Women, policy and the STEM pipeline: Bridging the gap between tertiary education and the workforce for female STEM students

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Executive Summary

Science, Technology, Engineering and Mathematics (STEM) have become fundamental to the technological development, industrial growth and economic success of any country as the world has transitioned into an age of automation. With this change, we have seen a shift in labour workforce participation, working arrangements, and the creation of new jobs and sectors of employment. While some would argue that technological advancements within STEM industries have increased productivity and innovation, policymakers are increasingly being tasked with addressing the consequences which have arisen from societies reliance and dependency on automation in the workplace (Workplace Gender Equality Agency 2020). An important area identified by the Australian Government is the education sector. As today's STEM graduates will "have to resolve tomorrow's problems in a world that is, as never before, progresses much more rapidly" (Madra & Cherotich 2016, p. 8), it is encouraging to see the growing number of initiatives implemented by the government that addresses STEM in relation to education (Panozzo 2020). Importantly, the Australian Government began to recognise that women are being unfairly impacted by technological advancements in the workplace which is causing the under-representation of females in STEM fields. This is commonly encapsulated by the use of the STEM pipeline metaphor, in which the retention of STEM graduates upon entry into the workforce requires active engagement with students throughout their entire education. This pipeline is essential for workplace diversity and workforce development, to ensure enough qualified candidates are available to work in the country's technologically evolving STEM industries. Thus, it is essential that female participation in STEM increases under government policy, so the available workforce may be efficiently utilised. Failure to retain women in STEM fields has been referred to as the 'leaky pipeline', in which high rates of attrition occur at the stage of higher education completion and career transition. While policies such as the Governments 'Advancing Women in STEM Strategy', and consecutive '2020 Action Plan', address these concerns for the future of women at work, the following report identifies several limitations in the Department of Industry, Science, Energy and Resources approach. As such, this report will conclude by outlining three policy aims and several policy recommendations to engage women and increase their participation across STEM fields. These include implementing intermediate steps between phase one and two of the government's 2020 Action Plan, increasing engagement with the tertiary education sector under phase one of the 2020 Action Plan, and increasing the overall budget of the 2020 Action Plan. As Madgavkar et al. (2019) aptly recognise, these "concerted and creative new solutions are needed to enable women to seize new opportunities in the automation age; without them, women may fall further behind in the world of work". Policies such as the 2020 Action Plan have the capacity to break down barriers for women in STEM, whilst opening up new economic opportunities, and helping women participate meaningfully and effectively in the workforce and education sectors.

Introduction

In an age where new technologies are dramatically transforming how we work and engage with the global economy, the STEM field is now regarded as an essential sector and career pathway. Advancements in automation have created new opportunities for businesses and governments. However, it has also established new challenges for women (Stone & Vogelstein 2019). While STEM careers hold tremendous promise for women globally, ongoing institutional gender barriers continue to prevent women from reaching their full potential in the field. Literature on the low representation of women in STEM often refers to a 'leaky pipeline', in which women systematically leave STEM vocations at various points along the education and career ladder due to gender inequities (Madra & Cherotich 2016, p. 9); (Department of Industry, Science, Energy and Resources 2021). Hence, new policies are required to address the retention of women in STEM, specifically at the intersection between higher education completion and career transition. In an Australian context, the Government continues to insist that STEM education is of critical importance for our current and future productivity, as well as for "informed personal decision-making and effective community, national and global citizenship" (Department of Education, Skills and Employment 2020). Similarly, the Government maintains that they are "committed to improving the STEM skills of young Australians to ensure that they have the skills they need to live and work in a globalised world" (Department of Education, Skills and Employment 2020).

As a result, in 2019 the Australian Government released the Advancing Women in STEM Strategy. This framework established the government and related sector's respective commitments to improving gender equity in STEM in Australia (Department of Industry, Science, Energy and Resources 2021). The following year, the government announced their '2020 Action Plan', which identified early priorities arising from the Strategy. Under the 2020 Action Plan the Australian Government outlined a coordinated approach to achieving sustained increases in STEM gender equity. This was separated into three action areas: 1) Enabling STEM potential through education, 2) Supporting women in STEM careers, and 3) Making women in STEM visible. The following policy analysis will focus on the first two action areas.

While the Australian Government claims that their strategy has already contributed to change in STEM systems, institutions and workplaces in promotion of gender equity, they have outlined that by 2030 the action areas will further ensure "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", whilst "Australian STEM workplaces support the active recruitment and retention of women in STEM roles at all levels" (Department of Industry, Science, Energy and Resources 2021). However, when reviewing the Action Plan, it is apparent that there are significant gaps in the policy. With high rates of attrition amongst Australian women between the completion of their tertiary STEM education and entry into the workforce, it is clear that the Government's current policy is failing to address a crucial point in the STEM pathway. Instead, the 2020 Action Plan continues to address gender equity in STEM careers and education as separate issue areas. Failure to bridge these gaps arguably contributes to the retention of a 'leaky pipeline'.

Using the Government's data-driven approach and culture of evaluation, which are 'key drivers' under the 2020 Action Plan, the following policy analysis will provide several recommendations on how to address these identified limitations. Firstly, the report will analyse STEM higher education, by discussing issues of self-efficacy and the importance of mentoring. Secondly, the report will discuss the STEM workforce in relation to female attrition caused by career insecurity, pay gaps, lack of flexible work arrangements and gender stereotyping. Finally, the third section of the report will outline three policy aims and several policy recommendations regarding the 2020 Action Plan for the Australian Government and related sector's to review. By addressing the weaknesses in the Action Plan, this report aims to recommend policies which can mitigate the high rates of attrition between tertiary education and the workforce for women in STEM throughout Australia. Gender equity and the retention of women in STEM is essential for economic growth in the current age of automation and should be a priority for the Department of Industry, Science, Energy and Resources if they wish to see female educational confidence translate into longer-term career success (Ananthram, Bennet & Bawa 2021).

Section 1
Women and STEM Higher Education

Understanding how women participate in STEM higher education can assist the government and other sectors in providing targeted support for women as they progress through the STEM pipeline, from higher education into the workforce (Department of Industry, Science, Energy and Resources 2021). Across academic literature, government documents and public discussion pieces, issues of self-efficacy and mentoring continue to be raised in relation to female engagement with STEM higher education.

1.1 'Advancing Women in STEM Strategy: 2020 Action Plan': Phase One — Enabling STEM potential through education

Phase one of the 'Advancing Women in STEM Strategy: 2020 Action Plan' addresses 'Enabling STEM potential through education'. More specifically, it aims to support the active inclusion of girls and women in Australia's education system, so they may explore their full STEM potential (Department of Industry, Science, Energy and Resources 2021). Interestingly, under this action area, all three education sectors are targeted using the same strategy. Despite the Australian Government's recognition that attrition is happening at the higher education stage of the STEM pipeline, there is a marginal difference between the approaches taken towards primary, secondary and tertiary education and their engagement with issues of gender equity in STEM. The Department of Industry, Science, Energy and Resources (2021) acknowledge that women often have negative experiences in university environments which contributes to a sense of not belonging in STEM career pathways, further hindering female engagement and performance, and often resulting in students leaving the field. This would suggest that tertiary STEM education requires cultural reform, to remove barriers that are limiting the capacity for women to pursue opportunities in STEM careers. The following statistics, gathered by the Governments STEM Equity Monitor, support this hypothesis.

While employment in STEM-related jobs has been increasing at a rate faster than any other employment sector in Australia, women are still less likely than men to pursue higher education in STEM. As of 2021, women made up 37.3% of undergraduate and 34.6% of postgraduate students in STEM degrees, whilst men made up 62.7% and 65.4% respectively. Similarly, women only account for 20.8% of completed STEM degrees in Australia (Department of Industry, Science, Energy and Resources 2021). In comparison, women comprised 60% of total non-STEM course enrolments and 61% of total non-STEM course completions as of 2018 (Department of Industry, Science, Energy and Resources 2021).

As Australia transitions into a digital and technologically driven economy, STEM knowledge and skills are increasingly regarded as important and invaluable industry resources. With this in mind, gender balance among STEM graduates must be a priority in improving policymaking that targets equity in STEM participation. This would ensure that the entire Australian workforce for STEM industries, regardless of gender, is being efficiently utilised (Department of Education and Training 2016, p. 7). Thus, cultural issues as well as rates of attrition amongst STEM graduates must be addressed if the Government hopes to see a substantial increase in female STEM higher education participation (Department of Industry, Science, Energy and Resources 2021).

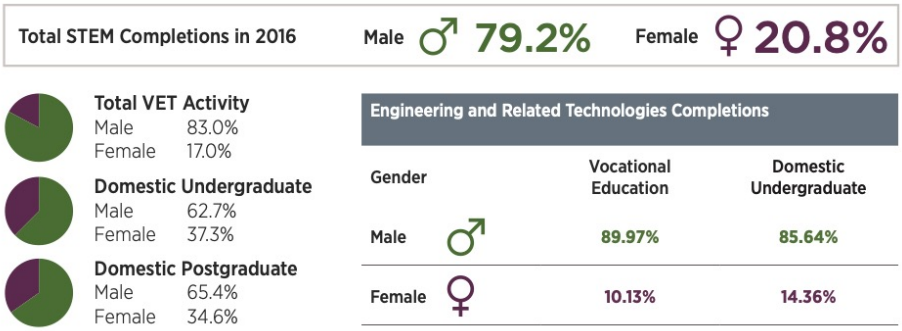


Image: (Department of Industry, Science, Energy and Resources 2021, p. 7)

1.2 Self-efficacy: Gender bias and stereotyping

Discussions regarding women in STEM have previously centred around issues of self-efficacy despite no innate cognitive differences between men and women when studying STEM-related degrees (Office of the Chief Scientist 2016, p. 1). The limited success of women in STEM careers has often been attributed to the perception that women are generally less confident in technical fields (Bennet, Bawa & Ananthram 2021, p. 1). The Office of The Chief Scientist aptly recognises that false perceptions regarding women's aptitude, interests and experience in STEM are holding back progress in science and society more broadly (Prinsley, Beavis, Clifford-Hordacre 2016, p. 1). Accounting for smaller percentages of university graduates across STEM disciplines, it is frequently assumed that women are simply disinterested and inherently less capable than men to successfully pursue STEM degrees. Both conscious and unconscious biases towards women in STEM have deep societal, cultural and institutional roots which continue to impede the capacity of women to confidently engage with STEM disciplines, as they are often marginalised within their degrees from the outset. This continues to impact women throughout their education and has been statistically shown to follow them into the workforce. As there are different preconceived societal expectations for women and men studying STEM degrees, learning experiences and levels of confidence in personal ability are vastly different between the genders (Prinsley, Beavis, Clifford-Hordacre 2016, p.1). Consequently, the Office of The Chief Scientist acknowledges that leaders and institutions must take an active and multifaceted approach to improving equality and diversity to address these systemic issues (Prinsley, Beavis, Clifford-Hordacre 2016, p. 2). Failure to eliminate these stereotypes and biases throughout tertiary education environments will continue to undermine the ability and confidence of women in the field (Office of the Chief Scientist 2016, p. 1-2).

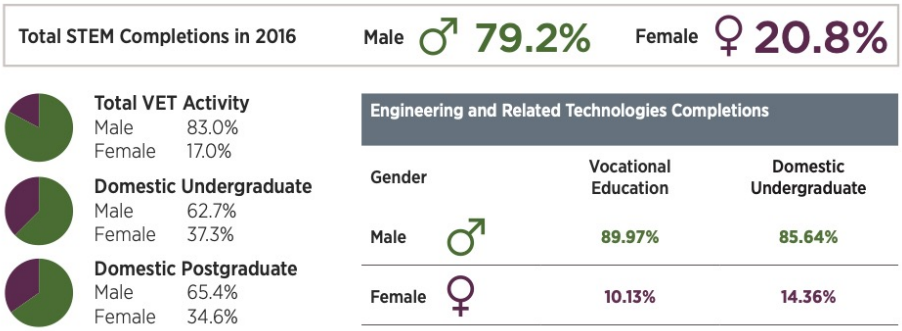
In a study regarding the employability confidence of 12,708 university students throughout Australia, Bennet, Bawa and Ananthram (2021) were able to conclude that female STEM students were no less confident in their abilities than male students. Rather, when addressing goal-directed behaviour, women demonstrated greater confidence than their male counterparts. Similarly, women in STEM degrees reported greater confidence in their problem-solving, decision-making, goal-directed behaviour and occupational mobility than women in non-STEM tertiary degrees (Bennet, Bawa & Ananthram 2021, p. 3). Despite women reporting higher rates of confidence in STEM fields, they are less likely to advance in their careers following the completion of their degree due to a range of external cultural and social factors. Thus, Bennet, Bawa and Ananthram (2021) assert that confidence among "commencing university STEM women is partly the result of the challenges they have already overcome when deciding to enter these male-dominated professions", however, they suspect that women in STEM degrees become aware of and are socialised into environments in which their expectations of career success are diminished (Bennet, Bawa & Ananthram 2021, p. 4). The report concluded that more attention must be paid to the confidence and career development of women in tertiary STEM education, particularly targeting the social cognitive changes in self-efficacy that occurs as a result of gender stereotyping and discrimination. While the study acknowledged that the economic importance of STEM industries has increased the Government's interest in engaging women with STEM disciplines through policymaking, they recognise that gender quotas in higher education are not enough to elicit institutional change (Bennet, Bawa & Ananthram 2021, p. 1). Reducing the gender gap in STEM higher education requires a unified approach from the government, educational institutions and related industries that addresses systemic cultural issues, such as self-efficacy, which are often overlooked. Factors such as these should be viewed as learnt behaviours stemming from gender biases and stereotyping, rather than preconditions of female STEM engagement.

1.3 Importance of mentoring

Several academic studies suggest that the retention of female STEM students in higher education is achievable if women are provided with the necessary support to pursue their education in a male-dominated industry. With a plethora of support services available for tertiary education institutions to implement and government policies to promote, mentoring programs continue to be cited as one of the most effective methods of engagement. By connecting female STEM students with female role models in the industry, it counteracts stereotypes and promotes the notion that everyone has the potential to succeed in STEM fields (Prinsley, Beavis, Clifford-Hordacre 2016, p. 2). It is particularly important at the higher education stage of the STEM pipeline to create an inclusive and supportive cultural environment for women, as this has been known to improve female participation in the sector. As STEM higher education institutions are often spaces where women feel outnumbered, mentoring can help foster a safe environment for women to freely engage with one another. Additionally, mentoring acts as a mutually supportive and positive reinforcement endeavour in which women are able to discuss their educational and professional experiences at different stages of the STEM pathway.

In Male, Gardner, Figueroa & Bennett's (2018) study regarding student's experiences of gendered cultures in STEM workplaces, their research found that female students faced a greater number of challenges in work experience placements than those experienced by male students. These included unconscious bias among supervisors, isolation, and a significant lack of role models. Although students reported that their overall learning experience in the workplace was positive, gendered hierarchies and masculine cultures dominated the organisational space at the expense of marginalising the professional identities of the female students (Male, Gardner, Figueroa & Bennett 2018, p. 361-362). With extremely low representation of women at managerial levels, female students were constantly exposed to "imposed gendered expectations, comments that drew attention to their gender, and requests based on their gender" (Male et al. 2018, p. 361). This marginalisation during work experience placements is a detriment to the retention of women in STEM higher education. The study concluded that educators and employers must pursue inclusivity training to improve the culture of STEM workplaces, whilst also preparing students for gendered work environments (Male, Gardner, Figueroa & Bennett 2018, p. 360). It is here that female mentors would be particularly helpful for students, as they can give practical advice based on their own personal experiences.

Fisher, Thompson & Brookes (2020), similarly found that mentoring has a positive effect on students, with mentees having increased or similar rates of optimism and confidence about a career in STEM by the end of mentorship programs (Fisher, Thompson & Brookes 2020, p. 1163). Without female role models, they argue that masculine cultures will continue to dominate higher education institutions and workplaces, which in turn perpetuates stereotypes and maintains gender imbalances (Fisher, Thompson & Brookes 2020, p. 1155). Fostering positive relationships between female students and female industry professionals has been proven to boost motivation and commitment to tertiary study and career prospects for the former (Ananthram, Bennet & Bawa 2021). The only limitation to this approach is that only 17% of STEM professors throughout Australia are women (Prinsley, Beavis, Clifford-Hordacre 2016, p. 2). Thus, mentoring programs at the stage of higher education in the STEM pipeline will have to heavily rely on external industry professionals to partner with female students.



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Section 2
Women and the STEM workforce

Evaluating graduate employment outcomes for STEM-qualified women provides valuable insight into factors that continue to impede women's progression and retention in STEM industries (Department of Industry, Science, Energy and Resources 2021). It is at this stage in the STEM pipeline that attrition is at its highest rate, making tertiary education completion and career transition a priority for policymakers.

2.1 'Advancing Women in STEM Strategy: 2020 Action Plan': Phase two — Supporting Women in STEM Careers

Phase two of the 'Advancing Women in STEM Strategy' targets 'Supporting Women in STEM careers'. This action area focuses on supporting the active recruitment and retention of women in STEM roles at all levels (Department of Industry, Science, Energy and Resources 2021). The Department of Industry, Science, Energy and Resources have stated that "understanding women's participation in STEM-qualified occupations and the STEM research workforce is critical to building an inclusive and diverse workforce that is positioned to take full advantage of the jobs of the future" (Department of Industry, Science, Energy and Resources 2021), which they see as increasingly important as STEM skills are now regarded as widely valued and applicable across multiple occupations and industries. As of 2019, only 14% of women were in STEM-qualified occupations, in comparison to 50% in non-STEM occupations (Department of Industry, Science, Energy and Resources 2021). While the percentage of women participating in STEM-qualified occupations has increased by 3% between 2009 and 2019, this is still a proportionally low figure for the country's technologically driven economy (Department of Industry, Science, Energy and Resources 2021). To address these figures, phase two of the 2020 Action Plan is using a data-driven approach to measure progress in STEM workplace gender equity. This includes the voluntary reporting of public sector organisations which have under 100 employees from 2021-2022, to evaluate and compare institutional practices and publicly report on the industry's progress. It is the intention of the Workplace Gender Equity Agency to highlight how STEM-qualified industries are responding to gender pay gaps and workplace inequalities (Department of Industry, Science, Energy and Resources 2021).

An in-depth assessment of the Workplace Gender Equality Agency initiative suggests that the Government recognises that at the intersection of gender and technology workplace inequalities persist (Workplace Gender Equality Agency 2020). While the future of the Australian workforce stands to benefit from advances in technology, the under-representation of women in STEM impacts how society interacts with technology, entrenches gender biases, and exacerbates existing workplace inequalities. Consequently, the Workplace Gender Equality Agency are seeking to remedy under-representation, to ensure women and their careers are not displaced amidst technological advancements. In their publication "Future of work: where technology and work intersect", the government agency highlights that the lack of women in STEM industries has already led to biased technological design and function. Certain technologies now operate differently and less effectively for women, as men continue to dominate design occupations. For instance, it is alarming that cars and seat belts are modelled off male physiques, whilst everyday software such as voice recognition can more easily identify a male voice over a woman's. Recent report's published in the United States further claim that as facial recognition software is predominantly designed by Caucasian men, females of colour are often 'unidentifiable'. As women are regularly expected to work with ill-suited technology, the Workplace Gender Equality Agency argue that this puts women's productivity, safety and health at risk. As such, occupational adjustments should be a priority in the workplace. By investing in women's education and training, organisational priorities may be realigned to ensure gender equality in the workplace. While this should occur both within and outside of the STEM sector, it is particularly important that this industry addresses the concerns identified above. With some of the countries lowest rates of workplace retention and career progression amongst women, the STEM industry requires extensive reform to ensure that measures aimed at women's education and skill-building, flexible working arrangements, and increased access to technology which benefits women in the workplace are appropriately implemented (Workplace Gender Equality Agency 2020).

It is well-established that women are the minority in Australia's STEM workforce, which is why it is to be expected that women with STEM qualifications experience poorer employment outcomes than men (Office of the Chief Scientist 2020). The Department of Industry, Science, Energy and Resource emphasise that working conditions and job insecurity have a strong negative impact on women entering into and maintaining careers in STEM (Department of Industry, Science, Energy and Resources 2021), which are long standing issues that have been inadequately addressed by current policies. Female STEM employees encounter less flexible working conditions, a greater number of short-term contracts, and career promotions that can be subject to gender bias. Similarly, the Office of the Chief Scientist reiterates that these systemic challenges faced by women in STEM, plus issues of gender discrimination and sexual harassment in the workplace, are the direct cultural and institutional causes of attrition in the industry (Office of the Chief Scientist 2020, p. 200). These barriers continue to limit female engagement, participation and retention in STEM industries, at the detriment of effective technological development and workplace diversification.

2.2 Issues of Attrition

Extensively discussed in relation to women in STEM industries, attrition refers to the gradual reduction of a workforce without employees being fired or laid-off. Rather, it is a process in which staff resign, retire or are replaced in their field of work. Academic research regarding the retention and progression of women in STEM careers often cite attrition in the industry as an international phenomenon. In the Australian context, female attrition in STEM is increasingly occurring at the point between tertiary education completion and career transition. Dockery & Bawa (2018) argue that women entering the STEM workforce face substantial challenges in their career paths, including issues regarding their wages, job prospects, progression, and job-security (p. 128). This continues to prevent women from reaching higher levels of STEM professions. As of 2015, only 12% of women in STEM fell into the top income

bracket, despite 75% of the fastest growing occupations requiring STEM skills (Professionals Australia 2015). There is a significant lack of information regarding the experience of women in the STEM labour market which is essential for government policy (Dockery & Bawa 2018, p. 126). Dockery & Bawa (2018) are critical of the government's priority to only target women and their participation as an approach to improving STEM workplace practices. It is their belief that this should be accompanied with cultural reform programs which facilitates "dominated STEM-based workplaces to be more equitable to women and more family friendly in order to fully engage women in STEM" (p. 128).

Concerningly, a survey conducted in 2015 by Professionals Australia, noted that women in STEM regarded balancing work/ life responsibilities, workplace cultures and a lack of access to senior roles as the greatest barriers to their career advancement (Dockery & Bawa 2018, p. 129). The study reported that 37.9% of the respondents, who were all female, said they felt they had to "become one of the boys" if they wanted to fit into their workplace, whilst 55.5% of respondents agreed that in the STEM industry women have to prove themselves whereas men are assumed to be capable (Dockery & Bawa 2018, p. 130). Professionals Australia found that women who gain a university degree in a STEM related field are less satisfied with their employment opportunities and feel that their skills are poorly utilised (Dockery & Bawa 2018, p. 145). It is concerning that women face these realities before they enter the workforce, and that once employed, respondents report that 51.6% were subject to discrimination during their employment (78.8% of these on the basis of gender), 25.8% were subject to sexual harassment, and 42.1% were subjects to bullying by employers and co-workers (Dockery & Bawa 2018, p. 130). These statistics are both alarming and detrimental to the retention of women in the STEM industry. Professionals Australia's (2015) aptly titled report 'Stemming the tide: Addressing the attrition of women from the STEM workforce' emphasised that "despite demand for STEM skills and the difficulties that employers face in recruiting and retaining key STEM staff, strategies to attract, retain and promote women professionals may be hampered by cultural barriers, inflexible working practices, systemic bias in advancement strategies" (Professionals Australia 2015). They claim that these barriers and obstacles to equal participation in the STEM workforce are day-to-day issues, and that entrenched systemic biases must be eliminated if working conditions for women are to improve (Professionals Australia 2015). Only when an equitable environment can be assured for women entering the workforce will the industry see a difference in rates of participation, engagement and retention.

Multiple academic sources have similarly postulated that women are less likely to pursue a career in STEM knowing that they will have to work in a male-dominated unsupportive workplace culture whilst experiencing persistent earning disadvantages (Xu 2017, p. 6). Xu (2017) insists that it is STEM workplace cultures, structures and practices that continue to impose masculinised expectations of female graduates, ultimately leading to attrition (p. 6). Despite evidence suggesting that women are well-prepared throughout their higher education to enter a male dominated workforce, isolation and marginalisation impedes job satisfaction and progression (Xu 2017, p. 14). Thus, Xu (2017) suggests that employers need to play an increasingly prominent role in the effort to prevent women's attrition in the STEM industry at the point of higher education completion and employment transition. Government policy should aim to inform employers about the "long-term benefits of increasing women's presence in STEM fields as well as in the overall STEM labour supply" (p. 17). As roughly one out of five women with a STEM degree (22.4%) work in an industry not related to their undergraduate course, the current workforce is not reflective of the supply that is currently available throughout Australia (Xu 2017, p. 16). Failure to effectively utilise and fully engage this sector of the STEM workforce could be detrimental to multiple industries and equitable technological advancements.

Lastly, Pearson (2019) poignantly recognises that it is not that women prefer other fields of study or occupation, but rather, that they will not feel welcome in STEM fields. As the STEM industry is already 'top-heavy' with men, the masculine culture that accompanies this makes STEM careers unappealing to women at every stage of the pathway.

Section 3
Policy aims and recommendations — fixing the 'leaky pipeline' for women in STEM

Based on the discussion and analysis above, the following aims and recommendations are made for the Australian Government and Department of Industry, Science, Energy and Resources to adapt the current Advancing Women in STEM Strategy: 2020 Action Plan to address the identified limitations. These have been heavily inspired by the South Korean Government's Basic Plan for Fostering and Supporting Women in Science and Technology implemented in 2004 (Lee 2010, p. 6). While the overarching policy aim is to mitigate high rates of female attrition from STEM fields at the transition from university to employment, the following section outlines three policy aims specifically targeting the 2020 Action Plan, followed by several policy recommendations to be enacted using an organisational development strategy.

Policy aims:

1. Implement intermediate steps between phase one and two of the 2020 Action Plan

To address the 'leaky pipeline', the assessment above concludes that the Australian Government cannot focus its energy in one place alone. Rather, they must consider how they can create a supportive and inclusive professional environment in which women in STEM can flourish upon entry into the workforce. This policy aim will require collaboration and holistic, strategic effort across the entire STEM pathway, to ensure higher education institutions and STEM businesses contribute to reform. This will require the Department of Industry, Science, Energy and Resource to refrain from creating policy responses under the 2020 Action Plan that deal with issues of women in STEM education and careers separately as they have in the past. The following policy recommendations prioritise the retention of women's participation in the STEM workforce through the use of adaptive measures.

Policy recommendations:

a. Establish an 'Institute for Supporting Women in STEM', modelled off the South Korea Institute for Supporting Women in Science and Technology (Lee 2010, p.8 — 9).

- Work in partnership with the Science in Australia Gender Equality (SAGE) initiative.
- Aim to foster and support female STEM graduates by "carrying out research in policy development; education, training, and consulting with women in STEM; providing information on employment" (Lee 2010, p. 8-9).

b. Make inclusivity training mandatory upon entry into the STEM workforce.

- Ensure STEM businesses with over 30 full-time staff members designate a senior officer in charge or female employees (Lee 2010, p. 6-7).

c. Implement a recruitment target system for STEM graduates.

- Aim to increase recruitment into the STEM workforce by 30% by 2022 (Lee 2010, p. 6).
- Make reporting hiring data to the STEM Equity Monitor mandatory for STEM businesses each financial year.

d. Reiterate commitment to measures that "increases women's participation and retention in STEM professions at the workplace and workforce levels to support gender-based STEM education initiatives" (Professionals Australia 2020, p. 145).

2. Increase engagement with the tertiary education sector under phase one of the 2020 Action Plan

While it is recognised that increasing tertiary enrolment in STEM degrees is important to the industry, it is essential to the success of the 2020 Action Plan that the Government moves past using quotas as core signifiers of policy success. The current policy is skewed towards prioritising secondary education, whilst the attention given to the tertiary sector is limited to targeting female enrolments rates in undergraduate STEM degrees. To address this oversight, the following policy recommendations incapsulate a participatory development approach to design and implementation, ensuring that university institutions, female students and female STEM mentors are engaged across the entire process. By consulting these stakeholders as equal partners with a significant say in decisions concerning their education and career pathways, women may be adequately prepared for STEM workplace cultures, whilst men may be taught what the new standards and expectations are for an equitable STEM workforce environment.

Policy recommendations:

a. Divide and create distinct programs for primary, secondary and tertiary education sectors under phase one of the 2020 Action Plan.

- Strengthen the STEM-education system to support teaching and learning on a national scale by addressing different levels of education separately (Professionals Australia 2020, p. 10).

b. Create and fund a government led mentoring program which links tertiary students with workforce leaders.

- Work in partnership with STEM businesses.
- Promote student leadership opportunities under the mentoring program by targeting university student unions (Xu 2017, p. 16).

c. Develop a tertiary level inclusive curriculum for STEM degrees.

- Aim to reform current understandings of and interactions with STEM workplace culture (Male, Gardner, Figueroa & Bennett 2018, p. 361).
- Include a compulsory internship placement in the last year of tertiary STEM degrees.

3. Increase the 'Advancing Women in STEM: 2020 Action Plan' budget.

These measures will be difficult to implement without an increase in budgetary funding. To ensure that these policy recommendations are effectively implemented, the Government needs to display a commitment to the equity of women in STEM. The current $4.5 million (Department of Industry, Science, Energy and Resources 2019) allocated to the entire Advancing Women in STEM strategy is comparatively small to other education and industry policies such as the Revitalising TAFE Campuses Across Australia Initiative which the Government has committed $50 million to from 2020-22 (Department of Education, Skills and Employment 2021). It is even smaller when compared to budgets such as Australia's $270 billion 10-year defence budget. While there are multiple government strategies that address issues of employment, tech development, and women, that operate in support of and parallel to the 2020 Action Plan, there is currently no approach which specifically targets systemic biases and cultural inequities within this sector. As such, there is minimal funding directed towards these causes of attrition, which must be rectified to ensure the policy is part of a long-term approach to increasing women's participation in STEM.

Policy recommendations:

a. Allocate exclusive research funds for female STEM students in tertiary degrees (Lee 2010, p. 8).

b. Introduce compensatory incentives for women studying STEM tertiary degrees.
   - Fund scholarships that meet the cost of studying in STEM courses.
   - Offer tax breaks to students who require the Higher Education Contribution Scheme and associated Higher Education Loans Program (HECS-HELP) (Dockery & Bawa 2018, p. 145).

c. Review the STEM Equity Monitor to ensure funds are being allocated to the appropriate sectors and initiatives under the Action Plan.
   - Create next steps for the 2020 Action Plan that use the Equity Monitor's statistics to enact a cultural adjustment strategy.
   - Pursue further statistical and analytical research in the field, to develop interventions that will address issues female STEM students and professionals continue to endure (Fisher, Thompson & Brookes 2020, p. 1164).

Conclusion

The Australian Government's Advancing Women in STEM strategy and subsequent Action 2020 Plan are strong foundations for pursuing female engagement in the STEM education and workforce sectors. However, as the analysis above has emphasised, there are several limitations to the current approach being taken by policymakers. High rates of attrition amongst women in STEM is particularly apparent between tertiary education completion and career transition. Failure to address the gaps identified in the government's strategy and action plan will contribute to the retention of a 'leaky' STEM pipeline. As such, this report has outlined several strategies to reform the 2020 Action Plan. By implementing intermediate steps between phase one and two, increasing engagement with the tertiary education sector under phase one, and increasing the overall budget of the 2020 Action Plan, the Australian Government and Department of Industry, Science, Energy and Resources may strengthen their approach to female engagement and participation in STEM. This is essential as the Australian workforce transitions into an age of automation, in which STEM knowledge has become increasingly fundamental to technological development, industrial growth and economic success. Significant adjustment must be made to the 2020 Action Plan for systemic biases to be eliminated and cultural reform to occur. Once this has been achieved, women may have the opportunity to participate equitably in the STEM workforce following the completion of their tertiary education.

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