Advancing Women in Engineering and Technology (AWET)

Literature Review

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EXECUTIVE SUMMARY

The purpose of this document is to bring together the literature on women in engineering and technology to explore the barriers they face and to identify potential policies and best practices to address these barriers. The review included a systematic search of the SCOPUS database using agreed terms to identify relevant academic papers as well as a search of the grey literature which was essential in identifying workplace initiatives and best practices. This literature review is the first part of a wider jurisdictional scan aimed at furthering our understanding of the representation and participation of women in the engineering and technology sectors.

There is overwhelming evidence that women are underrepresented in engineering and technology (Sassler et al., 2018). The ‘problem’ of the underrepresentation of women in science, technology, engineering, and mathematics (STEM) has been discussed and examined for more than 30 years (Wall, 2019). Debusschere and colleagues (2017) report the demographics of those in STEM continue to be overwhelmingly White and male, with women and minorities consistently underrepresented in spite of initiatives in schools, colleges and universities, and workplaces, all aimed at increasing the participation of women and underrepresented groups in the sector. The conclusion is that progress has been slow and limited (Kanny et al., 2014; Spearman & Watt, 2013). This lack of progress is problematic for the sector as it continues to expand, and there is a need to grow a skilled and trained workforce. In British Columbia there are projected skills shortages in 31 of the 45 technical occupations (Engineers, Geoscientists, Technologists and Technicians in B.C., 2015). If the sector in BC and elsewhere, is to meet these demands it must address the issue of the underrepresentation of women as they represent a potential talent pool (Corbett, Christine and Hill, 2015).

The literature shows that not all STEM sectors are the same in terms of their representation of women. Wall (2019) reported that women account for over half of those who receive a degree in biological sciences but they are underrepresented in male dominated disciplines including engineering and computing, which tend to offer higher salaries than the biological sciences. Nimmesgern (2016) summarized the situation for women across STEM, noting that fewer women enter the sector, more women leave after university, fewer women are in leading, or in decision making roles, and women are paid less, promoted less and win fewer grants, all compared to men. The underrepresentation of women in STEM starts early in the career pathway. Fewer girls participate in STEM subjects in high school and even less continue to study STEM subjects in university and to enter the workforce (Girl Guides, 2020).

The concept of a leaky pipeline has been used to explain the underrepresentation of women in STEM (Blickenstaff, 2005) by suggesting if enough girls and women enter the STEM pipeline, they will continue to a career within the sector (Bilimoria et al., 2008). While an increasing
number of girls are entering the pipeline, they are not flowing through to careers in STEM, and once in the profession, the leaks continue as women leave the sector. The leaks occur at school when girls choose not to study STEM subjects; when girls transition from high school to post-secondary institutions and decide not to continue with their STEM studies; as women transition to their first jobs; and the final leaks occur, when women who work in STEM decide to leave the sector. To stop the leaks, some initiatives have focused on individual women and provide supports including mentoring, coaching, networking, education and training, career and professional development, leadership development, and special funding and opportunities (Bilimoria et al., 2008). However, despite these efforts, women continue to be underrepresented in engineering and technology.

The literature suggests the reasons women leave engineering and technology are complex and inter-connected and are related to the barriers they experience at all stages in their career pathway. These include:

- negative stereotypes, bias and discrimination which result in women being seen as less – less competent, less valued, and with less career advancement opportunities than their male colleague (Ettinger et al., 2019);
- a lack of supportive policies and supports which leave women feeling left out and unable to participate fully;
- lack of a shared understand with male colleagues failing to recognize the inequities within the sector (Denend et al., 2020);
- lack of workplace survival skills as women enter the workplace as high achievers only to experience a situation in which they are unwelcome. Although they have the technical skills to do the job many do not have the social and management skills necessary to survive and thrive in the sector, and as such, they are ill-prepared for the realities of working in engineering and technology (Gill et al., 2008).

As researchers continue to examine the barriers women experience, increasing attention is being given to the organizational culture which is cited as one of the main reasons women leave the sector (Gill et al., 2017). Organizational culture determines the behaviour that is deemed appropriate and acceptable, and the sanctions for behaviours that are inappropriate and the rewards for effort (HR Tech Group, 2017).

This review identifies a number of supports and initiatives which have been developed to support women in the sector including those based in post-secondary institutions and workplaces. This review focused on best practices within workplaces and identified lessons from diversity and inclusion programs. There is a high level of consensus about the steps organizations should follow if they are serious about increasing the representation of women
(and other groups) and creating more diverse and inclusive workplaces. These include; analyzing the organization to assess where it is in terms of diversity and inclusion; designing a strategy that is tailored to their organization and reflects the current situation and the goals it hopes to achieve; a plan for implementation which has buy-in from leadership and has transparency and accountability; and finally a plan to monitor and review progress so that leadership and employees are aware of successes as well bottlenecks and that the data forms the basis of a discussion about next steps.

This review highlighted the different experiences of women within the sector and showed the importance of bringing a GBA+ lens to this discussion. This approach allows intersectionality to be explored which enables us to understand how multiple categories of difference (Cho and Crenshaw, 2013) work together to influence and impact individuals’ lived experience. These differences or social group identities may include gender, race, age, ethnicity, sexuality, religion, citizenship, ability, and languages. They work together to create multiple, interconnected identities and unique experiences and highlight that experiences of women in the sector are not homogeneous. This understanding is essential to develop strategies and programs that effectively work to address the underrepresentation of women.

Chesler and colleagues (2010) remind those in the sector, that it is not just a matter of time before things improve, it is a matter of effort. A clear message from the literature reviewed is that diversity and inclusion in STEM must go beyond mission statements and policies. It must include intentional and authentic actions that are transparent and measurable, and for which, there is accountability within an organization. Rather than focusing solely on fixing leaks along a pipeline, it is about changing organizational cultures so that women (and other underrepresented groups) feel welcome and valued for their skill set in the same way as other employees and ensuring they have the necessary supports (including mentoring and networking) to help them navigate and thrive in the workplace. The goal is when women enter the STEM sector they stay and thrive similar to their male colleagues. Engendering STEM (2018) cautions that changing organizational culture is no small task but that it can be achieved by small but significant steps that are implemented and sustained.

The best practices identified suggest practical steps that can be taken by those in the sector but cautions that changing workplace culture takes time and requires sustained and consistent effort. Changing workplace culture also requires some challenging conversations if the status quo in engineering and technology is to move in a positive direction. Organizations have to be convinced of the business rationale for making their workplace culture more inclusive. There is significant evidence to show that diverse and inclusive workplaces are more productive, more innovative and that these benefits are seen in their bottom lines. Those in leadership positions must be committed to diversity and inclusion and they must model the behaviour they want to see and to set the expectations and tone for all employees. Leaders have to lay the groundwork prior to implementing a diversity and inclusion strategy so employees are not skeptical and take
it seriously. Finally, the strategy must be owned by the organization and it cannot be the sole responsibility of the human resources department. In smaller organizations, the strategy where there might not be a human resources department, the diversity and inclusion strategy has to be championed by someone in a leadership position who has responsibility for implementation. The literature suggests moving beyond compliance, the diversity and inclusion strategy must be accompanied by meaningful and intentional actions for which there is accountability. Tracking, measuring, and reporting out on progress ensures this happens and keeps diversity and inclusion on the organizational agenda. These steps serve to remind organizations of one of the most important messages from the literature which is that diversity and inclusion are not an event; they are a process.
INTRODUCTION – WOMEN IN ENGINEERING AND TECHNOLOGY

Within the literature on women in engineering and technology, there is widespread agreement that women have, and continue to be, underrepresented in these two sectors (Sassler et al., 2018). The ‘problem’ of the underrepresentation of women in science, technology, engineering, and mathematics (STEM) has attracted considerable attention and has been discussed and examined for more than 30 years (Wall, 2019). Debusschere and colleagues (2017) report the demographics of those in STEM continue to be overwhelmingly White and male, with women and minorities consistently underrepresented in spite of initiatives in schools, colleges and universities, and workplaces, all aimed at increasing the participation of women and underrepresented groups in the sector. The conclusion is that progress has been limited (Kanny et al., 2014; Spearman & Watt, 2013).

This lack of progress is a ‘problem’ for the STEM sector because of a global shortage of people with STEM qualifications and skills that are necessary to tackle the challenges facing society (Gill et al., 2017). Women and other underrepresented groups represent a relatively untapped pool of talent (Chesler et al., 2010). This lack of diversity is also problematic for the sector. Research has also shown that increased diversity and inclusion in organizations supports increased productivity, creativity and innovation (Botella et al., 2019), which ultimately benefits the sector, and makes it more responsive to emerging and future challenges. While there has been some progress, the ‘problem’ of the lack of women and other underrepresented groups in the sector, has not, and will not, go away on its own (Corbett, Christine and Hill, 2015). Buse (2018) states while this is a complex issue, it is solvable. She suggests the way to increase the representation of women and other underrepresented groups is through intentional international action to move beyond compliance with anti-discrimination laws and diversity mandates, so that women in STEM see, and experience a sector that is welcoming.

The purpose of this document is to bring together the literature on women in engineering and technology to explore the barriers they face and to identify potential policies and best practices to address these. This literature review is the first part of a wider jurisdictional scan aimed at furthering our understanding of the representation and participation of women in the engineering and technology sector. This review will provide the context for the subsequent work which includes:

- a data assessment exercise of the Labour Market Insights, Evaluation and Outreach (LIMEO) dataset to explore how this information could contribute to our understanding of women in the sector in British Columbia by incorporating a GBA+ lens in the analysis
a maximum of eight key informant interviews with experts in the sector who will provide a provincial and national lens to explore the issues women in the sector face and to discuss some of the strategies being developed to address these

A maximum of 10 interviews with employers to explore current workplace practices and the barriers organizations encounter in trying to implement diversity and inclusion initiatives to improve the recruitment, retention, and advancement of women in the sector. These interviews will explore some of the recruitment and retention challenges faced by employers in BC

Three focus groups with women in the sector to explore their experiences in the workplace, their pathways to the sector and the reasons why they decide to stay or leave the engineering and technology sectors.

STRUCTURE OF REPORT

This literature review explores what this intentional action to increase the representation of women could entail. It begins by outlining the methodology and then reviews the literature on barriers women encounter in entering, remaining and in developing their careers in engineering and technology. It identifies factors that slow progress and then discusses initiatives that have attempted to “speed-up” and support progress. The review highlights current best practices in terms of initiatives aimed at increasing the participation of women in STEM. The importance of incorporating a GBA+ lens to diversity and inclusion is considered so as to ensure the initiatives meet the needs of the broad spectrum of women in the sector. The review concludes with a scan of current initiatives within the sector aimed at increasing the representation of girls and women in the sector. A brief summary is presented of these initiatives and more detailed information is presented in Appendix B.

Purpose and research questions

The research questions that shaped and guided this literature review are as follows:

(1) What challenges and opportunities for women to develop their careers in the fields of engineering or technology are identified in the literature?

(2) What best practices and initiatives have been developed to include women in engineering and technology?
(3) What factors contribute to a successful diversity and inclusion initiative within this sector? What are some of the key indicators and measures of successful diversity and inclusion initiatives?

(4) What are the major barriers to implementing diversity and inclusion initiatives within the sector? What evidence is there for strategies for addressing these?

(5) What insights does a GBA+ lens provide to the understanding of diversity and inclusion for equity seeking groups within the sector?
METHODOLOGY

LITERATURE SEARCH APPROACH

Scopus database was searched using the search terms outlined in Appendix A. A total of 4,866 literature documents were found from the search. Documents were excluded that were not in English (n=161). To further refine the initial search, we only included those that had one or more of the following keywords associated with the document: female; women; employment; technology; engineering/engineers; women in engineering; STEM/STEM (science, technology, engineering and mathematics); diversity; science; science and engineering; science and technology. 1,969 documents resulted from this refining process.

Two reviewers then screened through the documents, first by examining the title and abstract of the document, and finally by examining the full text. The following exclusion criteria were applied: 1) did not present empirical data or original analysis (i.e., conceptual papers, literature reviews, systematic reviews); 2) field of study is not in engineering or technology; 3) did not address the research questions; 4) did not address women in college or in career levels (i.e., elementary or high school students); and 5) did not focus on engineering/technology field development/advancement challenges, opportunities, and/or initiatives. This process resulted in over 100 papers and reports.

Grey literature

The Scopus search did not result in many relevant initiatives or best practices in the workplace. Thus, a grey literature search was conducted, consisting of governmental and non-profit organization records and information about workplace initiatives. A snowball approach was used to identify additional materials. Some of the organizations we referred to were Engineers Canada (https://engineerscanada.ca/), Society for Canadian Women in Science and Technology (https://scwist.ca/), and Society of Women Engineers (https://research.swe.org/).
RESULTS OF THE LITERATURE SEARCH

The overwhelming majority of the studies returned via the search criterion above, focused on inclusivity and diversity issues of women in the fields of engineering and technology in the post-secondary setting. A smaller proportion of academic studies focused on women in the engineering and technology workplace, including faculty members in post-secondary institutions. Information from the grey literature has focused on the diversity and inclusion in STEM workplace initiatives. Most of these workplace initiatives have not been evaluated nor peer reviewed but they are being implemented in workplace settings and reflect promising practices. They also highlight the responses of employers as they attempt to increase the representation of women in STEM workplaces and reduce attrition.

It should be noted that relatively few studies were conducted in Canada and the majority are based on data from the United States. Papers from Europe and Australia have also been included in both the SCOPUS and grey literature searches. Canadian data has been included when available.

OVERVIEW OF WOMEN IN STEM

The Engineers, Geoscientists, Technologists, and Technicians Labour Market Information (2015) report for British Columbia outlines the critical skills shortages projected out to 2024 in 31 out of 45 technical occupations. The report found “looming market supply challenges with more than 31,000 job openings needing to be filled by 2024, and nearly 11,500 new jobs in 31 key occupations will be created” (Advancing Women in Engineering and Technology, 2020, p. 2). However, despite an expanding sector and this predicted growth, the average rate of newly registered engineers in Canada who were women was 17.4 per cent, which has not changed over the last three years. In British Columbia in 2017, the percentage of new female engineers was the third lowest in Canada at 15.2 per cent.

The literature shows that not all STEM sectors are created equal in terms of their representation of women. Wall (2019) reported that women account for over half of those who receive a degree in biological sciences. Women are underrepresented in male dominated disciplines including engineering and computing, which tend to offer higher salaries than the biological sciences. Nimmesgern (2016) summarized the situation for women across STEM, noting that fewer women enter the sector, more women leave after university, fewer women are in leading, or in decision making roles, and women are paid less, promoted less and win fewer grants, all compared to men.
Girls in education and STEM

- Canada 2067 (2018) reports that internationally, Canadian students do well in the academic performance of science, and ranks third among OECD countries, but they report that this level of performance varies across provinces. They also report that despite this strong performance, student interest in STEM subjects decreases with age, and that less than one in two students graduate having completed senior STEM courses. They note that without Grade 12 math and science courses, “students will find the door to an estimated half of all universities and college pathway are closed to them” (p. 2).

- Research finds that girls do not differ from boys in pre-school and primary education in terms of their attitudes toward STEM (McGuire et al., 2020), and they outperform boys in STEM grades at this stage. However, the career beliefs of girls with regard to STEM are at odds with their attitudes and ability, and this seems to become entrenched as girls transition to high school (Wang & Degol, 2017).

- The Girl Guides of Canada (2020) conducted a literature review, jurisdiction scan and surveys with young women under 18 years of age to explore the process of getting girls into the STEM pipeline. Based on their work, they found that for girls, doors opened and closed at every stage. They called for girls to be empowered to navigate the STEM pipeline and to be supported to make informed decisions about education and careers. They also called for “harmful norms and stereotypes about what girls can do” (p. 4) to be debunked. The three main reasons they identified for doors closing were:

  - Girls hear the message that STEM is not for them. This message comes from society, the media (in its various forms), from parents, teachers and even their peers. Girls believe they should not be interested in STEM and that they are unlikely to be successful in this field.

  - Girls might not know how to open the doors to a career in STEM. Often the decision on what subjects to choose in high school occurs early, with STEM subjects in senior years requiring prerequisite courses. Girls might not be aware of the implications of their course choices. Many girls do not have the information needed to make decisions about choosing STEM.

  - Girls may not realize many of the doors even exist. Girls may not be aware of the range of possible STEM careers and the different routes into them. Many are unaware that these careers would allow them to be creative, help people and make the world a better place, all things girls are interested in.

- Girls typically have fewer opportunities to participate in STEM related activities. STEM activities outside of school can make a difference to girls, allowing them to participate in
STEM subjects. In the United States, middle school children from low-income families experience less hours of enrichment activities compared to children from middle-income families. Consequently, many middle school girls from low-income families are not exposed to STEM experiences making it increasingly unlikely they will participate in STEM courses at school (Sammet & Kekelis, 2016).

- On average, girls in high school tend to perform better in both math and verbal ability tests, compared to boys. Even though girls outperform boys in these subjects, girls have a broader range of possible subject options, and thus may not choose STEM subjects because they are perceived as not combining verbal ability with math (Zacharia et al., 2020). Boys with lower marks are more likely to choose a STEM course than girls with higher marks (Hango, 2013). Boys in high school are more likely to describe their mathematical ability as excellent compared to girls (50 vs 37 per cent), and the more confident students were of their STEM abilities, the more likely they are to choose a STEM program at the post-secondary level.

Women undergraduates and STEM

Wall (2019) has examined the persistence and representation of women in STEM programs in Canada. She found that:

- In 2016, Canadian women made up only 34 per cent of all those who were awarded STEM undergraduate degrees.

- Women received over half (55 per cent) of the degrees in biological sciences (physical and life sciences and technologies).

- Women were less likely to pursue a degree in engineering and engineering technologies (19.7 per cent) and computer and information sciences and supports (18.7 per cent).

- Women’s share of enrolments in STEM degree programs remained relatively stable between 2010 and 2015.

- The representation of women in STEM decreases as they progress from high school to post-secondary institutions and to work.

- Two thirds of first year STEM women undergraduate students remained in STEM as compared to 72 per cent of men.

- Women’s lower persistence in STEM was because they were almost twice as likely as men (23 vs 12 per cent) to switch from STEM to another subject, with most changing to a health-related degree choice.
Wall (ibid; p. 4) attributes the underrepresentation of women in STEM in Canada as mostly relating to the subjects chosen for majors when they first enroll in their degree program and the careers they choose on graduating.

Women who switched their degree course from STEM did so by the start of their second year (17 per cent), and by the start of their third year another 10 per cent had left. As women progressed in their STEM studies, the differences in the numbers leaving were similar to those of men.

In engineering, women’s persistence in their initial STEM field and STEM overall was greater than that of men. Wall (ibid; p. 6) suggests that the male dominated environment did not deter women and contradicts studies that suggests women are less likely to persist.

Furthermore, women in post-secondary education tend to undervalue their own capabilities. Women also report a lower social belonging and self-efficacy throughout their university careers (Fisher et al., 2020).

Women in the STEM workplace

In Canada, women represent 56 per cent of science and technology undergraduates. 27.6 per cent of women are enrolled in mathematics and computer and information science programs, and 19 per cent in engineering and technology programs. When they graduate, 3 in 10 women STEM graduates are employed in STEM compared to 4 out of 10 for men, and racialized women are even less likely to remain in STEM (Girl Guides, 2020; Wall, 2019).

The situation is similar in the United States and the United Kingdom. In the United Kingdom, women remain underrepresented in the STEM industry, where they represent only 23 per cent of the workforce. The STEM areas with the greatest underrepresentation of women are engineering (11 per cent women), information and communications technology (17 per cent women), and skilled trade (8 per cent women). Among science professionals, there is a better representation of women (42 per cent) (Guyan & Oloyede, 2019).

In 2011, Canadian women with a STEM degree had an unemployment rate of 7 per cent compared to 5.7 per cent for those with a non-STEM degree. The opposite was true for men – the unemployment rate for men with a STEM degree was 4.7 per cent and for those with a non-STEM degree it was 5.5 per cent. Women with STEM degrees also earned less their male counterparts (Hango, 2013).

Women are also underrepresented in leadership roles in STEM. Amon (2017) notes that in the United States, energy companies have the highest percentage of boards with no women, and in academia, only 31 per cent of full-time STEM faculty and 27 per cent of deans and
heads of departments were women. In the United Kingdom, Guyan & Oloyede (2019) found that just 15 per cent of women were in management positions.

The following sections look in more detail at the reasons for this underrepresentation. Gill et al. (2017) sums up the situation for women in engineering by stating:

“In the general move towards greater professional diversity, engineering stands out in terms of its continuance as a male-dominated profession. Firstly, engineering has been markedly slower than other professions to respond to the calls for greater diversity and inclusivity.”

DEFINITION OF DIVERSITY AND INCLUSION

Although the terms diversity and inclusion have been used interchangeably, they refer to two different concepts (Brimhall et al., 2017).

The HR Tech Group (2017) define:

- **diversity** as the variety of people and ideas within an organization and includes visible and/or invisible differences, such as: age, culture, gender, race, mental/physical status, religion, sexual orientation, language, education, socioeconomic status, life experiences, family status, perspectives, etc.

- **inclusion** is the environment where people feel involved, respected, valued, connected and where individuals bring their authentic selves to the team and business. Inclusion refers to the extent to which employees are encouraged and empowered to participate in the workplace (Brimhall et al., 2017). Included employees are valued for their unique characteristics and are comfortable bringing their authentic selves to work (Catalyst, 2020).

Those working within the diversity and inclusion field stress the importance of both concepts and suggest that diversity without inclusion is a “story of missed opportunities” (Sherbin & Rashid, 2017). Ferdman and Deane (2014) counsel that diversity in and of itself, does not lead to improved economic performance for organizations. What is important is the workplace culture, and the systems and processes that enable diverse employees to contribute and help employers and organizations benefit from diversity. Sherbin & Rashid (2017) use the following analogy: diversity is being invited to a party; inclusion is being asked to dance. In this sense, diversity is an important first step, that is, it is important to invite employees into the workplace, but an inclusive workplace enables those employees to fully participate, to dance. Inclusion unlocks the potential for all employees to feel valued and encouraged to participate fully in the organization.
Change Catalyst, an organization in the United States, partnered with LaunchVic, an organization in Australia, and produced a toolkit to support workplaces to implement policies and practices to increase diversity and inclusion. They identified five stages of inclusion (Figure 1), and suggest that for many workplaces, their diversity and inclusion policies stop at recruitment. However, to be inclusive, the workplace culture must make women feel safe and engaged so they want to stay and feel like they belong.

**Figure 1**  
Stages of inclusion

![Stages of inclusion](source: LaunchVic & Change Catalyst, n.d., p. 5.)

**CHALLENGES AND OPPORTUNITIES TO CAREER DEVELOPMENT**

In 2018, the National Academy of Engineering held a workshop to explore diversity and inclusion within the sector (The National Academies of Sciences, Engineering and Medicine, 2018). It concluded that the barriers women and other underrepresented groups experience to advancement are

> “no longer primarily a result of “bad apples” who resist the inclusion of underrepresented minorities .... Instead, subtle beliefs and practices, such as microaggressions, cognitive biases, and cultural processes, create disadvantages that progressively accumulate. Furthermore, [Cech] reported that a plateauing in the percentage of women receiving bachelor’s degrees in science and engineering over the past two decades suggests that these beliefs and practices do not necessarily improve over time” (The National Academies of Sciences Engineering and Medicine, 2018, p. 2)
Leaky pipeline

Gill et al. (2017) suggest that women who enter the STEM profession are highly able, intelligent and determined; yet despite these strengths, many experience barriers across the lifetime of their careers, and consequently, some decide to leave the sector. The concept of a leaky pipeline has been used to conceptualize and explain the underrepresentation of women in STEM (Blickenstaff, 2005). This approach suggests that if enough girls and women enter the STEM pipeline, they will continue to a career within the sector (Bilimoria et al., 2008). While an increasing number of girls are entering the pipeline, they are not flowing through to careers in STEM, and once in the profession, the leaks continue as women leave the sector.

The leaks occur at different points as discussed above; at school when girls choose not to study STEM subjects; when girls transition from high school to post-secondary institutions and decide not to continue with their STEM studies; as women transition to their first jobs; and the final leaks occur, when women who work in STEM decide to leave the sector. To stop the leaks, some of the initiatives implemented, have to some extent, focused on the individual women. These initiatives include components such as mentoring, coaching, networking, education and training, career and professional development, leadership development, and special funding and opportunities (Bilimoria et al., 2008). The National Science Foundation (2015) find that while the leaky pipeline concept was useful within the K-12 setting, it is less useful to understand why women in the STEM workplace leave. They argue the pipeline analogy stresses a linear career progression and focuses attention away from identifying other pathways to a career in STEM. In addition, HR Tech Group (2017) state that the problem of underrepresentation is not just a pipeline problem but that workplace culture is also important.

Reasons women leave STEM

The reasons women leave the STEM sector are complex and interconnected. We outline some of the various reasons why women leave STEM in the following sections below.

Workplace culture

- In reviewing the reasons women leave engineering, Gill and colleagues (2017) cite a body of work that finds the culture of an engineering department and or workplace, is the one of the main reasons women leave. Organizational culture plays an important role in driving women away from the sector as it determines the behaviour that is deemed appropriate and acceptable, and the sanctions for behaviours that are inappropriate and the rewards for effort (HR Tech Group, 2017). Research shows the women who left engineering were very similar to those that stayed; the difference was not the women, but in the culture of the
workplaces (Corbett & Hill, 2015). Corbett and colleagues cite Fouad in discussing the results of her survey exploring why women leave who said,

“A lot of the studies have focused on fixing women — fixing their confidence, fixing their interests. We did not find that any of those factors influenced women engineers’ persistence decisions at all, which is why we are saying we really need to be focusing on the environment.”

- Women leave the STEM sector at higher rates than their male colleagues (Fouad et al., 2017). Women who leave are less likely to have had opportunities for training and development, have less support from colleagues and supervisors and have less support for balancing work and non-work roles. They leave these professions when they lack recognition and opportunities for progression. When the workplace culture is more inclusive, women succeed in male dominated professions, and they stay when they are provided with challenging, meaningful and novel work (American Association of University Women and Dell, 2017).

- There is considerable work that documents the existence of an unsympathetic climate for women in STEM disciplines and that highlights how this climate serves as a barrier to the recruitment, retention and career development of women (Meiksins et al., 2019). For example, women in engineering and technology often describe the workplace culture as masculine and male-dominated and, that are exclusionary to women, which leaves them feeling they are not part of the “guy’s club” and not “one of the boys” (Hill et al., 2010). While excluding women from non-work events leaves women feeling isolated, it can also exclude them from the decision making process as work could be discussed and decisions made at non-work events (Belinsky & Blagg, 2011). Hewlett et al. (2008) describe a “macho culture” that excludes women from the spaces in which the real business happens — after hours at the lab or smelter, after work at the bar or golf course — and, as a result, women are not privy to vital information (p. 7). Miller (2004) found similar experiences reported by female engineers and geologists in the oil industry where women were treated differently to men in the workplace and excluded from non-work activities.

Negative stereotypes, bias, and discrimination

- Weber (2018) discusses the pervasiveness of negative stereotypes of women in engineering which play an important part in how individuals determine whether someone can, and how well, they can do their job. HR Tech Group (2017) state that these negative stereotypes create barriers as they provide mental processing short-cuts which reinforce the belief that women are less capable (Buse, 2018).
Hill et al. (2010) discuss why there are so few women in STEM, and suggest that in male-type occupations, women are viewed as less competent than men, and when women demonstrate this is not correct, they pay “the price” of social rejection in the form of being disliked. Being disliked has negative consequences on career advancement and women are left to reconcile being perceived as competent or being disliked.

In addition, women also report being treated in a condescending manner. In her Canadian qualitative study with female engineers and geologists in the oil industry, Miller (2004) writes about “condescending paternalism” (p. 50), in which women described their male colleagues as overtly courteous, or women receiving extra attention from male colleagues just because they are women.

Schmader et. al. (2016) found that Canadian women engineers reported feeling less valued by their companies compared to male engineers, and they had a higher intention to leave than their male colleagues.

The use of gendered language in organizational materials and job advertisements can also serve as a barrier to women entering the sector. Engendering STEM (2018) reported that although legislation exists that prevents deliberate discrimination and bias in recruitment materials, an examination of 77,000 advertisements found 478,175 words which were deemed to infer gender bias, an average of six words per advert and these were most common in male dominated occupations.

Canadian undergraduate students and those in technical institutions in Alberta also report negative biases from male students and being perceived as less capable in their fields. Similar to women in the workplace, in post-secondary institutions, women often feel frustrated working in groups with male students. Female students perceive that their male classmates are not communicative with them, and assign administrative tasks to women such as taking notes or performing calculations (Dell et. al., 2018).

Undergraduate women in engineering and technology programs may also experience gender bias from their instructors. In a study conducted in the United States surveying women studying a STEM major, including bioengineering or bioinformatics, the researchers found 34 per cent of the women reported experiencing gender bias from their instructors and classmates at least once. (Leaper & Starr, 2019). They also reported this contributed to lower STEM motivation and career aspirations.

Denis & Heap’s (2019) study of three Canadian universities report that women engineering students, particularly in large campuses did not feel welcome and they felt discouraged by the departmental climate, which they saw as favouring male students. The women did not think their professors were supportive of women engineering students and reported that stereotypical and negative comments about women were made in class.
Riegle-Crumb et al. (2020) found that amongst female undergraduate and graduate students studying chemical engineering and chemistry in the United States, and who were just about to graduate, women’s interaction, whether positive or negative with their peers, did not play a role in them committing to working in STEM fields. On the other hand, positive interactions with faculty members increased women’s commitment to STEM occupations.

Madill and colleagues (2004) report negative stereotypes in recruitment, where young women believed they were treated differently than their male colleagues because hiring committees believed they would want to start a family soon.

Biases in engineering towards women include being viewed as less competent than men engineers, not fully being part of the team, and not being a good leader (Ettinger et al., 2019). Research has shown that experiencing and perceiving bias and discrimination in the workplace is linked to intention to leave the field and poor job satisfaction (Reilly et al., 2019).

Lack of a clear career path and development opportunities

Frank (2019) used the Canadian longitudinal census date to explore the career pathways for women and men. The career pathway for female and male STEM graduates differed – male graduates with a STEM degree were more likely than female graduates to be employed in STEM. Frank’s analysis found that among STEM graduates in 2006, women were more likely than men to have moved to a non-STEM occupation by 2016 compared to men (one third of women and one quarter of men) (p. 6).

The Westcoast Women in Engineering, Science and Technology (WWEST) program (2014) reported that 60 per cent of women have non-linear careers. When women leave careers in STEM, they do so for a range of reasons including family demands, opportunities, and educational leaves. Their average time away from work is 2.2 years. Over 90 per cent want to return but only 73 per cent do those that do sometimes feel penalized for their time away.

Cardador & Hill (2018) examined the difference in the career paths between men and women in engineering in the United States. They report that women are more likely to be in managerial roles than men and that men tended to remain in technical roles. Women in managerial roles experienced the lowest levels of job satisfaction and connectedness with their colleagues, and highest levels of intending to leave engineering than those women in technical or a combination of managerial and technical roles.

Women also report encountering physical barriers that hinder or prevent them from doing their job and benefiting from workplace opportunities. A recent example of this was the cancellation of the first all female spacewalk because NASA did not have two space suits that
fitted the women astronauts. The mission proceeded with one woman and a man who fitted the other suit (Fortin & Zraick, 2019). Studies also report more mundane barriers, including feeling unwelcome on-site visits and sites not being designed to accommodate the needs of women.

- Women in post-secondary institutions, both faculty and doctoral students, report a lack of career progression opportunities. Women are less likely to be hired as associate and full professors compared to men, and tenured women are more likely to be hired as assistant professors and adjunct lecturers compared to men (Schnell et al., 2009). Additionally, women are 29 percent more likely to report no job offers at the end of their PhD program compared to men (Kinoshita et al., 2020).

- In a case study examining the change in gender equality in a start-up high-tech firm that went public, the researcher found that as a start-up, female employees reported that everyone took on different roles and responsibilities, even outside of their job positions (Mickey, 2019). When the firm went public, however, women oftentimes found themselves working in human resource marketing positions, whereas men obtained technical jobs.

- Denend et al. (2020) found that women in technology careers are hesitant to self-promote themselves to senior leadership roles, and these women also feel uncomfortable speaking up freely in meetings which hinder their job satisfaction.

- In the Canadian context, studies have shown that women experience challenges in finding meaningful mentoring opportunities and are concerned they would be perceived as less independent if they had a mentor (Saffie-Robertson, 2020).

**Lack of supportive policies and supports**

- The culture of an organization is determined by a combination of policies, practices, and leadership. While many organizations and companies have policies, women report a lack of implementation, a lack of accountability and a lack of transparency within their organizations of these policies and that this inaction creates barriers (Engendering STEM, 2018).

- Lack of a supportive and family-oriented culture is another barrier reported by women in the sector although it is something men also experience. Men and women working in STEM report flexibility to balance work and family is important to them when choosing a job (Funk & Parker, 2018). Cech and Blair-Loy (2019) explored the experiences of new parents working in the STEM field, and found that there was substantial attrition for this group: nearly a half of new mothers and a quarter of new fathers leave full-time STEM employment after having
The reason for this was the challenges in balancing the demands of work and family.

- Researchers in the United States found that 42 per cent of women left full-time STEM occupations within three years of having their first child, compared with 15 per cent of new fathers (Cech & Blair-Loy, 2019). Most did not move back into these occupations when their children reached school age. The authors suggest that this is a feature of the sector.

- Data suggests that the attrition rate for women spikes 10 years into a career. One potential explanation for the attrition is that by their mid 30’s, women in STEM experience barriers to career advancement at the same time when they may also be experiencing family pressures. Hewlett and colleagues (2008) describe this as a perfect storm and as a ‘fight or flight’ moment.

- Singh et al. (2018) find that family interference with work (FIW) is positively related to occupational turnover intentions among women engineers (i.e., FIW encourages female engineers to consider leaving engineering altogether, not just their current positions). Work interference with family did not have a similar effect. The authors also find that occupational commitment is stronger, and the effects of FIW are weaker in organizations where the employer is perceived as supportive, while the reverse is true where perceived organizational support is absent.

- In workplaces that do provide maternity leave programs, some women experience barriers on their return to work. Gill et al. (2017) reported that after women take maternity leave, the relationships they had with their male colleagues changed, they no longer felt that they fitted in, and they felt they were not respected as an engineer or seen as not being a serious engineer. They also felt their skills were under used. All these negative experiences contributed to women feeling discouraged and excluded.

- A lack of informal organizational and professional networks also creates barriers for women in the sector and negatively impacts career progression (Bilimoria et al., 2008).

- A critical mass of women is needed within organizations to help them feel empowered – studies have shown that 30 per cent or at least three women in a team is the tipping point for women to fully participate (American Association of University Women and Dell, 2017; Torchia et al., 2011).

- Echoing the feeling of being left out by male colleagues and not feeling they belonged in the workplace, studies with university students report similar findings. In a study examining three universities in Canada, Denis & Heap (2019) report that women engineering students, particularly in a large university, did not feel very welcome on campus, felt discouraged by the departmental climate that favoured male students, did not agree that professors were...
supportive of women engineering students, and reported stereotypical and negative comments about women were made in class.

**Lack of a shared understanding**

- There is a disconnect in how men in the sector understand the experiences of their female colleagues. Electricity Human Resources Canada (2020) recently reported that almost 1 in every 5 men (18 per cent) believe that it is actually easier for women to succeed in their workplace than it is for men. Women have a different perspective: 3 of every 4 women (75 per cent) believe women have a harder time. Research by Funk and Parker from the PEW Research Center (2018) found that 20 per cent of women and 15 per cent of men employed in STEM reported that not enough attention was paid to diversity policies and practices in their workplaces. However, the same study reports that twice as many men as women think their workplaces pay too much attention to diversity (13 vs 5 per cent).

- In their study of professional engineer and human resources employees in 28 companies in Canada, Schmader et al. (2016) found that male employees overestimated the number of gender inclusive policies their company had, and perceived that people in the company had positive attitudes towards all of the gender inclusive policies and, that both men and women benefitted from these policies. Similarly, Denend et al. (2020) reported that in the United States, more male employees in health technology perceived fewer gender inequalities in the workplace than women.

**Lack of workplace survival skills**

- Gill et al. (2008) found that undergraduate and post-graduate education did not properly prepare women for the realities of working in engineering and technology. Their work suggests that for women, while their undergraduate training provided them with the technical skills, it did not prepare them with the necessary social and management skills necessary to survive. Combined with this, many women had high expectations for themselves and had anticipated fulfilling roles in the workplace: “*Instead in a significant number of cases their experience was profoundly affected by the need to adopt strategies whereby the fact of their being female did not compromise their capacity to perform effectively and to be respected as a worthy colleague*” (p. 11).

- Many women who experience a chilly or unwelcoming workplace often either try to ignore it or rationalize their experience, and do not usually report the negative experiences (Meiksins et al., 2019). Instead, women tended to rely on “individual-level solutions” to make it work (Ettinger et al., 2019). Many women in engineering understand that they must have “thick skins” to be successful in the male-dominated field of engineering (Denis & Heap, 2019).
Pay gap

- Across the STEM sector women consistently earn less than men (Wall, 2019). In a 2020 survey of people across science, technology, engineering and other fields, it was found that the gender pay gap in the United Kingdom was 20 per cent, and this increases with age and experience (SRG and New Scientist Jobs, 2020). In discussing similar findings from 2018, Fleming (2018) quotes Heather Metcalf of the US Association for Women in Science who says that “the data show that when women have the same titles and jobs in the same industries, and after controlling for other factors, a wage gap persists that is left unexplained by anything other than societal biases and discrimination.”

- In Canada in 2010, men aged 25 to 34 who had a STEM degree and worked full-time earned a median income of $62,300 per year, while women earned $53,200 per year (Hango, 2013).

- The Conference Board of Canada (2017) reported on the pay gaps between men and women in STEM. They found that the size of the gap varied by sector and it is lowest in chemical engineering (3.9 per cent) and highest in aerospace engineers and industrial and manufacturing engineers (24 per cent). The existence of this pay gap between men and women has long term financial implications as well as impacting job satisfaction. The lack of transparency in pay and reward systems is also problematic for women in the sector as salary rates are not disclosed (Zacharia et al., 2020). Since 2017, UK companies with more than 250 employees must publish data about their gender pay gap (Government of the United Kingdom, 2017). For the UK this data shows the women engineers in the UK earn around 11 per cent less than their male colleagues on average although it is smaller than the gender pay gap for all UK workers (Royal Academy of Engineering & WISE Campaign, 2020).

Discrimination and bias

Discriminatory policies and practices and bias are identified as one of the most common barriers to the recruitment, retention, and career advancement of women in engineering and technology as this determines the culture of the organization, the behaviour of employees and the barriers and opportunities women face in the sector. In 2016, the US Office of Science and Technology Policy reported on strategies to reduce the impact of bias in the STEM workforce. As part of their review they defined three types of biases (p. 1):

- Explicit bias refers to the intentional, consciously articulated beliefs that result in discriminatory attitudes and behaviours towards others. This type of bias and discrimination is illegal and should be solved by good candidate screening, human resources and lawsuits (LaunchVic & Change Catalyst, 2017, p. 10).
Institutional bias refers to policies and practices of an institution that may make it more difficult for some members of certain groups to succeed.

Implicit or unconscious bias refers to unintended and unconscious assumptions, often based on stereotypes about gender and ethnicity, which may improperly influence judgements about other people and their work.

Funk and Parker (2018) examined the experiences of women and men in STEM workplaces. They conclude that for women, the workplace is a different, sometimes more hostile environment than their male colleagues perceive (p. 6). Their study also found that discrimination and sexual harassment are more common for women and that gender is seen as a barrier to career development. They report that:

Women were more likely to experience discrimination if they work in organizations where they are outnumbered by men, if they work in computing jobs and if they have postgraduate degrees. The types of discrimination women reported includes: earning less than a man for doing the same job (29 per cent for women and 6 per cent for men), treated as being less competent than a colleague of the opposite gender (29 per cent for women and 4 per cent for men), and women receiving less support than a man doing the same job (18 per cent). However, women working in organizations with mostly men reported higher rates of discrimination than women in other STEM workplaces (78 vs 44 percent). Women in these workplaces are three times as likely to say their gender made it more difficult to succeed in their job (48 vs 14 per cent) and women in these organizations felt they had to constantly prove themselves. Women in male dominated workplaces were almost three times as likely to report that their organizations did not pay enough attention to gender diversity (42 vs 15 per cent) and 48 per cent of women reported that sexual harassment was a problem in their workplace compared to 33 per cent in more mixed workplaces.

In addition, undergraduate students studying various fields in STEM, including engineering also have reported experiencing sexual harassment from faculty members, teaching assistants, or graduate students, which was then associated with low STEM motivations and career aspirations (Leaper & Starr, 2019).

Opportunities for women in engineering and technology

Cooperative work placements and internships

Cooperative work placements and internships have significant benefits for female engineers (Ingram & Mikawoz, 2006). In studying male and female engineers from medium and large sized organizations in Manitoba, Ingram et al. (2009) concluded that cooperative work placements had
long term benefits for women, including gaining work experience, being exposed to different roles and responsibilities, learning about workplace dynamics, building relationships, with some securing a job placement post-graduation. These women received a higher starting salary compared to other women with no work experience. These placements and internships increased the positive relationships women reported with their colleagues when they accepted a position in the company.

*Mentorships, networking, and positive working environments*

Mentors and mentoring programs are helpful in providing advice and guidance to women, especially if they are faced with difficult career decisions (American Association of University Women and Dell, 2017). Mentors serve as positive role models for women in the sector and help to increase an employee’s belief in themselves. Bilimoria and colleagues (2008) suggests that mentors may also help women with their career development, by showing what is possible but also introducing these women to a wider professional network. Posselt and colleagues (2018) report the mentor relationship allows for the sharing of personal stories and a shared understanding of the experience of women in the sector.

Canadian studies showed that women in cooperative work placements were able to gain insightful information on the workplace dynamic from their mentors. They were also able to go to informal meeting spaces (e.g., lunches with managers) by an invitation from their mentors, and network. This opportunity led to some women to be noticed by those in positions of higher authority (Ingram & Mikawoz, 2006). Positive experiences with mentors may also influence women to stay in their fields (Denis & Heap, 2019; Madill et al., 2004).

Several studies have shown that having a mentor in the workplace and post-secondary institutions provide benefits to women in engineering and technology fields. For example, mentors can provide opportunities for women to meet new people and to make new connections (Saffie-Robertson, 2020). Undergraduate women in engineering are more likely than men students to be involved in student engineering associations, such as the Women in Science and Engineering (WiSE) which they found helpful. Women are also more likely than men to find engineering social events useful in terms of networking (Denis & Heap, 2019). Female industrial engineer students from the University of Oklahoma also voiced that one of the reasons they remained in this field of study was due to caring and passionate professors (Brawner et al., 2010).

**INITIATIVES**

There are a number of initiatives in organizations and post-secondary institutions across Canada and the United States. Most initiatives – particularly the ones in Canada – were not found by the
search of academic papers but rather through the search of the grey literature and thus have no empirical reporting on the assessment of these initiatives. The following sections describe these initiatives beginning with those in Canada and then ones in the United States, as well as the assessment outcomes if available. Also included are some of the successful strategies and challenges of implementing initiatives to retain, recruit and advance women in engineering and the technology.

**Canadian initiatives**

**30 by 30 (nationwide)**

30 by 30 is an initiative started by Engineers Canada that aims to increase the representation of engineering women to 30 per cent by the year 2030. This initiative has been adopted by many organizations across Canada including Engineering and Geoscientists British Columbia, Association of Professionals Engineers and Geoscientists of Alberta (APEGA), Professional Engineers Ontario, as well as post-secondary institutions. Recently, Engineers Canada reported the percentage of newly licensed women engineers had increased from 17 per cent in 2014 to 18.1 per cent in 2018 (Engineers Canada, 2018; Polyzou, 2017).

**Project RISE: Realizing Identity-Safe Environments (University of British Columbia)**

Project RISE is an initiative from Engendering Success in STEM instigated by members at the University of British Columbia. The objective of the project is “to create positive cultural change for women and men working in science, technology, engineering, and math.” The core component of the project includes intervention workshops, with the goal of at least 33 per cent women participation, delivered to various organizations, and conducting outcome surveys for two years. Employees are to be randomly assigned to participate in an inclusion-based workshop or a leadership-based workshop. The company will be then evaluated for “creating beneficial social connections,” “reducing gender bias,” “benefitting personnel,” and “benefiting the organization” (Engendering Success in STEM, 2017).

**Project SINC: Shaping Inclusive Network Cultures (University of British Columbia)**

Project SINC is another initiative from Engendering Success in STEM. This particular project aims to support young women transitioning from university to the workplace by ensuring that women have mentoring supports and inclusive networks and encourage women and men to promote each other and have positive interactions with one another. Specifically, Project SINC will be analyzing the implementation of social inclusion interventions among university students across the University of Toronto, McMaster University, the University of Waterloo, and the
University of British Columbia, who will be participating in internships and co-operative work placements (Project SINC: Shaping Inclusive Network Cultures, n.d.).

**Make Possible (British Columbia)**

Make Possible, developed by the Society for Women in Science and Technology (SCWIST) is an online initiative to “help women connect, collaborate and lead through a dedicated mentoring network in STEM” (Make Possible, n.d.). They offer mentoring support, networking connections, leadership opportunities, and professional development.

**Initiatives in the United States**

**Advance FORWARD (Focus on Resources for Women’s Advancement, Recruitment/Retention, and Development) (North Dakota)**

The FORWARD project is part of the National Science Foundation ADVANCE program, and this particular project aims to increase the participation and involvement of women faculty members employed at the North Dakota State University (Bilen-Green et al., 2010). FORWARD offers professional development and mentoring opportunities for women faculty members, climate issue workshops for academic administrators and faculty, and encouraging a supportive environment by developing men faculty to be allies. The project has pushed out several initiatives, and some are explored below.

**Mentoring cohorts for junior faculty:** Mentorships are offered in groups made up of four junior faculty members as mentees, and two senior faculty members as mentors. Group members are the same sex. Furthermore, mentors and mentees have the opportunity to partake in training on topics such as goal setting.

**Administrator training programs:** Department chairs are given the opportunity to participate in training sessions through this initiative. Chairs were also invited to speak about how to improve the climate, recruitment, retention, promotion, and advancement of women faculty members in their departments, as well as the barriers to meeting these goals.

**AdvanceRIT (The Rochester Institute of Technology, United States)**

The AdvanceRIT project aims to improve the career advancement and representation of women in STEM faculties through multiple initiatives. We will highlight two initiatives and their outcomes, namely the Connectivity Series and the Connect Grants, but many other initiatives have been implemented including the Resource Allocation Committee (RAC), and the Promotion and Tenure SMARTS program (The Rochester Institute of Technology, n.d.-c).
The Connectivity Series initiative is made up of different professional development workshops for faculty members and staff at the Rochester Institute of Technology (The Rochester Institute of Technology, n.d.-b). The workshops cover an array of topics including organizational learning, unconscious bias, the recruitment, retention, and advancement of women in the faculty. The workshops also aim to make systemic improvements for female faculties and staff who are of colour, as well as deaf and hard of hearing. Over the seven years (2013 to 2020) that this initiative was implemented at the Rochester Institute of Technology, a total of 1,086 faculty and staff have attended the Connect Series events, including 458 men. The majority of staff who participated in the Connectivity Series agreed that attending the session was valuable, and the session was relevant to their roles in the recruitment, retention, and advancement of a diverse faculty (Dell et al., 2017).

The Connect Grants initiative supports and encourages faculty recruitment, and career development and advancement through grant opportunities (The Rochester Institute of Technology, n.d.-a). To date, 95 per cent of the funding recipients have been women faculty members.

ADVANCE Project TRACS Program (Montana State University, United States)

The ADVANCE Project TRACS (Transformation through Relatedness Autonomy and Competence) Program focuses on several initiatives designed to benefit female faculty members in STEM. The initiatives include: enhancing research capacity and opportunity, enhancing work-life integration, and enhancing cultural attunement (Smith, 2016).

Smith et al. (2018) conducted a longitudinal study spanning three years with STEM faculty women – of which 34 per cent were in the College of Engineering – across nine colleges in the United States. Women faculty members reported positive changes in their psychological need satisfaction (measures of competence, autonomy, and relating to colleagues) and thus, greater job satisfaction the more a faculty member was involved with Project TRACS.

Women in Science and Engineering – Future Professionals Program (WiSE-FPP) (Syracuse University)

The Women in Science and Engineering – Future Professionals Program (WiSE-FPP) is a peer-mentoring initiative set out by Syracuse University Graduate School and the Colleges of Engineering and Computer Science and Arts and Sciences. The objectives of the initiative are to provide mentoring and networking opportunities to female graduate student in STEM through connecting them with female faculty members, industry professionals and peers in related STEM fields. Furthermore, professional development opportunities such as building portfolios are offered to the women (Syracuse University, n.d.).
In their study assessing the peer mentoring component of the WiSE-FPP, Bhatia and Amati (2010) concluded that the initiative helped graduate women receive guidance, support, and self-confidence during their studies. Furthermore, women felt empowered to take on multiple responsibilities including being a teacher, a scholar, and a mother.

Critical Mass of Engineering Technology Scholars (COMETS) (The Rochester Institute of Technology)

The Critical Mass of Engineering Technology Scholars (COMETS) initiative was designed to support the retention, recruitment and graduation rates of women undergraduate students studying engineering and technology at the Rochester Institute of Technology. The core components of the COMETS initiative were: providing financial support of up to $10,000 USD per academic year, meetings with faculty mentors for career and academic advice and encouragement, and opportunities to participate in workshops and outreach activities through the Women in Technology (WIT) program (Dell, 2019).

In an evaluation study of the initiative, Dell (2019) found that the women who participated in COMETS reported positive feelings of relatedness due to joining the WIT program and other clubs and organizations, having faculty role models, and participating in professional societies. The program also allowed women to find a voice and feel confident in themselves. Participants, however, also reported still feeling frustrations after participating in COMETS, mainly due to the lack of women and diversity in their programs, experiencing stereotype threat and constantly proving themselves as competent women to men, and being assigned gendered roles such as note taking in group projects.

Although not a large increase, after the implementation of COMETS, the percentage women in engineering and technology at the Rochester Institute of Technology increased from 9.49 per cent to 13.2 per cent from 2011 to 2017. Dell (2019), however, notes that COMETS was not the only existing program at the university to improve the retention and recruitment of women so the increase in diversity cannot be solely attributed to COMETS.

Successful strategies and challenges within implementation of initiatives

Engineers Canada and the Canadian Council of Technicians and Technologists (2008) reviewed ten Canadian initiatives aimed to increase the participation of women and other underrepresented groups, as well as outlined the elements that made initiatives successful and the challenges that each organization and post-secondary institutions faced. Below, we reiterate their findings.

Some of the strategies that create successful initiatives which are aimed at supporting diversity in the engineering and technology workplace include: partnerships with professional
associations, organizations, post-secondary institutions, and employers; providing mentorship opportunities, skills development and work placements within the engineering and technology industry to participants; opportunities to gain experience in the Canadian context (particularly for international individuals); and a suggested twelve to eighteen months’ duration of programs.

One of the main challenges that organizations and post-secondary institutions face when implementing initiatives is lack of human resources. Particularly amongst non-profit organizations, it may be difficult to hire, schedule and maintain staff and instructors, and organizations may also see high turnover rates and consequently, frequent new staff training. Funding instability is also highly problematic as organizations and institutions will need to apply for additional funding if they choose to improve the design of the program after an evaluation has been conducted, and the allocation of funding to train staff and support participants may be difficult.

Summary of the barriers and enabling factors women in STEM experience

The challenges and barriers as well as the enabling factors for girls and women in engineering and technology are summarized below. Enabling factors include actions, resources, and supports that make it possible (or easier) for individuals/organizations or populations to change their behaviour or environment. The barriers and enabling factors identified exist across schools, post-secondary institutions and in the workplace. They operate on four different levels, macro or societal level, within organizations including educational settings and workplaces, between individuals and also at an individual level.
**Figure 2  Challenges and enabling factors for women in STEM**

<table>
<thead>
<tr>
<th>Challenges and Barriers</th>
<th>Enabling Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implicit and explicit biases in society about the abilities and roles of girls and women in engineering and technology</td>
<td>Initiatives and programs to raise awareness of women in sector including positive role models, advocacy and enforcement of diversity and inclusion legislation</td>
</tr>
<tr>
<td>Gender-biased practices, policies, norms and standards in schools, post-secondary institutions &amp; workplaces. Lack of a shared understanding &amp; resources</td>
<td>Initiatives in education settings to encourage girls and women to participate. Equitable hiring and advancement practices. Policies to create and support a welcoming</td>
</tr>
<tr>
<td>Negative stereotypes, discrimination, lack of support and encouragement from peers and others which discourage girls and women from participating in sector</td>
<td>Role models, mentors, strong professional networks that can encourage and guide girls and women in sector</td>
</tr>
<tr>
<td>Lack of knowledge about potential careers in sector and pathways into sector. Lack of self belief and confidence and support</td>
<td>Roles models highlighting success of women in sector, supports to address individual needs including resources and tools to survive and thrive in the workplace &amp; other settings</td>
</tr>
</tbody>
</table>
What practices constitute best practices? What are some of the key indicators and measure of successful initiatives?

Chesler and colleagues (2010) remind those in the sector, that it is not just a matter of time before things improve, it is a matter of effort. A clear message from the literature reviewed is that diversity and inclusion in STEM must go beyond mission statements and policies; it must include intentional and authentic actions that are transparent and measurable, and for which, there is accountability within an organization. Rather than focusing solely on fixing leaks along a pipeline, it is about changing organizational cultures so that women (and other underrepresented groups) feel welcome and valued for their skill set in the same way as other employees. The goal is when women enter the STEM sector they stay and thrive similar to their male colleagues. Engendering STEM (2018) cautions that changing organizational culture is no small task but that it can be achieved by small but significant steps that are implemented and sustained.

This section focuses on best practices within workplaces and it draws on lessons from diversity and inclusion toolkits and literature developed by organizations in the sector. What is emerging is that there is a high level of consensus about the steps organizations in STEM should follow if they are serious about increasing the representation of women (and other groups) and creating more diverse and inclusive workplaces. Most of the guides reviewed have been developed by or for organizations which have established human resources departments; only one guide, Engendering STEM, was specifically developed for small, medium enterprises. A brief overview of four guides is presented before we delve into a deeper discussion of the best practices and steps to increasing diversity and inclusion in STEM organizations.

Engendering STEM – Best Practice Guide for Small and Medium Enterprises

The guide, Best Practice Guide for Small and Medium Enterprises (2018) was produced in Scotland in 2018 by a collaboration between partners in the Netherlands, Scotland and the Basque Country in Spain, and the program was co-funded by the Erasmus+ Programme of the European Union. The guide stresses the need for comprehensive and holistic change but offers a range of incremental steps and actions employers can take to improve diversity and inclusion. Engendering Success acknowledges that for smaller organizations there may not be a well funded human resources department and that internal resources and capacity may be limited. It offers a range of free tailored support to companies which have a commitment to achieving gender equality. The guide has 12 sections that include practical actions to support recruitment, retention, career advancement, outreach, education and training and benchmarking and accreditation. The guide identifies the barriers for each section and suggests steps to overcome these barriers. Case studies with organizations are included to highlight how they have implemented the steps. The guide includes a series of tools (worksheets) for reviewing the gender practices in an organization, for getting the whole organization involved, which walks
organizations through who they need to talk to and asks what role they will play in implementation, for reviewing policies in the workplace and the questions to explore to ensure they are effective. The final worksheet provides examples of micro inequalities that women may experience and encourages discussion about how they can be overcome.

**WEGA Gender Equality Strategy Guide**

This guide was produced by the Australian Government’s Workplace Gender Equality Agency (WGEA) in 2019. It is a generic guide in that it is not aimed specifically at organizations in STEM but at those institutions and employers wanting to start or continue the process to improve gender equality. There are two components – a gender equality strategy guide (WEGA guide) (Workplace Gender Equality Agency, 2019b) and a gender equality diagnostic tool (WEGA DT) (Workplace Gender Equality Agency, 2019a). The WEGA guide identifies eight steps that business need to work their way through to develop, implement policies and to monitor their effectiveness. The WEGA DT has 17 focus areas that organizations can review with a series of question to establish the state of gender equality in their organization. The authors of the guide suggest that organizations may need to customize these focus areas to meet their need and advise smaller organizations to start with a few focus areas. For each focus area there is a series of questions, there is a score for each focus area which produces a score card. Organizations can use WEGA DT to review progress and assess their current situation. The WEGA guide provides detailed supports for each step of the process including how to develop a business case and make it relevant to departments and teams across an organization. It also includes examples and suggestions for communicating to everyone in the organization about the rationale and steps for the diversity and inclusion plan including developing a communication plan for managing a backlash or resistance to the diversity and inclusion program. The eight steps begin with building a business case, gain leadership commitment, assess gender equality in the organization, capture the vision, develop and implement the strategy, prioritize action, embed and communicate the strategy and finally, to monitor and review.

**PlayBook on Best Practices – Gender Equity in Tech (2017)**

The American Association of University Women (AAUW) and Dell developed the *Playbook on Best Practices – Gender Equity in Tech* (American Association of University Women and Dell, 2017) which lists a set of specific actions and strategies that have been shown to increase the representation of women in the engineering and computing professions. The practices they identify have been validated by research or successfully used in workplaces. They stress that a comprehensive approach is required for success and that diversity and inclusion cannot be a one-off event. The Playbook is divided into three sections; support for an inclusive talent pipeline; building equity into recruiting practices; and creating and sustaining a winning culture for all. The guide identifies the barriers women experience and suggest practical actions to
overcome these. Throughout the guide, examples of best practices are provided from within the sector.

Electricity Human Resources Canada (2020)

The *Leadershift: Pathways to Gender Equity* guide (Electricity Human Resources Canada, 2020) stresses the importance of having diverse and inclusive leadership in the sector. This resource provides detailed information on how to implement diversity and inclusion initiatives in the workplace. While this resource is aimed at increasing women in leadership positions, it also has general applicability. A checklist has been developed that identifies promising practices for organizations. The checklist lists actions for executives, human resources, the data to gather and monitor, communication, address myths and misconceptions, inspire change and demonstrate inclusive behaviours. The steps identified are: communicate, educate and measure – this involves having open and frank conversations with all staff to raise awareness and get buy-in so that employees are assured that employers understand the barriers; make it personal – support champions to connect gender issues to other experiences and help them to recognize problematic situations and behaviours; make it work for men; ensure the workplace culture supports work-life effectiveness for everyone, men and women; and make it work for women – change the narrative from trouble-maker to ‘trailblazer.’ Some women hesitate to get involved in gender inclusion initiatives because of a potential backlash. The goal is to normalize inclusive behaviour so that it is not only a ‘woman’s issue’ and to make it part of the value system.

BEST PRACTICES

All the best practice guides identify the need to carefully plan any diversity and inclusion strategy. Workplace Gender Equality Agency (WGEA) identifies four components to implementing a successful diversity and inclusion program to increase the representation of women (Workplace Gender Equality Agency, 2019b):

1. **Analyze** – Understand the workplace culture in the organization and assess what stage of development the organization’s diversity and inclusion is at. WEGA guide identifies a continuum to establish the maturity of diversity and inclusion in organizations. It ranges from ignoring issues, compliance, some evidence of programs through to a sustainable program. Organizations need to identify where they are on this continuum as it will determine where they should start. For example, if the workplace culture ignores gender equality issues, the first step should include building trust before organizations try to implement diversity and inclusion policies.
2. **Design** – Each organization needs to develop a diversity and inclusion plan that reflects their needs and circumstances. It should provide a roadmap or a how to guide, that clarifies the steps that will be taken by the organization to achieve its goals.

3. **Implement** – The strategies, programs, and activities have to be implemented in a coordinated and sustained manner. The advice of all the guides is not to over-reach by trying to change everything at once, but to start small, with some achievable wins. WEGA and others suggest developing an action plan that provides a timeline, visibility, and accountability for the diversity and inclusion plan.

4. **Monitor and Review** – This step is key to implementing a diversity and inclusion plan. Organizations need to establish benchmarks to know where they are starting from and then, to track progress. The more useful the data is, the better the data quality so employees need to know that data will be used and reported out on to leadership and employees in ways that protects individual privacy but that shows progress and identifies next steps. These monitoring and review processes should include data on recruitment, retention and promotions but also include employee feedback through staff engagement surveys, focus groups, and exit and stay interviews.

**Diversity and Inclusion Best Practice – Nine Steps to Success**

Figure 3 presents a modified version of the WEGA steps to implementing a diversity and inclusion strategy. The modifications are based on the literature and the other guides reviewed. A key message is start small, with actions that will be followed through on to gain and build trust and momentum.
Figure 3  Modified WEGA nine steps to implement a diversity and inclusion strategy

Step 1 – Develop a business case

The purpose of the business case is to explain why an organization believes it is important to have a diverse and inclusive workplace culture and how it will benefit the organization and all staff. The HR Tech hub (https://diversity.hrtechgroup.com/business-case) provides resources for organizations to use to develop their own business case. The WEGA strategy suggests the inclusion of the following information:

- improve the health and wellbeing of all employees as well as staff engagement;
- increase productivity as diverse teams are more productive and this will improve profits;
- improve organization’s reputation as being a good place to work and help attract and retain staff as women will want to work in the organization. This will reduce recruitment and onboarding costs;
- improve competitiveness as there will be more diverse skills and experience which will enhance the engineering process;
- reflect the clients and end users.

The business case must explain to all employees, at all levels of the organization, why diversity and inclusion matters to them and the work they do.

**Step 2 – Secure commitment from leadership**

Securing commitment from leadership is a key step in all diversity and inclusion strategies. Leadership must buy-in to the need for increasing the representation of women in the organization by prioritizing the strategy, modelling the behaviour they want to see and avoid making any comments that undermine the diversity and inclusion strategy. This buy-in has to include all levels of leadership, from the CEO down to managers and supervisors, and when managers say or do something that undermines diversity and inclusion, it must be addressed or risk not being taken seriously by employees. To support this positive approach, it may be necessary to provide training to those in leadership positions to ensure consistency in messaging and that leadership are actively supporting the diversity and leadership initiatives.

**Step 3 – Analyze workplace culture and assess diversity and inclusion in the organization**

Three of the four best practice guides provide tools (WEGA strategy and DT, Engendering Success and Electricity Canada Human Resources) that can be used to assess the culture of the organization. These tools walk organizations through the areas they may wish to assess. What is important is that this step should include some organizational data on employee numbers, recruitment, retention, promotion and pay which are examined by gender. In addition, organizations need to include information from employees about the everyday culture in the organizations that provide an accurate picture of diversity and inclusion. The tools and worksheets included in the resources identified provide suggestion of the types of questions to ask employees. The resources note that asking questions about diversity and inclusion may lead to some difficult conversations within organizations and they counsel employers to be aware of this and to be prepared to engage constructively with employees. These conversations could include difficult topics including, bias, bullying, discrimination, inappropriate behaviour as well as other issues. Employers have to be prepared to engage in an ongoing conversation with employees and be willing to address their concerns otherwise they risk alienating some employees.
Paradigm4Parity suggests the following organizational indicators (Figure 4) to track including:

- current employees by gender/title/role;
- historical statistics in relation to current seniority to understand progression over time;
- length of time in role, how long employees have been in current role by gender which can identify where women get stuck;
- retrospective review of data (three years is suggested) on the gender mix of recent applicants and recruits;
- promotion by gender.

Three of the four best practice guides suggest conducting an employee engagement survey and conduct exit interviews with staff who leave. However, if there is a low level of trust within the organization then they advise using an external and independent organization to broker these discussions. Engendering Success suggests conducting stay interviews to identify what is working well and to raise awareness of potential issues for employees.
Step 4 – Develop an organizational vision for diversity and inclusion that has leadership buy-in

This organizational vision for the diversity and inclusion initiative should resonate with employees across the organization. To do this it should be grounded in organizational data and address the concerns of employees. Leadership has to buy-in to this vision in an authentic way and training should be made available to those in leadership positions to ensure this is achieved.

Step 5 – Develop an action plan with priorities, resources, and timelines

The action plan needs to provide a roadmap for the diversity and inclusion strategy. It should identify the goals, the priorities, resources required and the timelines. Accountability should be built in and the plan should identify who in the organization is responsible for which actions. The goals should be aligned with appropriate metrics so progress can be measured. The action plan should detail the training and supports that will be available including unconscious bias training. WEGA suggest incorporating ideas from employees to address some of their concerns and to help get their buy-in. For example, implementing policies to avoid scheduling meetings very early or late in the day, ensuring decisions are made in meetings during the working day and in the workplace. The plan should specify how it will impact key practices and policies including as recruitment, retention, pay and career advancement.

Step 6 – Implement the plan

It is important that implementation is phased so that the organization and employees are not overwhelmed – the message from the literature is, start small. Changing the culture in an organization takes time and employees may require some training, support, and encouragement. The Electricity Canada Human Resources strategy (2020) stresses the need to make the strategy inclusive so that it works for men and women. Part of the implementation messaging may need to remind male employees of the benefits of a diverse and inclusive work and that it does benefit everyone, and that it does not just favour women. Women also have to buy into implementation. Good practice suggests changing the narrative from women as ‘trouble-maker’ or ‘complainer’ to being good employees or trailblazers so they feel safe and encouraged to participate. The ultimate goal is to present diversity and inclusion as something that is good for the organization and employees – not just something that is a woman’s issue. The diversity and inclusion strategy should be embedded into the organization.

Step 7 – Communicate the plan to leadership and managers so all are on message and ensure that employees are aware and understand the diversity and inclusion strategy

WEGA sets out a clear plan for developing a communication strategy and provides examples of the types of messaging. It highlights the need to plan for push-back on the strategy from those employees who are resistant to change. The plan should identify the key messages, the audience,
and explain, educate, engage, and convey a sense of ownership. Communication needs to be planned as the messages will have to be phased and repeated.

**Step 8 – Monitor and review progress, identify and celebrate successes, and identify bottlenecks**

The guides all stress the need to monitor progress to identify and celebrate successes and identify bottlenecks. The monitoring and review process enables organizations to be responsive and to adjust implementation or identify needs for additional training.

**Step 9 – Share information with organization, and engage in authentic discussion about next steps**

It is vital that information about the progress or challenges is communicated with employees. It may not be appropriate to share all information, but employees need to know the organization takes the strategy seriously, wants to learn about what is and is not working and what the next steps are and to get their input.

**Enabling factors to support a diversity and inclusion plan**

The best practice guides reviewed all identified enabling factors that could be incorporated into an action plan as part of a diversity and inclusion strategy. This information has been compiled into the table below. This table should be seen as a work in progress as it will be updated with information from other elements of the jurisdictional scan.

**Table 1**  
**Enabling factors that could support a diversity and inclusion strategy**

<table>
<thead>
<tr>
<th>Recruitment</th>
<th>Retention</th>
<th>Career development</th>
<th>Workplace culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use neutral language in job adverts, marketing materials and other documents</td>
<td>Provide mentoring and networking opportunities</td>
<td>Monitor allocation of career development opportunities</td>
<td>Leadership support for diversity and inclusion who model behaviour</td>
</tr>
<tr>
<td>Remove the “essential person specification” description as this deters women from applying</td>
<td>Review how project work is allocated</td>
<td>Develop promotion competencies and guidelines and make these visible</td>
<td>Offer flexible working arrangements</td>
</tr>
<tr>
<td>Recruitment</td>
<td>Retention</td>
<td>Career development</td>
<td>Workplace culture</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Use of blind reviewing of resumes</td>
<td>Mixed project teams when possible – ideally at least three women</td>
<td>Support the development of a career plan for staff</td>
<td>Provide diversity and inclusion training including unconscious bias for all staff</td>
</tr>
<tr>
<td>Use of panels to interview candidates and agree objective criteria, include women on panel and have standard questions</td>
<td>Include diversity and inclusion questions in performance review</td>
<td>Invest in leadership training and ensure women are included</td>
<td>Include diversity and inclusion targets in performance reviews</td>
</tr>
<tr>
<td>Ensure diverse candidates are interviewed</td>
<td>Provide training to managers and supervisors about diversity and inclusion and bias</td>
<td>Review data on pay and develop pay scales or bands that are competency based</td>
<td>Provide training that highlights why diversity and inclusion is important including business case information</td>
</tr>
<tr>
<td>Include diversity and inclusion statements in mission statement and in other materials</td>
<td>Call out unacceptable behaviour. Initiatives to support this action have been developed by BC Women in Trades¹</td>
<td>Review data on who is promoted and how long staff are in roles</td>
<td>Make the unwritten rules in an organization known to all</td>
</tr>
<tr>
<td>Recruit from a broad and diverse network including women returning to the sector</td>
<td>Encourage women to chair meetings</td>
<td>Develop existing staff to allow for career progression</td>
<td>Make the physical environment welcoming to all</td>
</tr>
<tr>
<td>Include information about flexible working and other supports</td>
<td>Ensure project administration and other non-project tasks are shared fairly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure all those involved in interviewing receive training on bias</td>
<td>Conduct exit interviews to find out why staff left</td>
<td></td>
<td>Have work-life effectiveness or balance conversations</td>
</tr>
</tbody>
</table>

### Literature Review: AWET

<table>
<thead>
<tr>
<th>Recruitment</th>
<th>Retention</th>
<th>Career development</th>
<th>Workplace culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor who applies</td>
<td>Conduct stay interviews to identify problems and what is working</td>
<td></td>
<td>Make diversity and inclusion a standing item on management agenda</td>
</tr>
<tr>
<td>Develop an outreach program with schools and colleges</td>
<td></td>
<td></td>
<td>Report out on diversity and inclusion in annual reports</td>
</tr>
<tr>
<td>Promote female role models</td>
<td></td>
<td></td>
<td>Salary levels should be based on an assessment of job position, professional designation with salary supplements set by clear and objective criteria – consider pay audits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ensure social events include everyone and are arranged at appropriate times and places</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Survey staff about diversity and inclusion</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Make sure women have appropriate access to equipment</td>
</tr>
</tbody>
</table>

### Challenges implementing a diversity and inclusion strategy

HR Tech (2017) reviewed reasons why diversity and inclusion strategies fail in technology companies. The main reasons include:

1. Lack of focus as the diversity and inclusion strategy was not a priority for leaders in the organization and it was not embedded into the organization

2. Limited understanding of diversity and inclusion strategy and its business benefits

3. Lack of funds and resources within small to mid-sized tech companies to focus on diversity and inclusion
4. Lack of monitoring, reviewing, and reporting on diversity and inclusion both at an organizational and sector level.

Other challenges to the implementation of a diversity and inclusion strategy are:

5. It takes time and resources to develop and implement a diversity and inclusion strategy; they are not a quick fix and one size does not fit all. For example, working in diverse teams requires a level of cross-cultural awareness if there is to be an inclusive environment in which everyone fully participates. These teams may struggle in the short-term but they produce stronger results in the long run that will benefit everyone including the organization (Debusschere et al., 2017).

6. Organizations also must do the groundwork before implementing diversity and inclusion strategies. If there is not a history of trust and openness, a diversity and inclusion strategy may be viewed with some skepticism. McCarthy and colleagues (2019) analysed data from 700 employees in three civil engineering firms and found a relationship between the perception of fairness within an organization and attitudes towards equality initiatives. This work suggests that before organizations implement diversity and inclusion initiatives, they must first address whether employees view the organization as fair.

7. In small and medium organizations, the informality of the structure may not translate through to policies and processes. This can create a scenario when relationships and fitting-in, rather than competencies, determine what happens in the workplace. The Engendering STEM team suggest that this tends to disadvantage women (Engendering STEM, 2018).

**APPLYING A GBA+ LENS TO DIVERSITY AND INCLUSION IN STEM**

Gender-based analysis plus (GBA+) is a process to examine how various intersecting identify factors impact how people experience policies and programs. The GBA+ lens looks beyond gender to consider all the factors that impact individual lives. Intersectionality is a framework for understanding how these intersecting identity factors or multiple categories of difference (Cho and Crenshaw, 2013) work together to influence and impact individuals’ lived experience. These differences or social group identities may include gender, race, age, ethnicity, sexuality, religion, citizenship, ability, and languages. They work together to create multiple, interconnected identities and unique experiences and highlight that experiences of women in the sector are not homogeneous. Mack and colleagues (2014) state that the intersectional lens

> “pushes us to ask new questions about the conditions under which talent can thrive. ... To truly understand what needs to be done we have to address these issues with nuanced perspectives that cannot be captured through broadly drawn dimension of gender or race.”
An intersectional lens highlights that the experiences of women in STEM are not homogeneous. For example, there is a gender pay gap in STEM between women and men. However, the data presented by Engendering Success in STEM (2019) demonstrates a more nuanced story – White women earn more than Black men, and Black men earn more that Latinx and Black women. Black women in leadership are perceived more negatively than Black men and White women. Another example comes from Tao and McNeely’s (2019) analysis of engineering workforce data from the US. They found that White American men are retained in engineering careers at the highest rate, while Asian American women are retained at the lowest rate. For women specifically, White American, and Hispanic American women are retained at higher rates than African American and Asian American women. They also identified differences in reasons for leaving among different groups of women and men, with White American women most likely to leave because of a change in career interests and family-related reasons, and African American and Hispanic American women most likely to leave due to the job they wanted not being available to them and a change in career interests.

The trend is similar in computing. In the US in 2017, women represented only 26 per cent of those working in the computing sector. However, for women of colour, their participation in this sector was much smaller. Asian women represented five per cent of the workforce, black women represented three per cent and Hispanic women represented one per cent of women (National Center for Women and Information Technology, n.d.).

These figures highlight the experiences of women in this sector is varied. The implications of this data are that diversity and inclusion policies need to reflect these different experiences of women and provide the supports and inclusion strategies to meet their needs.

Applying an intersectional lens to our understanding of women in STEM reveals that women of colour face a “double jeopardy” (Engendering Engineering Success in STEM, 2019). This means they experience prejudice and discrimination both as a woman and a person of colour. The impact of “double jeopardy” can multiply when a person holds many marginalized identities. This suggests, it is important to not only focus on gender when trying to increase the representation of women in STEM to develop effective programs that support women and girls.

Gaps and opportunities in the supports for women in the sector across the province

This section will be updated with information from other components of the jurisdictional scan including a review of initiatives in BC designed to support women in the sector; findings from the focus groups with women in which they will be asked to identify the initiatives that supported their participation in the sector and any gaps in the support. In addition, information from key informant interviews that will also explore supports and gaps in provision will be
The interviews with employers will be used to explore the challenges and barriers they experience in implementing diversity and inclusion programs.

The information presented below is based on data from the literature review.

The main sources of supports to women in the sector include professional associations, universities and polytechnical institutes, national and regional organizations. The majority of these organizations provide outreach support to schools to promote and encourage the participation in STEM and, to raise awareness about the diversity of STEM careers. All post-secondary institutions provide support to women in their programs aimed at increasing participation, retention, and graduation. Some universities offer programs which extend to the workplace. These include initiatives aimed to support the transition of women to working in STEM as well as programs, toolkits, and training to workplaces to support them in developing and implementing a diversity and inclusion strategy. Training and workshops on bias and on developing women within leadership in the sector are also provided. Not-for-profit organizations also offer support to women in the sector by providing training, events, mentoring and networking opportunities.

HR Tech has a hub, which provides information and resources to employers and individuals around all aspects of diversity and inclusion in technology.

### Gaps in support

One of the biggest challenges for both women in STEM and employers in the sector, is in accessing the available support and resources. There is a considerable amount of information available, but it is not housed centrally, and this makes accessing it difficult. The HR Tech Hub brings together some of this information and the AWET website will also provide information and resources.

The main gaps in support include:

- Transitioning to working in STEM including dealing with workplace cultures that may not be welcoming and inclusive
- Navigating career pathways and progression so that women have a career plan
- Accessing supports and resources aimed specifically at small and medium enterprises, which do not have a human resources department or other internal resources to support diversity and inclusion initiatives
Raising awareness in all organizations but especially the small and medium enterprises of the value of diversity and inclusion to their businesses and that it is not just a function of human resources

Recognizing effort and providing incentives for employers to invest in diversity and inclusion that extends beyond compliance

Raising awareness and understanding of the importance of a GBA+ lens to diversity and inclusion in the sector and how this could be achieved.

SCAN OF BC-BASED DIVERSITY AND INCLUSION INITIATIVES

As part of this review a scan was conducted of the British Columbia diversity and inclusion initiatives that are currently supporting girls and women in the sector. Thirty initiatives were identified, 19 of which support women in the sector and the remaining 11 provide resources and activities to encourage girls in school or women in post-secondary institutions to enter and remain in STEM. A detailed list of the initiatives is provided in Appendix B. This list will be updated by the AWET project team and will be hosted on their the AWET webpage.

CONCLUSION

The reasons women are underrepresented in the STEM sector are complex and to address them requires a comprehensive and sustained approach. Some initiatives within the STEM sector have focused on increasing the number of women entering the sector. These pipeline initiatives suggest that if more women are encouraged to enter STEM, then the gender gaps in the sector relating to participation, advancement, compensation, and retention will decrease and eventually disappear. A key message from the literature included in this review, is that this approach has been met with limited success and gender gaps persist in recruitment, participation, career progression and in salaries especially within engineering and technology.

The problem with the pipeline approach is that it still leaks, so no matter how many women enter, if they continue to feel unwelcome, unequal, do not feel belonged, and do not have the same opportunities to engage in interesting work and to progress, they will continue to leave engineering and technology and find employment in other sectors. As a result, the skills shortage within the sector will continue, and the benefits of having a diverse workforce will remain a series of lost opportunities for the businesses and society.

The literature included in this review suggests the way to increase the participation of women in the sector is to change the organizational culture within engineering and technology so that it is more diverse and inclusive. Women want to be part of organizations where they feel welcome.
and valued for their skills and expertise and, that their gender is not a barrier to their career development. To do this, diversity and inclusion initiatives must be authentic, intentional and go beyond compliance to remove barriers and the biases women encounter in engineering and technology organizations. The best practices identified suggest practical steps that can be taken by those in the sector, but these stress that changing workplace culture will take time and require sustained and consistent effort. Changing workplace culture will also require some challenging conversations if the status quo in engineering and technology is to move in a positive direction. Organizations have to be convinced of the business rationale for making their workplace culture more inclusive. There is significant evidence to show that diverse and inclusive workplaces are more productive, more innovative and that these benefits are seen in their bottom lines. Those in leadership positions must be committed to diversity and inclusion; moreover, they must model the behaviour they want to see and to set the expectations and tone for all employees. Leaders have to lay the groundwork prior to implementing a diversity and inclusion strategy so employees are not skeptical and take it seriously. The strategy must be owned by the organization and it cannot be the sole responsibility of the human resources department. In smaller organizations, the strategy where there might not be a human resources department, the diversity and inclusion strategy has to be championed by someone in a leadership position who has responsibility for implementation. The literature suggests moving beyond compliance, the diversity and inclusion strategy must be accompanied by meaningful and intentional actions. The organization and those in leadership have to buy-in to the strategy and be held accountable for it which necessitates tracking, monitoring and reporting out on progress. The most important message from the literature is diversity and inclusion are not an event; they a process.
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APPENDIX A: SCOPUS REFINED SEARCH TERMS

1. Woman or women
2. ("working parent" or "working mother" or "employed parent" or "employed mother")
3. or/1-2
4. Engineer-
5. Technolog-
6. Technician
7. "applied science"
8. STEM
9. or/4-8
10. (career or employ- or job)
11. (university or college or school or educat-)
12. (workplace or "work place")
13. or/10-12
14. Divers-
15. Inclus-
16. Retain-
17. Recruit-
18. Gender
19. "Gender balance"
20. “Pay gap”
21. ("workplace culture" "work place culture" or "organizational culture" or "engineering culture")
22. Leadership
23. (satisfact- or engag- or valu-)
24. Reputation
25. Responsib-
26. ("career develop-" or "career advance-")
27. or/14-26
28. Initiative
29. “best practice”
30. (program or train-)
31. Opportunity
32. Implement*
33. (challeng* OR barrier or discrep*)
34. Or/28-33
1. 3 and 9 and 13 and 27 and 34
APPENDIX B: SCAN OF BC-BASED DIVERSITY AND INCLUSION INITIATIVES

WEBSITES FOR CAREERS FOR WOMEN IN TECHNOLOGY AND SCIENCE

<table>
<thead>
<tr>
<th>Name</th>
<th>Mission and activities</th>
<th>Web link</th>
<th>Population served</th>
<th>Location served</th>
<th>Barriers addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve Anything Foundation (AAF)</td>
<td>AAF aims to inspire future female leaders in STEM, from the shop floor to top floor. They provide hands on experience in “non-traditional” fields for women, including sailing and flying.</td>
<td><a href="https://www.achieveanything.ca/index.html">https://www.achieveanything.ca/index.html</a>; <a href="https://www.girlsfly2.ca/">https://www.girlsfly2.ca/</a></td>
<td>Women in the sector</td>
<td>National</td>
<td>Lack of leadership training and opportunities for women</td>
</tr>
<tr>
<td>IEEE WiE Vancouver Women in Engineering</td>
<td>Goal is to facilitate the recruitment and retention of women in technical disciplines. The organization provides networking opportunities, develops programs to encourage girls and women to enter the sector through outreach to schools and administers the Student-Teacher and Research Engineer/Scientist program (STAR) to mentor young women. This is an international organization with branches across Canada.</td>
<td><a href="https://vancouver.ieee.ca/wie/wie-home/">https://vancouver.ieee.ca/wie/wie-home/</a></td>
<td>Women in technical disciplines</td>
<td>International organization with branch in Metro Vancouver Area</td>
<td>Recruitment and career advancement of women in sector; raising awareness of women in sector; encourages female students to study STEM</td>
</tr>
<tr>
<td>Tech Girls in Canada (TGC)</td>
<td>TechGirls Canada is the hub for Canadian women in Science, Technology, Engineering, and Math (STEM). It is a not-for-profit organization committed to conducting research and co-designing solutions that address barriers for diversity and equity in science and technology sectors by championing LGBTQ+, immigrant, refugee, and Indigenous women, women of all colors and all abilities.</td>
<td><a href="https://www.techgirls.ca/">https://www.techgirls.ca/</a></td>
<td>LGBTQ+, immigrant, refugee, and Indigenous women, women of all colors and all abilities</td>
<td>National</td>
<td>Diversity and equity in the technology for women, LGBTQ+, immigrant, refugee and Indigenous women, women of all colors and all abilities</td>
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</tbody>
</table>
**Name** | **Mission and activities** | **Web link** | **Population served** | **Location served** | **Barriers addressed**
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Athena Pathways | Athena Pathways is a partnership of academia, government and industry that aims to educate women in the science and commercialization of artificial intelligence. As women are underrepresented in AI technology Athena Pathways goals is to address this gender gap by encouraging women to enter and remain in the sector. | https://athenapathways.org/about-us | Women in artificial intelligence sector and industry | National | Lack of representation of women in artificial intelligence sector

BC Women in Technology (BCWiT) | Women in Technology (BCWiT) Team represents women who are members of Applied Science Technologists and Technicians of British Columbia and the organization spans the various disciplines in the technology field. BCWiT recognizes that it is critical to capture the interest of girls at a younger age and they hope to achieve this by providing hands on events and focused career counselling. Their mission is to provide support, be an information resource and promote awareness of women in technology careers and career opportunities to women. | https://wit.asttbc.org/ | Women who are members of ASTTBC | Provincial | Lack of awareness and knowledge of the career potential for women in sector

Canadian Coalition of Women in Engineering, Science, Trades and Technology (CCWEST) | CCWEST is a collaboration of groups, institutions and industries that has a mission to expand the recruitment, retention, and promotion of women in the engineering, trades, and technology workforces. CCWEST host conferences and events with forums, panels, speakers, and networking opportunities for women in SETT (science, engineering, trades, and technology). | http://www.ccwestt.org/ | Women in Science, Engineering, Trades and Technology | National | Recruitment retention and career advancement of women in SETT
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<tr>
<td>Centre for Training and Excellence in Mining (CTEM)</td>
<td>Provide diversity and inclusion resources that are intended to be useful and practical for employers, Employees, Educators, and general public. Provides leadership training for women.</td>
<td><a href="https://www.bc-ctem.ca/diversity-%E2%80%93-women">https://www.bc-ctem.ca/diversity-%E2%80%93-women</a></td>
<td>Women in sector, employers, educators, and general public</td>
<td>National</td>
<td>Lack of representation of women in mining sector; lack of leadership training and opportunities.</td>
</tr>
<tr>
<td>Engineering and Geoscientists of BC – Women in Engineering and Geoscience Division</td>
<td>This organization provides a range of supports to women in engineering including hosting events aimed towards women engineers. They offer mentoring, volunteering, and networking opportunities for women. awards programs. They are also part of the national 30 by 30 initiative which is aimed at increasing the representation of women in the sector.</td>
<td><a href="https://www.egbc.ca/About/Our-Team/Divisions/Women-in-Engineering-and-Geoscience-Division">https://www.egbc.ca/About/Our-Team/Divisions/Women-in-Engineering-and-Geoscience-Division</a></td>
<td>Women at all stages of their engineering or geoscience career</td>
<td>Provincial</td>
<td>Lack of recognition of women in sector. Provides training, networking, and mentoring</td>
</tr>
<tr>
<td>Engendering Success in STEM (ESS)</td>
<td>Consortium is a research partnership with the goal to increase women's inclusion and success in STEM. There are four main projects: CLIMB – focused on childhood and based in elementary schools. This initiative partners with Science World and is developing interventions to change gender bias. Developed Super Science Club and Science World's Meet -a-Scientist Program with the aim of changing the learning of implicit math biases: PRISM – aimed at adolescents in grades 7-9 to reduce barriers to girls choosing STEM and delivers summer science camps to girls; SINC – implementing and evaluating intervention programs in three universities to reduce social exclusion in professional networks; RISE – early career focus to create more inclusive workplace cultures. Provides training and workshops for employers</td>
<td><a href="http://successinstem.ca/Project">http://successinstem.ca/Project</a> CLIMB</td>
<td>Women at all stages of their careers in sector</td>
<td>Provincial</td>
<td>Gender bias in sector, lack of awareness of career opportunities for girls and women, supports employers to develop inclusive workplaces</td>
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<td><a href="http://successinstem.ca/projects/climb/">http://successinstem.ca/projects/climb/</a></td>
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<td><a href="http://successinstem.ca/projects/prism/">http://successinstem.ca/projects/prism/</a></td>
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<td><a href="http://successinstem.ca/projects/rise/">http://successinstem.ca/projects/rise/</a></td>
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<td><a href="http://successinstem.ca/projects/sinc/">http://successinstem.ca/projects/sinc/</a></td>
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<td><strong>Engineers Canada Women in Engineering</strong></td>
<td>Engineers Canada has created the 30 by 30 initiate, a national program with the goal of raising the percentage of women who are newly licensed engineers to 30% by the year 2030. The program focuses on barriers to entry and retention for women in the profession.</td>
<td><a href="https://engineerscanada.ca/diversity/women-in-engineering">https://engineerscanada.ca/diversity/women-in-engineering</a></td>
<td>Women at all stages of their engineering or geoscience career</td>
<td>National</td>
<td>Recruitment, retention, and career development of women in sector</td>
</tr>
<tr>
<td><strong>EUReKA! Thompson Rivers University</strong></td>
<td>EUReKA! Provides school workshops, camps, clubs, and events for youth in the Kamloops area to encourage students to choose to study STEM subjects in school. The programs are for students in grades K-9 and they provide customized programs for girls.</td>
<td><a href="https://www.tru.ca/eureka.html">https://www.tru.ca/eureka.html</a></td>
<td>Students in Grade K-9. They provide customized programming for girls</td>
<td>Kamloops, BC</td>
<td>Lack of awareness and knowledge of STEM careers amongst female students</td>
</tr>
<tr>
<td><strong>Gender Equity in Mining (GEM works)</strong></td>
<td>Provides tool and guides to support increased representation of women in mining. Program includes eLearning, executive development session as well as guides and tools. Also have an industry taskforce and industry champions both aimed at sharing good practice.</td>
<td><a href="https://mihr.ca/inclusion-diversity/gender-equity-in-mining-works-gem-works/">https://mihr.ca/inclusion-diversity/gender-equity-in-mining-works-gem-works/</a></td>
<td>Employers and women working in mining sector</td>
<td>National</td>
<td>Gender bias in sector</td>
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<tr>
<td><strong>Girl Guides Girls in STEM</strong></td>
<td>Girl Guides Girls in STEM program provides girls ages 5-17 an opportunity for hands on experience in STEM. The goal is to encourage greater participation of girls in STEM. Girls are exposed to engineering through meetings, camps, conferences, and workshops. The program also provides support and connections to women mentors in the field.</td>
<td><a href="https://www.girlguides.ca/web/GGC/Programs/GGC/Campaigns/2019/Girls_in_STEM.aspx?ads=stem2019">https://www.girlguides.ca/web/GGC/Programs/GGC/Campaigns/2019/Girls_in_STEM.aspx?ads=stem2019</a></td>
<td>Girls aged 5 to 17</td>
<td>National</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers</td>
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<tr>
<td>Girls and Steam</td>
<td>Girls and Steam is a Science World program aimed at girls 11-13 interested in all things science, technology, engineering, art and design, and math (STEAM). Girls and STEAM put on events including workshops and events featuring speakers from the sector. Their goal is to increase the participation of girls in STEM.</td>
<td><a href="https://www.scienceworld.ca/event/girlsandsteam2020/">https://www.scienceworld.ca/event/girlsandsteam2020/</a></td>
<td>Girls aged 11 to 13 years</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers</td>
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<tr>
<td>Girls Exploring Physics, Simon Fraser University</td>
<td>Girls Exploring Physics provides free workshops for girls in grades 9-10 located at the SFU Burnaby campus. They provide hands on activity sessions and a tour of the new Trottier astronomical observatory.</td>
<td><a href="https://www.sfu.ca/physics/outreach/girls-exploring-physics/gepgirlsworkshops.html">https://www.sfu.ca/physics/outreach/girls-exploring-physics/gepgirlsworkshops.html</a></td>
<td>Girls aged 11 to 13 years</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers</td>
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<tr>
<td>GIRLsmarts4tech</td>
<td>Based at UBC this program offers workshops for grade 7 girls in computer science. Programs include demonstrations and hands on activities such as writing your own computer program, building a website and 3d printing.</td>
<td><a href="https://www.cs.ubc.ca/girlsmarts4tech/">https://www.cs.ubc.ca/girlsmarts4tech/</a></td>
<td>Girls in Grade 7</td>
<td>Provincial</td>
<td>Lack of participation of women in sector, lack of awareness and knowledge about potential technology careers</td>
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<tr>
<td>Immigrant Services Society of BC (ISSBC)</td>
<td>TechWomen provides newcomer women with skills in web development, technical language skills and job readiness training. Techwomen also provides networking and job shadow opportunities to landed immigrants, caregivers (with open work permit), refugee claimants, or naturalized citizen. Their goal is to enable newcomer women to enter the sector.</td>
<td><a href="https://issbc.org/our-services/techwomen">https://issbc.org/our-services/techwomen</a></td>
<td>New immigrant women in the sector</td>
<td>Provincial</td>
<td>Lack of participation of women in sector, lack of awareness and knowledge about potential technology careers</td>
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<td>Indigenous STEM program</td>
<td>As part of the Indigenous STEM program, the University of Victoria hosts the Annual Indigenous STEM Middle &amp; High School Tours. During these day-long events, up to 100 Indigenous youth from school districts 61, 62, and 63, have the opportunity to go behind the scenes at the University of Victoria to explore the laboratories, to meet students and professors, and to participate in hands-on activities.</td>
<td><a href="https://www.scienceventure.ca/stem">https://www.scienceventure.ca/stem</a></td>
<td>Middle and High School Students</td>
<td>Vancouver Island</td>
<td>Lack of participation of indigenous students including girls in STEM. Specific barriers addresses are lack of awareness and knowledge about potential technology careers</td>
</tr>
<tr>
<td>Island Women in Science &amp; Technology</td>
<td>Based on Vancouver Island, Island Women in Science and Technology hosts networking and professional development events on the island for women in STEM.</td>
<td><a href="http://www.iwist.ca/">http://www.iwist.ca/</a></td>
<td>Women in STEM at all stages of their careers</td>
<td>Vancouver Island</td>
<td>Lack of support and networking opportunities for women on Vancouver Island</td>
</tr>
<tr>
<td>Science AL!VE Simon Fraser University</td>
<td>Provides school workshops, camps, clubs, and events for youth across BC. The programs are for youth in grades K-9 and they provide customized programs for girls.</td>
<td><a href="http://www.sciencealive.ca">http://www.sciencealive.ca</a>.</td>
<td>School aged children K-9 with customized programming for girls</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers</td>
</tr>
<tr>
<td>Science World Mentor Program</td>
<td>This is a volunteer-based program that helps address British Columbia's need for more scientists, engineers, technologists, technicians, creative technology professionals and innovators to promote students' interest in these areas. The goal is to inspire students with exciting, in-school presentations by career mentors. The program is offered to Grades K–12 everywhere in BC.</td>
<td><a href="https://www.scienceworld.ca/sis/">https://www.scienceworld.ca/sis/</a></td>
<td>School – Grade K to 12</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
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<tr>
<td>Society for Canadian Women in Science and Technology (SCWIST)</td>
<td>Not for profit society, that specializes in improving the presence and influence of women and girls in STEM. It does this through activities in education, networking, mentorship, collaborative partnerships, and advocacy. It delivers programs in BC and Yukon and nationally through partner organizations.</td>
<td><a href="https://scwist.ca/">https://scwist.ca/</a></td>
<td>Youth, women in STEM careers, newcomers</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers</td>
</tr>
<tr>
<td>Society of Internationally Trained Engineers of British Columbia (SITE-BC)</td>
<td>SITEBC supports internationally trained engineers by providing networking opportunities, information sessions and knowledge and skills transfer to help them succeed in Canadian work environment.</td>
<td><a href="https://sitebc.ca/">https://sitebc.ca/</a></td>
<td>Internationally trained engineers</td>
<td>Provincial</td>
<td>Lack of support and networking opportunities for internationally trained women in STEM</td>
</tr>
<tr>
<td>Society of Punjabi Engineers and Technologists of BC and Technologists of BC (SPEATBC)</td>
<td>SPEATBC provides assistance to new immigrant engineers from the Indian subcontinent and to new graduates by providing professional guidance to support career development. SPEATBC promotes the engineering profession in this community by fostering fellowship amongst its members. This organization includes all disciplines including Electrical, Computer, Civil, Mechanical, Chemical, Environmental, Metallurgical Engineers and all Applied Science Technologists and Technicians. The organization provides networking opportunities as well as scholarships to women and newcomers.</td>
<td><a href="https://speatbc.org/">https://speatbc.org/</a></td>
<td>Engineers who are recent newcomers to Canada, recent graduates, and students</td>
<td>Provincial</td>
<td>Lack of support and networking opportunities for internationally trained women in STEM</td>
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<td><strong>The Canadian Association for Girls in Science (CAGIS)</strong></td>
<td>This is a national organization which holds monthly events to provide hands on activities to girls aged 7-16 years. Their goal is to encourage girls to consider studying and a career in STEM. The sessions are available in person and virtually and they are hosted by experts in their fields.</td>
<td><a href="https://girlsinscience.ca/">https://girlsinscience.ca/</a></td>
<td>Girls aged 7 to 16 years</td>
<td>National organization which has chapters in Vancouver and Victoria. Sessions are also available online.</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
</tr>
<tr>
<td><strong>The Canadian Centre for Women in Science, Engineering, Trades and Technology (WinSETT Centre)</strong></td>
<td>Through collaboration and partnership, the WinSETT Centre fosters opportunities that encourage women to enter, stay and grow in SETT careers. Its goals are to maximize Canada’s human resource potential, increase innovation, and support Canadian economic development.</td>
<td><a href="http://www.winsett.ca">www.winsett.ca</a></td>
<td>Women in science, engineering, trades, and technology to support recruitment, retention, and career advancement. It also works to promote women as leaders in the sector</td>
<td>National</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers</td>
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<td>The Metallurgy and Materials Society</td>
<td>The purpose of MetSoc is to serve members, society and others involved in the research, development and application of the science and technologies for the environmentally responsible extraction, fabrication, utilization and recycling of metals and materials. This organization achieves this by advancing and promoting the metallurgical and materials professions in Canada; producing timely quality publications; creating networking opportunities and acting as an expert source for technical knowledge and best practices. Conducted a special project in 2016 interviewing women in the sector.</td>
<td><a href="https://www.metsoc.org/wistem/women-of-innovation/">https://www.metsoc.org/wistem/women-of-innovation/</a></td>
<td>Professionals working in the field. Provides awards for emerging professionals and networking opportunities</td>
<td>National</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
</tr>
<tr>
<td>UBC Geering Up</td>
<td>This is an outreach program for youth in school. The program Provides school workshops, camps, clubs, and events across BC. They provide customized programs for girls.</td>
<td><a href="http://www.geeringup.ca.">http://www.geeringup.ca.</a></td>
<td>School Grades K-12 with customized programs available for girls</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
</tr>
<tr>
<td>University of Victoria's Science Venture</td>
<td>University of Victoria's Science Venture program provides innovative science, technology, engineering, and math programming to Vancouver Island youth, 5-18 years of age. Programming includes workshops, after school clubs, summer camps, and events – all designed to stimulate the interest and passion for these subject areas and encourage students to consider STEM as a career.</td>
<td><a href="https://www.scienceventure.ca/">https://www.scienceventure.ca/</a></td>
<td>School Grades K-12</td>
<td>Vancouver Island</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers</td>
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<td><strong>Vancouver Women in Technology (VanWIT)</strong></td>
<td>A non-profit society that supports women pursuing careers in the technology sector. We provide mentorship, networking, and educational opportunities to help women thrive in Vancouver's technology community. Provides support to women at all stages of their careers. The organization hosts events for women.</td>
<td><a href="https://vanwit.ca/">https://vanwit.ca/</a></td>
<td>Women in Technology at all stages of their careers</td>
<td>Vancouver</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
</tr>
<tr>
<td><strong>Westcoast Women in Engineering Science and Technology</strong></td>
<td>WWest's mission is to engage industry, the community, and students to increase the awareness and participation of women and other under-represented groups in Science, Technology, Engineering, and Mathematics (STEM) fields of study and careers. WWEST works regionally and, in conjunction with the other chapters, as well as nationally to support policy, research, advocacy, facilitation, and pilot programs that support women in science and engineering. Provides mentoring and networking opportunities as well as other career tools.</td>
<td><a href="https://www.winsett.ca/">https://www.winsett.ca/</a></td>
<td>Women at all stages of their careers in science, engineering, and technology</td>
<td>Provincial with chapters across BC</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
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<tr>
<td><strong>Women in Consulting Engineering (WCE)</strong></td>
<td>Women in Consulting Engineering (WCE) is devoted to supporting and empowering women in engineering and increasing gender diversity and inclusion in the sector. Organization hosts events and is engaged in many different outreach events including hosting career fairs for young women.</td>
<td><a href="https://wcevancouver.com/">https://wcevancouver.com/</a></td>
<td>Women at all stages of their careers in engineering</td>
<td>Provincial</td>
<td>Gender bias in sector, lack of awareness of career opportunities for girls and women, supports employers to develop inclusive workplaces</td>
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**Literature Review: AWET**

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<tr>
<td><strong>Women in Engineering (WiE)</strong></td>
<td>A University of British Columbia Engineering initiative aimed at increasing female enrollment in UBC Engineering from 18 to 30 per cent. This initiative supports scholarships for outstanding students, supports outreach programs for K-12 student, teachers, and parents to help encourage young women to consider engineering. It also has industry focused initiatives including mentorship and provides supports as graduates transition into the workplace.</td>
<td><a href="https://engineering.ubc.ca/giving/faculty-priority-projects/together-wie-can">https://engineering.ubc.ca/giving/faculty-priority-projects/together-wie-can</a></td>
<td>Female students in high school and post-secondary, teachers, and industry</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
</tr>
<tr>
<td><strong>Women in Mining BC</strong></td>
<td>WIMBC is an organization that provides women in the mining industry with a way to connect to each other, share knowledge and experiences and build relationships that encourage growth and diversity. Organization provides tools and resources as well as networking and other opportunities.</td>
<td><a href="https://www.wimbc.ca/">https://www.wimbc.ca/</a></td>
<td>Women in mining at all stages of their careers</td>
<td>Provincial</td>
<td>Lack of participation of women in mining, lack of awareness of potential careers for women in mining, training, and networking opportunities for women in mining STEM</td>
</tr>
<tr>
<td><strong>Women in Science and Engineering (WiSE) Mentoring Program</strong></td>
<td>WiSE aims to support the success of young women to transition from their undergraduate education to a career in science or engineering and to prepare and mentor them to remain in the sector.</td>
<td><a href="http://wise.ok.ubc.ca/">http://wise.ok.ubc.ca/</a></td>
<td>Female high school and post-secondary students</td>
<td>Provincial</td>
<td>Lack of participation of women in STEM, lack of awareness and knowledge about potential STEM careers, lack of mentors for women in sector</td>
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Social Research and Demonstration Corporation
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