The EXCITE strategic plan

South Australia
The State of Science

Quantum technology researcher, Dr Benjamin Sparkes within the Precision Measurement Group in the Institute for Photonics and Advanced Sensing, at The University of Adelaide

The EXCITE Strategy harnesses a range of initiatives to attract new research investment across the fields of STEMM to deliver innovative products and services to take SA to the world.

Excellence, Collaboration, Innovation, Translation and an Enabled future workforce.

- *The Australian Wine Research Institute, Viticulture, Jacqui Way Photography*

Message from the Chief Scientist for South Australia

When we developed the EXCITE Strategy with stakeholders from across South Australia it was clear that there was a shared ambition to put our state on the global map as Australia's **State of Science**.

Implementation of the EXCITE Strategy will capture that ambition to:

- place SA in the **top quartile of OECD nations** by 2030 for key measures of performance in the research and innovation value chain which are key to delivering better health, our climate smart goals and economic growth, employment and productivity; and
- support the emergence of Adelaide as one of the world's vibrant **Magnet Cities** – one that attracts young wealth creators and global innovators who seek to grow more economically, socially and environmentally beneficial outcomes.

Global experience has demonstrated that sustainable economic and social transitions are underpinned by new ideas forged through collaboration and enabled by new technologies which drive innovation.

Artificial intelligence and machine learning connected to the 'internet of things', robotics and sensors support better health care, enable remote operations in mines, monitor the health of our water, soil and environment from space, or present us with personalised options as consumers based on our known choices.

These outcomes each began with ideas which were game changers and which also required targeted collaborations with leaders in industry and professions to ensure that innovation was translated to deliver value.

The EXCITE Strategy will ensure that the growth plans for priority industry sectors in South Australia are each underpinned by a high performing research and innovation value chain.

EXCITE will connect game changing ideas with small and large businesses across priority industry sectors to build competitive advantage. We will attract innovators with proven track records in delivering value to industries and communities. We will also focus on ensuring our industry and research communities have access to the major infrastructure, facilities and frontier technologies required to support innovation which delivers new products, services and processes.

We will 'power up' Innovation and Translation Districts where intermediaries broker effective partnerships between business, researchers and innovators, establish frontier technology capability hubs and support the next generation of the future workforce in each of our priority industry sectors.

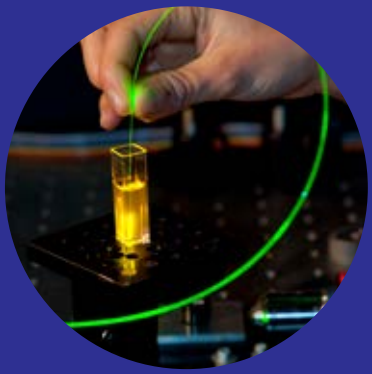
We will establish knowledge transfer networks across Innovation Districts to benchmark metrics of success and accelerate the uptake of effective strategies in Districts located across the state.

Importantly we will also collaborate across sectors in mapping how education, skills and training pathways ensure that bright talented South Australians – no matter their background, location and gender - will be equally equipped for success in the future workforce.

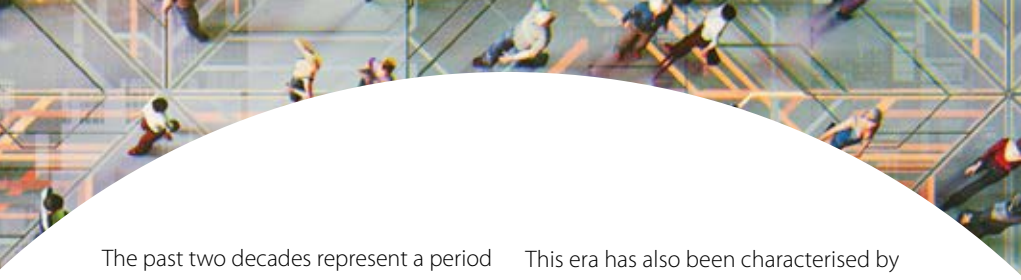
South Australia's history and DNA have their origins in a commitment to social equity and justice and a passion for discovery and education. In this next phase we will see SA emerge on the global stage as the **'State of Science'** where a commitment to equity and excellence and a passion for creativity and innovation will underpin the success of our key regions, communities and industries.

The EXCITE Strategy is a key contributor to this next phase - I invite you to join us on the journey.

Professor Caroline McMillen
Chief Scientist for South Australia




Context



The past two decades represent a period of profound geopolitical, economic and social change. A number of nations, regions and cities across the globe experienced the loss of established industries and jobs often with associated declines in living standards when their traditional industry base moved offshore to compete on price. Across this challenging period, however, there were regions and cities across the world where 'rustbelts' emerged as 'brain belts' and cities in decline became revitalised to become 'magnet cities' attracting young talented creative arts and science professionals to regrow the population and economy.

Such transformations across industrial and civic landscapes have occurred in part through realising the benefits of the connectivity of new technologies which first emerged as 'frontier' R&D technologies and which have been integrated into all aspects of our business, community and social lives. Artificial intelligence and machine learning connected to the 'internet of things', robotics and sensors support better health care, enable remote operations in mines, monitor the health of our water, soil and environment from space and present us with personalised options as consumers based on our behaviours and choices.

This era has also been characterised by waves of discovery and invention and the emergence of new technologies across all fields in science, technology, engineering, maths and medicine (STEMM) which have converged to deliver innovation and industry transformation.

Global STEMM policies also focus increasingly on 'grand challenges' as governments seek to redirect technological change from existing trajectories towards more economically, socially and environmentally beneficial technologies.

In parallel, communities hold governments and industries to high standards of transparency, accountability and for delivery of outcomes consistent with these benefits. Confidence in being able to trace the origin or provenance of products in global supply chains- whether they be our clothing, our food or the source of our energy has become increasingly important in terms of industry and consumer trust. Governments also face a crucial trade-off between relevance and stability: there is a need to anticipate, adapt to and mitigate rapid technological and social changes, while maintaining stability and confidence in existing public systems.

As summarised in the Review of the *South Australian Government's International and Interstate Engagement Bodies and Functions* (Joyce Report, 2019), South Australia has experienced historically low growth rates in its economy, population, employment, wages and labor productivity over the past decade when compared with most mainland states and territories.

Since around 2004, productivity growth has also fallen in Australia and other advanced economies (*Industry Insights: Future Productivity Report DIIS Office of the Chief Economist 2018*). During this period, The Australian economy has moved from a reliance on agricultural exports and manufacturing towards more digitally enabled, service-oriented industries, based on strengths in mining.

Orange sandstone erosion layers and agricultural fields at Murtho, Riverland, Australia

Dr. Jim Gehling Ediacaran fossil of Spriggina floundersi (6 cm long), SAM P29801, Flinders Ranges, South Australia.

A major contributor to South Australia's low economic and employment performance has been the relatively low level of business investment including foreign investment with the decline in the contribution of traditional manufacturing (-26%) and agriculture (-8%) to the Gross State Product (GSP). Across this period, the greatest increases in the sector contributions to GSP occurred in health care and social assistance (41%), rental and real estate services (40%) and professional, scientific and technical services (35%).

These changes reflect those in the global and national environment where services sectors based on R&D, innovation, high productivity and greater numbers of skilled workers have emerged as drivers of economic growth.

Olympic Dam

The Role of STEMM Research and Innovation in Driving Economic Transformation

STEMM research and innovation play key roles as global, national and regional drivers of economic transformation.

R&D activity has been estimated to explain up to 75% of national total factor productivity growth, and has high rates of return, at around 10-30% for private return and an estimated more than 40% for social return. The 2017 *Australia 2030: Prosperity through Innovation Report* also highlighted the role of innovation as a driver of productivity growth and employment and the increasing importance of skills across STEMM disciplines given occupations requiring these skills are outstripping overall employment growth in the Industry 4.0 era.

Innovation active businesses also make a disproportionate contribution to business income and employment, are 2-3 times more likely to report increased productivity and twice as likely to export compared to non-innovation active businesses.

The 2017 *Australia 2030: Prosperity through Innovation Report* noted that those companies that can solve a global need with technology achieve significant scale and that regions with globally successful firms benefit disproportionately.

There are three key components which make up a STEMM Research and Innovation (R&I) 'value chain' - knowledge creation, transfer and application. The interactions of these components are complex and operate in a non-linear and dynamic manner and there are differences in their roles across different research and innovation fields and industry sectors.

It is possible, however, to identify the ***enablers*** of these components which are key to the successful operation of any STEMM R&I value chain and to its role in the delivery of economic and non-economic outcomes.

As highlighted in the figure below, the key enablers include:

Wardliparingga Aboriginal Research Unit, SAHMRI.

Future Industries Institute, University of South Australia

Tonsley Manufacturing Innovation Hub, Flinders University

ThincLab, University of Adelaide

Excellence of research and innovation outputs;

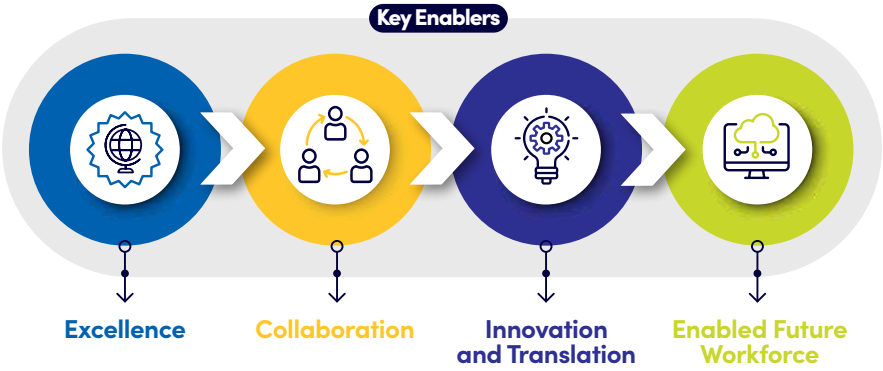
Collaboration between the world's best researchers and businesses and between business and research to drive knowledge transfer;

Innovation and Translation – delivery of new to the world products, processes and services based on R&D intensity, and the translation of innovation including through commercialisation;

An Enabled Future Workforce –with the skills capability, capacity and diversity to meet the demands of a growth in STEMM and technology-based industries

University of South Australia – Technology for sustainable living, with an emphasis on urban and peri-urban food production through innovative water recycling and aquaculture. Associate Professor James Ward.

STEMM Research and Innovation Value Chain



EXCITE Strategic Plan 2020–2030

Vision

By 2030 South Australia will be recognised globally as


‘The State
of Science’.

Between 2020 and 2030 South Australia will deliver a productivity growth rate which places South Australia in the top quartile for the OECD.

Outcome

Objectives

By 2030:

South Australia will be placed in the top quartile of OECD nations for key input and output measures of performance in the STEMM research and innovation value chain expressed where relevant relative to the size of the state's economy;

Strong industry-research collaboration will drive a highly connected STEMM research and innovation value chain in South Australia to deliver 'new to the world' innovation and increased competitiveness in national and global markets;

South Australia will emerge as a magnet for talent and a leading recruiter of 'young wealth creators' who work in the creative arts and STEMM fields and in associated industry sectors and who are attracted by a State committed to building a healthy economy, environment and community;

The **EXCITE Strategic Plan** focusses on strategies to increase the performance of the key enablers of the STEMM R&I Value Chain to a level consistent with those in the top quartile in the OECD as highlighted below.

Strategic priorities

Enablers of Excellence

Investment

South Australia has experienced a decline in the share of total national higher education research related revenue (HERDC) earned by all universities between 2012 and 2017, which is an area of concern.

The associated fall in National Health and Medical Research Council research income across this period is a particular concern in relation to the significant opportunities generated by the Medical Research Future Fund to support health innovation and translation and build health and medical technology industries.

It is noted that South Australia performed well in attracting national Cooperative Research Centre related funding between 2012 and 2017 although this income is a relatively small component of total HERDC revenue.

Strategic Opportunities

The downward trend in research funding is in contrast to the measures of the overall quality in South Australia's STEMM research outputs as assessed against the world standard across a range of STEMM fields. A focus for South Australia will be to achieve the level of research funding required to harness excellence ***at scale*** in order to deliver economic and social impact.

Strategy

There is a need to build ***Scalable Excellence*** to realise the high quality of South Australia's STEMM research. This will require a coordinated focus on major research and innovation schemes including Cooperative Research Centres, the Medical Research Future Fund, and major National Centres of STEMM research, technology and innovation which are associated with significant co-investment from federal, international, industry and other sources.

World Class Infrastructure

Strategic Opportunities

In 2016 the Australian Government announced an additional $2.2bn investment through to 2028-2029 into National Research Infrastructure (NRI) through the Research Infrastructure Investment Plan. Eight scoping studies for the National Collaborative Infrastructure Strategy (NCRIS) have been and will be carried out in the next 24 months which will focus on synthetic biology, national environmental prediction system, HAAS/Indigenous research, biobanks, biosecurity, precision measurement, High Performance Computing and ACCESS – the Australian Community Climate and Earth-System Simulator.

These scoping studies will determine national infrastructure requirements and potential investments in frontier technology areas for the next decade. The scoping studies will also engage with state and territory governments and research institutions to seek views on infrastructure priorities and co-investment strategies. Securing the opportunities to be a lead site for a major national research facility or to house national research infrastructure is highly competitive because of the major spill over benefits.

The challenge will be to strike a balance between the role of the Australian Government in investing in NCRIS priorities and the role of state and territory governments and research institutions in identifying strategic priorities for NRI and for co-investment and facilitating location of strategic infrastructure.

Strategy

Develop a ***South Australian 2030 Horizon Major Research Infrastructure and Technology Plan*** to ensure strategic input into national collaborative infrastructure planning and deliver a competitive capability for SMEs, businesses and industry sectors across South Australia.

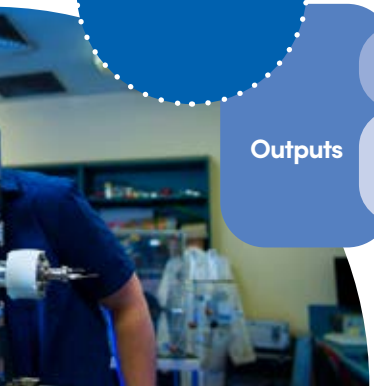
Potential measures of Excellence performance are listed below. South Australia's performance will be referenced to Australia's performance and to the top quartile of performance against each measure in the OECD including our ranking within the OECD where appropriate.

Excellence Strategy Summary

- Leverage Major National Funding Programs to deliver an increased South Australian share of investment to drive industry-research collaboration and economic impact
- Take a targeted and coordinated proactive approach to leveraging national investment in world class infrastructure and technology – currently $2.2 billion Federal Australian Government investment forecast through the NCRIS that will deliver increased productivity and industry competitiveness in national and global markets. Deliver a '2030 Horizon Infrastructure and Technology Facility Plan' to support industry-research collaboration and industry competitiveness in new markets.

Excellence

	Potential Measures of Performance
Inputs	Gross Expenditure on R&D relative to GSP (GERD)
	Higher Education Expenditure on R&D relative to GSP (HERD)
	Government Expenditure on R&D relative to GSP (GovERD)
	SA national share of total HERDC revenue (%) Growth in SA's share of national HERDC revenue (%)
	SA share of NCRIS investment (%)
Outputs	Citation Impact of STEMM publications in previous 5 years relative to Australia and the OECD
	Proportion of total STEMM publications in the Top 1% in the world in previous 5 years relative to Australia and OECD



Future Industries Institute, University of South Australia.

Enablers of Collaboration

There is a need to enhance economic outcomes from South Australian Innovation Districts by increasing industry- research collaboration and the translation and commercialisation of research and innovation to increase productivity and jobs in priority industry sectors.

Global Innovators

Strategic Opportunities
Research institutions play a major role as employers in the attraction, development and retention of STEMM talent.

An opportunity to enhance industry research collaboration is the targeted recruitment of leading researchers who are also ***global innovators***. There are leading researchers who produce both highly cited research outputs and highly cited patents who work with industry to add significant value to products and access to global markets.

The recruitment of such global innovators can accelerate knowledge transfer between academia and industry and the translation of innovation in businesses which is 'new to the world'.

These leaders also provide role models for early to mid-career researchers on how careers spanning both academia and industry can deliver impact.

The recruitment of such innovators in emerging technology sectors shortens the time to translate technologies from research to industry sectors and deliver competitive benefits to industry partners.

Strategy
Target recruitment of global innovators in frontier R&D and technology areas relevant to the global competitiveness of South Australian priority industry sectors.

Australian Cyber Collaboration Centre - Cyber Test Range - capabilities for SMEs, researchers and government to collaborate.

Tonsley Innovation District

Powering Innovation Districts and Neighbourhoods

Strategic Opportunities

There is an opportunity to harness prior capital, operating and infrastructure co-investments made into Innovation Districts and Neighbourhoods across South Australia (e.g. Tonsley, Mawson Lakes, Health Innovation and Translation Neighbourhoods etc.) to build scalable excellence, drive knowledge transfer between research and industry and develop the role of intermediary organisations to translate innovation into the market place (see below).

It will be important in the first instance to determine the extent to which industries and business have benefited through the translation of innovation that has occurred to date through their engagement within these Districts. Ensuring that each Innovation District/ Neighbourhood has a strong governance structure together with a suite of 'metrics of success' aligned to South Australia's growth targets is also key.

Strategy

As a co-investor, the South Australian Government will work with other major co-investors on the strategic and governance framework required to deliver the 'metrics of success' for each of the existing Innovation Districts and Neighbourhoods. This will ensure performance can be reviewed and measured against global and national innovation and translation benchmarks and realise the growth ambitions of South Australia.

Adelaide BioMed City - a hub for health and life sciences.

Frontier Technology Capability Centres

The South Australian Government is providing strategic co-investment to support the provision of expertise and infrastructure related to key frontier and platform technologies including Artificial Intelligence (AI) and machine learning, photonics, automation, robotics and biomaterials, cybersecurity, renewable energy technologies etc. These investments enable competitive positioning and outcomes for start-ups, SMEs and industry partners in South Australia.

Strategic Opportunities

It is important to integrate the breadth of applications of platform technologies into research and industry fields and to support their use in businesses seeking to develop a competitive edge in global markets. Emerging areas in quantum computing, AI focussed molecular design, new energy sources, space technology and the fusion of technology and creative arts inputs through integration of STEAMM (STEMM including Arts) activities may offer South Australia specific opportunities in the development of advanced products, processes and business models.

Strategy

Integrate ***Frontier Technology Capability Centres*** within South Australia's Innovation Districts and Neighbourhoods to support SME and business leaders harness the capability of emerging technologies to:

- add value in competitive global markets and;
- introduce frontier technology expertise into traditional research areas to enhance delivery of innovation and impact.

The development of the ***South Australian 2030 Horizon Major Research Infrastructure and Technology Plan*** noted above will also inform the focus of the Frontier Technology Capability Centres.

Vineyard drones, Waite Research Institute, University of Adelaide

Industry Doctoral Training Centres

Strategic Opportunities

Collaborative Industry Doctoral Centres such as the highly successful national model introduced and developed in the UK by the Engineering and Physical Sciences Research Council deliver knowledge transfer between research and business, innovation relevant to industry problems and support greater mobility of graduates between academia and industry. The key to the performance of such Centres is the drawing of research supervisory strength from across institutions and the harnessing of supervisory strength from companies to focus on the needs of specific industry sectors.

Strategy

Develop new models of ***Industry Doctoral Training Centres*** within Innovation Districts and Neighbourhoods.

Potential measures of Collaboration performance are listed below. South Australia's performance will be referenced to Australia's performance and to the top quartile of performance against the measure in the OECD including OECD ranking where appropriate.

Collaboration

Potential Measures of Performance

Inputs

- Business Expenditure on R&D relative to GSP (BERD)
- BERD as % GERD
- Industry revenue as % share of national HERDC past 5 years

Outputs

- % STEMM research publications with industry co-author %SA, Australia and Top Quartile OECD and Ranking past 5 years
- % STEMM research publications with international co-author %SA, Australia and Top Quartile OECD and Ranking past 5 years
- Number of researchers in industry/'000 employed in industry SA, Australia and Top Quartile OECD and ranking

Enablers of **Innovation and Translation**

Innovation Intermediaries

Strategic Opportunities

Intermediary organisations operate to facilitate technology transfer from research institutions into business including SMEs. Intermediaries operate either within or outside research institutions. Examples of internal intermediaries are university technology transfer offices whereas external intermediaries operate as bridges between universities and businesses but are independent and autonomous structures funded through a combination of public and private sources. There are a range of global examples of external intermediary organisations including the Fraunhofer Institutes in Germany, Catapults in the UK, Carnot Institutes in France, the Ontario Centres of Excellence and the Industrial Technology Research Institute (ITRI) in Taiwan.

Strategy

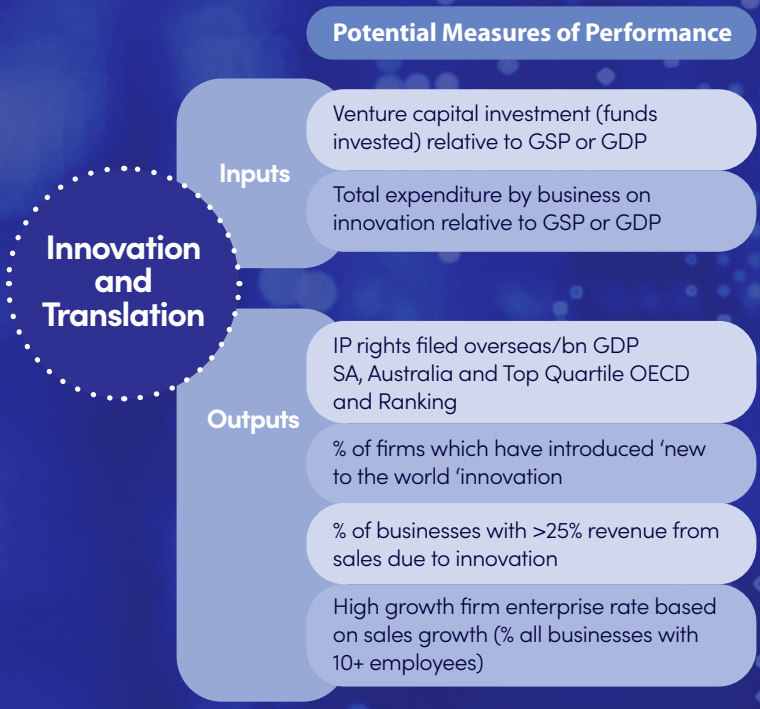
Establish ***Innovation and Translation Intermediaries*** within South Australia's Innovation Districts and Neighbourhoods, focused on SMEs, to enhance industry-research collaboration and increase knowledge transfer, technology capability, growth in revenue and export as part of a South Australian Knowledge Transfer Network.

Innovation Challenges

Strategy

Global and national STEMM policies now focus increasingly on 'grand challenges' as governments seek to redirect technological change from existing trajectories towards more economically, socially and environmentally beneficial technologies.

Innovation Challenges and The South Australian Global Innovation Prize will provide the South Australian Government with a proactive approach to harness the emergence of disruptive technologies and attract global investment to facilitate the convergence of R&D from across technology domains to support industry sectors and start-ups gain early market advantage.


Potential Measures of Performance
Innovation and Translation
Inputs
Venture capital investment (funds invested) relative to GSP or GDP
Total expenditure by business on innovation relative to GSP or GDP
Outputs
IP rights filed overseas/bn GDP SA, Australia and Top Quartile OECD and Ranking
% of firms which have introduced 'new to the world 'innovation
% of businesses with >25% revenue from sales due to innovation
High growth firm enterprise rate based on sales growth (% all businesses with 10+ employees)

- *MicroX portable scanners*

- *2015 STEM Educator of the Year – Tertiary Teaching, Dr Maria Parappilly Flinders University*

- *A world-renowned visual effects sector (including Rising Sun Pictures, Kojo, Resin and more recently Technicolor's Mill Film), puts South Australia at the cutting edge of the global film and TV industries*

Enablers of the Future Workforce

Matching Demand and Supply

Strategic Opportunities

South Australia has embarked on a strong and visionary program to build STEMM and entrepreneurship programs in schools across the state and to strengthen links between schools and industries within their suburb and region.

Universities across South Australia also continue to align educational programs with the future of STEMM R&D and industry needs. All education institutions are focusing on flexible pathways into STEMM programs and on modular programs for professionals seeking to update their knowledge on emerging technologies in a changing global market.

Strategy

Integrate inputs from relevant stakeholder groups to deliver evidence based short and long-term projections of the skills and capacity of South Australia's future STEM workforce. Integrated reporting on future workforce projections through an Annual Workforce Forum will allow timely insight into any emerging gaps in skills or in future workforce capability.

Strategy

Host an annual ***South Australian Future Workforce Forum*** which brings together leaders from across industry and all education sectors to review the detailed mapping of the demand and supply pressures for the future STEMM workforce. This Forum will also support co-development of solutions to pressing short term issues and shape longer term strategies which address key demand and supply mismatch issues.

Diversity for STEMM

Strategic Opportunities

As summarized in the 2017 ISA Report, '*promoting greater diversity in the research and innovation workforce*' is key to meeting the needs of the future Australian workforce.

South Australia is fortunate to have educators, researchers and industry professionals who are committed to building a more diverse STEMM workforce with a focus on increasing the participation of girls and women and of Aboriginal and Torres Strait Islanders in STEMM programs across all education levels and in the STEMM workforce.

There is an opportunity to build scale within those existing programs which deliver positive outcomes and to identify new opportunities to support more South Australians to participate in the skilled STEMM workforce of the future.

Strategy

It is proposed to harness the energy and commitment of the current champions for diversity in STEMM who are working across South Australia and at all levels within the education and workforce sector to deliver programs which develop STEMM talent. The establishment of a ***South Australian Champions for Diversity in STEMM Group*** will ensure that those programs which deliver strong outcomes can be scaled up to deliver the future faster. The outcomes of the work of this Steering Group will form a key input into the annual ***South Australian Future Workforce Forum*** noted above and position South Australia strongly in the national and global arena.

Dr Shelley Paull, Scientist and Natural Resources Eyre Peninsula Marine Parks Coordinator. Educational and on-ground and in-water activities in her local community.

Inspiring SA

Strategic Opportunities

The work of Inspiring SA, Science Alive, the National Science Week teams and many other groups which support citizen science, community engagement and input on 'all things STEMM' forms a critical public platform for STEMM engagement. Bringing this work to the foreground in South Australia and providing a greater exposure for the outcomes of these programs will allow opportunities for greater engagement with industry, communities and regions and ensure alignment with the work of the ***South Australian Champions for Diversity in STEMM Group.***

2015 STEM Educator of the Year – School Teaching, Mr Simon Brooks

Strategy

Harness the existing national and state programs which support ***Inspiring SA and National Science Week*** to support the development of the future STEMM workforce and the global brand of South Australia as '***the State of Science***'.

Future Workforce & Diversity for STEMM

Potential Measures of Performance

Inputs

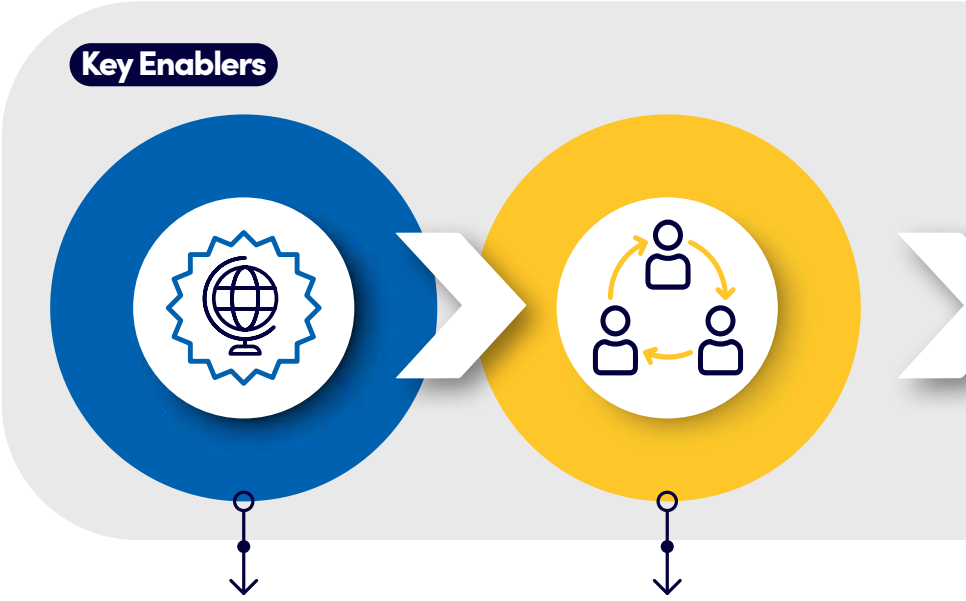
- Growth in number of enrolments in STEMM subjects in Year 10-12 % female and male
- Growth in number of enrolments in STEMM fields at University and at TAFE % female and male
- Growth in number of permanent migrants and non-student temporary entrants with higher education qualifications (/'000 population)

Outputs

- % Population aged 25-34 with a university degree and/or a TAFE qualification in STEMM related subjects % SA % Australia and Top Quartile OECD and Ranking
- Researchers (FTE) in government, business and higher education per '000 population SA, Australia and Top Quartile OECD and Ranking
- Proportion of Universities that have received Athena SWAN Silver Award SA, Australia and World (measures in 2026 and 2030)
- % of female authorships on STEMM research publications %SA, % Australia and Top Quartile OECD and Ranking

2013 Finalist STEM Educator of the Year – School Teaching, Dr Leone Shapter

STEMM Research and Innovation Value Chain – **EXCITE action plan**

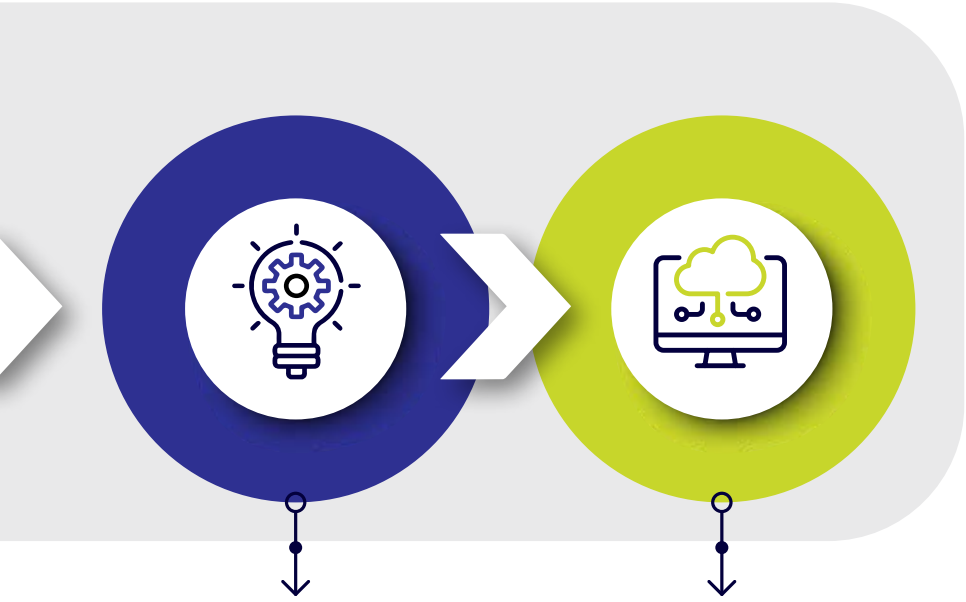


Excellence

- A focus on global standing
- Leverage excellence to build global scale
- 2030 Horizon Major Research Infrastructure and Technology Plan

Collaboration

- Sticky for Talent: Attracting Global Innovators
- Powering Innovation Districts and Neighbourhoods
  - Frontier Technology Capability Centres
  - Industry Doctoral Training Centres



Innovation and Translation

- Innovation Districts and Neighbourhoods
  - Innovation and Translation Intermediaries
  - Knowledge Transfer Networks
  - Innovation Challenges
  - Impatient capital

Enabled Future Workforce

- STEMM Skills
- Demand and Supply
- The Diversity of STEMM

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Chief Scientist for South Australia

Contact.

For further information about the EXCITE Strategy, contact the Office of the Chief Scientist for South Australia.

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www.innovationandskills.sa.gov.au

Government of South Australia