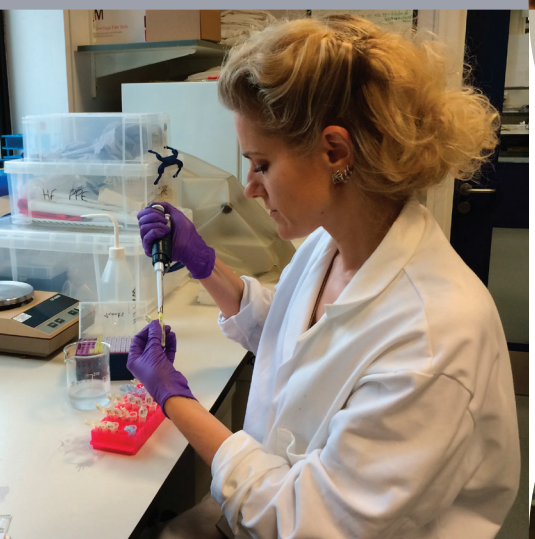
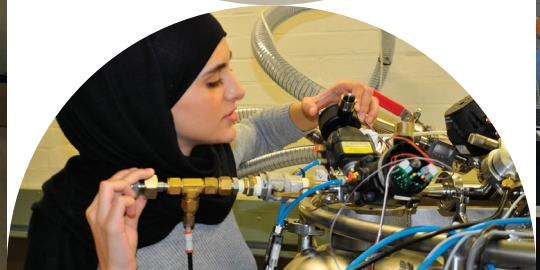
Australian Government

ADVANCING
WOMEN IN STEM





MINISTER'S FOREWORD

Australia is well known for its contribution to science, technology, engineering and mathematics (STEM) — from laying the foundations for the field of radio astronomy and developing the basis of efficient computer processing, to identifying the cause of global mass extinctions in frogs and discovering how to detect breast cancer through a blood test.

Australian women have played key roles in all of these great contributions that have had unquestionably positive impacts on our lives. However, if we do not take action, the current gender imbalance in STEM means that we are at risk of losing the important contributions that Australian girls and women stand to make. This is simply unacceptable. By ensuring STEM is representative of the society in which we live we have the opportunity to achieve much more, making great advances for our nation, and for the world. Building an inclusive and diverse STEM workforce also ensures we are positioning Australia to take full advantage of the jobs of the future, whether as a robotics engineer, cyber security analyst, or commercial space pilot.

Addressing gender inequities in STEM is a key challenge not only for Australia, but for many countries across the world. That's why there has never been a more important time for the Australian Government to continue showing leadership to drive change in our systems, institutions and workplaces to encourage and enable more girls and women to pursue STEM studies and careers.

The Liberal National Government is committed to improving the participation of women in STEM across all fields. In the 2018-19 Budget, we committed to the development of a Women in STEM Strategy and a Women in STEM Decadal Plan. Together, these documents set out the path forward for sustained increases in women's STEM participation and retention, through early childhood, education and careers. I believe that by working together, government, industry, academia, research, education and the community can achieve better outcomes for our girls and women, and for all Australians over the next ten years.

It is my pleasure to present *Advancing Women in STEM* – the Australian Government's commitment to ensure all Australians, regardless of gender, have the opportunity for rewarding, high income jobs in workplaces that value the talent and skills of their people.

KAREN ANDREWS
MINISTER FOR INDUSTRY, SCIENCE AND TECHNOLOGY

INTRODUCTION

The National Science Statement, released in 2017, articulates the Government's commitment to the science sector. It outlines the importance of science, technology, engineering and mathematics (STEM) as vital building blocks for Australia's future prosperity and wellbeing.

Rapid technological change is driving new workforce needs. The skills required for work have changed, and will continue to evolve on an increasingly fast basis. Workers need to be able to augment and develop their skills as technology advances in order to fulfil the jobs of the future. STEM skills are critical in this.

STEM skills play a crucial role in innovation, which is a key driver of economic growth. Businesses that innovate are twice as likely to use STEM skills.[1] Research by the Australian Council of Learned Academies (ACOLA) has found that the integration of STEM skills is important to the success of leading firms and organisations across a wide range of industries.[2] STEM skills, particularly in combination with other interdisciplinary skills – such as entrepreneurialism – provide the problem solving, critical thinking and communication skills that are vital to a wide range of jobs, beyond the narrowly defined traditional disciplines.[3] As many industries become more reliant on technology, the need for STEM skills is becoming increasingly widespread. STEM skills are not just for scientists and engineers – everyone needs some fundamental STEM knowledge, whatever their field of work, as it underpins new and existing industries. A base knowledge of STEM also supports citizen engagement in discussions on many of the big issues facing Australian society – from healthcare to energy use.

ADVANCING WOMEN IN STEM

Australia must have a deeper STEM talent pool. Women are underrepresented in STEM education and careers, and women from minority groups are particularly underrepresented. From reduced confidence in STEM subjects by year four, through to the lower numbers of women STEM professors, the inequality crosses sectors, disciplines, and levels. Girls and women's underrepresentation across the full pipeline must be addressed if Australia is to fully engage in the opportunities that an increasingly digital, technological, and STEM-driven world will provide.

Gender inequity not only limits the available talent – it is bad for business. Gender diverse companies are 15 per cent more likely to financially outperform their counterparts.[4] The Grattan Institute has estimated that an extra six per cent of women in the workforce could add up to $25 billion to Australia's Gross Domestic Product.[5] There is an incredible opportunity here for the STEM sector should it achieve greater participation of women.

The causes of the inequality in STEM participation are broad, complex and long-standing. Cultural issues such as bias and stereotyping shape girls and women's views of STEM from an early age. STEM working environments, which are often male dominated and can have strongly hierarchical natures, can support a higher risk of issues such as sexual harassment.[6]

These are not issues that have simple solutions, nor will we see an overnight change. Increasing the participation of girls and women in STEM requires a system level response with long-term strategic action from across the sector – government, industry, academia and education – to address the cultural and systemic barriers, as well as compliance with relevant legislation and regulations. We need to determine what is working through evaluation, broadly implement what works, and measure the relevant data across the full pipeline – from childhood to senior leadership participation – to track our progress.

This is why the Australian Government has supported the development of a Women in STEM Decadal Plan, to provide a roadmap for sustained increases in women's participation in STEM over the next decade. Developed by the Australian Academy of Science and the Academy of Technology and Engineering, the Decadal Plan was released on 1 April 2019. The Decadal Plan will provide high level guidance to the STEM sector in tackling the systemic issues affecting the ongoing participation of women in STEM.

Advancing Women in STEM responds to the issues outlined in the Decadal Plan and forms the Government's commitment to the sector and to future generations. It outlines where Government can play a role in supporting increased gender equity across the STEM sector. It sets out the Government's enduring vision for *an **Australian society that provides equal opportunity for people of all genders to learn, work and engage in STEM***.

WOMEN IN STEM DECADAL PLAN

The Women in STEM Decadal Plan, developed by the Australian Academy of Science in partnership with the Australian Academy of Technology and Engineering, provides a guiding framework to set the direction for all in the STEM sector to take action on gender inequity. The plan aims to create a diverse, inclusive and equitable STEM ecosystem, free of gender barriers to participation and progression.

The Decadal Plan sets out six key opportunities to support improved gender equity in STEM:

1. Leadership
2. Evaluation
3. Workplace culture
4. Visibility
5. Education
6. Industry action

Advancing Women in STEM responds to the Decadal Plan, noting how government can lead the way through its support for gender equity and enable action across the STEM sector, through education, workplaces and the broader culture. The Australian Government will continue to work with the STEM sector and the Academies on the implementation of the Decadal Plan.

A SNAPSHOT OF DISPARITY IN STEM

Australia's talent pool is limited by the underrepresentation of half of Australia's population – girls and women – in STEM education and careers. The causes of poor attraction and retention of girls and women in STEM begin from an early age and compound as progression to more senior careers is made. Often referred to as a 'leaky pipeline', the result is a system with low representation of women in STEM education, workplaces, and senior level leaders, and a society that undervalues the opportunities and contributions a career in STEM can provide for girls and women. Differing participation rates in STEM education and fields also means that gender inequities can transpire at different points of the career path depending on the individual field.

At the school-level, despite boys and girls having similar average performance in the National Assessment Program – Literacy and Numeracy (NAPLAN), in 2017 fewer girls achieved at the highest levels in NAPLAN year 3 and 5 numeracy tests compared to boys.[7] By year 12, there are marked participation differences in a number of STEM subjects. For example, while girls comprise over 50 per cent of enrolments in year 12 *Sciences* subjects, they are underrepresented in *Information and Communication Technology and Design and Technology* subjects with only 26.3 per cent of year 12 girls enrolling in 2017 compared to 39.4 per cent of year 12 boys.[8] In year 12, boys outnumber girls 3 to 1 in physics and almost 2 to 1 in advanced mathematics.[9] Low participation in these critical subjects directly impacts future opportunities for girls, whether in a STEM career or not, and is a major contributor to the gender imbalance in STEM tertiary education and the STEM workforce.

At the tertiary level, both at universities and in vocational education and training (VET), underrepresentation in information technology (IT) and engineering education is of particular significance, especially as these skills will be increasingly important as Australia transitions to a digital and technologically-driven economy. In 2016, women comprised less than 15 per cent of domestic *Engineering and Related Technologies* undergraduate course completions[10,11] and less than 11 per cent of vocational education course completions.

While participation rates in other broad fields of tertiary STEM education such as the *Natural and Physical Sciences* may not present cause for concern at the surface level, deeper examination also shows underrepresentation of women in more specific fields of education such as *Mathematical Sciences* (37 per cent of domestic undergraduate and postgraduate completions in 2016) and *Physics and Astronomy* (29 per cent of domestic undergraduate and postgraduate completions in 2016).[12] Comparison of enrolment and completion data indicates most women who enter into these fields of education complete their courses, suggesting issues other than attrition are of importance during this stage of the career.[13]

Consistent low levels of participation in STEM education means the number of women participating in the STEM workforce is not increasing at a substantial rate. Of the STEM qualified population, women comprised only 17 per cent in 2016.[14] In academia, participation at junior levels is not an issue for all STEM fields, however women are still poorly represented as a total of STEM academics (31 per cent in 2016).[15] Representation of women at senior levels (14.5 per cent in 2016) is extremely poor, even for traditionally female dominated fields such as biology – in 2016, women comprised 56 per cent of postdoctoral biology academics, but only 18 per cent of professors.[16] These issues are not specific to academia and cut across much of the STEM workforce. In engineering, women represented only 12.4 per cent of the workforce in 2016, with men more likely to be employed at higher levels of responsibility and women at less senior levels.[17,18] In IT, women are also poorly represented in higher positions and made up only 28 per cent of the workforce in 2017, a figure that has remained unchanged since 2015.[19] This trend of workforce distribution, with the compounding factors of low participation rates, more women working at lower levels than in senior positions and high levels of midcareer attrition due to these factors, also results in a gender pay gap for STEM. This ranges from 11 per cent in engineering and 12.4 per cent in science, to 20.2 per cent in IT.[20]

WHAT IS CAUSING THIS DISPARITY?

Issues of women's participation are not exclusive to STEM fields. In the Australian workforce, women have lower work participation rates than men and also earn less than men, with the weekly pay gap currently at 14.2 per cent (average weekly ordinary time earnings for full-time employees).[21] Women's participation is lower for a variety of reasons, from cultural barriers in the workplace through to women being more likely to be a primary carer for children or other family members. As at January 2019, there is a 9.3 percentage point difference between men (83.0 per cent) and women (73.6 per cent) labour force participation for persons aged 15 to 64 years.[22]

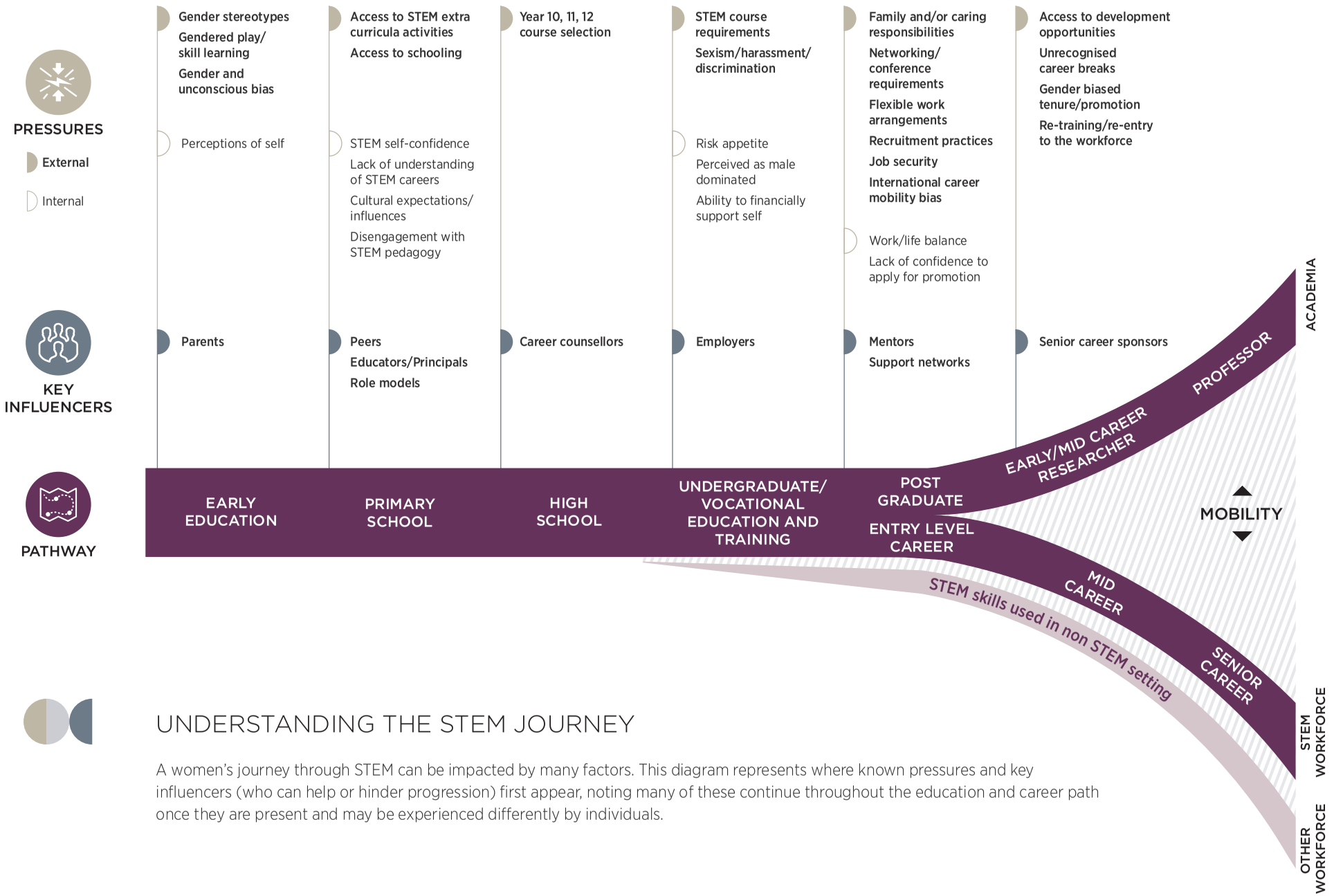
Girls and women, especially those from minority groups, rural and remote areas and disadvantaged backgrounds, face multiple barriers to STEM participation and as a result have to overcome more challenges than their male counterparts.[23,24] Factors such as bias and stereotyping, career insecurity, a lack of flexible work arrangements, and lack of female role models have been demonstrated to greatly influence girls and women's decisions to enter and remain in STEM education and careers.[25,26]

Experiences of bias and stereotyping begin early in life and have a significant impact on girls and women's development of confidence and interest in STEM.[27,28] The perception that some STEM fields are a better fit for males, particularly by influencers such as parents, educators, and career counsellors, is one of the biggest barriers to girls and women participating and persisting in STEM.[29]

A lack of diverse female role models in STEM, whether in the classroom, at work or on the screen, further decreases girls' and women's likelihood of persisting in STEM education and considering STEM as a career option. For girls, female role models are crucial to their perception of whether they could work in STEM.[30] In fields where women are particularly underrepresented such as physics and engineering, surveys have found more than 80 per cent of women perceive a lack of female role models as a significant hurdle for gender equity in their field.[31]

Working conditions and job insecurity have a strong negative impact on women entering into and maintaining careers in STEM, and are longstanding issues. STEM employees encounter less flexible working conditions, large numbers of short-term contracts, grant dependent positions, and pathways to promotions that can be subject to gender bias. Particularly in academia, finding ongoing positions (tenure) can be very difficult. Additionally, the pathway to senior positions in STEM academia and industry has traditionally been seen as one where there are no career breaks or access to part-time duties, with STEM professionals reporting that taking maternity leave is detrimental to their careers.[32]

In many STEM fields, maintaining skill sets and professional networks are vital to career progression, however gendered caring expectations and different work place approaches to facilitating part-time work make opportunities to undertake training to re-learn, maintain or gain new skills and attendance at networking events or conferences difficult. A further lack of support networks, including mentors, career sponsors and professional groups, contributes to women feeling out of place in STEM fields, and can lead to thoughts about leaving the field.[33] Feeling like a misfit, or an imposter, hinders achievement, engagement, and persistence in STEM education and careers, and causes girls and women to question their abilities and interest in STEM.[34]



UNDERSTANDING THE STEM JOURNEY

A women's journey through STEM can be impacted by many factors. This diagram represents where known pressures and key influencers (who can help or hinder progression) first appear, noting many of these continue throughout the education and career path once they are present and may be experienced differently by individuals.

WOMEN IN STEM AT A GLANCE

DIFFERENCES IN INTEREST AND CONFIDENCE IN STEM **APPEAR EARLY**, AND ARE PARTICULARLY CONCERNING FOR INFORMATION TECHNOLOGY AND ENGINEERING

1 Female students are **less interested and less confident** in STEM subjects compared to males, particularly in the areas of engineering and technology.

Level of interest in STEM subjects	♂ Male	♀ Female
Science	68%	61%
Technology	75%	54%
Engineering	55%	28%
Mathematics	56%	45%

Confidence in getting good results in STEM subjects	♂ Male	♀ Female
Science	64%	60%
Technology	73%	56%
Engineering	50%	26%
Mathematics	65%	60%

2 When considering the importance of STEM knowledge for future employment, female students consider **technology as the most important and engineering as the least**.

science	technology	engineering	mathematics
75%	86%	54%	80%

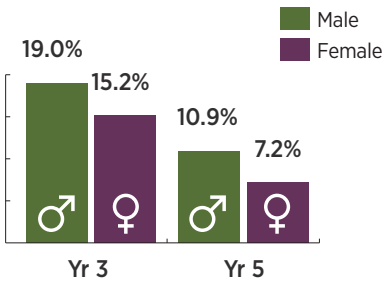
3

When asked what type of career they would like to have in the future, **twice as many male students aspired to a STEM-related career than females**.

Male ♂	Female ♀
41%	20%

FEMALE STUDENTS ARE PARTICIPATING IN STEM EDUCATION AT **SIGNIFICANTLY LOWER RATES** THAN MALES

4 In 2017, despite having similar average performance, **fewer girls achieved at the highest levels in NAPLAN** numeracy tests compared to boys.



5 Female students are enrolling in year 12 *Information and Communication Technology (ICT) and Design and Technology* subjects at **much lower levels than males and rates are declining**.

	2010	2017
Male ♂	41.1%	39.4%
Female ♀	28.1%	26.3%

6 **Completion of tertiary STEM education**, particularly engineering and related technologies studies, is **far lower amongst women.**

Total STEM Completions in 2016	Male ♂ 79.2%	Female ♀ 20.8%

Total VET Activity
Male 83.0%
Female 17.0%

Domestic Undergraduate
Male 62.7%
Female 37.3%

Domestic Postgraduate
Male 65.4%
Female 34.6%

Engineering and Related Technologies Completions		
Gender	Vocational Education	Domestic Undergraduate
Male ♂	89.97%	85.64%
Female ♀	10.13%	14.36%

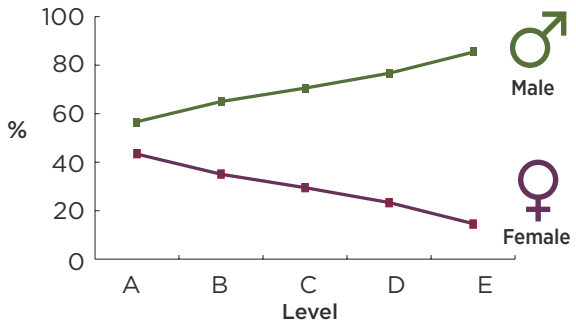
WOMEN ARE **POORLY REPRESENTED** IN THE STEM WORKFORCE AND **EARN LESS** THAN THEIR MALE COUNTERPARTS

7 Of the STEM qualified population, women **comprised only 17 per cent in 2016**.

		VET	Higher Education	Total STEM Qualified
Female ♀	2006	9%	28%	15%
	2011	9%	29%	16%
	2016	9%	31%	17%

8 In **academia**, women are **underrepresented** as a total of STEM academic and research staff and in senior positions.

- In 2016, women comprised **only 31.0 per cent** of STEM academic and research staff.
- In 2016 **only 14.5 per cent** of STEM professors were women.



9 In the **broader workforce**, women are particularly **underrepresented** in engineering and IT.

Only **12.4 per cent** of engineers were women in 2016.

Only **28.0 per cent** of the ICT workforce were women in 2017.

10 Women **earn less** than their male counterparts in science, engineering and IT roles

PAY GAP

engineering
11.0%

science
12.4%

ICT
20.2%

11 Visibility of women working in STEM careers is **poor.**

Only **28 per cent** of STEM academic writers featured in The Conversation in 2017 were women.

OUR VISION

AN AUSTRALIAN SOCIETY THAT PROVIDES EQUAL OPPORTUNITY FOR PEOPLE OF ALL GENDERS TO LEARN, WORK AND ENGAGE IN STEM

In order to achieve our vision, the Government will play a strong leadership role, working in partnership with the broader STEM sector, to support, guide and advocate for action on STEM gender equity. This is underpinned by the Government's role in supporting STEM education, careers, and culture, which together are the building blocks for achieving system level change and improving the overall participation of women in STEM.

THE ROLE OF GOVERNMENT: LEADING THE WAY

The Government can play a strong leadership role to support improved gender equity in STEM and galvanise action across the sector. Working in partnership with the STEM sector to address gender inequity in STEM will bring greater opportunities for mutual growth and innovation. The Government is part of the STEM sector and can lead action within its own organisations to improve women's participation. The Government can enable further action as an advocate while supporting broader activity across the STEM system that targets key gaps in efforts.

ENABLING STEM POTENTIAL THROUGH EDUCATION

A strong and supportive education that encourages the interests of girls in STEM is key to building a solid base for future STEM education, skills development and career choice.

Without this base, girls and women will not be well positioned to engage in STEM education and into their careers.

Empowering girls, and supporting their teachers and parents, to see a future for themselves in STEM will be crucial to ensuring a future pipeline of women in STEM.

SUPPORTING WOMEN IN STEM CAREERS

Improving gender equity in STEM workplaces is beneficial for both employees and employers. If the options of half of Australia's population are limited we will not be able to reach our full potential and help the economy thrive.

Addressing organisational, cultural and gender inequities that prevent organisations from attracting women to, and retaining women in, the STEM sector will help all Australians see a future in STEM.

MAKING WOMEN IN STEM VISIBLE

A supportive Australian culture plays a key role in helping girls and women feel welcome to participate in STEM. Visibility and strong role models help to shape our culture.

Creating diverse, strong role models will ensure women in STEM are visible and will help to address the bias and stereotyping that currently exists in STEM.

Increased visibility of STEM careers will ensure girls and women are aware of the many different pathways a STEM career can take.

ADVANCING WOMEN IN STEM

THE ROLE OF GOVERNMENT: LEADING THE WAY

The National Science Statement, released by the Government in 2017, reflects the principle that the Government will both show and promote leadership in actively addressing inequality in science education, participation and employment. The Statement identifies three roles for the Government in the science system – a participant, a supporter and an enabler. In addressing the issue of gender diversity in science, all three of these roles of Government are relevant.

THE GOVERNMENT **PARTICIPATES** IN THE STEM SYSTEM, INCLUDING AS AN EMPLOYER OF STEM PROFESSIONALS.

The Government is committed to ensuring that women working in STEM roles across government are valued and supported. The Government recognises that 'STEM roles' encompass a broad range of activity within government, from those who undertake research in a publicly funded research agency (PFRA) to those working to support our IT systems.

The Government is also an employer of women with STEM qualifications who play an important role working across a variety of non-STEM roles. This helps to ensure our Government policy and programs are evidence-based, using the critical thinking and problem solving skills that a STEM education can provide.

As an employer, the Government must take action to support its workforce and model best practice to the broader sector.

ACTIONS

Five[1] PFRAs are currently participating in the ***Science in Australia Gender Equity*** (SAGE) program, an initiative which is advancing gender equity in the higher education and research sector. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Australian Nuclear Science and Technology Organisation (ANSTO) both received bronze accreditation as part of the first cohort in 2018. Through programs such as SAGE, our PFRAs are ensuring that their culture and workplaces support the full participation of women and enable them to contribute at all levels, including as senior leaders in STEM fields.

Across government, many departments have in place initiatives to support women working in STEM roles, such as scholarships, internships and mentoring programs, particularly targeting areas such as IT where women are significantly underrepresented. The Australian Broadcasting Corporation's (ABC) ***Women in Broadcast Technology Scholarships*** has helped increase the representation of women in technologist roles at the ABC from 2.4 per cent in 1993 to 15.4 per cent in 2016. The Digital Transformation Agency's ***Women in IT Executive Mentoring Program*** (WITEM) is helping to attract and retain talented women with IT skills within the Australian Public Service and increase the gender diversity of senior IT employees. To date over 780 participants have been involved, with many past participants attributing professional confidence and career growth to their completion of the program. In 2010, KPMG undertook an independent review of WITEM, which was found to be highly regarded by participants and to represent value for money. In 2018 WITEM received the Australian Public Service Commission Gender Equality award for its work in addressing underrepresentation of women in the IT profession.

1 Australian Institute of Marine Science, Australian Nuclear Science and Technology Organisation, Commonwealth Scientific and Industrial Research Organisation, Defence Science and Technology Group, Geoscience Australia.

THE GOVERNMENT **SUPPORTS** ACTION ON GENDER EQUITY IN STEM THROUGH A NUMBER OF INITIATIVES.

The Government supports and invests in a range of activities intended to increase women's participation in STEM. The Government, as appropriate, is focusing its support on long-term strategic interventions that will effect national change or target areas of particular need, and encourages evaluation to gauge whether initiatives are achieving their intended outcomes and shape future interventions.

ACTIONS

The Government has supported the delivery of a range of STEM gender equity initiatives through the ***Women in STEM and Entrepreneurship (WISE) grants program*** which has provided an opportunity to pilot or champion initiatives that boost the participation of girls and women in STEM education and careers, including as entrepreneurs. Announced under the National Innovation and Science Agenda (NISA), the WISE program has already provided $8 million to support 46 projects and will continue to provide up to $1 million per year to support targeted STEM gender equity initiatives.

The WISE grants program provides a vehicle for the Government to continue to support projects that are identified and led by the STEM community. The Government will look to target funding under the WISE program to focus on key strategic initiatives, for example targeting disciplines with particularly low levels of participation, such as engineering or information technology, or scaling up existing, successful initiatives. The Government will also ensure evaluation of project impacts and outcomes is undertaken as a condition of funding.

The Government undertakes a range of science engagement activities, including through the ***Inspiring Australia – Science Engagement Programme***, and will continue to work collaboratively with other levels of government, business and the community to prioritise activities with a demonstrated focus on diversity. Through the new ***Eureka Prize for STEM Inclusion***, funded under the Inspiring Australia program and to be awarded for the first time in 2019, the Government is recognising and awarding successful initiatives that have led to greater inclusion in STEM of typically underrepresented groups, including girls and women.

WOMEN LEADING THE WAY

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) recently appointed Dr Cathy Foley to the position of Chief Scientist. This unique role will help champion science, its impact and contribution to the world, as well as the people behind the science.

Dr Foley joined the CSIRO Division of Applied Physics in 1985 as a National Research Fellow. 'My early aptitude for science was combined with a compassion for people and a sense of wanting to see more fairness in the world. So CSIRO was the perfect vehicle for me to realise this vision,' says Dr Foley. 'At CSIRO, the work we do has an enormous impact and makes a difference to everyone every day. If you ask the people I work with, they all say that what they love about working at CSIRO is that "we do things that actually change the world".'

When asked about the importance of having women in leadership positions in science, Dr Foley noted 'you can't be what you can't see!'

'Gender bias and stereotypes begin at an early age – where young girls are growing up with a lack of overall female scientists in the public eye. This kind of imbalance sends a clear signal to girls at a young age that they don't fit the classic mould of a scientist – in turn girls lose confidence in their STEM abilities at a young age. When it comes time for young women to choose a discipline at university, it's no surprise they're demotivated to choose a STEM career,' says Dr Foley.

'If we want to inspire more women to get into STEM and leadership roles, then we must increase the number of visible role models in the public sphere', says Dr Foley. 'As Chief Scientist, my priority is putting science, and people in science in the spotlight – especially women. I want to show that we can solve the big challenges for the nation when we use the full human potential'.

'Australia needs to step up its game with getting more women into the STEM workforce – and as Australia's national science agency, we must to play our part,' says Dr Foley. 'We know that diverse teams drive innovative thinking. We also know that visible diversity matters. If we want to realise our vision for future science impact it's critical that we harness the talents of women into the future. It's also the right thing to do!'

THE GOVERNMENT **ENABLES** ACTION ON GENDER EQUITY IN STEM THROUGH ITS ROLE AS A LEADER AND ADVOCATE SHAPING THE SCIENCE SYSTEM.

How the broader STEM community responds to issues of gender inequity can be shaped by the institutional arrangements and regulations put in place by the Government. The signals the Government provides to the sector are important in helping to shape it, both locally and globally.

The government can also lead and advocate for greater evaluation and data collection. There are a large number of initiatives focused on supporting greater participation of girls and women in STEM, which are led across the STEM sector, but very little evaluation on impact. The Government can ensure that the initiatives it supports are appropriately evaluated. This will assist in ensuring that we understand what works and can implement it more broadly, and provide an important signal to the sector. The accurate and timely collection and analysis of data is also key so we can better understand where we are now, where we want to go and how we are progressing towards this.

Many economies, particularly in the developed world, struggle with the underrepresentation of women across the STEM sector. Around the world, the issue of STEM gender equity is a common issue that governments are recognising the need to step up on and prompt action, whether through legislation or other government funded initiatives, to address. The Australian Government is helping to shape this global conversation.

ACTIONS

Our national research funding bodies, the ***Australian Research Council*** (ARC) and the ***National Health and Medical Research Council*** (NHMRC) are key funders of the research system and through their work, helping to set clear expectations and shape the culture of the STEM sector. The ARC requires institutions administering ARC funding to comply with their obligations under the *Sex Discrimination Act 1984* and has required the last two rounds for ARC Centres of Excellence to have in place gender equity plans. The NHMRC similarly requires institutions administering NHMRC funding to adhere to all Australian laws and have policies and procedures that support the progression and retention of women in health and medical research. For example, NHMRC requires all institutions administering its funding to have an institutional strategy to address the underrepresentation of women in senior positions, have working arrangements that cater for individuals with carer responsibilities and employment strategies that encourage the recruitment, retention and progression of women in health and medical research, as well as strategies to address the need for the provision of support for childcare.

The Department of Industry, Innovation and Science, through the Business Grants Hub, will develop ***best practice guidelines*** by the end of 2019 to ensure that all grants programs, including those supporting STEM activity, are administered in such a way that do not disadvantage women. The department recently took action to ensure that the Prime Minister's Prizes for Science provide every opportunity for women to be nominated and considered fairly in the program, including introducing unconscious bias training for the Prizes committees, evaluating the guidelines for gendered or barrier language and implementing a communications campaign to encourage nominations from a diverse pool of candidates.

Internationally, Australia has advocated through the G20 for greater participation of women in the digital economy. The opportunities of the digital age are firmly grounded in STEM. Through the ***Bridging the Digital Gender Divide*** report (2018) commissioned by Australia through the Organisation for Economic Co-operation and Development (OECD), the Government is investing in an evidence based approach to unlocking the benefits of greater participation by girls and women in technological development. This global response positions Australia's highly skilled STEM workforce at the forefront of emerging opportunities, regardless of gender.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute of Statistics ranks participation of women in STEM in the East Asia and Pacific region poorly – second last of eight regions, with women making up on average just 23 per cent of the research workforce.[35] The Government is developing a ***regional framework*** for STEM gender equity with our partners in the Asia-Pacific Economic Cooperation (APEC) and the Association of South East Asian Nations (ASEAN). The work leverages Australia's gender equity leadership in the region, and presents a model for greater collaboration.

Bilateral relationships underpin our support for STEM gender equity in the region, and generate opportunities for deep partnerships, both at the government level as well as at the institutional level. On 22 February 2019, the Australian and New Zealand Governments announced an inaugural ***Women in STEM bilateral dialogue***. This bilateral partnership with one of our closest allies demonstrates and recognises the importance of gender equity in building a strong international environment to enable economic success through STEM capability.

ACTION AREA:
ENABLING STEM POTENTIAL THROUGH EDUCATION

Outcome: Australia's education system, from early education to tertiary, supports the active inclusion of girls and women and enables them to explore their full STEM potential.

WHY FOCUS ON EDUCATION?

A quality STEM education builds the foundation for everyone, including girls, to aspire to a career in a STEM field and gives all Australians the base on which to build life-long skills. Without a foundational STEM education, girls may not aspire to STEM careers and may be disadvantaged in pursuing opportunities in related fields that build on STEM knowledge, such as econometrics or architecture or in seeking re-training in STEM in later life. STEM literacy also supports girls and women to make important decisions about their life, such as making informed health and financial choices for themselves and their families.

There are a broad range of established programs promoting STEM for pre-school and school-aged young people being delivered by Government, industry and education providers. These include programs directed at children, such as Questacon's Smart Skills initiative as well as programs such as Little Scientists which focuses on training educators and teachers to promote inquiry-based STEM learning. In 2015, all Australian education ministers agreed to the *National STEM School Education Strategy 2016–2026*[36] which aims to ensure that the education system provides students with a strong foundation in STEM and inspire them to take on more challenging STEM subjects. Exposure to STEM at a young age through programs designed to feed children's curiosity for science, maths and technology can be very effective in placing girls on course for a career in STEM.[37]

Research shows that girls' perceptions of, and engagement in STEM, are strongly influenced by both parents and teachers.[38,39,40] Feminine gender role stereotypes have been shown to orient girls towards developing social skills and gravitate towards activities that emphasise interpersonal relationships, whilst masculine gender role stereotypes orient boys to acquire skills, explore the physical world, and gravitate towards activities that emphasise problem solving.[41,42] International research has also found that boys are more likely to be encouraged to pursue computing and engineering roles by parents, teachers and the media, and are more likely to be told they could be good at computer science.[43] Girls' participation in STEM is also impacted by a lack of knowledge and awareness as to what a STEM career might involve and the influence of their peers' perceptions.[44] Highlighting the opportunities available in STEM and challenging gender stereotypes and bias, particularly those of key influencers, is critical to engaging young girls in STEM and teachers should be supported and empowered to undertake this work.

Lower participation and engagement in STEM at primary and secondary school translates to lower enrolment in tertiary studies at undergraduate and postgraduate levels. Women in university courses often have a negative experience in this environment which leads to a sense that they do not belong in STEM career pathways. Feeling like a 'misfit' in STEM courses hinders women's engagement and performance, and is associated with thoughts about leaving the field.[45,46] Important to combating this is tertiary institutions actively supporting initiatives to remove barriers and encourage women in STEM, as well as showing the variety of STEM careers available and the different opportunities these can bring.

An education system that actively supports and encourages girls in STEM, from early education to tertiary level, will help build a workforce of Australian women who are empowered to make scientifically informed decisions and take advantage of the opportunities of the jobs of the future.

EXPANDING CURIOUS MINDS

The Australian Mathematics Trust and Australian Science Innovations Curious Minds program has been enabling high potential year 9 and 10 girls to explore all aspects of STEM through a mix of hands on activities, theoretical learning, and mentoring since 2015.

Jayde, an Indigenous woman of Warumungu descent, attended the inaugural Curious Minds program and is now studying physics and mathematics at the University of Queensland. She is the first member of her family to attend university and says 'it was only once I had finished the Curious Minds program, that I become confident in my ability to pursue STEM at a tertiary level.'

'Curious Minds gave me the opportunity to explore and really expose myself to all areas of STEM. I was able to challenge myself with female students from across Australia who held the same enthusiasm for STEM that I do. My favourite part of the program was meeting female STEM researchers. After hearing all their amazing stories, I became inspired. By the end of the camp, I was motivated to continue my pursuit of STEM and my future in this field was cemented,' says Jayde.

Imogen, a 16 year-old from regional Tasmania, participated in the 2017-18 program. Imogen says the program helped both her and others at her school to learn about fantastic STEM opportunities, 'Before I went to the Curious Minds program, neither I nor my school had heard of the Australian Science Olympiads program, meaning that Curious Minds has helped not only me to stay interested in science, but likely also many students from my school in years to come.'

Curious Minds also expanded Imogen's understanding of what a STEM career means. 'Before the program I was definitely interested in a career in a STEM field, but I mostly only knew about jobs in medicine and other well-known careers. The program opened my eyes to the wide range of possible jobs.'

ACTIONS

The Government has committed over $500,000 to the development of a ***Girls in STEM Toolkit***, which will be delivered in August 2019. It will educate girls, as well as parents, teachers, career counsellors and other influencers, on opportunities in STEM and the types of careers that can arise from STEM education to break down gender stereotypes.

The Government has invested $25 million over ten years to support the greater participation of Indigenous girls in STEM. This includes $20 million for *the* ***Indigenous Girls STEM Academy***, which will support up to 100 Indigenous girls each year to explore the possibilities of a STEM career through school, tertiary education and into the workforce, and $5 million to support the ***Stronger Smarter Institute***, which will support Aboriginal and Torres Strait Islander women who are teachers of STEM subjects.

In 2017–18, Questacon delivered a successful pilot of ***Engineering is Elementary*** (EiE). Developed by the Museum of Science, Boston, EiE has proven successful in introducing students to the breadth of engineering careers using school aged protagonists who work alongside a mentor to solve a community problem. The majority of EiE units feature girls or women as main characters to demonstrate to girls, boys and educators that girls and women can be engineers. This positive messaging challenges the gendered stereotypes that puts downward pressure on girls' participation in STEM. EiE also works to build the skills and confidence of teachers to deliver STEM activities in the classroom. The Government is continuing to support initiatives delivered by Questacon, with the 2019–20 Budget committing $15.1 million over three years for the expansion of Questacon's education and outreach programs to engage more kids in science and technology.

In-school initiatives are complemented by extra-curricular activities that can provide an extension to the concepts discussed in the classroom. Through the NISA, the Government supported ***digIT***, to support year 9 and 10 students that are underrepresented in STEM and IT subjects to engage in digital technologies and related careers. Delivered by the Australian Mathematics Trust (AMT), digIT exposes students to role models and helps them understand the many possibilities a future in IT may hold.

In late 2018, the Government extended its support for the ***Curious Minds*** program, which provides STEM summer schools and a coaching program for high potential female students in years 9 and 10. This program, delivered by the AMT in partnership with Australian Science Innovations (ASI), aims to ignite girls' passion and participation in STEM.

MAKING POSITIVE CHANGE FOR GIRLS IN STEM

With the support of a WISE Grant, Education Changemakers ran five face-to-face WISE Changemakers workshops in 2017 for 30 female educators across Victoria with the aim of increasing the engagement and retention of girls in STEM. At the end of the program Education Changemakers and the program participants awarded two grants to the educators to pursue their project ideas through a peer review process.

One grant recipient was Leanne Smith, founder of ECO Inquire – a specialist education provider. Ms Smith's current work entails delivering STEM incursions for K-12 students that meet NSW and Victorian curriculum requirements and providing high quality professional development opportunities for teachers and pre-service teachers across STEM disciplines.

'In my role as an educator within the Albury-Wodonga region, I noted that early, positive exposure to STEM played a critical role in recruiting and retaining girls and underrepresented groups in STEM. I recognised the need for industry and schools to partner in order to support teachers with relevant methods and information and enable young people to pursue their interest and gain a greater understand of what STEM entails.'

The Changemakers Program offered Ms Smith tools for professional development including coaching, mentoring and case studies to implement an initiative for change.

'My involvement in the Changemakers workshops was a career defining experience. It was here, among the "thinkers, achievers and changemakers" that I was inspired to launch the *SySTEM Connect* project and step up in a leadership journey,' says Ms Smith. *SySTEM Connect* is on an online platform that enables educators to seek STEM role models and mentors for their students, introducing them to relatable and diverse role models within the Albury/Wodonga community.

'Alongside study, exposure to industry role models is important to helping shape students life choices. We often encourage our students, children and grandchildren to follow their passion. But how do young people find out what they are passionate about?," says Ms Smith. 'It is important for girls to have the opportunity to meet industry-based role models whose roles they can identify with and aspire to. Female role models can enhance STEM visibility, counter girls' misconceptions and expose girls to a wide range of study options and career possibilities.'

'*SySTEM Connect* has had a profound positive ripple within organisations just as much as it has within school communities,' says Ms Smith. 'STEM professionals have relished the opportunity to showcase their work and have their passion for STEM emulated by students. The honest and encouraging messages of STEM experts has gone a long way in changing student's perceptions about future study possibilities.'

In the first two years of the program, 70 per cent of girls participating in the program said that it had helped them decide that their future study will be in STEM and 80 per cent had increased their confidence in doing STEM. Through the Inspiring Australia program, the Government is also providing support to the AMT to enable the participation of Australian high school girls in the ***European Girls Mathematical Olympiad*** (EGMO). In 2018, the first time Australia has been represented at the EGMO, the four high school girls participating were recognised for their high achievements including silver and bronze medals.

The Office of the Chief Scientist's ***STARportal***, is Australia's first centralised national portal for exciting and engaging STEM activities from around the country. This searchable database connects parents, students and teachers with their local and online STEM activities. The Government supported the addition of a filter that allows users to search for programs focused on supporting girls' participation in STEM. This will help increase visibility of STEM programs available for girls, and make these programs more accessible to students, educators and parents.

The Government is helping to promote the opportunities of a STEM career for those in tertiary education. The ABC's ***Women in Broadcast Technology Scholarships*** offers paid work experience and support for tuition costs for women undertaking electronics technology, electrical, communications engineering, or computer systems/shared technology related courses nationally, while ANSTO's ***WISE School*** promotes careers in nuclear science and engineering to first year female undergraduate students. The Government is also providing scholarship support such as the ***Defence University Sponsorship*** scheme of which engineering is one of three general areas eligible for support. Under this scheme the Air Force supports four women each year to undertake an electrical/electronics engineering degree. Initiatives such as this are useful in supporting action in areas of particular disadvantage, such as engineering and IT.

The Government's ***National Research Internships Program*** supports new internships for PhD students across Australia providing them the opportunity to gain industry experience and explore careers options. The program focuses on gender equity in particular providing internship opportunities for women in STEM fields.

ACTION AREA:
SUPPORTING WOMEN IN STEM CAREERS

Outcome: Australian STEM workplaces support the active recruitment and retention of women in STEM roles at all levels.

WHY FOCUS ON THE WORKPLACE?

Addressing gender inequality in STEM takes more than just addressing the numbers. Workplace culture and conditions are integral for recruiting and retaining women in STEM careers, as well as supporting their progression to leadership positions. Currently, women are underrepresented as both a proportion of STEM staff in the workplace and as a proportion of employees in higher-paid positions.[47] Similar to many industries in Australia, gender pay gaps are prevalent across the STEM sector, including in fields where women are represented as a greater proportion of the workforce such as in the life sciences.[48]

Gender inequality in STEM workplaces limits the talent available and makes it more difficult to do business, particularly when women are not present at senior levels — diversity in leadership is strongly correlated with higher returns, profitability and share price.[49] Workplaces must address organisational, cultural and gender inequities that prevent organisations from attracting women to, and retaining women in, the STEM sector, and to ensure employers have access to the largest possible pool of qualified employees. This includes supporting parents returning from parental leave to reintegrate into the workplace and providing employees with the flexibility to determine how best to combine work and caring, consistent with operational requirements. Those in leadership positions should visibly promote gender equity within the workplace. Addressing embedded issues in the workplace, such as bias, stereotyping and inequitable practices, will remove potential obstacles and barriers and improve opportunities for women to advance in their careers.[50]

Working in environments that are male dominated, isolated due to remote field sites or lab work, and have hierarchical and dependent relationships mean the STEM environment can create higher levels of risk for harassment—sexual and non-sexual—to occur. [51] In June 2018, Australia's Sex Discrimination Commissioner, Kate Jenkins, announced a national inquiry into sexual harassment in Australian workplaces. Currently being undertaken by the Australian Human Rights Commission, the inquiry will examine the prevalence, nature and reporting of sexual harassment, the drivers of these behaviours and the adequacy of the existing legal framework.[52] Workplaces must take responsibility for actions that reduce and remove behaviour, to create safe work environments for women that support them to be retained and progress within the STEM workforce.

THE DIVERSITY ADVANTAGE

For gender equality in STEM to become a reality, industry leaders need to take an active role. The Male Champions of Change (MCC) initiative does just that by engaging male leaders to drive and accelerate change. MCC recognises that women's lack of retention and progress in STEM signalled persistent barriers that needed to be addressed. That's why, with funding from the Australian Government, MCC-STEM was launched.

In 2017, CEO of MYOB, Tim Reed became a founding member of MCC-STEM. When asked why he joined the program, Mr Reed said, 'I've lived most of my business life like many men- believing gender equality in tech is not my issue, that it is a pipeline issue. I became a Male Champion of Change when I realised it is everybody's issue.'

'Talent is distributed evenly across men and women. Yet when you look at those that reach the highest positions in tech, and almost any industry, it is overwhelmingly men. A system that has been built by men, and works for men, drives these outcomes,' says Mr Reed, 'it is time we addressed this and created systems that work equally for men and women.'

Mr Reed believes it's important for everyone to step up and play a part in helping address gender inequality in STEM, but much of this responsibility sits with men because they are the people who control these systems and can drive change. 'For a long time it felt like the best thing to do was to step aside and let women lead the way with regard to gender equality. However, I now believe that standing beside women to speak out about gender equality, and more importantly act on it, is not about speaking for or saving women, it's about men, who are still in positions of privilege, being accountable for gender equity results,' says Mr Reed.

Being a Male Champion of Change has also affected the way Mr Reed sees the world. 'I'm now far more aware of the impact of the images we portray, of the language we use and how it is perceived differently and what we expect of one another in the workplace,' says Mr Reed, 'I grew up in Australia believing we live in a meritocracy, and then one day it struck me that it was easy for me to feel that way, because I'm a white man. I don't want to be responsible for perpetuating a system that continues to produce such biased outcomes. I want everyone to start with an equal chance.'

MYOB have implemented a number of methods to improve gender equity since joining MCC-STEM. Gender targets were set for teams and regular gender pay gap analysis is conducted to determine the progress being made against the targets. MYOB's parental leave policy has been strengthened and is equally accessible to men and women. The business has taken a number of steps to make sure flexibility isn't just a policy on paper but is a real option that is supported and adopted throughout the organisation. MYOB also launched DevelopHer, an internship for women wanting to become programmers. 'As a technology business, we recognise a diverse workforce is a key competitive advantage. The same goes for our economy, which is why we need inclusive leadership to ensure women are supported to thrive at all levels of business,' says Mr Reed, 'MYOB is just at the beginning of our journey. We've committed ourselves to challenging traditional gender roles in our business and taking real action in the pursuit of gender equality in the workplace.'

Australia's future economic competitiveness and prosperity relies on the skills and capabilities of our future workforce. Critical to the ability of Australia's workforce to respond to future opportunities, will be the number of women that choose careers in STEM and our capacity to address the factors that cause them to leave the STEM workforce.

ACTIONS

A NISA investment of $2 million over three years supported the establishment of ***Male Champions of Change for STEM*** (MCC-STEM). Seventeen Australian male STEM leaders have stepped up to the challenge of addressing gender inequity in their organisations. The first progress report, published October 2017, shows that members have committed to action on gender equity, introduced flexible working arrangements and set targets for gender balance on boards and in senior positions.

The Government also provided $2 million over three years to support the expansion of the ***Science in Australia Gender Equity*** (SAGE) pilot which is based on the UK's successful Athena SWAN model. SAGE now includes 44 Australian universities, medical research institutes and research agencies – encompassing around half of the nation's publicly funded research sector. Since the launch of SAGE, member organisations have improved arrangements for carer's leave, expanded on-campus child care, and undertaken women only recruitment processes.

An evaluation of the SAGE pilot undertaken by the Australian Council for Educational Research found early evidence that SAGE is starting to have an impact and demonstrated the potential for transformational change. In light of these positive outcomes the Government will provide an additional $1.8 million over the next three years to support the ongoing operations of SAGE. This will assist SAGE beyond the pilot stage as they expand their operations to engage more of the publicly funded research sector and develop Silver and Gold Awards schemes.

According to the Australian Bureau of Statistics, the women's share of employment in the resources sector, which is heavily reliant on STEM skills, has not changed in over 10 years.[53] Through the ***National Resources Statement*** the government will promote an inclusive workforce by working with industry and the states and territories to attract and retain women in the resources sector workforce, particularly in STEM fields.

The ***Women's Economic Security Statement*** (WESS), launched on 20 November 2018, outlines the Government's commitment to supporting greater economic participation of women in Australia. It builds on *Towards 2025: An Australian Government strategy to boost women's workforce participation*, which recognises that more needs to be done to ensure girls and women are prepared for the jobs of the future.[54]

The Government committed to further measures supporting women in the STEM workforce in the WESS. The ***Boosting Female Founders initiative*** will provide targeted funding and support for women engaging in innovative entrepreneurship, including in STEM sectors, to help female founders overcome barriers to accessing early stage capital. This initiative will target and support female founded start-ups with the potential to expand to global markets. Increasing the gender diversity of founders will strengthen the performance of Australia's start-up and innovation ecosystems over the longer term.

BREAKING DOWN WORKPLACE BARRIERS

In 2018, Edith Cowan University (ECU) became one of 15 institutions to be awarded a SAGE Athena SWAN Bronze Award. The award recognises the institution's progress in addressing gender inequity and supporting greater diversity and inclusion.

Deputy Vice-Chancellor and Vice-President, Professor Cobie Rudd has spent the last few years actively addressing the gender imbalance in STEM at ECU. 'We cannot reach our full potential unless we can benefit from the talents of everyone. The SAGE Pilot of the Athena SWAN Charter is key to lifting our game in this space; it's an accreditation framework which drives cultural transformation by removing outdated practices that create roadblocks for the female workforce,' says Professor Rudd.

'ECU undertook the two year journey for a Bronze Award and this required us to take a brutally honest look at ourselves. The end result is a hard-hitting action plan that will span four years of big changes.'

'We really have broken down barriers and removed obstacles for women in the workplace,' says Professor Rudd, 'From the outset, ECU's Vice-Chancellor and I modelled a gender balance in our communications and with other University leaders, we ran staff workshops on all campuses, which enabled meaningful and honest conversations on how things could be done better to improve gender parity at a grass-roots level.'

Professor Rudd says the outcomes of the process have transformed ECU and are already having a positive impact on staff members. One ECU staff member said 'As someone who has returned to work this year from parental leave, I think it's brilliant that ECU has been very inclusive, thoughtful and a leader in providing support mechanisms to encourage and make it easier for women to return to work. I really like where ECU is heading with encouraging and supporting women to pursue their careers whilst supporting them should they choose to take a career break.'

The SAGE Athena SWAN process has also has a profound personal impact on Professor Rudd. 'It's given me more confidence and courage. We have been brave in revealing our weaknesses and gaps, and it has served to make us stronger as a whole and so my personal pride in ECU has skyrocketed. I've also finally knocked the imposter syndrome on the head!' says Professor Rudd.

'Leaders set the tone for workplace culture and at ECU, the leadership has been at the centre of its gender equality movement. In order for there to be true equality, the expectation needs to be set where it is clear that people will be treated equally and ultimately it is the leadership that sets these standards through what they prioritise, profile and resource,' says Professor Rudd; 'at ECU, it is not our role simply to elevate the voices of women at our University but to also ensure they are heard across boundaries, having sector-wide impact across STEM culture.'

ACTION AREA:
MAKING WOMEN IN STEM VISIBLE

Outcome: Girls and women see STEM education and careers as viable and interesting paths and understand the opportunities of STEM for their futures.

WHY FOCUS ON VISIBILITY?

As a nation we are all responsible for shaping the society in which we live. We must work together to change attitudes, beliefs, behaviours and perceptions to ensure that all Australians have the opportunity for rewarding, high income jobs in workplaces that value the talent and skills of their people, regardless of gender or background.

At the heart of this is ensuring women in STEM, from a diversity of backgrounds, are visible and that STEM studies and careers are seen across our society as a positive and relevant choice for all young women in Australia. Recent research by Professionals Australia showed that a majority of Australian women in STEM professions reported that a lack of role models and women in senior positions presented an obstacle to career advancement.[55] Increasing visibility of positive female role models in STEM, whether on the screen, in the classroom or at work, will help girls and women to see STEM as a viable and attractive career option.

Creating an Australian culture that supports the participation of all in STEM will help to counter the prevalent view that scientists are only 'white haired men in lab coats' and will help all Australians understand the range and nature of STEM careers – from astronomers studying the furthest stars, those working in laboratories to develop future vaccines, the engineers collaborating on the production of bionic limbs, to the forensic scientists helping to solve crimes.

Facilitating a greater visibility of the opportunities in STEM, the amazing women already working across the sector and creating strong role models will help to address the bias and stereotyping that currently exists in our system. The Government is committed to driving this cultural change, in partnership with the broader STEM community, to support greater participation in STEM.

SUPERSTAR SCIENTISTS

Science & Technology Australia's 'Superstars of STEM' program is helping to raise the profile of the nation's female scientists to inspire the next generation.

Tien Huynh, is a senior lecturer at Royal Melbourne Institute of Technology (RMIT) specialising in plant biotechnology and environmental sustainability. Dr Huynh, a participant in the first cohort of superstars, says she joined the program to gain knowledge and experience to use social media and online technology to communicate her passion for nature and science to the world, particularly ethnic minorities who make Australia the multiculturally diverse community it is.

'The benefits were more than I ever expected, from features on SBS world news that had international reach, Nature magazine that led to collaborations with world leading researchers, and segments on Gardening Australia leading to invitations as an honoured guest and speaker with top ranking Indian universities. I also had my documentary from the 8-Percent Productions shown on Virgin airlines for 3 months, and was praised in the most widely circulated newspapers in Vietnam and India such that hotels treated me like a celebrity,' says Dr Huynh.

Ronika Power, a Macquarie University Associate Professor of Bioarchaeology – the study of living things from the ancient world – and fellow participant in the program, says that the program provides the opportunity to learn about how to communicate across platforms and with different audiences to inspire and connect with people across Australia.

'I built a strong social media presence; received accelerated promotion at work; gave a TED talk and public lectures; participated in meetings with the Prime Minister and other national and international politicians, and received invitations to serve on national and international advisory boards at high-profile institutions – all due to my participation in the Superstars program,' says Associate Professor Power.

Dr Huynh, who came to Australia as a 6 year old girl as a refugee seeking asylum from the Vietnam War, 'plans to build on the momentum internationally and pass forward my knowledge to girls and young children in underprivileged communities in rural Australia and developing nations in Asia. There is still much inequality in the world and I am determined to change that.'

'Coming from a traditional patriarchal society, girls were trained from birth that we were inferior, to be seen but not heard. Having visible and positive role models in any field changes that perspective so that we are valued as significant contributors to the family, society and the world,' says Dr Huynh, 'STEM constitutes such a substantial input in our lives and it should be promoted so that girls can see the opportunities available and how rewarding a career it is.'

Associate Professor Power says, 'The Superstars of STEM program seamlessly aligns with my life's purpose: to make the world a better place by inspiring people of all ages and backgrounds – especially women and girls – to participate in education, mentorship and knowledge exchange in academic, professional and personal contexts.'

Superstars of STEM doesn't just benefit the women who participate in the program, 'it also benefits the thousands of young women and girls with whom we interact and influence across Australia,' says Associate Professor Power, 'in the absence of positive female role models in STEM, we compromise the possibility of best outcomes not only for women and girls, but for everyone in all aspects of society.'

ACTIONS

In October 2018, the Government announced that award-winning astrophysicist, Professor Lisa Harvey-Smith, would take up the role as Australia's inaugural ***Women in STEM Ambassador***. The Women in STEM Ambassador is charged with advocating for greater gender equity in STEM, providing advice on issues affecting girls and women in STEM, and increasing visibility of girls and women in STEM education and careers. The Ambassador will play a large role in helping to shape an Australian culture that recognises the need to encourage girls and women into STEM.

From 2019, the Government will work with the Ambassador on a ***digital awareness raising initiative*** to reach young Australian women on the importance of STEM to their future. The Government is committing $1.5 million to the initiative from 2019-20 to 2021-22, to change the broad public perception of women in STEM by reducing stereotypes and gender bias around STEM education and careers, and will look to engage other players in the STEM sector in support of the initiative.

Complementing the Ambassador's role, Science & Technology Australia's (STA) ***Superstars of STEM*** initiative, originally supported under the Women in STEM and Entrepreneurship (WISE) grants program, is inspiring girls and women in schools, universities and workplaces around the country through increasing visibility of women working in STEM. The first cohort of Superstars reached more than 7800 high school students, and 70 per cent of the Superstars reported new opportunities for career progression as a result of the program. In March 2018, the Government announced it would provide an additional $1.3 million funding for a second phase of Superstars of STEM, which has doubled the number of women participating in each cohort to 60 participants and extended the program for an additional four years. The 2019 cohort includes women from Australian universities, research institutes, government and PFRAs.

Other Government initiatives such as those delivered by Questacon or the CSIRO's STEM Professionals in Schools, are actively showcasing women STEM professionals in order to demonstrate the diversity in STEM roles and the people who work within them.

A CHAMPION FOR STEM EQUITY

As Australia's first Women in STEM Ambassador, Professor Lisa Harvey-Smith, is at the forefront of the Australian Government's efforts to increase visibility and encourage girls and women to study and work in STEM. She is ideally positioned to work at a national level to build relationships and act as a unifying force across the sector.

Professor Harvey-Smith is an award-winning astrophysicist, a prolific and talented science communicator, and committed to enhancing public understanding of science.

'Having worked as an astrophysics researcher for the past 15 years, I was acutely aware of the issues that can create barriers to women in STEM. I have strived for many years within my workplaces and professional communities to create cultural and structural changes that make STEM better for all,' says Professor Harvey-Smith, 'but when the Australian Government's Women in STEM Ambassador position was announced, a unique opportunity to change the world presented itself. I simply couldn't resist.'

'Australia needs a Women in STEM Ambassador to advocate for cultural change in STEM workplaces, to enhance the visibility of role models and to support and encourage young women to engage with STEM education,' says Professor Harvey-Smith.

'In this role, I will focus on raising awareness of the barriers faced by Women in STEM and bringing together evidence-based best practice and advice to organisations that will enable them to reduce barriers for women and under-represented groups,' says Professor Harvey-Smith, 'I will work across government, education, academia and industry to catalyse social and cultural change.'

'I hope that in the future women are able to fully participate in STEM to strengthen Australia's research, scientific and business capability and receive equal pay and recognition for their achievements,' says Professor Harvey-Smith, 'that systems will support women to stay in STEM careers, obstacles to career advancement will be removed. And that all girls will have the self-belief and encouragement to pursue STEM study and access opportunities.'

CONCLUSION

The Australian Government is committed to supporting greater gender equity in STEM and has put in place initiatives that will help shape a more gender equal future in the STEM sector.

Advancing Women in STEM articulates the Government's commitment to continuing action to achieve equality across the STEM sector. This sits alongside the Women in STEM Decadal Plan, which has set out a ten year roadmap to support the STEM sector – government, industry, research and education – in working together to address the underlying causes of gender inequity.

Bridging the gap between the participation rates of men and women in STEM will not happen overnight. It requires long-term commitment to action. It will take a change in our culture to recognise the integral place of girls and women in STEM. This is not about pushing girls into a STEM career – it is about creating freedom of choice and ensuring our systems, institutions and workplaces support this choice. Helping all Australians understand this – and the opportunities that success in this area will provide – is a key priority of the Government.

The opportunities Australia stands to gain from increasing the representation of women in STEM are extensive. The evidence has shown that gender diverse businesses are more productive and prosperous, and industries with access to more employees with STEM skills are more adaptive and innovative, vital traits as we transition into the economy of the future.

However, the benefits go far beyond the economic. Through removing the systemic cultural and institutional barriers in these sectors, Australia as a whole will become a more confident and capable global presence, one whose entire population is equipped with the essential skills to succeed and excel in the future.

STEM knowledge and skills are the pathway to more efficient services, individually tailored products, advances in resource management, improved personal and national security, better education and care – ultimately, a more sustainable and resilient society that all Australians will benefit from in their daily lives. As long as half of the population is being held back from exploring and applying their abilities and celebrating their achievements in STEM, Australia is also being held back from reaching its full potential.

Advancing Women in STEM will continue to guide the Government's activities in STEM gender equity, ensuring that we focus on those initiatives with real, long-term impact. Only in this way can we truly make a difference.

DEFINITIONS

Equality – Gender equality refers to the equal rights, responsibilities and opportunities of girls and boys and women and men.[56]

Equity – Equity is fairness of treatment, regardless of gender, according to respective needs. This may include equal treatment or treatment that is different but considered equivalent in terms of rights, benefits, obligations and opportunities.[57] Through gender equity, gender equality is possible.[58]

STEM – We take STEM – science, technology, engineering and mathematics – to include the natural, physical and life sciences, mathematics, engineering, ICT and technology related disciplines. However, we recognise that there is no line that clearly divides STEM from non-STEM fields or jobs, and that many different occupations require or make beneficial use of STEM skills. References to STEM do not include or exclude any particular field unless clearly specified.

STEM sector – The STEM sector includes all organisations involved in work, research or education in STEM disciplines, including, but not limited to, universities, vocational education providers, STEM industry and schools.

Women – The term women (including girls for minors) encompasses cisgender (personal gender identity corresponds with sex assigned at birth), transgender, non-binary and intersex persons who identify as women (girls).[59]

INFOGRAPHIC EXPLANATORY NOTES

1. **Student Edge, 2019, *Youth in STEM Research*, published 8 March 2019.**
   https://www.industry.gov.au/data-and-publications/youth-in-stem-research

   The Department of Industry, Innovation and Science commissioned a survey to be carried out by Student Edge on young Australians' attitudes towards and perceptions of STEM. The survey asked more than 2000 students, aged between 12 and 25 years old, questions to establish a national benchmark of young Australians' awareness and perception of STEM subjects and careers, and particularly focuses on the difference between male and female students. Results were weighted to ensure the population of interest was accurately represented, and respondents came from all states and territories across Australia.

   Students were asked about their level of interest in specific STEM subjects. More than 1800 students from across high school and university responded, with results indicating that female students have significantly lower interest across science, technology, engineering and maths. A similar number of responses to the question 'how confident do you feel that you can study and get good results in each of the following subjects?' showed that boys and girls have similar levels of confidence in science and maths. However, girls have significantly less confidence in technology and engineering.

2. **Student Edge, 2019, *Youth in STEM Research*, published 8 March 2019.**
   https://www.industry.gov.au/data-and-publications/youth-in-stem-research

   More than 1000 female students from across high school and university responded to the question 'Thinking about getting a good job in the future, how important do you believe it is to have knowledge and skills related to each of the subjects that make up STEM?'. Responses indicate that girls see technology as the most important subject to study for gaining future employment, with 86 per cent stating it is 'very' or 'somewhat' important. Girls see engineering as the least important with only 54 per cent stating it is 'very' or 'somewhat' important, significantly lower than male students with 65 per cent.

3. **Student Edge, 2019, *Youth in STEM Research*, published 8 March 2019.**
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   The National Assessment Program – Literacy and Numeracy (NAPLAN) is an annual assessment for all Australian students in years 3, 5, 7 and 9. The numeracy component tests students in number and algebra; measurement and geometry; and statistics and probability. NAPLAN has an achievement scale with ten "bands", which represent increasing complexity of knowledge and skills. Six of the bands are used for reporting student performance at each year level. The year 3 report shows bands 1 to 6, the year 5 report shows bands 3 to 8, the year 7 report shows bands 4 to 9, and the year 9 report shows bands 5 to 10. The highest recorded achievement band is Band 6 for year 3 and Band 8 for year 5. Data shown reflects the proportion of students achieving in or above these bands, split by gender.

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   https://www.ncver.edu.au/research-and-statistics/vocstats

   Department of Education and Training cube data are based on selected higher education micro data collected through the Higher Education Statistics Collections. Cube data records students who have requested their gender to be recorded as neither male nor female as female. University data refers to domestic graduates in STEM degrees. Undergraduate completions data includes: Bachelor's Graduate Entry; Bachelors Honours and Bachelor's Pass degrees. Postgraduate completions data includes: Doctorate by Coursework; Doctorate by Research; Higher Doctorate; Masters by coursework; Masters by research. Vocational educational data refers to all completions in STEM courses. Total VET Activity refers to Total VET Activity for STEM vocational education completions. Broad STEM fields of education included in analysis: *Natural and Physical Sciences*, *Information Technology*, *Engineering and Related Technologies*, *Agriculture Environmental and Related Studies*.

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   Refer to https://www.chiefscientist.gov.au/2016/03/report-australias-stem-workforce/ for STEM qualifications included in analysis.

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