



RESPONSE TO INNOVATION AND SCIENCE AUSTRALIA'S

2030 STRATEGIC PLAN ISSUES PAPER

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by arrangement with the Office of Innovation and Science Australia



The University of Melbourne welcomes the opportunity to provide a submission to Innovation and Science Australia's (ISA) national consultation on the development of a 2030 Strategy for Australia's innovation, science and research system.

We endorse the recognition in the Issues Paper that researchers, investors, all levels of government and business/industry are key partners in building and delivering the objectives of strategic plans such as the 2015 National Innovation and Science Agenda (NISA) and the forthcoming 2030 Strategy. As a leading research, teaching and learning institution, the University of Melbourne is committed to continuing our work to generate an ever-stronger, top-tier Australian innovation hub – internationally recognised – whose work underpins a diversity of internationally competitive industries, life-changing research and meaningful social impact.

In addition to making this written submission, the University has been pleased to host a number of policy roundtables on relevant topics of innovation and the role of research hubs with the ISA board members, consultants and public officials from the Department of Industry, Innovation and Science.

For further information or to discuss our submission, Vice-Principal of Enterprise Mr Doron Ben-Meir can be contacted on d.benmeir@unimelb.edu.au or 03 8344 5078.

Building a national shared vision for innovation and science

The University commends and supports the 2030 Vision for Australia's innovation system expressed on p3 of the Issues Paper. In pursuance of that national Vision, the University has a clear and well-aligned sense of our potential and contribution to the innovation system within our sphere of influence.

The University's innovation vision: Like many publicly-minded research and civil society institutions the University is well-advanced on a project of identifying and implementing fundamental changes to ensure our work will have maximum – and escalating – impact on productivity and innovative outputs. There are numerous strands to this endeavour that are discussed in more detail later in this submission, including:

- *Bolstering research and workforce foundations:* We are maintaining and bolstering our world-recognised research excellence, which is a key driver of innovation, while continuing our high-quality graduate model of higher education;
- *Boosting innovation activity and pace:* We are drawing on international experience to accumulate and stimulate the economic, physical and cultural networking assets that are essential ingredients for building successful research and innovation precincts (or clusters/districts) within or in close connection to our campuses;
- *Bridging innovation gaps:* We have proactively launched institutional capabilities, programs and resources to bridge well-known innovation-stifling gaps in supportive infrastructure, such as capability gaps at the earliest phase of the research commercialisation pipeline;
- *Building partnerships for impact:* With the doors of the University thrown wide open, we are partnering with hundreds of small, medium and large businesses on undertakings including: research commercialisation opportunities; profitable applications of research; start-up and entrepreneurship acceleration; in-demand workforce readiness and connectedness for our graduates; and policy- and problem-solving collaborations between the Academy and external participants.

These are some headline examples of the many innovation activities underway at the University of Melbourne that demonstrate our alignment to the purpose of ISA's consultation. Attached as **Appendices A** and **B** to this submission are further details on some of these initiatives.

However, it is recognised that there is unrealised potential for innovation still ahead of the University, as ahead of the nation. It is well-understood across our Academy and administration that Australia's innovation performance lags behind global competitors, as noted by ISA's report on the Performance Review of the Australian Innovation, Science and Research System 2016.

The University of Melbourne has a clear and achievable vision of how we can quickly and effectively scale up the above headline activities – and add others – to elevate our impact as a public research organisation and share our research- and expertise- based innovation to increase economic and social outcomes in Australia.

There are many levers and options being considered by ISA at a time of budget restraint and competing priorities. The University urges ISA to look for investment and policy opportunities that deliver optimum outcomes. The most efficient way of achieving this is to identify pockets of demonstrated momentum and, drawing on existing innovation assets, scale these up to a greater level of achievement. Policy coordination across the federal government and between levels of government is a necessary prerequisite for outcomes that will start to match those achieved internationally.

Stunning innovation success stories may appear to be serendipitous, but they are not accidental and are usually underpinned by persistent public sector leadership and purposeful gathering of the right mix of elements and actors. As the Brookings Institute has noted, when fundamental assets combine with a supportive, risk-taking culture they create an innovation ecosystem – a synergistic relationship between people, industry and locality – that facilitates ideas and accelerates outcomes (Katz and Wagner, 'The Rise of Innovation Districts: A New Geography of Innovation in America', Brookings Institute, May 2014).

Prominent international examples of urban precincts that have grown over years to positions of innovative strength include: Cambridge Science Park, now Europe's largest technology cluster; and Eindhoven in the Netherlands, a specialised high-tech leader known as the 'Invention City'. Google's urban hubs including Tech City in London, New York City's Chelsea district and Pittsburgh's Bakery Square in Pennsylvania now crucially support its well-known corporate campus in Silicon Valley. Traditional exurban innovation campuses like Research Triangle Park in Raleigh-Durham, North Carolina, have purposefully moved to establish complementary, vibrant and eclectic urban research precincts that attract a dynamic mix of firms along with collaborative living and working environments. Beyond these urban precincts there are well-known and pioneering global innovation districts such as Kendall Square in Boston (MIT/Harvard); Silicon Valley (Stanford); Tel Aviv (Tel Aviv University; Technion, Hebrew University); and New York (NYU; Columbia).

In each of these examples, large international firms, a constellation of innovative start-ups and at least one leading university are the essential elements. The universities are the anchor tenants of these precincts – the nucleus around which the ecosystem forms. Other elements include facilitative and consistent Government policies sustained over time; talented people and thinkers drawn to the precinct; high activity density; culture of collaboration; and physical assets that enable accessibility and sociability with surrounding community and amenities.

Major research institutions like the University are in many ways a microcosm of the nation. Our experience and proven record of developing dynamic urban innovation ecosystems contribute an instructive and fertile model for a national innovation strategy. For instance, the University of Melbourne has over several decades worked with domestic and global partners in the Melbourne Biomedical Precinct to build a large-scale medical research and clinical practice base that is internationally recognised. This district hosting more than 10,000 clinicians and researchers has enabled collaboration with hundreds of industry partners including CSL International and IBM.

In the current Australian environment, leading research universities are strongly placed to serve as magnet, enabler, magnifier and anchor to those key elements, building up functions over time to become critical nodes in the Australian innovation ecosystem. For the Australian Government's part in driving innovation, the University recommends broadly that the Government is best placed to focus on policy areas and initiatives that are squarely within the government's power and responsibility and that will not, or cannot, be addressed by the market.

Key Recommendations

As requested by the Issues Paper, the University's key recommendations include up to three 'highest priority' responses to each of the Challenges outlined by the Issues Paper.

Challenge 1 – Moving firms to the innovation frontier

Precincts are one of the world's most powerful models for innovation impact, particularly in mid-sized 'Knowledge Capital' cities anchored by a leading university. As a group these mid-sized Knowledge Capital precincts boast third-highest average economic output and the highest nominal GDP per capita (Brookings Institute global analysis 'Redefining Global Cities', 2016).

Recommendation A: The 2030 Strategy should include a resolute and selective approach to precinct development, aiming at providing co-investment to scale up and leverage activity hubs and fertile innovation districts where the inputs and outcomes are already present and will be responsive to enabling policy settings, aligned and light touch regulation, and incentives for co-location and co-investment.

Start-ups are major global generators of new jobs and industries, including in Australia where start-ups created 1.44 million jobs between 2006 and 2011 (according to the Department of Industry, Innovation and Science).

Recommendation B: In addition to existing resources for incubators and accelerators, government should co-invest selectively to facilitate scale up and maintain support for successful accelerator programs on university campuses and provide effective incentives for industry to sponsor places in these programs.

The **R&D Tax Incentive** is an effective influencer of behaviour and has the potential to drive higher returns on public investment in research.

Recommendation C: Modify the R&D Tax Incentive to improve collaborative research outcomes and ensure optimal return on public investment; and

Recommendation D: Encourage and leverage collaboration with public research providers and public research infrastructure by establishing a higher third tax concession tier for businesses to partner with public research organisations.

Challenge 2 – Moving Government to the innovation frontier

National and State data release and data sharing infrastructure will unlock significant benefits to research, innovation, business and policy-making, all of which underpin innovation outputs.

Recommendation E: The 2030 Strategy should include principles and/or measures that reflect the innovation potential and urgency of national data sharing and data management reforms, including appropriate resourcing for implementation of reforms such as the framework proposed by the Productivity Commission in its report on Data Availability and Use, and careful alignment of data mechanisms and policies at all levels of government.

Policy and regulatory impediments at Commonwealth and State/Territory level undermine key parts and growth of the innovation ecosystem.

Recommendation F: Government policy must be aligned and mutually supportive across portfolios and between levels of government. A priority should be to identify and remove (and avoid in future) innovation impediments in policy and taxation, such as the ATO's proposed changes to scholarship taxation and recent changes to the 457 visa regime that will unintentionally prevent the recruitment of the world's best and brightest to our research institutions.

IP reforms could function as a gateway for boosting the volume of new Australian intellectual property and enhancing innovation outcomes.

Recommendation G: The Australian Government should develop and publish a consolidated intellectual property framework to operate under a single Ministry to provide clearer guidance for Australian technology transfer and licensing agreements in academia and industry.

Challenge 3 – Delivering high-quality education for Australians throughout their lives

Boost high-quality graduate education such as the Melbourne Curriculum Model by promoting lifelong education with a distinctive mix of broad undergraduate and professional-entry postgraduate degrees, which provide students with a breadth of knowledge and skills that position them well to be the innovative leaders of the future.

Recommendation H: Sustain and boost the integrity of Australia’s high-quality graduate education sector through regulatory and funding settings that promote differentiation, specialisation and student choice.

Lifelong engagement with industry-partnered higher education will be key to the future exchange of information and ideas and the development of relevant knowledge, understanding and skills in Australia’s twenty-first century workforces.

Recommendation I: Expand opportunities through Innovation Connections or complementary programs for academic secondment to industry, two-way mobility programs for researchers and industry-based postdoctoral opportunities.

Challenge 4 – Maximising engagement of the research system with end users

There is an early innovation gap in the university commercialisation pipeline that cannot be solved by the market, relating to a deficit of skills and resources in academia for successfully catalysing a research finding into a viable commercial prospect. The gap between where basic research output ends and commercial investment interest begins can be bridged through appropriate translation machinery (e.g. venture catalyst) and soft infrastructure.

Recommendation J: Co-invest with universities in mechanisms to address the translation gap currently faced by early stage research commercialisation proposals in public research institutions.

Research funding for Higher Degree Research is not currently targeted to grow Australia’s world-class research baseline and deliver the strongest possible innovation dividend.

Recommendation K: Re-assess the funding differential for Higher Degree Research completions via the research training program to maintain and grow strength in broad and inter-disciplinary fields of education.

Basic research funding in Australia continues to decline in real terms, even though basic research is the proven bedrock of research and innovation ecosystems around the world.

Recommendation L: Encourage the Australian Government to provide more funding for basic research to maintain Australia’s world-class research as the bedrock of innovation. This funding can be leveraged by policy settings that incentivise diversified sources of funding.

Challenge 5 – Maximising advantage from international knowledge, talent, capital

Changes to subclass 457 visa regulations risk undermining smart business practice and the attractiveness of the Australian business and research environment for the world’s most innovative companies, universities and researchers.

Recommendation M: Include a set of principles or policy parameters in the 2030 Strategy for future Australian immigration regulation that enables, rather than undermines, innovation and international talent mobility and ensures Australia is an attractive destination for companies and the world's leading researchers.

International competitiveness and collaboration require support and resourcing to ensure Australian research and innovation remains internationally visible, connected and highly-regarded.

Recommendation N: Support access to research funding for international collaboration and better align research funding with international opportunities addressing global challenges.

Challenge 6 – Bold, high-impact initiatives

A failure to make progress with the existing **STEMM gender imbalance** will be to the detriment of Australia's workforce in the fastest growing occupations of the twenty-first century, most of which will rely on technical literacy and advanced skills.

Recommendation O: Support large-scale national initiatives that maintain and grow the STEMM pipeline, including programs to reinforce the importance of maths teaching at schools and early intervention programs to encourage girls to study maths and sciences.

The **National Collaborative Research Infrastructure Strategy** forms the foundation of Australia's innovation and research ecosystem, enabling world-leading, productive and pioneering research across the network of facilities.

Recommendation P: The University recommends the 2030 Strategy incorporate support for Australia's world-class research infrastructure by implementing, in full, the 2016 National Research Infrastructure Roadmap and establishing a dedicated National Research Infrastructure Fund with an initial capital commitment sufficient to cover infrastructure investment requirements for at least ten years.

Challenge 1: Moving more firms, in more sectors, closer to the innovation frontier

DEVELOP UNIVERSITY-ANCHORED INNOVATION PRECINCTS: The ISA Issues Paper seeks views about the role ‘clusters’ of innovative activity could play in fostering high-growth firms. There is a key role for universities as anchor tenants in the innovation ecosystem. Not only are education and research institutions generating substantial export income but they offer fertile ecosystems for adding high value to existing enterprises; for engaging with collaborators to problem-solve through research; and for translating new ideas into commercial opportunities.

Precincts are the world’s most powerful model for innovation impact, and in many countries including Australia, university-based research precincts operate at the innovation frontier. Harnessing the theory of agglomeration, they help catalyse innovation by connecting the key organisations (industry, researchers and government) and building capability across key activities (R&D, education, entrepreneurship, technology diffusion, knowledge-translation, engagement and research commercialisation).

The centrality of universities to successful innovation precinct development was recently reported on by the Brookings Institute (Wagner and Katz, ‘Australia’s pathway to innovative growth lies with its universities’, 31 May 2017). This piece argues strongly that if Australia is to become a rising star in innovation, ‘one of Australia’s first moves should be to transform its R&D-laden universities to become hyper-compact, connected, and collaborative locales of spiking innovative growth’.

For this reason, the University proposes that the development, enhancement and supercharging of key research precincts around the country should be seen as a national interest imperative delivering societal rewards including: improved productivity, greater competitiveness, greater economic growth and better living standards. Measures to enable the escalation of university innovation precincts and support for cross-sectoral engagement in those precincts are key ways of moving more firms to the innovation frontier. The core supporting arguments for effective precinct development are outlined below.

Precincts are places of fresh thinking and places of making: Innovation precincts are environments where people work together in creative and entrepreneurial ways. They support interaction between sectors, disciplines and geographic boundaries. In the words of a 2016 report published by the Office of the Chief Scientist, ‘an innovation system is a web of knowledge creation and diffusion’. By these terms, university precincts can form the physical heart of the web and supporting structure of the local innovation system.

Precincts are innovation multipliers: International literature and practice indicates that focusing innovative activity within powerful local precincts can catalyse improved national innovation performance and help solve wicked problems, such as the need for economic transformation to environmentally sustainable industries.

Precincts are talent magnets: Precincts attract both world-class talent and leading companies, which improves innovation outcomes by concentrating scarce resources on the people most likely to deliver breakthroughs. It delivers physical proximity, relationships of trust and personal interaction, and interdisciplinary collaboration, all of which maximise innovation outcomes (see report ‘The Third Revolution: The Convergence of Life Sciences, Physical Sciences and Engineering’, MIT, 2011). Over time, success breeds success, with the world’s top talent increasingly attracted to working with ground-breaking researchers and firms based at the precinct but working expansively.

Organisations don't innovate; people do: Creating places for human intellect to collide with applied purposes and new technology and ideas has always been part of the history of human progress. As such, following through effectively on a strategic intention to create innovation precincts will strengthen Australia's role in global innovation. While talented people are a key ingredient to a successful innovation cluster, there are other fundamental inputs that have shown to be present in high-achieving innovation hubs around the world. These include:

- Co-location of collaborators, due to the growing empirical evidence on the causal link between proximity and impact;
- Convergence of disciplines working on inquiries of mutual interest;
- Activity density around a core research enterprise functioning as an anchor;
- Visibility and sociability, so that the precinct is well-linked to the community through transit and urban amenities like cafes, retail and offices, to enable openness to ideas, knowledge translation and diffusion.

Rather than relying on serendipity, a strategic, sustained and farsighted approach by government, universities and industry to precincts will enable key participants to 'make their own luck' and deliver innovative technologies, business ventures and industries that will add to Australia's productivity growth. The rewards of a strategic approach will magnify outcomes and flow-on impact to broader society in a unique and distinctive way. Research precincts are uniquely placed to ensure joint projects aim for powerful outcomes and are co-designed with and by end users. In terms of the physical spaces necessary, a precinct approach means architectural design and culture can be leveraged to foster collaboration, trust and social capital.

The University's experience with the Melbourne Biomedical Precinct informs this view. This experience is also being used to develop the next significant precinct development in Australia – an innovation precinct focused on STEM research applications and multidisciplinary partnerships on the site of the former Royal Women's Hospital site at Carlton.

In the national innovation interest, the University recommends:

Recommendation A: The 2030 Strategy should include a resolute and selective approach to precinct development, aiming at providing co-investment to scale up and leverage activity hubs and fertile innovation districts where the inputs and outcomes are already present and will be responsive to enabling policy settings, aligned and light touch regulation, and incentives for co-location and co-investment.

SUPPORT INCUBATORS AND ACCELERATORS: A second way to bring more firms to the innovation frontier is to provide adequate and sustained support for start-up incubation and acceleration. The University further adds that building up accelerators based at university innovation precincts would enable government policy to strike a balance between adding value to existing innovation leaders and facilitating the emergence of the next generation of entrepreneurs.

The NISA expansion of the CSIRO Accelerator Program and the Australian Government's increased funding over four years for the Incubator Support Initiative are steps in the right direction for giving Australian researchers and entrepreneurs the support they need to develop their ideas, test them and take them to market. But there is still a long way to go. So far, Australian enterprises have not shown scale-up rates equivalent to comparable economies, and Australia ranks last for high-growth

enterprise rate measured by employment amongst OECD countries. Low start-up growth rates are failing to attract investors with a portfolio of start-up investments, which contributes to the challenge of local capital-raising.

Accelerator and incubator programs are a way for universities and partner organisations to cultivate the start-up entrepreneurial culture we need in Australia and cultivate business talent amongst our dynamic thinkers. Australia risks an entrepreneurial brain drain as other nations draw foreign entrepreneurs to their shores by opening up diverse opportunities for value creation.

As elaborated in **Appendix A**, the University is making headway within our own innovation system by establishing the Melbourne Accelerator Program (MAP), a start-up accelerator based in our innovation precinct headquarters. Despite starting only five years ago, in 2016 MAP was ranked the 8th best university accelerator program globally by Swedish research firm UBI Global. MAP runs hackathons to tackle social challenges; offers paid internships and hosts student and academic commercialisation projects that range from web and app development to policy research; leads young entrepreneurs on missions to Silicon Valley and other hotspots for mentoring, networking and business pitching; works with industry partners such as Australia Post and IBM to develop regional start-ups and research applications; and since 2012 has supported local start-up teams that have raised over \$23 million in funding, created more than 250 jobs and generated over \$28 million in revenue.

Proximity to a dynamic research enterprise like a university delivers two-way benefits to start-ups, incubators and accelerators; it brings business ideas closer to researchers and expert problem-solvers, and cutting-edge research closer to the commercial slipstream. The surrounding activity density of a university also means the incubator/accelerator has access to a greater volume and selection of start-ups and commercialisation prospects, meaning quality controls can pick out the strongest ideas and back them to delivery with greater chance of success. This rich, deep and broad start-up pipeline is a significant and valuable commodity. Our challenge is to leverage this growing diversity of start-up enthusiasm with the market-making power of larger corporate players, to enhance select companies so they can speed up to the point of critical mass.

Corporate sponsors can add significant value to existing, successful accelerators by focusing on areas where they bring critical market access and scale. This capacity adds to the value proposition of accelerators to prospective participants. It further provides an important value proposition to Universities, which are hungry to establish multi-threaded relationships with industrial players. The University of Melbourne's experience with Australia Post has already shown signs of delivering this type of enhanced value addition. A greater diversity of corporate partners would further strengthen an already powerful accelerator brand and improve the prospects of MAP becoming self-sustaining.

Accelerators that achieve this level of critical mass are well-placed to run outreach programs to areas where innovation density is shallow, by providing resources, connections and skills through targeted outreach programs. This is a cost-effective way of ensuring the benefits of start-up incubation and acceleration are shared across Australia, without having to establish new sub-critical enterprises in every location. To move more firms in more sectors to the innovation frontier, the University recommends the 2030 Strategy include the following measure:

Recommendation B: In addition to existing resources for incubators and accelerators, government should co-invest selectively to facilitate scale up and maintain support for successful accelerator programs on university campuses and effective incentives for industry to sponsor places in these programs.

R&D TAX REFORM TO UNLOCK INNOVATION: A third high-priority proposal for ISA's 2030 Strategy is to reform the R&D Tax Incentive. This proposal from the University responds to the ISA Issues Paper's query on what regulatory reform, and in what sectors, is required to help firms move closer to the innovation frontier and enable greater adaptability.

By far the largest investment that the Australian Government makes in R&D is ~\$3 billion through the R&D Tax Incentive. As the University submitted to the R&D Tax Incentive review led by Ferris, Finkel and Fraser in early 2016, the very significant quantum of Commonwealth funds provided to this measure makes the Tax Incentive a powerful influencer of behaviours.

In advancing the nation's innovation agenda, retaining incentives for industry to invest in R&D is critically important. In addition, the University submits this significant funding pool for research could be better targeted to fuel the collaborative research ecosystem desired by Government, universities and industry to have the most impact on research and research translation.

The R&D tax incentive should be modified to ensure it addresses the original policy intent of encouraging R&D that would not otherwise have occurred. This will require adjusting policy settings to improve collaborative research outcomes and ensure optimal return on public investment (following the principle of additionality). The Tax Incentive could be more closely targeted to increase the incidence of industry-research collaboration and the output of research through public research organisations. Better targeting of this investment to support and encourage collaborative research and new-to-market R&D would increase industry engagement and effective spending of national R&D funds.

The R&D Tax Incentive harnesses market dynamics to best allocate government support in the form of tax concessions, and in doing so provides a valuable mechanism to support R&D work for private Australian companies. Given the R&D tax incentive has proven so popular with Australian industry and has delivered significant benefit, the 2030 Strategy provides an opportunity to explore ways additional value can be derived from this measure. For instance, the University supports existing proposals for a higher third tax concession tier for businesses that leverage other public investment in research and drive collaborative enterprises with our public research organisations to realise the most benefit for the Australian Government's total investment in research and development.

To move more firms to the innovation frontier, the University recommends:

Recommendation C: **Modify the R&D Tax Incentive to improve collaborative research outcomes and ensure optimal return on public investment; and**

Recommendation D: **Encourage and leverage collaboration with public research providers and public research infrastructure by establishing a higher third tax concession tier for businesses to partner with public research organisations.**

Challenge 2: Moving and keeping Government closer to the innovation frontier

RESOURCE AND IMPLEMENT DATA SHARING REFORMS: The Issues Paper seeks feedback on ‘how government can seek to leverage greater social benefit and public value from major program expenditure’, as well as ‘how government can reduce impediments to innovation within the public sector’.

A critically important gateway resource for innovation is the implementation and resourcing of a coordinated and comprehensive framework for data availability and use, such as the framework recently mapped out by the Productivity Commission in its landmark report on the inquiry into Data Availability and Use (tabled in Federal Parliament on 8 May 2017). In May, the University welcomed the Australian Government’s establishment of a Taskforce to assist Cabinet with developing its response to the Productivity Commission’s report and stands ready to contribute to consideration of implementation aspects.

Data is a crucial research infrastructure across the natural, physical, medical and social sciences, as well as for data-driven innovation on digital technologies, products and services. Significant benefits to research, innovation, business, citizens’ policy engagement and policy-making will flow from efficient and effective establishment of legislation and new institutional mechanisms across sectors to unlock data for use by appropriate users, e.g. trusted users for sensitive data and general public for non-sensitive data.

From the research and innovation perspective, there is outstanding research value in core datasets held by public sector agencies, such as census and labour force longitudinal data, geocoded National Address files, personal income and business tax data, health interventions and benefits data and social society data. However, these flagship public resources make up only part of the untapped data wealth that could translate to innovation, including medical advances. Increasing technological ability to link disparate datasets further amplifies the potential impacts and benefits of data analytics, and places even greater value on policy reforms to enable efficient access to diverse data resources.

From an educational perspective, there is unrealised promise in the role that big data and learning analytics can play in providing students with genuinely adaptive learning environments in a time of mass education. Data, infrastructure and applied learnings from these will be able to create environments that understand students’ previous learning experiences and adapt to meet their educational needs, representing an exciting opportunity for the education and training sector.

Existing blockages, including lack of a comprehensive data sharing and security framework to protect and empower individuals and public agencies alike, serve as impediments to innovation and inhibit the leveraging of greater value from public resources. Likewise, lack of resourcing for enhanced data infrastructure and resources for public sector agencies and public research institutes to make use of data constrains the capability of key institutions to work together to gain greater value from unique and high-value public sector data holdings.

A good example of where data infrastructure directly impacts innovation is in the field of life sciences. The University is a node in the national EMBL Australia Bioinformatics Resource (Melbourne Bioinformatics). To ensure Australian life science data remains a globally unique drawcard, it must be curated and annotated to a standard which is attractive to international collaborations (public and private). This will in turn enable our researchers to access international data – this is not currently allowed for in current funding models and is often lacking in our researcher training.

A sophisticated policy that encourages innovation and commercialisation will require a culture of Open Science, as recognised by many submissions to the Productivity Commission's inquiry. To create opportunities for innovation, life science data needs to be findable, accessible, interoperable, and re-usable. Australian research nodes at the University are regularly finding that potential international collaborators are demanding multi-disciplinary research capability incorporating transparent, rigorous and reproducible data from different fields, in order to run studies and clinical trials to generate new knowledge and medical treatments.

A final recommendation relating to the public sector role in innovation is to propose that data be used by the Australian Government, in collaboration with other levels of government, to map out sectors of innovation strength. The public sector holds vast reserves of data (e.g. health, economic, social, research, tax data) evidencing areas of activity, strengths and weaknesses of different Australian sectors. However, a lack of linkage and linked analysis means these resources are not used to paint a coherent overall picture of sector based ecosystems. Government datasets are uniquely placed to generate a quantitative, real-time ecosystem mapping providing rich information and the capacity for trend analyses over time (how sectors are growing, where the productive relationships are emerging, value chain bottle necks, etc). Strategic usage of such data could provide valuable insights to policy-makers on how to design highly-targeted, evidence-based programs and initiatives to boost innovation outcomes.

To keep government closer to the innovation frontier, the University recommends:

Recommendation E: The 2030 Strategy should include principles and/or measures that reflect the innovation potential and urgency of national data sharing and data management reforms, including appropriate resourcing for implementation of reforms such as the framework proposed by the Productivity Commission in its report on Data Availability and Use, and careful alignment of data mechanisms and policies at all levels of government.

AVOID INNOVATION IMPEDIMENTS SUCH AS SCHOLARSHIP TAXATION: The Australian Government has demonstrated valuable policy leadership in setting out the objectives of the NISA and related measures, which seek to improve university/industry collaboration and increase engagement of PhD students with industry amongst other innovation goals. The University endorses this policy leadership and encourages the continuation and alignment of this strategic agenda at all levels of government.

To ensure government moves and stays closer to the innovation frontier, the University recommends avoiding misaligned policy changes that undermine key parts of the innovation ecosystem, such as the ATO proposal to tax scholarships based on the primary purpose of the provider, rather than the primary purpose of the activity (that is, education).

In response to national science and innovation priorities, an increasing number of Higher Degree by Research (HDR) students undertake research training while answering research questions of interest to industry. The Government has also established a national PhD internship program to provide 1400 PhD internships in the medium term. However, under the ATO's proposed interpretation of taxation legislation, an HDR student's scholarship could be subject to taxation.

This taxation change could influence HDR students to not engage in internships or industry relevant research training. This unintended consequence will impact the NISA objectives and is contrary to the recommendations of the Review of Australia's Research Training System (2016).

The University recommends that scholarships for full-time enrolled HDR students including scholarships that are for internships that are part of the student's course and regardless of the provider of the training, should be deemed to be principally for educational purposes and should be tax exempt. The pipeline of well-trained, industry-engaged and 'work-ready' graduates coming out of universities would be severely reduced if this taxation policy were to be pursued, with detrimental impacts on future Australian innovation.

Similarly, recently announced changes to the subclass 457 visa regime will negatively impact Australia's innovative capability and international competitiveness. Preventing the free flow of global talent will remove a valuable source of academic capability from the university lecture halls, classrooms and laboratories. The market for senior research leaders and postdoctoral fellows, in particular, is international. Consequences of these visa changes will be to prevent or deter talented individuals from gaining employment with Australian universities or deter talented postgraduates who may find their pathways to postdoctoral work and/or permanent residency reduced or removed. The changes will also put at risk Australian universities' international rankings, which rely, in part, on a diverse and international talent pool working at an institution.

The University recommends that to move and stay closer to the innovation frontier, the Australian Government:

Recommendation F: Government policy must be aligned and mutually supportive across portfolios and between levels of government. A priority should be to identify and remove (and avoid in future) innovation impediments in policy and taxation, such as the ATO's proposed changes to scholarship taxation and recent changes to the 457 visa regime that will unintentionally prevent the recruitment of the world's best and brightest to our research institutions.

INTELLECTUAL PROPERTY REFORMS: The Australian Government is well-placed to provide leadership in intellectual property (IP) regulation. Further gateway reforms to IP would enhance outcomes in collaborative research.

The University is a research and teaching organisation with significant expertise in IP law, with extensive ownership of patents and utilisation of copyright, trademarks and online investment in digital media. We welcomed the prospective IP changes highlighted in the NISA and the release in September 2015 of the Australian IP Toolkit for Collaboration. However, to further simplify and streamline IP in Australia, the Australian Government through the 2030 Strategy could move towards realising the potential benefits of regulatory consolidation.

The University recommends the 2030 Strategy should encompass the following aim:

Recommendation G: The Australian Government should develop and publish a consolidated intellectual property framework to operate under a single Ministry to provide clearer guidance for Australian technology transfer and licensing agreements in academia and industry.

Challenge 3: Delivering high-quality and relevant education and skills development for Australians throughout their life

SUSTAIN AUSTRALIA'S HIGH-QUALITY, SPECIALISED GRADUATE EDUCATION: The ISA Issues Paper covers a number of topics at Challenge 3 that are deeply important to Australia's future and prosperity. The Issues Paper aptly expresses the predicted volatility and change in the future of employment and the significant challenges this poses for the structure and approach to education and training in the long term.

There are a number of factors that create this volatility. One is the changing nature of the relationship of the citizenry to information and knowledge with the rise of the Internet. Another factor is the oft-mentioned rise of automation and artificial intelligence, with implications for the future of employment and the role of education and training organisations alike ('Australian Higher Education Workforce of the Future', PWC, January 2016). The changing nature of work – and subsequently what it means to be educated and trained for work – present significant challenges in an era where citizens are likely to change their work roles more frequently and when they are likely to live, and presumably work, longer.

Educating and training in the timeframe of the 2030 Strategy and beyond through the twenty-first century will still emphasise credentialing and competencies. Awards and academic certificates that show what trained people are capable of will still hold value. For this reason, in response to the Issues Paper's query on 'how can we create a cohesive education and training system that is integrated into the innovation and research system', the University points to the critical importance of postgraduate by coursework training formats and the continued availability of high-quality specialist graduate schools in Australia's leading universities.

For instance, the University of Melbourne has established a distinctive model known as 'the Melbourne Curriculum' model within Australia's higher education sector that combines generalist, high-quality undergraduate degrees with specialised professional entry graduate programs. In an era where information is a click away, there will be an increasing emphasis on developing graduates with indispensable 'work-ready' skills of evaluative judgement, teamwork, communication, critical thinking and problem-solving. Additionally, forthcoming generations of graduates' skillsets will need to be completed with twenty-first century capabilities of agility, creativity, and adaptability – the foundations of entrepreneurship.

To maintain the availability of high-quality and relevant education throughout Australians' lives, the University recommends the 2030 Strategy:

Recommendation H: Sustain and boost the integrity of Australia's high-quality graduate education sector through regulatory and funding settings that promote differentiation, specialisation and student choice.

INVEST IN ENGAGEMENT BETWEEN EDUCATIONAL AND PROFESSIONAL STREAMS: The Issues Paper seeks responses to how to increase people and idea exchanges between industry and the education and training system.

The kinds of skills, attributes and capabilities mentioned in the above section cannot be developed in a vacuum. While foundational discipline-based knowledge and understanding will remain critical, in

the era of the 2030 Strategy there will be an increased emphasis on the application of knowledge. Education and training approaches that emphasise inquiry-based and challenge-based learning – in which students undertake investigation to resolve, often in innovative ways, real-world, applied problems – are one clear way in which education and training can be more tightly integrated with innovation and research systems. These approaches are relatively common in education and training now, but will likely expand in the future, whether within educational institutions or in partnership with industry and other research organisations.

Partnerships between education and training providers and industry will be key to the exchange of information and ideas and the development of relevant knowledge, understanding and skills. Many educational institutions, including the University of Melbourne, already see partnerships with government, industry and other educational institutions as a significant priority for research and education alike.

Efficient delivery of quality HDR training is critical for the Australia’s innovation system. PhD degrees provide the unique skills mix needed for a career as a researcher and the HDR training system must continue to provide the future research workforce. Although Australia currently produces around 8,000 PhD graduates a year, only a fraction will ever work as an academic. Australia’s HDR training system therefore must be reformed to ensure all graduates gain the skills necessary to contribute their unique capabilities more broadly across Australian industry and society, in roles other than research academics.

The University has been developing ways to integrate further skills training into doctoral training, within current program scope and time limitations. For example, the introduction of internship subjects into the PhD allow doctoral students to access placements sourced either through the Australian Mathematical Science Institute industry internship program or directly.

The University supports the development of targeted researcher and HDR student secondment and mobility programs to help overcome cultural barriers between universities and industry. We are taking action on campus to develop such programs. The University applauds the Government’s investment of \$28m to deliver up to 1400 PhD internships over the next four years and notes that NISA funded Innovation Connections, which includes matched grants to support graduate and postgraduate researcher placements in businesses and matched grants to support business researcher placements in publicly funded research organisations.

Enhanced Australian Government co-investment, particularly in the later years of education, to foster, enhance and grow exchanges through internships, placements, secondments, work-integrated learning, in-house education, and continuing education, will result in benefits to educational institutions, individuals and industry and through them, the innovation system. This investment will supplement the investment being made by universities to enable these sorts of exchange programs to take place.

To deliver high-quality and relevant education and skills for Australians throughout their lives, the University recommends:

Recommendation 1: Expand opportunities through Innovation Connections or complementary programs for academic secondment to industry, two-way mobility programs for researchers and industry-based postdoctoral opportunities.

Challenge 4: Maximising the engagement of our world-class research system with end users

BRIDGE THE GAP IN THE COMMERCIALISATION PIPELINE: To maximise engagement between research and end-user, the University urges the 2030 Strategy to consider actions to also address the early stage gap in the commercialisation continuum in public research institutions and, subsequently, in Australia's innovation ecosystem.

Unlike the US, and increasingly the UK, Australian research is seldom funded far enough to present viable investment opportunities. As a result, companies and investors seeking to leverage university-sourced intellectual property have access to better developed propositions in the US and UK. It is therefore unsurprising that those countries lead the world in accelerating the development of products or services from new inventions to commercial viability by providing specialised skills and resources to support the critical pre-Proof of Concept and pre-clinical junctures.

Even with NISA, the translation gap in supportive infrastructure at the earliest phase of the research commercialisation pipeline remains. Namely, that part of the pipeline where research discoveries have been made with recognised commercial potential, but still too early to attract commercial investment (the first 'Valley of Death').

The translation gap in the commercialisation pipeline restricts the development of research ideas into prototypes suitable for commercialisation. At this early stage, the invention tends not to attract the dedication of a suitably skilled, experienced entrepreneur to plan and execute its commercial trajectory because the risks are considered too high by venture capitalists and corporate investors.

Provision of support at the very early stage is critical to building a pipeline of potential commercialisation ventures that can go on to bid for seed and venture capital funding. The University of Melbourne, for its part, is undertaking actions towards addressing the translation gap. We have hired Enterprise and business development teams and established ancillary infrastructure to cover that earlier and inevitable filtering stage of the commercialisation process. Co-investment between universities and Government would enable this 'Venture Catalyst' infrastructure to reach the scale and resourcing levels necessary to make a strong contribution to Australia's national innovation position.

This co-investment with universities and other research centres, in measures targeting the earliest-stage 'Valley of Death' in the translation pathway would also complement and strengthen new commitments to building venture capital opportunities, such as the Innovation and Biomedical Translation Funds. It would also enable Australia to capture more of the benefits of major investments in research, for example through the Medical Research Future Fund.

Investing in the people to lead the catalytic process is also crucial. The skills and experience necessary to achieve great scientific breakthroughs are very different to those required for translating technologies into compelling products and services. At the University we have many world-class researchers, but we also need to build world-class translation teams. While some researchers naturally possess both research and commercial skills, not all do and nor would all researchers be expected to have or develop commercial skills.

This is why public research institutions need to build reservoirs of management and business skills to complement scientific and technical skills. Universities are taking proactive steps towards addressing these. For instance, the University of Melbourne and Monash University are collaborating in order to

jointly develop a world-class, sustainable drug discovery and biomedical science translation enterprise. The two universities have jointly established BioCurate Pty Ltd, an independent, financially self-sustaining vehicle designed to optimise commercial outcomes from biomedical research.

With support from the Universities, government and business, BioCurate will bridge the early translation gap and act as a catalyst between researchers and industry. BioCurate will offer the necessary soft infrastructure of an experienced management team to develop assets to a point where they are attractive to commercial interests.

The University recommends the 2030 Strategy incorporates the following measure to maximise engagement with end-users:

Recommendation J: Co-invest with universities in mechanisms to address the translation gap currently faced by early stage research commercialisation proposals in public research institutions.

MAINTAIN AUSTRALIA'S WORLD-CLASS RESEARCH BASE: The importance of protecting and preserving a world-class research system cannot be overstated. As a report from MIT noted, investing in basic research is critical for delivery of an 'innovation dividend' to boost the economy and society ('The Future Postponed: Why Declining Investment in Basic Research Threatens a US Innovation Deficit', MIT Committee to Evaluate the Innovation Deficit, 2015). The research of leading universities forms the bedrock of Australia's research and innovation ecosystem, enabling world-leading, productive and pioneering innovation across the network of facilities and between participants from academia and other sectors.

Research is the foundation of the University of Melbourne's innovation contribution. The University is a world-class research-intensive university. In 2016 the University's expenditure on research was \$1.04 billion, reflecting a sustained effort to grow investment in research. In line with institutional targets, in 2016 the University continued to grow its research income from public sector, industry, and Cooperative Research Centres with an increase to \$244.3 million from the previous year. This income represented approximately 55 per cent of the University's total research income.

As outlined in other parts of this response, the University is continuing to scale up its research and innovation capability as it seeks to derive ever more economic and societal value from our leading research. This in turn better equips our graduates with the skills and capabilities they will need to be successful in the workplace of the future.

For instance the University is a major partner with leading hospitals in the Melbourne Biomedical Precinct (MBP), an internationally significant aggregation of medical research and clinical practice that brings together 10,000 medical and scientific experts to conduct high-impact research, teaching and research training. The MBP houses nationally important NCRIS research infrastructure including the 7 Tesla magnetic imaging system hosted at the Melbourne Brain Centre, as well as other research platforms based at the University's Bio21 Institute for Molecular Science and Biotechnology, Victorian Comprehensive Cancer Centre and the Peter Doherty Institute for Infection and Immunity. The University has strong relationships with companies such as CSL, which is co-located at the Bio21 Institute, and IBM with its supercomputer facility at the Victorian Life Sciences Computing Initiative.

The MBP will soon expand the Bio21 Institute, further broadening the University's capability in multidisciplinary R&D and industry engagement across biotechnology and life sciences fields. The expansion will also enable the implementation of the Bio21 Institute's 'school to bench to workplace' vision, based on a purposeful collision of academic research, commercial research and the co-located Elizabeth Blackburn specialist science school for Year 11 and 12 students. The strength of the biomedical precinct can be seen in biotech giant CSL's decision in 2016 to base its global hub for research and translational medicine at Melbourne with Bio21, doubling the number of its scientists at the University of Melbourne and showing great confidence in Australia's innovation push.

Another of the University's cutting-edge research and innovation precincts is Carlton Connect Initiative, Australia's premier research hub focused on technology, cross-discipline collaboration and sustainability. Anchored by the University of Melbourne and accommodated in the former Royal Women's Hospital site, CCI leverages a co-location and collective impact approach to tackle challenges relating to water, urban futures, energy, food security, social equity, pervasive information technology, climate change and adaptation, entrepreneurship, risk and resilience.

Over the past decade, the University has conscientiously built up mechanisms to ensure the benefits and impacts of our world-class research flow out into the broader community. In order to support academic staff to engage with industry and to support exchanges our institutional policies have been re-written to allow for industry secondments in and out of industry and for more flexible sabbatical leave. The first cohort of Enterprise Professors have recently been appointed to the University, allowing those with specialist industry or professional knowledge to contribute to the academy through enhancing partnerships and collaborations and strengthening research and graduate outcomes. These appointments complement the strategic engagement of industry representatives/mentors in PhD advisory committees, together with impact drivers and measurement in the training of graduate researchers.

We note the comments in the Issues Paper at Challenge 4 that research undertaken in Australia, 'must be supported by appropriate funding levels, equitably shared across the system and supported by world-class research infrastructure'. Funding should always be directed wherever excellence is demonstrated.

We recommend that there should be a re-assessment of the funding differential for HDR completions via the Research Training Program. In the Research Training Program defined 'high-cost' broad fields of education are rewarded at a rate 2.35 times higher than 'low-cost' fields of education. This is driving some institutions to narrow their focus to high return completions only. A comprehensive system that supports inter- and trans-disciplinary research and research translation requires expertise in, for example, public policy, urban planning, IT support for big data, and therefore should incentivise investment in these fields of research.

In addition to [Recommendation A](#) on co-investment with universities on university-anchored precinct development, the University recommends the 2030 Strategy:

Recommendation K: Re-assess the funding differential for Higher Degree Research completions via the research training program to maintain and grow strength in broad and inter-disciplinary fields of education.

Recommendation L: Encourage the Australian Government to provide more funding for basic research to maintain Australia’s world-class research as the bedrock of innovation. This funding can be leveraged by policy settings that incentivise diversified sources of funding.

Challenge 5: Maximising advantage from international knowledge, talent and capital

ENABLE GLOBAL MOBILITY OF THE WORLD’S FINEST TALENT: The ISA Issues Paper on p6 states that ‘we need to encourage the transfer of the smart business practices that international markets require to businesses of all kinds. Improvements in effective competition policy, management capability and an increased appetite for risk in business will create a dynamic business environment necessary for international competitiveness’. The University endorses these statements as crucial aspirations for an innovative Australia in 2030.

However from the University perspective, a policy announcement made earlier in 2017 by the Australian Government regarding changes to subclass 457 skilled visas carries a risk of undermining the achievement of smart business practice and the attractiveness of the Australian business and research environment for the world’s most innovative companies and universities.

The subclass 457 visa program provides individuals with the ability to live and work in Australia for a defined employer on a temporary basis. Thereafter, a subclass 186 visa provides employers with an avenue to sponsor individuals for permanent residency directly or after a period working for the employer on a 457 visa. Universities, including the University of Melbourne, are regular users of this visa subclass and are greatly concerned at the material, detrimental impacts that would be caused by the proposed changes.

The policy proposes removing a number of occupations related to research and engineering fields from the eligible occupations list, and/or moving occupations such as ‘University lecturer’ which is used to hire research academics to the short-term (two year) visa. This is a significant deterrent to recruiting high calibre researchers to Australia.

With the removal of Research and Development Managers from the eligible occupation classes for 457 visas the ability of research intensive organisations to recruit managers with international experience and skills is also severely impacted. This decision is already impacting recruitment of professional staff from the US where most Australian institutions have potential to seek greater levels of funding and investment.

For example, the joint university venture BioCurate (covered above under Challenge 4 responses) will imminently need to source skillsets currently unavailable in Australia. Access to the global talent pool of experts in drug development and commercialisation will be essential if the venture is to succeed, but the visa changes will inhibit this process.

As a consequence of the proposed changes, Australian institutions will be unlikely to fully develop and exploit international funding opportunities if unable to recruit and transfer these skills and expertise to the domestic workforce and create the dynamic environment identified in the strategy as necessary for greater international competitiveness.

Aspiring to be a nation that is among the top tier of innovation nations is laudable but without the capability to attract international professionals familiar with the systems, policies and programs of other top nations this aspiration will be challenged by our visa regulations. Indeed immigration control of this type would seem to not just be an impediment to academic freedom and cutting-edge research, but also innovation and enterprise as a whole.

The implementation outcomes of the proposed visa changes mean Australia will not be viewed as an attractive place to study, work, live and invest by the global scientific and research community. In addition, the failure of Australia's research agencies to better leverage global investment in research programs and infrastructure has potential to leave us out of future global consortia, their discoveries and impact. Australia has signed several bilateral scientific agreements with nations viewed as strategic partners and yet has only limited bilateral programs to support true engagement and collaboration with these countries at a national level.

As a result it is left to individual researchers to continue the 'bottom-up' approach to international collaboration. While these collaborations tend to be robust as a result of being largely personal commitments, it is likely many potentially valuable relationships are not captured given our general lack of support for developing larger, more impactful, programs of work with international peers, their partners and systems.

The proposed subclass 457 changes carry the risk of proving to be a policy intervention that failed to take into account the global nature of the university research workforce (both academic and professional) and the centrality of global mobility for the sector. As such, the University recommends that to avoid undermining Australia's attractiveness to international business and talent, the 2030 Strategy should:

Recommendation M: Include a set of principles or policy parameters in the 2030 Strategy for future Australian immigration regulation that enables, rather than undermines, innovation and international talent mobility and ensures Australia is an attractive destination for companies and the world's leading researchers.

SUPPORT GLOBAL COLLABORATION: On p9 the ISA Issues Paper states that 'research done in Australia addresses the needs of the nation, as well as global challenges'. This is true but the important role of international collaboration in generating the required knowledge and skills to make impactful discoveries and generate innovations is underplayed.

The ARC has stated that the majority of the research it funds involves international collaboration. Many Australian universities benefit therefore from access to international knowledge, expertise and infrastructure. This internationalisation of Australian research output and impact is recognised in the international rankings of these institutions. As international competition and collaboration increases it will be those systems that ensure access for the best global talent to study and train, undertake research and develop new enterprises that will thrive.

Limiting access to research funding for international collaboration, while failing to better align research funding with international opportunities addressing global challenges, will result in Australian researchers working in an increasingly isolated innovation system. It may detract from positive

developments in Australia's research and innovation strategy such as the securing of national priorities and funding certainty in relation to the Medical Research Future Fund.

The University recommends the 2030 Strategy:

Recommendation N: Support access to research funding for international collaboration and better align research funding with international opportunities addressing global challenges.

Challenge 6: Bold, high-impact initiatives

MORE WOMEN IN STEMM, INCLUDING STEMM LEADERSHIP: Additional Science, Technology, Engineering, Mathematics and Medicine (STEMM) programs aimed at vastly increasing participation rates of women in those disciplines – and leadership positions for women in STEMM – are deeply needed in the Australian setting. A failure to make progress on STEMM gender imbalance will severely limit Australia's workforce in the fastest growing occupations, most of which will rely on technical literacy and skills.

It is well-documented that women are opting out of certain STEMM studies too soon. Roughly equal numbers of men and women study STEMM at the start of their careers, but over time, women are significantly outnumbered or nearly absent in the higher ranks of particular STEMM disciplines. The 2011 Census data showed that of all the STEM-qualified people in Australia, just 16% were female. In science, 47% of the qualified population were women, but in engineering, the figure was only 7% (as stated in the report on 'Australia's Stem Workforce', Office of the Chief Scientist, 2016).

In 2016 only 28% of the University's mathematics students were female students. Even earlier than that, young women are also disengaging or dropping out of the innovation pipeline at the important stages of the primary and secondary education. It is thought that a number of early factors contribute to this trend, resulting in a lack of computational skills and STEMM confidence across the spectrum amongst young women. Primary and secondary teaching of maths and science will be a crucial factor for the 2030 Strategy to consider with regard to improving Australian women's ongoing STEMM participation.

To drive change it is important to provide role models for female students and provide female mentors. The University is making strategic moves at the institutional level to drive changes, including though hiring (including offering women-only academic and teaching positions in maths and statistics), programs, mentor networks, female staff and student awards, and other campus-wide initiatives to lead an evidence-based evaluation of policy and practices and drive cultural change. The University is also one of many institutions taking part in the Science in Australia Gender Equity (SAGE) Athena Swan pilot – a partnership between the Australian Academy of Science and the Australian Academy of Technological Sciences and Engineering. The SAGE initiative, launched in 2015, is focused on addressing the under-representation of women in academic and leadership roles. This is also a key priority identified in the University's People Strategy 2015–2020.

The Australian Government has made valuable policy investment in growing female participation in STEMM study and jobs in recent years. Further investment at a much greater level and national scale – linked directly with innovation strategy – would deliver broader benefits to Australian innovation and productivity as well as generations of female STEMM practitioners. The University recommends:

Recommendation O: Support large-scale national initiatives that maintain and grow the STEM pipeline, including programs to reinforce the importance of maths teaching at schools and early intervention programs to encourage girls to study maths and sciences.

IMPLEMENT NATIONAL RESEARCH INFRASTRUCTURE ROADMAP AS A KEY INNOVATION INPUT: The National Collaborative Research Infrastructure Strategy (NCRIS) is a critical component of Australia's research and innovation ecosystem, enabling world-leading, productive and pioneering research across the network of facilities.

The University urges ISA's 2030 Strategy to support on-going and sufficient public investment in national research infrastructure as a fundamental public good. Investment in NCRIS at scale cannot solely be met by either research institutions and/or industry. NCRIS broadly supports discovery research, which by definition is too risky for wide commercial investment. Nowhere in the world do expensive, high-end operator dependent facilities work in a cost neutral way, whether operated by research institutions or by industry. Of course, industry and research institutions can make meaningful contributions to build and sustain an effective national ecosystem of research infrastructure. However, the 'market failure' aspect of discovery research requires government intervention as part of the broader innovation agenda of Australia.

As highlighted in several reviews, and most recently in the 2016 National Research Infrastructure Roadmap, a crucial part of national research infrastructure underpinning innovation is the involvement of professionals who are skilled in providing specialist technical support to research undertakings. This research-enabling workforce demands investment in workforce planning, career progression and employment security.

In Australia to-date, the demand for highly-skilled technical and research staff has not been met by supply. In leading research countries overseas, professional research officers, such as laboratory engineers and bioinformaticians who build the infrastructure and tools to speed up data analytics, are a well-established role within the infrastructure investment ecosystem. Over recent years in Australia, many of these critical positions have become insecure short-term and contract-based roles, undermining confidence in and take-up of career pathways in these critical workforces. Such national research infrastructure capabilities, as well as data itself, crucially facilitate international research exchanges that underpin excellence in innovation.

Not yet addressed in national infrastructure provisioning, is the availability of a dedicated funding stream for capital investment. The September 2015 Final Report of the Research Infrastructure Review recommended the establishment of a dedicated fund, and the scale of that fund to be an amount equal to between 8% and 10% of Government research outlays, excluding the R&D Tax Incentive.

Recommendation P: The University recommends the ISA 2030 Strategy incorporate support for Australia's world-class research infrastructure by implementing in full the 2016 National Research Infrastructure Roadmap and establishing a dedicated National Research Infrastructure Fund with an initial capital commitment sufficient to cover infrastructure investment requirements for at least ten years.

APPENDICES A and B

Further details on selected innovation initiatives at the University

BioCurate Pty Ltd: BioCurate was launched in June 2016 to facilitate the translation of biopharmaceutical intellectual property from promising research outputs into commercially investible projects. A joint venture of the University of Melbourne and Monash University, and supported by the Victorian State Government, BioCurate will leverage its initial funding to engage independent specialist expertise in drug development and commercialisation to systematically attract both philanthropic and strategic/financial investors.

Pfizer CTI: The University of Melbourne joined the collaborative research network of biopharmaceutical company Pfizer, becoming one of 30 academic institutions (including from Boston, New York, San Diego and San Francisco) participating in Pfizer's Centres for Therapeutic Research program. The program offers researchers the potential to work closely with Pfizer scientists to identify and develop new treatments, improve the University's research capabilities and gain access to Pfizer's expertise in drug development and protein sciences.

International School on Research Impact Assessment: The International School on Research Impact Assessment (ISRIA) aims to foster global collaboration for excellence and innovation to support the sustainability of research systems. The University of Melbourne partnered with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and hosted the fourth edition of ISRIA at the University in September 2016.

Translating Research at Melbourne: Providing essential resources to research teams. Translating Research at Melbourne (TRaM) gives research teams across the University access to essential resources including funding, space within Carlton Connect's LAB-14, structured mentoring and networking, and opportunities to pitch to industry and investors to identify and test market interest in their research.

Supporting entrepreneurs to drive industries of the future: Melbourne Accelerator Program (MAP) is a University of Melbourne program aimed at inspiring entrepreneurial ambition amongst students and faculty; engaging alumni of the University to add value to their alma mater and providing large corporates with a mechanism to engage with the University and the start-up sector. MAP is recognised by UBI Global as one of the world's top ranked university based accelerator programs. MAP supports founders at the early stages of their start-up journey, from ideation to later stage start-ups. MAP injects life into the start-up community through talent development and accelerator programs.

Enterprise Professors – Bridging industry and academia: Established in 2015 and drawn from diverse industries, Enterprise Professors bring deep practitioner skills to the University of Melbourne to improve industry networks and inspire the University research community to apply their research towards solving problems and making impact. So far 12 outstanding individuals have been appointed across five faculties, with more to follow.

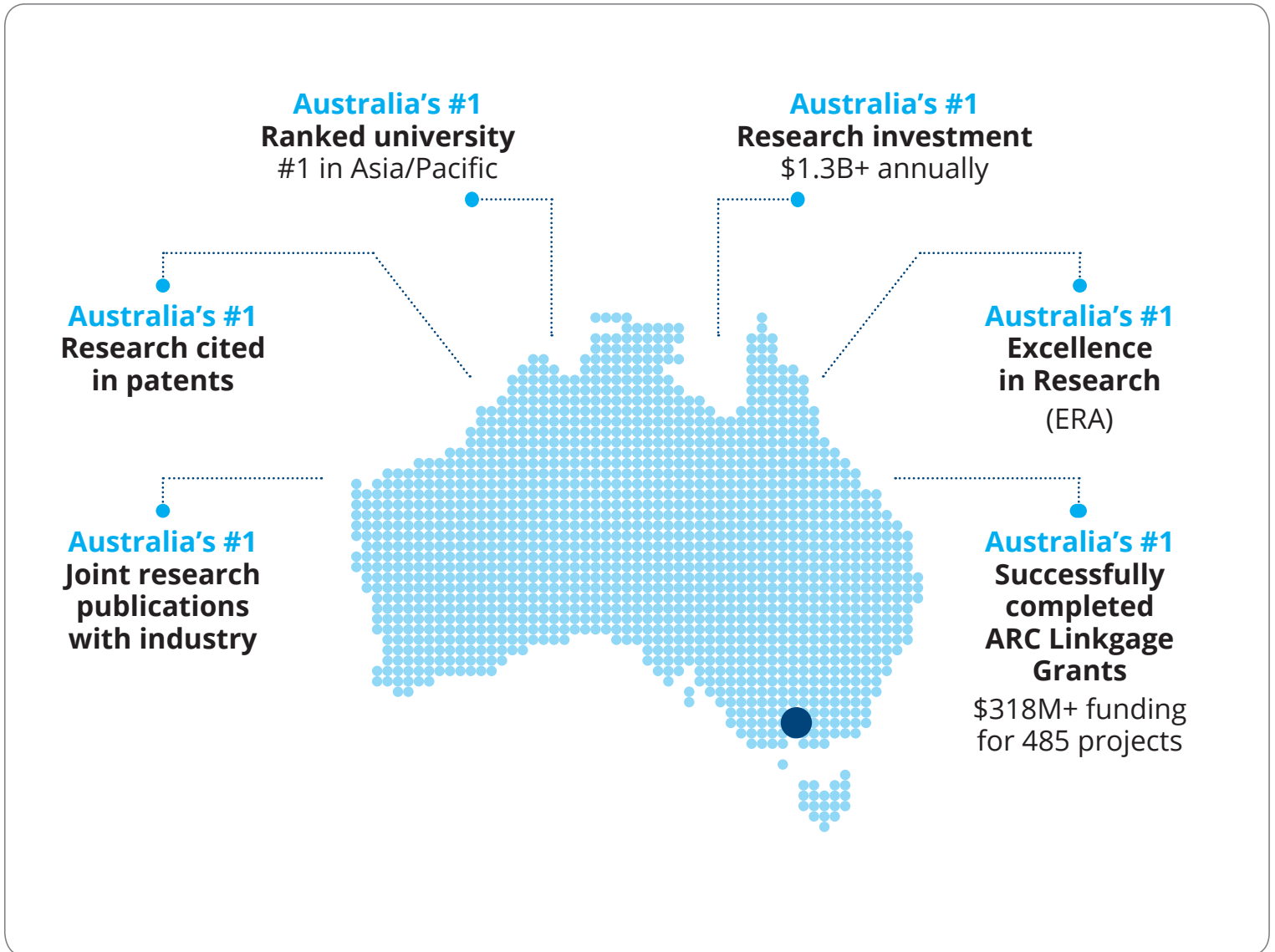
Industry panels: The University has established discipline-based industry advisory groups across various faculties and schools. These groups provide valuable insights on strategic planning, teaching and research programs. For example, the Melbourne School of Engineering has established six panels of independent industry experts advising MSE academics on value creation from R&D and course design across its disciplines.



THE UNIVERSITY OF
MELBOURNE

Anchoring innovation in Australia

#1 in Australia



Global impact

#8

Ranked university
business accelerator
in the world

Melbourne Accelerator Program

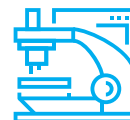


1st

University to partner with
NASDAQ Entrepreneurial
Centre in San Francisco

TOP 5

Biomedical precinct
in the world



\$140M

Host of Bio21 –
largest biomedical
institute in the
Southern Hemisphere



THE UNIVERSITY OF
MELBOURNE

Anchoring innovation in Australia

University footprint

67,800+

People at
the University
of Melbourne

60,000+ students
4,000+ PhD students
7,800+ staff and researchers
22,000+ international students
from 130 countries
220,000+ alumni



\$2.1B+

University budget
Equivalent to an ASX 100
listed company



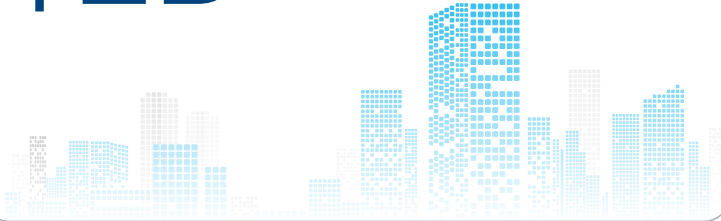
#1

Science city
in Australia
(Melbourne)



\$2B+

Continuing investment in
innovation infrastructure



740+

Active industry
collaborations



90+

Unique research
centres, institutes and
centres of excellence



\$10M

Wade Institute of
Entrepreneurship

#2



Alumni who have held
CEO positions in world's
Fortune 2000 companies

13,400+

People attended innovation
events in 2016



Melbourne Biomedical Precinct



10,000+

Medical minds
Scientists, clinicians and technical staff



25

Hospitals and
research institutes

\$5B+

Public and private investment
in last decade

