innovation and benefits.

At UTS our model is based around the strengths of disciplines working together, with both technology-driven innovation and design-led innovation as central themes.

(e) Current policies, funding and procedures of Australia's publicly-funded research agencies, universities, and other actors in the innovation system;

In his 2014 Report Federally Supported Innovations: 22 Examples of Major Technology Advances that Stem from Federal Research Support, Peter Singer demonstrates a number of key technologies (e.g. Google search engine, GPS, Smartphone technologies, Medical Resonance Imaging) that would not have come about in the US, were it not for federally funded and supported research programs focussed on basic research.

It is essential that the Government continues to provide an avenue (i.e. Category 1 funding) that deliberately aims to advance knowledge and is assessed through a peer review process that is, to some extent, agnostic of the "demand pull". Not only is this good for each discipline area, it is essential for Australian society and culture to balance investments in medical and STEM disciplines with the arts, humanities, business and economics research.

The Government's role is to act as an enabler of a national innovation system. Policies, funding and procedures should be reviewed against this value. Easy Access IP provides a good example of a mechanism designed to enable innovation. UTS is one of four NSW universities that has adopted this model, providing up to 70% of its IP for free. We continue to transact high commercial value IP, but recognise that engagement, partnerships and adoption/impact are much higher order priorities.

Current government initiatives that work well and should be maintained include Block grant funding; Sustainable Research Excellence; and Linkage Infrastructure, Equipment and Facilities (LIEF). These are key mechanisms for achieving a diversity of equipment, geography and core scholarly activity across a range of relevant disciplines.

(f) Potential governance and funding models for Australia's research infrastructure and agencies, and policy options to diversify science and research financing;

It is important that the Government retains and continues to fund the National Collaborative Research Infrastructure Strategy (NCRIS), particularly the collaborative aspects and the rigour in decision making in the allocation process.

More broadly, infrastructure support and investment should be considered on an international scale to avoid unnecessary replication.

Solid partnerships with North and South America/Europe/Asia in this regard would be positive, given the size of our economy and relative opportunity.

(g) The effectiveness of mechanisms within Australian universities and industry for developing research pathways, particularly in regards to early and mid-career researchers;

Research career pathways are a challenging balance of academic excellence, early successes, growth of an independent research capability, high productivity and output. Given increasing global competition for resources and expertise, there can no longer be an expectation that a research career will continue indefinitely based on institutional funding or tenure.

The role of inter-institutional and international mobility is key in rounding out skills, networks and experiences. To some extent a "brain drain" is an inevitable consequence of Australia's distance, size of our research sector and the quantum and types of investment we are making. Internationally, UTS provides opportunities for early and mid-career researchers through exchange opportunities with our Key Technology Partners in China, India and Europe. This not only provides opportunities for our own researchers to gain international experiences, but serves to attract international researchers into Australia.

(h) Policy actions to attract, train and retain a healthy research and innovation workforce;

As the global economy becomes increasingly uncertain, it is critical for the nation that Australian students develop a robust entrepreneurial mindset and have the skills necessary to execute innovation strategy and implement business ideas.

Educational policies to foster innovation have traditionally focused on increasing participation in STEM disciplines. Recently however, a more comprehensive view of innovation, which recognises the contribution of a wider set of skill and disciplines, has emerged. They are: subject-based skills, thinking and creativity skills, and behavioural and social skills. Fostering critical thinking, creativity, and behaviour and social skills should be viewed as a central skill set for university graduates.

UTS has a strong interest and track record in entrepreneurial education and innovative engagements with business and the community. The key differentiating feature of the UTS approach is the development of 'boundary crossing' skills such as collaboration, problem solving and design thinking, as well as specialised discipline knowledge. These broader skills are as important for an entrepreneurial approach to leadership in large organisations as they are to new business start-ups and small and medium enterprise growth and innovation.

UTS provides opportunities for students to develop and apply entrepreneurial skills in a range of programs at undergraduate and postgraduate levels and in our externally focused executive development programs, some with access to business incubator facilities. For example, our Bachelor of Business features an 'Integrating Business Perspectives' module in the first year; several programs, including our EMBA, make provision for live business consulting by student teams; the new Bachelor of Creative Intelligence and Innovation double-degree enables students to take an idea from concept to commercial reality; and our executive education programs are designed for deep engagement with firms and organisations around implementation strategies for improved productivity performance and business transformation.

UTS, along with the other ATN partners, offers Australia's first initial Industrial Doctoral Training Centre (IDTC), funded by the previous Australian Government as part of its Research Workforce Strategy. The IDTC provides a "new paradigm of research and research training" (ref: <https://www.atn.edu.au/Partners/idtc/>), enabling students to perform research in an industry context, as opposed to the more traditional academic context. Through industry partnerships, students are selected to address real-world research problems that industry is trying to solve.

(i) Policy actions to ensure strategic international engagement in science, research and innovation;

The Australian innovation system generates only 3% of world knowledge, so the economy relies on innovation generated elsewhere. It is important to understand how our innovation system fits with other innovation systems in countries of the Asian region, such as China, India, Republic of Korea, Japan, and Singapore.

For example, China intends to increase R&D investments from 1.4% to 2.5% of its GDP by 2020, decreasing its dependence on foreign technologies. It has attracted research centres from major companies like GE, Unilever, Intel, Novartis and others, while at the same time building new and significant research partnerships with US and European universities so as to offer new learning experiences for Chinese students. India is adjusting its research strategy to move from pure science to entrepreneurial focused initiatives with a wide range of global companies in order to create new value and significant benefits for their society and economy. These bold initiatives are government driven.

The Global Innovation Index 2014 shows the attraction of foreign R&D investment is a big weakness for Australia, relative to other nations (rank 42). Government supported opportunities to attract foreign public investment such as the Australia-China Science and Research Fund and the Australia-India Strategic Research Fund provide important channels for research collaboration over the longer term, and should continue to be supported.

(j) Policy options to create a seamless innovation pipeline, including support for emerging industries, with a view to identifying key areas of future competitive advantage.

Increasingly innovation is conceptualised as an ecosystem rather than a pipeline. As outlined in section (d) above, Australia has learned much from the Silicon Valley (SV) success stories, and despite Sydney being depicted by the Startup Ecosystem Report 2012 as not significantly differentiated from the SV startup ecosystem model, we have a long way to go to reach a position of global influence.

Table 1. Summary of findings on Sydney from the Startup Ecosystem Report 2012:

Positive/Supportive	Room for improvement
Sydney entrepreneurs are as highly educated as SV entrepreneurs (37% Master & PhD vs. 42% in SV).	Startups in Sydney raise 59% less capital than startups in Silicon Valley. Funding sources in Sydney are skewed towards self-funding, friends/family and incubators; significantly away from super angels and Venture Capitalists.
Entrepreneurs in Sydney have a similar amount of mentors per startup as entrepreneurs in Silicon Valley.	Startups in Sydney have 43% fewer employees per stage compared to SV.
The key challenges for Sydney startups are similar to SV startups. Both consider customer acquisition, building the product, funding, and building the team to be their primary challenges.	

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According to the World Economic Forum (WEF), in its report *Entrepreneurial Ecosystems Around the Globe and Company Growth Dynamics* (2013), "three areas of an entrepreneurial ecosystem [are identified] as being of pivotal importance – accessible markets, human capital/workforce and funding & finance".

In parallel with the Global Innovation Index 2014 that highlights Australia's strength in Human Capital, the WEF report indicates that the accessibility of Human Capital Workforce in Australia is a strength, on par with the UK but behind the US and Silicon Valley. This shows that whilst we have an existing strength, there is room for improvement. The challenge is to build a tightly connected interwoven innovation ecosystem powered by new talent, entrepreneurial skills and access to capital.

The Australian Federal Government is uniquely positioned to lead in the creation and enrichment of innovation ecosystems around Australia by bringing together the critical elements required for large enterprises, SMEs, startups, universities and research institutions to strengthen their bonds and work together to scale, to generate new value, and to seek and optimise new opportunities.

The Global Economic Corridor in Sydney emulates the Silicon Valley ecosystem. Running from Sydney airport, through the Sydney CBD then out to Macquarie Park, this Sydney ecosystem comprises four major research universities (Sydney, UTS, UNSW and Macquarie), research institutes including NICTA, and some of most successful and innovative firms specialising in knowledge-intensive activities such as engineering, IT, healthcare, finance, professional services, marketing and a host of creative ventures. According to SGS Economics and Planning, it accounts for about 50% of NSW's gross state product. Employment growth in that corridor has been three times higher than the rest of Sydney since 2008 and about 40% above the national average. Globalisation and the advance of technology have put some industries, especially manufacturing, under great pressure. But enterprises along the economic corridor appear to have thrived on those same forces. The success of this global economic corridor has been attributed to effective urban planning and an innovative and dynamic mix of new economy businesses including ICT, pharmaceuticals and high-value manufacturing such as biotechnology, and creative industries.

In conclusion, for the global economic corridor in Sydney with UTS at its heart, a world class research and education base, a collaborative technology-driven and design-led innovation partnership between universities and industry, and a culture of innovation and entrepreneurship based on focused new economy businesses must be actively and sustainably implemented, and supported by an effective innovation system. The specific businesses for this global economic corridor will involve the intimate interdisciplinary interplay of health, ICT and creative industries. It will allow this global economic corridor to reach a high level of global influence, and contribute to a knowledge infrastructure that benefits the future prosperity of all Australians.

Yours sincerely,

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