Advancing Women in Engineering and Technology (AWET)

Final Research Report

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

> *"Talent is equally distributed across all sociocultural groups; access and opportunity are not. This is particularly true in science, technology, engineering, mathematics, and medicine … The underrepresentation of marginalized groups in STEMM contexts is pervasive."* (Byars-Winston and Dahlberg, 2019, p. ix)

The Advancing Women in Engineering and Technology Project (AWET) was a two-year project funded through the Ministry of Advanced Education and Skills Training Sector Labour Market Partnerships (SLMP) Program. The goal of AWET was to increase the participation of in the engineering and technology by supporting the implementation of diversity and inclusion strategies in BC. The Covid-19 public health emergency necessitated changes in the delivery approach and the focus of the AWET. The Social Research and Demonstration Corporation (SRDC) had been commissioned to evaluate the AWET and, in response to the change in focus, it was contracted by the AWET project to conduct a jurisdictional scan. This report brings together data generated from the AWET evaluation, a literature review and qualitative interviews with employers, key informants and women in the sector. The purpose of the report is to explore the factors that contribute to a successful diversity and inclusion initiative, to identify the major barriers and what to consider the insights a GBA+ lens brings to the understanding of diversity and inclusion for equity seeking groups in the sector.

There is overwhelming evidence that women are underrepresented in engineering and technology (Sassler et al., 2018). The 'problem' of the underrepresentation of women and equity seeking groups in the sector has been discussed for more than 30 years (Wall, 2019). The data suggests that there are many complex reasons for a lack of diversity in the sector, and that the solutions to address these require a comprehensive and sustained approach. 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 which includes intentional and authentic actions that are transparent and measurable, and for which, there is accountability within an organization.

Some initiatives within the sector have focused on increasing the diversity of those entering the sector in the hope that this action will reduce the gap. A key message from the literature and the data generated by AWET, is that this approach has been met with limited success; gender and diversity gaps persist in recruitment, participation, and career progression. The problem with the pipeline approach is that the pipeline still leaks, so no matter how many women and diverse engineers and technologists enter, if they feel unwelcome, that they do not belong, and do not have the same opportunities as their male colleagues 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 sector and society.

The data included in this report suggests the way to increase diversity in the sector must include changing organizational culture so that it is not only more diverse but more inclusive as well. The data suggest that if initiatives are to achieve this, they must be authentic, intentional and go beyond legislative compliance to remove biases encountered in engineering and technology organizations. The promising practices identified suggest practical steps to increase diversity and inclusion.

Changing the culture of an organization and a sector will take time and require full participation from all employees as well as sustained and consistent effort. It will also require some challenging and even uncomfortable conversations with those in the sector. In reviewing the reasons women leave engineering, Gill and colleagues (2017) found that workplace or organizational culture was the one of the main reasons women left the sector. It plays an important role in driving women away from the sector as it determines the behaviour deemed appropriate and acceptable, and the sanctions for inappropriate behaviours and the rewards for effort. Research has shown the women who left engineering were very similar to those that stayed; the difference was not in the women, but in the culture of the workplaces (Corbett & Hill, 2015).

There is substantial evidence on the business case for increasing diversity and inclusion. Diverse workplaces are more productive, creative, happier, and healthier and that these benefits are seen in their bottom lines. Yet despite this evidence, some organizations lack the impetus to change. 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 including following through on implementation Leaders must 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, 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.

Workplace diversity and inclusion initiatives must be data driven. Those from equity seeking groups believe that the data will speak for itself and will demonstrate the lack of diversity and inclusion in organizations. Without the data, the lack of diversity and inclusion is easier to ignore. Employers need to track and monitor a range of diversity and inclusion indicators and report out on these using a GBA+ lens to highlight discrepancies between employees based on gender, ethnicity, and the presence of a disability. The goal is when women and equity seeking groups enter the sector they stay and thrive like their male colleagues.

Most of employers, key informants and women who participated in interviews support the literature which suggests diversity and inclusion initiatives must broaden their focus. Providing training and or supports to women and equity seeking groups to better equip them to deal with the lack of diversity and inclusion is doomed to fail if the systemic biases within the system are not addressed.

While there are some employers and organizations in the sector that have prioritized diversity and inclusion and worked hard to create workplaces in which all employees are welcomed and respected, they are the minority. Diversity and inclusion within the sector are at best a patchwork of initiatives rather than comprehensive policies and programs that are embedded in the organization and championed by leadership.

The focus groups, interviews with key informants and employers remind us that not all employers are the same. There are employers who have worked hard to create welcoming, safe, and respectful workplaces for all employees. Most employers interviewed described diversity and inclusion as a process, a journey, and while they had made progress, they acknowledged they were not "where we want to be yet."

The most important message from this report is diversity and inclusion are not an event; they are a process. The literature and those interviewed had reasons to be optimistic that the engineering and technology sector would become more diverse and inclusive. While all acknowledged change had been too slow, they were hopefully that as more diverse engineers and technologists entered the sector, they would expect equal opportunities and they anticipated this expectation would help drive greater change and transformation. The caveat is that employers have to do their part to authentically address the biases and create a welcoming and equitable workplace culture. Actions have to be intentional and aimed at building trust. The key informants speculated good employers would rise to the challenge, not only because it was the socially just thing to do, but because it made good business sense. These employers would become the employer of choice and would benefit from recruiting and retaining the best engineers and technologists. Other employers it was argued, would need a 'burning bridge', an unavoidable mandate for change, but respondents stated that with skills shortages looming, what choice do they have?

Recommendations for next steps:

1. The engineering and technology sector has to find the 'burning bridge' that will persuade all employers to address diversity and inclusion within their organizations. Currently the impetus for change is coming from two sources: internally from employees and progressive leaders and externally as customers and contracts require reporting on diversity and inclusion policies and practices.

2. Raise awareness about the benefits of diversity and inclusion to the organization and sector. Consider recognizing or rewarding those employers who actively and authentically promote diversity and inclusion in their organizations.

3. An array of carrots and sticks will be needed to bring some employers to the table. These should reflect the capacity and context within which they are operating.

4. Make how-to information readily and easily available and consider providing supports to employers. Provide workshops on how to make recruitment and career advancement processes more diverse and inclusive as well as what and how to track and monitor progress.

5. Empower and train HR professionals to promote and respond to employees who have experienced bullying and discrimination because of their gender or are racialized.

6. Provide unconscious bias training that is scenario based and that goes beyond defining bias but helps employers and employees know how to respond to it. Some employers may be concerned about what they discover so training should provide a bridge to action.

7. Consider convening a leadership table that focuses on diversity and inclusion in the sector to share best practices and to highlight what is possible.

8. Provide support to outreach programs in elementary and high schools to encourage girls and those from equity seeking groups to participate in STEM.

INTRODUCTION

"Talent is equally distributed across all sociocultural groups; access and opportunity are not. This is particularly true in science, technology, engineering, mathematics, and medicine … The underrepresentation of marginalized groups in STEMM contexts is pervasive." (Byars-Winston and Dahlberg, 2019, p. ix)

The Advancing Women in Engineering and Technology Project (AWET) was funded through the Ministry of Advanced Education and Skills Training Sector Labour Market Partnerships (SLMP) Program. The goal of SLMP is to support long term, strategic and sustainable changes to improve workforce development. AWET was a two-year project that began in 2019 and was led by the Applied Science Technologists and Technicians of British Columbia (ASTTBC). The aim of AWET was to increase the participation of women in the engineering, geoscience, technology, and technician occupations by supporting the implementation of diversity and inclusion strategies to recruit, retain and support career development of women within these professions.

As part of AWET, ASTTBC commissioned the Social Research and Demonstration Corporation (SRDC) to evaluate the project and to conduct a jurisdictional scan. The evaluation report has been completed and is a standalone document.[1] The jurisdictional scan explored the broader issues experienced by the sector relating to the recruitment, retention, and the career development of women. It included a literature review, a scan of the range of BC initiatives to support women in the sector and identified current promising practices (September 2020). Additional primary data was also collected as part of this scan, namely interviews with employers and key informants as well as focus groups with women in the sector.

This final research report brings together the findings from the jurisdictional scan and key insights from the evaluation report to review the experiences of women and other equity seeking groups in the sector to contribute to a discussion on promising practices and next steps.

SRDC, AWET partners, Project Team, and Advisory Group gratefully acknowledge that we are fortunate to have conducted this work on the territories of the First Peoples of BC.

OBJECTIVE AND RESEARCH QUESTIONS

This final research report explores key challenges and opportunities within the sector that impacts the participation and advancement of women and other equity seeking groups in

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[1]   AWET Evaluation Report (December 2020).

engineering and technology. A key object for this report is to support a discussion on promising practices and potential next steps for those in the sector. The three research questions that guided this report are:

1. 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?

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

3. What insights does a GBA+ lens provide to the understanding of diversity and inclusion for equity seeking groups within the sector?

Data sources

An extensive array of data sources was used to address the above three research questions. They consist of existing data collected by SRDC either as part of the evaluation of AWET or as a component of this scan. To enhance these existing data sources, SRDC also collected additional primary data from employers, key informants, and women in the sector.

Existing AWET data sources

SRDC produced a literature review of published and grey literature which explored the recruitment, retention, and career advancement of women in engineering and technology sector. This document also presented information on the initiatives to support women in the sector in BC and identified barriers as well as initiatives that supported women. This review was submitted in September 2020 and is available on request.

SRDC evaluated the Advancing Women in Engineering and Technology Project. The final evaluation was submitted in December 2020 as a standalone document and some key insights and findings are used to support the discussion on the retention, recruitment, and career advancement of women in the sector. These include:

- SRDC conducted an online survey with individuals working in the sector in BC. The Advancing Careers in Applied Sciences survey was conducted with members from ASTTBC and Engineers and Geoscientists BC in October 2019. The survey consisted of six key sections: career and employment, current workplace, job and career satisfaction, career development, awareness of diversity and inclusion initiatives, and educational and demographic information. Engineers and Geoscientists of BC and ASTTBC emailed survey invitations to all their members and a link to the survey was sent to a total of 37,779 people.

The survey had a total of 3,414 responses (response rate 9.0%) of which 3,079 (8.2%) were valid responses. The survey results were analyzed using a Gender Based Analysis Plus (GBA+) lens through which the experiences of diverse groups of people in the Applied Sciences field was analyzed. SRDC explored differences in experiences and responses based on gender differences, country of birth and physical, mental or health disability.

- As part of the evaluation of AWET, SRDC conducted six telephone interviews with employers in BC working in the sector. The interviews were conducted with employers who were members of Association of Consulting Engineering Companies BC (ACEC-BC) during October and November 2019. The evaluators worked with ACEC-BC to identify respondents from BC. The interviews were conducted with a senior member of staff who had knowledge of the organizations employment policies and practices. The interviews were conducted by telephone and were approximately 45 to 60 minutes in duration. Respondents were sent a copy of the questions and a consent form prior to the interview. The interviews were recorded, and notes taken after the completion of the interview, the interviews were analyzed thematically.

- Data collected by SRDC from 2019 to 2020 on the implementation, activities and events conducted by the AWET project team. This includes findings from AWET project administrative data, interviews with those involved in the implementation and data from the event satisfaction surveys.

New primary data

Additional qualitative data was collected by SRDC between September and December 2020. This included:

Interviews with employers – eight interviews were conducted with employers in the sector. Employers were identified via suggestions from the advisory group, the AWET project team and by snowballing. The interviews were conducted by telephone and lasted approximately 40 minutes. Employers were sent a copy of the questions prior to the interview. Permission was sought to record the interviews and detailed notes were taken and the data was analyzed thematically.

Interviews with key informants – eight interviews were conducted with key informants. These were individuals within the engineering and technology sector in BC who had significant professional experience relating to the recruitment, retention, and career development of women. Those interviewed included, human resource managers, diversity and inclusion leads, those involved with groups supporting women in the sector. These interviews were conducted by telephone and lasted between 40 and 60 minutes. Respondents were sent a copy of the questions

prior to the interview. Permission was sought to record the interviews and detailed notes were taken and the data was analyzed thematically.

Focus groups with women working in the sector – two focus groups were conducted with women in the sector. The groups explored the experiences of women currently working in engineering and technology and discussed the challenges encountered as well as the supports for recruitment, retention, and career development. The focus groups were conducted online and discussions lasted 90 minutes. With the support from the Ministry, one focus group was conducted with women who work for the provincial government within an engineering and technology capacity. The second group was conducted with women who worked in mostly in the private sector. Those who attended the focus groups worked in a variety of settings and disciplines. Permission was sought to record the interviews and detailed notes were taken and the data was analyzed thematically.

STRUCTURE OF REPORT

This report begins by providing a brief overview of the context relating to recruitment, retention, and career advancement of women in engineering and technology by drawing on the literature review and survey data. This section explores the 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 section 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 to ensure the initiatives meet the needs of the broad spectrum of women in the sector. The review concludes with a review of current initiatives within the sector aimed at increasing the representation of girls and women in the sector. This section concludes by presenting findings from interviews and focus group conducted with employers, stakeholders, and women in the sector.

The subsequent sections of the report address each of the research questions and the report concludes with a discussion of the implications for future policies and practices aimed increasing the recruitment, retention, and career advancement of women. Finally, the report ends with a discussion of equity, diversity, and inclusion within the sector as well as the potential next steps for policymakers, employers and others in the sector based on the best available evidence.

BACKGROUND INFORMATION – THE AWET PROJECT

AWET was a two-year project, which began in February 2019 and was managed by Applied Science Technologists and Technicians of BC (ASTTBC). The goal of AWET was to provide

supports that would meet regional priorities and needs and leverage existing resources. The four economic regions were Mainland Southwest, Vancouver Island/Coast, Thompson-Okanagan, and Kootenay. Each region had a regional coordinator who convened a local action group and who worked with its members to implement a range of activities. The regional coordinators were supported by a provincial team. A key task of the AWET project team was the recruitment of champions who were intended to support AWET events and activities at the regional and provincial level. However, changes within the project governance and the restrictions that have resulted from COVID-19 necessitated changes in the delivery approach and the focus of the AWET. The stay-at-home order issued in March 2020 prevented AWET from continuing to deliver and participate in in-person events and activities and when possible, these moved to online delivery. These online activities included a series on webinars to support those in the sector. Information about the AWET project is available via the SRDC evaluation report and the AWET project reports.

WHAT IS 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 and 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 dance and fully participate. 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
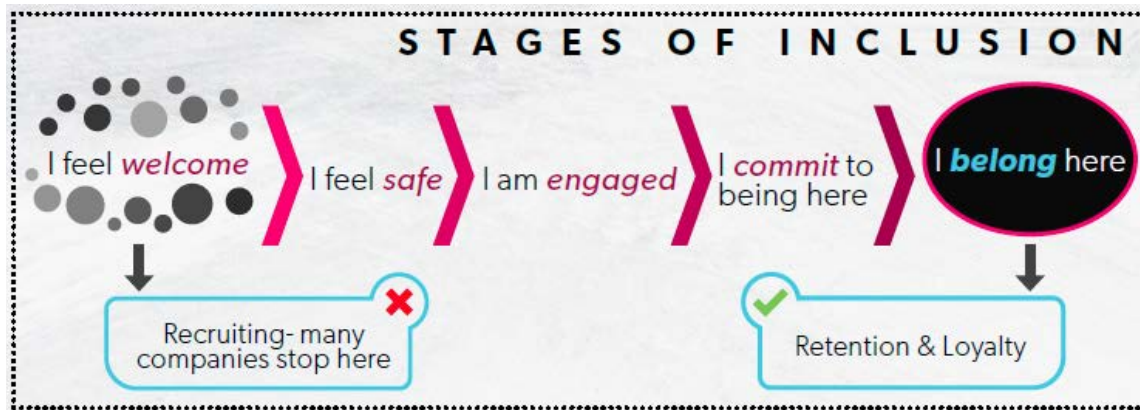
Source: LaunchVic & Change Catalyst, n.d., p. 5.

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)

Key among these challenges is the presence of bias. 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).

- **Systemic or 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.

DEFINITIONS OF MENTORING AND SPONSORSHIP IN ENGINEERING AND TECHNOLOGY

In the following sections of this report, the literature review and the interviews with employers and those in the sector discuss the role of mentors and or sponsors to support the participation of women and equity seeking groups in the sector. For purposes of clarity these concepts are defined as:

- Byars-Winston and Dahlberg (2019) identified over 50 definitions of mentoring. In their review of effective mentorship, they defined it as "a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial supports." (p. 2)

- Huston et al. (2019) define sponsorship as providing proactive and instrumental support to help advance an individual's career. They suggest, that while a mentor might provide support and counselling, a sponsor "leverages influence" and takes action to promote the developmental of an individual's career. The sponsor is seen to have a seat at the decision-making table within an organization (p. 2341).

WOMEN IN ENGINEERING AND TECHNOLOGY – KEY FINDINGS FROM THE LITERATURE REVIEW

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. Authors conclude 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). Researchers 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). 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 lack of women and other equity seeking groups in the sector is also problematic in that it is symptomatic of a lack of diversity. Research has 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 that 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 literature shows that not all STEM sectors are the same in terms of their representation of women. Wall (2019) and Simon and Nene (2018) 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.

GIRLS IN EDUCATION AND STEM

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 Girl Guide report called for "harmful norms and stereotypes about what girls can do" (p. 4) to be debunked.

- Canada 2067 (2018) reports that internationally, Canadian students do well in the academic performance of science, and ranks third among OECD countries, but 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).

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.

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."*

Reasons women leave the sector

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. 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 understanding 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 women 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. As such, they are ill-prepared for the realities of working in engineering and technology in which they feel unwelcome (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) rather than just focusing on the women or specific equity seeking group. Organizational culture determines the behaviour that is deemed appropriate and acceptable, and the sanctions for behaviours that are inappropriate as well as the rewards for effort (HR Tech Group, 2017).

SUPPORTING WOMEN IN THE SECTOR

A number of supports and initiatives have been developed to support women in the sector including those based in post-secondary institutions and workplaces. Reviews of these suggest there is a high level of consensus about the steps organizations and employers should follow if they are serious about increasing the representation of women (and other groups) and creating more diverse and inclusive workplaces. These steps 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 a plan to monitor and review progress so that leadership and employees are aware of successes as well bottlenecks.

KEY FINDINGS FROM ASTTBC AND ENGINEERS AND GEOSCIENTISTS OF BC MEMBERSHIP SURVEY 2019

The findings from this survey with those in the sector in BC, echo those reported in the literature review described above.

The survey found that while the engineering and applied sciences fields are diverse, they lack representation from certain groups. Over 80 per cent of respondents reported that there were more men than women in their workplace (82%) and 16% estimated there was an even number of men and women. About 37% of respondents were born outside of Canada, representing over 95 different countries. However, the percentage of respondents who identified as transgender, two-spirit, non-binary or another gender was less than 1%. A similar proportion of the sample reported identifying as an Indigenous person.

The data suggests women's employment experiences in the sector were different to those of men; they reported lower average years with employer, on average, men had been employed 7.8 years with their current employer compared to 5,5 years for women. There were fewer women employed at senior levels compared with men, 11 per cent of male respondents were employed at a director or executive level compared to 5 per cent of women. Approximately 15 per cent of men reported as being employed as a manager compared to 12 per cent of women. Just over 40 percent of men had 26 or more years work experience compared with only 13 per cent of women. Similarly, fewer women reported being self-employed (7% of women compared to 16% of men).

There were differences in the levels at which foreign and Canadian-born respondents were employed. Canadian-born respondents were employed in higher proportions in both higher and starting level positions. Foreign-born respondents were only over-represented in senior level positions (30% of foreign-born compared to 21% of Canadian-born).

Respondents who experienced disabilities were more likely to be self-employed and work part-time which could be due to challenges they faced in traditional workplaces. They were also less likely to have permanent contracts. Meanwhile, foreign-born respondents appeared to face more challenges finding employment in their profession than Canadian-born respondents.

Career satisfaction

Over 90 per cent of respondents reported being satisfied or very satisfied with their career (91%) and over 80 per cent were satisfied with the progress they had made towards their career goals (83%). There were differences in levels of satisfaction between men and women. Overall, less women reported being satisfied with their careers than men. Approximately 90 per cent of

male respondents stated they were satisfied with their career (92%) and with their current role (89%); for women this was 88% and 82%. However, only 74 per cent of women were satisfied with the progress they had made towards their career goals compared with 86 per cent of men.

Respondents identified the three most important factors that influenced career and employment satisfaction. The three most important factors were being in a workplace that is diverse and inclusive (average ranking of 8.6), having flexibility to balance work and family needs (average ranking of 8.5), and being in a workplace that is free from discrimination (average ranking of 8.4). Men and women identified the same factors as important.

Women were less likely to agree their salary and position were commensurate with their education and professional experience. Just over half of women were confident in applying for a promotion and were aware of the criteria and processes of how to do so. In general, foreign-born respondents were less likely to feel their compensation and position were commensurate with their education and experience than those who were Canadian born. They were also less likely to report they received support from their supervisors or managers to develop their skills, careers, and to apply for promotions and were less likely to less likely to have adequate opportunities for training and development in their workplace.

There were also differences between foreign-born men and women. The biggest percentage point difference between foreign born men and women were in terms of the confidence they had in applying for promotion (57% for women vs 73% for men) and their knowledge of the criteria and processes for promotion (56% for women and 69% for men).

Respondents with disabilities had lower levels of career satisfaction than those without disabilities. The largest percentage point differences between respondents with and without disabilities were in terms of the receipt of support from managers to support career development (58% vs 77%) and access to adequate opportunities for training and development (58% vs 70%). There were also differences between men and women with disabilities. The largest percentage point differences were in feeling confident in applying for promotion (for women with disabilities there was a 28-percentage point lower), their salary being commensurate with their education and experience (19 percentage points lower) and being familiar with the criteria and processes for promotion (18 percentage points lower).

Career advancement

The survey data suggests women, foreign-born and respondents with disabilities face additional challenges in terms of career advancement. Respondents were asked about the factors that promoted their career advancement. Seventy per cent stated that support from their manager or supervisor was important for their career advancement (70%). Other common factors were

support from colleagues (60%), opportunities to learn new useful techniques for the workplace (60%), and professional development opportunities (59%).

However, there were significant differences between men and women in terms of the factors identified as supporting career advancement. For women, the most important factors were support from a manager/supervisor and support from a colleague. While for men the most important factor was support from a manager, the opportunity to learn new and useful skills for the workplace was also seen as important. Professional networks were significantly more important to men and their career advancement than they were to women (51% for men and 45% for women). The least important factor for both men and women were workplace diversity and inclusion initiatives. Only 30 per cent of the sample was aware of these types of initiatives and only 15 per cent of men and 17 per cent of women saw them as helping with their career advancement.

There were differences between foreign-born and Canadian-born respondents in terms of factors that supported their careers. A lower proportion of foreign-born respondents reported mentorship and support from their partners as factors that supported their career advancement. In contrast, foreign-born respondents were more likely to report professional networks, diversity, and inclusion initiatives, and learning techniques required for the job as more important than respondents born in Canada.

In general, respondents who had experienced a physical, mental, or health disability reported lower satisfaction rates with their career. Respondents with disabilities were more likely to identify diversity and inclusion initiatives as a factor that supports their career advancement (19% vs 15%).

Factors which limited career advancement

Approximately one third of respondents reported their career advancement had not been limited (31%). For the remaining two thirds of respondents, the main factors which limited career advancement were the lack of opportunities for promotion (40%) followed by support for professional development (22%) and lack of negotiation skills (21%).

The top three factors that were seen by women to limit their career advancement were lack of promotion opportunities (48% for women and 37% for men), a lack of negotiation skills (32% for women and 18% for men) and discrimination (26% for women and 8% for men). One fifth of men and almost a quarter of women also reported that a lack of opportunities for training and professional development also limited their careers but the differences between men and women were not significant. However, there were significant differences between men and women in terms of knowing about the criteria for promotion (24% for women and 16% for men).

Twenty-two per cent of women compared to six per cent of men stated that taking time off to care for family had limited their career advancement. In addition, women reported that a lack of a flexible work environment (16% vs 8%) and part-time employment (12% vs 4%) also had a negative impact on their careers. The proportion of women who reported being socially isolated at work was twice that of men (18% vs 9%) and the proportion of women who described their workplace as non-inclusive was three times that of men (15% vs 5%). All these differences were statistically significant.

A slightly lower proportion of foreign-born respondents reported their career had not been limited (28% compared to 32% of Canadian-born). However, the types of factors that were seen to limit the careers of foreign-born respondents compared with Canadian-born included lack of part-time job opportunities, lack of support for training and professional development, discrimination, and non-inclusive work environments.

The proportion of respondents who reported their career advancement had not been limited was also smaller among people experiencing disabilities (25% of respondents with disabilities compared to 32% of people without disabilities). Lack of negotiation skills, lack of support for professional development, discrimination in the workplace and isolation were reported more often as career advancement limiting factors by respondents with disabilities.

Work environment

Respondents were asked to rate their agreement with several statements about their work environment. While over 90 per cent of respondents agreed that their workplaces were welcoming (92%) and there were policies to prevent workplace bullying/discrimination/sexual harassment (90%), only three quarters of respondents agreed that within their workplaces there was a commitment to promote equity and diversity (76%) and that their workplaces promoted a healthy work/life balance (78%). However, just over 80 per cent of respondents stated they were successful managing the demands of their paid work and personal life (82%).

When the work environment was explored by gender, a lower proportion of women reported that there was a real commitment in their workplace to promote equity and diversity (65% of women compared with 80% of men). Fewer women believed their workplace had a positive work environment (84% of women compared to 87% of men) and a lower proportion believed they were successful managing paid work and personal life (78% of women compared to 83% of men).

Higher proportions of foreign-born respondents agreed that their workplace promoted healthy work/life balance (81% of foreign-born compared to 77% Canadian-born) and that professional networks and networking was important to their career development (87% of foreign-born compared to 78% of Canadian-born).

Discrimination

The questionnaire also asked respondents if they had experienced discrimination in the workplace. One in four respondents reported they had experienced discrimination in their professional career (25%) while 19% said they may have experienced discrimination. Women, respondents with disabilities, and foreign-born respondents were more likely than men to have experienced or to have possibly experienced discrimination in their professional career.

Respondents who had experienced discrimination in their professional careers believed their skills had been under utilized (60%), that they had been treated as if they were not competent (58%) and they had received less support from senior managers as a result of this discrimination (49%). The survey found that discrimination remains a current problem in the workplace. In general, discrimination experienced by women respondents has not changed, with similar proportions of women reporting discrimination experiences in their professional career within the last year and more than 10 years ago (30% and 34% of women who experienced discrimination, respectively). Across all subgroups, career satisfaction was lower for those respondents who reported they experienced discrimination or may have experienced discrimination in their professional careers.

Discrimination was more likely to be perceived as a big problem in the industry by those who had experienced it. The proportion of women who believed discrimination is a big problem was twice that of men (39% of women compared to 19% of men). The proportion of respondents who believe discrimination is a big problem was also higher among those who had disabilities and for those born outside of Canada.

INTERVIEWS WITH EMPLOYERS

A total of 14 interviews were conducted with employers; eight were conducted in the Fall of 2020 as a part of this jurisdictional scan and six were conducted in the Fall of 2019 as part of the evaluation of the AWET project. As the interviews explored similar issues, the data from all 14 interviews has been included in this discussion.

Profile of employer organizations

The majority of the companies who participated were small to medium sized enterprises that ranged from 20 to 600 employees. Most employers had more than one office located across BC, with some having offices across Canada. Three employer organizations were larger with several thousand employees as they were part of international organizations. The business focus of the

companies spanned the range of engineering and technology sector and included engineering, technology, computing and information technology, and health technology.

Women in the workforce

The employers varied in the proportion of women they employed. For most employers, their workforce consisted of between 15 and 25 per cent women, with two companies estimating women consisted of 40 per cent of their workforce. Within organizations, women were represented in all aspects of engineering and technology and at most levels within the company. However, there were few women represented at the executive level.

The majority of employers recognized the lack of women in their workforces and at senior level and saw it as "*problematic*." Employers understood the business case for having a diverse workforce, that it increased creativity, helped them to respond to the client and customer needs and most importantly it was about being "*financially profitable*."

Increasingly employers reported being asked by clients and potential employees who look at their websites and annual reports and ask,

> *"where's the women? … where [are] your people of color? And our leadership are scratching their heads. We're like, oh, my God, this has been a total gap for us."*

Most employers reported that historically diversity and inclusion had not been a priority issue for them. The lack of women and other equity seeking groups was described as "unintentional." For some, the issue had been dismissed by "older or seasoned" male employers who would say,

> *"that there were none in his class. There was one person in his class, and then she ended up doing something else. So, part of the story that I think maybe the men start telling themselves is that there were not enough women. And I just think that we haven't been looking in the right places."*

Some organizations recognized that previously they had *"loved working with certain types of people and [they] had lots of friends in industry. And we just hired our friends."*

For most employers who participated in these interviews, the current situation was very different. For these employers, diversity and inclusion has become a key issue for them. The impetus for this change has come from a variety of sources, and includes the business case which includes increased productivity, creativity and financial returns, a push from clients who ask about diversity and inclusion, a need to be the employer of choice so they are able to recruit and retain high quality talent and a "groundswell" pressure from existing employees who want a career path and want to see themselves represented at all levels of the organization.

While a small number of employers had been working on diversity and inclusion for several years, for most it was only within the last three to five years they have actively pursued diversity and inclusion. By actively, employers meant assigning time and money to the endeavour. Most described the process as a "journey" and they were aware they had "barely scratched the surface of what is possible" in terms of developing and implementing diversity and inclusion policies and practices within their organization. Employers knew they were at the start of the "journey" and that considerable work remains to be done. However, a requirement to include data on diversity and inclusion efforts in annual reports brought the issue to the attention of the board, shareholders, and clients. For most employers, the first step in this process was educating leaders, managers, and employees, and raising the awareness and significance of diversity and inclusion and tying this to the success of the organization.

Approximately two thirds of employers stated that increasing diversity and inclusion, "was just the right thing to do." They wanted their employees to have a "sense of belonging" and to feel they could bring "their whole selves to work." These employers wanted to connect with their communities in meaningful ways. Some added they themselves were immigrants to Canada and wanted to create an inclusive workplace. Others noted that they have daughters and want them to feel welcome in their organization.

Policies and practices

There was considerable variation among organizations as to whether they had written diversity and inclusion policies. While the majority of employers had a shared values statement, which included references to diversity and inclusion, only approximately a third had written policies and these also varied in their content. Those employers without written policies fell into three groups: those for whom diversity and inclusion was not a major issue and these tended to be smaller employers, employers who saw themselves as progressive organizations who believed their workplace cultures were inclusive and that diversity and inclusion policies was "part of our DNA." The remaining employers had written policies but described their written policies as a work in progress.

Within organizations, policies and practices were aimed at increasing diversity and inclusion more widely rather than on specifically increasing the proportion of women in the workforce. Employers were concerned that policies directed at increasing the number of women could be seen as affirmative action and could alienated existing (male) employees. Therefore, including increasing the participation of women as part of the remit of diversity and inclusion initiatives was the preferred strategy. This also resonated with employers who want to send the message that all employees were welcome and valued.

It's a smart business decision. We have opportunities that we're losing because we don't have representation of women at the table and clients are expecting that we have a strong representation. So, this is actually impacting our business. And so, I think our leaders are also pressuring our team to make sure that we're changing the way that we recruit so that we can make sure that there's at least one female candidate in the pool presented to the leaders, that we change who the interviewers are, that we train the interviewers to be consistent, that we can leverage technology where possible ..."

Employers acknowledged that a diverse and inclusive workplace was important not just because it reflected society, but also improved decision making and problem solving. A diverse and inclusive workforce was seen to be happier and healthier, and happier employees were believed to be more productive. The goals of the existing policies and practices were to enable the organizations to recruit the best person for the job, to ensure they felt comfortable and safe in the workplace and, they had the supports they needed to thrive. All organizations had a zero-tolerance policy on workplace harassment and bullying.

Creating an inclusive culture was seen to be part of an ongoing and dynamic process and, while the policies were important as they set the tone for the organization, management and staff had to 'walk the talk' in terms of creating a respectful, welcoming, and inclusive workplace. Employers were aware of the importance of following through on policies and to have buy-in from leaders and managers and staff. Some employers brought in external consultants to help them develop policies and to report out on implementation. Others established employee resource groups to monitor and advise the leadership team on diversity and inclusion. Employers wanted to avoid raising employee expectations only to have them dashed when the internal culture did not make positive changes. The risk was higher employee turnover and less diversity and inclusion.

Recruitment

Recruitment policies and practices did not vary significantly across organizations. The recruitment process was overseen by Human Resource (HR) professionals or by individuals with responsibility for recruitment. Jobs were advertised in a variety of media and organizations tried to ensure the postings were inclusive, with four organizations having postings reviewed by female or minority staff to try and increase diversity. No organization blinded resumes and removed information relating to gender and ethnicity but most assessed candidates against an agreed list of competencies.

There was some awareness that employers "needed to do better" in terms of recruitment strategies. The typical process was reported as a leader/manager indicating to HR they had an

open position. The manager and HR would draft the job specification which would be posted to various job boards and staff would be asked for referrals. The resumes would be reviewed, and a short-list drawn up which would be sent to the leader/manager. Employers were aware that bias was part of this process as managers looked at the "name, the school and start to make decisions."

All organizations stressed they wanted the best candidate for the job irrespective of gender or ethnicity. However, candidates also had to be seen to be a "good fit" for teams, many of which required good communication skills. While this was not problematic in terms of gender, it did create challenges for racialized individuals whose first language may not be English. Only a couple of organizations offered training to help improve communication skills.

Organizations had onboarding processes, which were seen to set the tone and to make explicit the culture of the workplace and the expectations in terms of behaviour for all employees. The onboarding processes varied from in person training, online courses, meetings with supervisors and new employees being paired with an existing employee who answered their questions and provided support.

In general, organizations did not track information about the candidates who applied for postings in terms of the overall numbers, gender identity or in terms of diversity.

Retention and career development

All organizations had annual review processes which ranged from meetings one-on-one meetings between employee and supervisor and full 360-degree reviews. The review process was used to develop career plans, as opportunity for the employee to air concerns and/or ambitions and for them to receive constructive feedback. If an employee had concerns, there were processes in place across all organizations to enable these to be raised with more senior levels of staff. All organizations stated these concerns were taken seriously when they did occur. The organizations all reported that attrition was not a significant issue and what little there was mostly attributed to retirement, and individuals moving for new opportunities or leaving the Vancouver area because of the cost of living. Organizations tracked data on the number of employers, number of employees promoted but only a few included data on gender and ethnicity.

Flexible workplace

All organizations offered employees some degree of flexible working. Larger organizations tended to have a more formalized system for flexible working which often included working from home, adjusting start and end times and core hours. For most organizations, flexible

working was agreed on an individual basis depending on need. Individuals were expected to request flexible working hours from their manager. Organizations did their best to satisfy these requests especially in areas where it was difficult to recruit good staff, but the challenge was to balance the needs of the individual with those of the business.

Promoting diversity and inclusion

The majority of employers who participated in these interviews viewed themselves progressive and proactive in developing diverse and inclusive workplaces. Most described the sector as having made significant improvements with respect to gender equity and diversity and inclusion but acknowledged there was still a long way to go.

> *"So I think that we're well on our way. But again, we recognize that this is a journey and by no means has [name of organization] reached its end game."*

All employers agreed the leadership team sets the tone for the workplace culture, including the extent to which diversity and inclusion is promoted within the organization. While most respondents reported their leadership teams understood the business case for increasing diversity and inclusion, they also acknowledged there was some hesitancy and concern about addressing some of the practices and behaviours and biases that perpetuated the dominant white male culture in their organizations. Employers stressed the need for leadership to authentically buy-in to diversity and inclusion and to model the behaviours they wanted to see.

Two key challenges identified by organizations to diversity and inclusion were systemic bias and unconscious bias. Organizations did have policies and practices in place to address some of these challenges, but many wanted additional resources and supports when trying to bridge the policy practice gap. A key question raised by some organizations was how to implement diversity and inclusion policies in such a way that they did not alienate existing staff or disrupted the workplace.

Employers were asked about the added value of developing diversity and inclusion policies using a GBA+ lens. Employers wanted policies that were inclusive and saw the GBA+ lens as a way of broadening the approach so that it was not about one group of employees. Most employers acknowledged workplace training and supports may need to be tailored to meet the needs.

INTERVIEWS WITH KEY INFORMANTS

Eight telephone interviews were conducted with key informants in the Fall of 2020. Interview participants included diversity and inclusion experts within engineering and technology sector, senior managers, retired senior managers and members of sector advocacy organizations. The

purpose of the interviews was to draw on respondents' experiences and insights to reflect on the barriers and opportunities for diversity and inclusion within the engineering and technology sector in B.C. The main themes that emerged from these interviews are discussed below.

Diversity and inclusion in the engineering and technology sector

All respondents agreed that diversity and inclusion within the sector could best be described as "a work in progress." Respondents were aware of employers in the sector who invested in diversity and inclusion and these organizations were examples of what could be achieved when employers focussed on the issues. However, these employers were described as being in the minority within the sector. There were thought to be a 'good number' of employers in the sector that were seen as yet to start, or to be at the beginning of the process, to increase diversity and inclusion in their workplaces. Although respondents were disappointed that this was the case, they were not surprised. They reported it was short-sighted *"given the tsunami of retirements from baby boomers that is coming."*

All respondents knew of women and individuals from equity seeking groups who had left the sector because they did not feel welcome or did not believe they had opportunities for advancement. Respondents suggested some employers in the sector wanted to maintain the status quo as there was relatively few business drivers pushing for change. For them, implementing diversity and inclusion policies took time and resources away from key business processes.

When respondents were asked what would persuade and encourage these employers to become actively engaged in diversity and inclusion, the response was "they need a burning bridge." Quite simply there was not currently enough impetus for change. This was believed to be especially true for smaller employers where profit and operating margins were tight. Respondents described this approach to equity and diversity as "supply and demand" in that as more women and people from equity seeking groups graduated university, there would naturally be an increase in representation as it was just a matter of time.

For those employers that had diversity and inclusion policies and practices, respondents suggested their burning bridge or reasons for change came from a variety of internal and external sources. Internal drivers for diversity and inclusion came from the desire to position companies as the 'go to' employer of choice. These employers wanted to develop a reputation of recruiting and retaining the best employees. To do this, respondents suggested 'smart' employers recognized many younger employees wanted and expected a welcoming and equitable workplace and this was reflected in internal employee feedback. These employers were also aware of the business case for diverse and inclusive workplaces which included increased productivity and happier and healthier workplaces. Respondents suggested that some employers

were more progressive leaders. Externally, respondents reported that customers and clients were asking about diversity and inclusion within organizations, with some employers being mandated to report out on diversity and inclusion statistics.

Understanding diversity and inclusion in the workplace

Respondents were keen to focus attention on the fundamental aspects of diversity and inclusion in the workplace, which they identified as being welcomed, respected, and valued. Respondents called for a level playing field that recognized and rewarded skills and expertise of all employees. Some cautioned against calling for more women engineers or more ethnically diverse engineers arguing women, and those from equity seeking groups, wanted to be engineers or technologists first, and not seen as women engineers, but primarily as engineers.

Respondents highlighted the negative impact that non-inclusive workplaces had on women and equity seeking groups. This included a loss of confidence, negative effect on health and wellbeing as well as financial implications that come from lower salaries. For example, being the only woman in the room was described as exhausting because it entailed constantly having to remind male colleagues that *"your role was not to make the coffee or take the notes."* Most of the respondents were aware of the Be More than A Bystander program[2] within the trades and suggested a similar program which encouraged others to speak up to promote diversity and inclusion would be beneficial.

Changing workplace culture

The respondents all stressed that changing workplace culture to make it more welcoming for all employees was going to take time and effort to initiate and sustain. Key to success was the authentic buy-in from leadership who led by example as the tone was "set by top." Respondents warned that a lack of authenticity risked alienating employees. Changing workplace culture was not a simple undertaking as the environment was complex. Respondents noted white male employees in engineering and technology workplaces made up at least 70 per cent of the workforce. If change was to occur, the majority had to participate in and support new policies and practices. Education, messaging and initiatives had to engage these employees. Respondents saw it as *"a balance between making sure that you are creating those safe spaces for minority populations so that they can tell you about their experience, but also, you know, minimizing difference in some respects so that we find those commonalities where people can engage in those types of conversations."*

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[2]   https://bccwitt.ca/whatwedo/bystander/

GBA+

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 & 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.

Key informants were asked if and how diversity and inclusion could incorporate a GBA+ lens to ensure policies and practices reflected the social identities of all equity seeking groups. Respondents agreed a GBA+ lens should be adopted and was the 'way forward.' They suggested that a GBA+ lens moved the discussion from particular groups and allowed the sector to focus policy broadly on inclusion and diversity. However, the practices and initiatives to support equity seeking groups should reflect the challenges experienced and they should set the tone and expectations for the organization. The programs supports and training should be seen as a continuum that help organizations become more diverse and inclusive.

Key features of diversity and inclusion in workplaces

The interviews with key informants explored the key features of successful diversity and inclusion policies and practices.

1. Engage and listen to employees – Employers need to prepare their staff and organizations prior to developing or implementing diversity and inclusion policies. Feedback from employees will help identify the main concerns and suggest an appropriate starting point. The development of a long-term diversity and inclusion plan was recommended.

2. Clear expectations – Employers need to set clear expectations for all employees and action were needed to address instances when these expectations were not met. They advised that initially this should be with supports and, then if necessary, sanctions. Accountability and transparency were seen as essential. To communicate, respondents advocated for clear and consistency messaging which had inclusive language.

3. Provision of education, training and supports – Workplace education and training was important to raising awareness about diversity and inclusion, what it is and why it is important to the organization. Respondents stressed that awareness was a first step only and that action was necessary. Education was needed at all levels of the organization especially

for decision makers for recruitment and career advancement. Training and education on unconscious bias was deemed essential to raise awareness of the existence of unconscious biases and how these could be addressed. Respondents who had developed and delivered this training recommended scenario-based training to engage employees and to inform them what it is, how it shows up in the workplace and how to respond. Education was needed around cultural competencies to orient people who may be new to the organization and this could help resolve misunderstanding.

4. Organizational and employee targets – The majority of the key informants agreed that setting realistic but ambitious targets for organizations was important. They also stressed the reporting responsibility for these should be with a representative of the leadership. Some respondents suggested the targets should be a standing item on management agendas to ensure continued focus. It was suggested that employees also have targets that could include attending diversity and inclusion training, participating in mentoring activities and supporting outreach activities.

5. Monitoring and review – Most respondents said some version of 'what gets measured, gets done' and added this was particularly so in this sector. Data allowed for benchmarking and identifying progress which should be celebrated and bottlenecks which should be addressed. Respondents were not specific on the metrics to be collected but they should provide information about recruitment – who applies and what happens to them; retention and attrition – who leaves and their reasons for doing so and career advancement – who is promoted and differences between those who do and do not get promoted. Data should also be collected and review on the targets set and any programs implemented. An example of one issue that could be tracked was onramps for returning employees, including those returning from maternity and paternity leave.

Advice to employers

Key informants were asked what if any advice they could offer to employers on diversity and inclusion.

- Diversity and inclusion policies and practices should be aligned with other organizational policies. In addition, diversity and inclusion should be an organizational endeavour and not just left to the HR department or the person responsible for recruitment and staffing.

- Diversity and inclusion policies should be proactive and intentional and be incorporated into the strategic planning. Reactive policies aimed at addressing specific issues are often not sustained and are viewed as punitive.

- Organizations need to assess honestly where they are on the diversity and inclusion continuum and to develop policies and practices that reflect this. Policies practices should not be static but should evolve as needs changes.

FOCUS GROUPS WITH WOMEN IN THE SECTOR

Two focus groups were conducted with women currently working in the engineering and technology sector. In the first group, participants were employed by the BC provincial government, in the second participants worked in public, private, and consulting engineering and technology organizations, which ranged in size from small/ medium enterprises to consulting engineering firms with offices across Canada and North America. Participants worked across a broad range of engineering and technology disciplines and positions, from entry level to senior managers.

Choosing engineering and technology careers

Most participants had been interested in maths and science at school and were encouraged to apply to university to study science, engineering, or technology. Approximately a third of participants had a family member or a close family friend who was involved in engineering and these individuals were a source of encouragement and information. Most of the remaining participants were interested in maths and science and were good at it. Only a couple of participants had attended university open days or science camps, but they applied to science and engineer because school and parents encouraged them to apply.

> *"I had never heard of anything in engineering. No one in my family did."*

This participant applied to study science; it was only while at university choosing an elective that she decided to switch majors. Other students applied to engineering and technology without realizing the diversity in the potential careers and were surprised to find themselves as a metallurgist who specializes in welding, environmental engineer, electrical and a mining engineer.

Other reasons for choosing a career in engineering and technology was because it was perceived to offer good stable career with a better than average salary. In hindsight, participants acknowledged their naivety in that they did not think about the sector being male dominated and being surprised when she started working,

> *"... university ... and high school's equal and elementary schools are equal, and most things are. And then that working world, in the stem world, is so unequal it comes as a huge shock to people."*

Most participants were similarly shocked when they started working but while some had "horrific" experiences in which they were bullied, harassed, and experienced discrimination, all were adamant they loved their work. They explained they found the work challenging, interesting and exciting. They loved the problem-solving aspect to their jobs, and it was this passion that kept them in the sector. It also encouraged them to participate in outreach work in elementary and high schools to encourage young girls to consider engineering and technology at university and as a career and to encourage them by demonstrating the range of careers available. For example, participants went into elementary schools to talk to students about science and engineering and to offer them a hands-on activity that would be of interest to both boys and girls. One offered welding using chocolate to explain the science, another held a build your own chair lift to explain basic engineering principles.

Workplace culture

All participants agreed that workplace culture was important in determining whether they felt welcomed, safe, and respected. Organizations and leaders were identified as being responsible for the type of culture that existed in the workplace. Managers and leaders set the tone and expectations for acceptable behaviour.

Eight out of 10 participants reported they now worked in an organization where they felt welcomed and respected. Only participants employed by the provincial government reported their workplaces were diverse and inclusive and there were clear policies, practices, training and supports available to all staff. Participants in other organizations had a mixed experience of diversity and inclusion in their current workplaces as organizations varied in the presence and extent of their diversity and inclusion policies and practices. For example, one small employer had only just formed a human resources department and policies and practices were yet to be developed. However, despite the absences of written policies, the workplace culture was described as positive. Medium and larger organizations had some written diversity and inclusion policies.

In some organization the diversity and inclusion policies were viewed somewhat cynically, in that they were more for external publicity than a reflection of an authentically diverse and inclusive culture. When these participants were asked about the effectiveness of workplace diversity and inclusion initiatives, they laughed. The reason for the cynicism was,

> *"what happens is that they create a committee and usually hire some people and they say, we're going to do this. And then about six months later, they say, look, we're amazing because we've done this. You're on the ground. You're saying, wait, we haven't done anything. But it's the cynical part, it is all just … for external use. It's a publicity stunt. Then they wrap themselves in a diversity*

cloak, but it doesn't mean anything for the people on the ground. So sorry, but that's been my experience.

Would the rest of you agree with that?

Yes, from group.

Yeah, I agree with that. I also think that the people that have to put the material together are not the women working in the field. They have ... people that have that have done research on it or something, but they are not really the women that you hear tonight ... that have been there and can tell the story. It's just like as [name] was just saying, they just hire some outsider coming in. And then, of course, they have to look good because its their job and then they create all these flashy, great stuff!"

When some of the participants received emails about diversity and inclusion initiatives, they deleted them without opening them because in their experience they were not authentic because *"actions speak louder than words."*

Discrimination and bullying in the workplace

Approximately, seven out of the 10 participants had experienced some degree of workplace discrimination and/or bullying usually during their first job that they subsequently left. Two participants had been harassed, one sexually. Participants described these experiences as "horrendous", "horrific", and "soul-destroying".

Participants gave examples from their time at other organizations of being yelled at by male company owners/employers on multiple occasions which left them feeling humiliated, destroyed their confidence and, any respect they had with their male colleagues, vanished. For example, one participant who was a relatively recent graduate, worked for "a fairly big engineering" organization and was excited to be employed there. This participant described her experience as "sobering" and "shocking". She was the youngest person in the group by over ten years and, she subsequently discovered, that junior staff left after about three years. Women in the team were expected to do all the administrative tasks and other more senior female, had been passed over for promotion. The workplace was descried as *an old boys club essentially."* Other focus group participants had similar experiences or had friends who had.

One participant described situations in which there was,

"... like a ton, a ton of implicit and explicit sexism. I mean, honestly, sometimes I thought I was like in an episode of like Mad Men or something like I just couldn't

I just couldn't believe the things that were being said about like what women were wearing and, you know, how women shouldn't get paid as much as men. And people were like justifying this and having a discussion, like at someone else's computer, a serious discussion. ... And then I would also get, like, yelled at for things that people wouldn't really explain why they were getting mad at me. And, you know, just things how reports were written or analyses were done. But then I would ask for feedback and how I could do better next time. And there was there was never really anything specific."

Participants contrasted these experiences with their time at university, where they were treated equitably and respectfully. By contrast, the bullying and harassment had a very negative impact on their health and well-being of participants who had similar experiences. Participants thought of "quitting" but could not until they had another job because of student loans.

Two participants raised bullying and harassment concerns with HR departments and hoped they would help resolve the situation. Instead, they were told by a member of HR team,

"I've been working here for twenty years and I've been hearing this for twenty years. And I'm going to tell you, like these will be documented, but nothing will probably change."

Nearly all of the participants knew someone who had similar negative experiences. *They knew of friends who were in the engineering sector and who were "struggling" and who did not have any resources to help and they did not have "anyone who could be that objective person to come in and resolve an issue if there is one, without compromising their jobs."* They were stuck.

The overall consensus between participants was disappointment, frustration and anger that this culture was and existed and caused young female engineers and technologists to leave the sector. What is interesting and important to note is that, although participants did not use any company name, other participants were aware of one company through its reputation.

The experiences of women in the sector were not all negative. However, participants wanted readers to understand the instances of discrimination, bullying and harassment described are not isolated events, but nor are they the everyday experiences of all women in the sector. None of the women were surprised by the stories they heard during the focus groups. All participants now worked in organizations where the workplace culture was more positive. They stressed that throughout their careers, participants did have male colleagues who supported them, who treated them respectfully and welcomed into the workplace.

The current experiences of participants were more positive. Although the organizations varied in the degree to which diversity and inclusion was actively implemented, the participants loved their work and felt they had opportunities to grow and develop. Those who continued to

experience discrimination said it was "less overt" and was more to do with career advancement issues. The participants stated they now had the confidence to address these issues directly with managers. The women employed by the provincial government experienced a very different workplace which had well publicized policies relating to diversity and inclusion. There was a process in place for them to raise concerns which they knew would be taken seriously. Participants had not needed to use this process.

Creating a diverse and inclusive culture

Participants agreed it was possible to create a diverse and inclusive culture within the sector but stressed it depended on leadership and the level of their commitment. The word that was used repeatedly throughout the two focus groups was "*authentic*" – participants called for authenticity, by which they meant accountability, transparency, sustained effort, an allocation of time, resources, and training to support changes. Implicit or unconscious bias training was deemed essential to raise awareness and identify positive actions. There was no single action or initiative that was going to change workplace culture overnight, what was needed was a combination of strategies that began with the foundational piece of listening to people in the workplace. Participants stressed an inclusive workplace benefitted all employees; employees were happier, healthier, and more productive. It was a "*win win*".

In terms of individual actions, participants were very committed to supporting and encouraging other women within their organizations and the sector. They provided constructive feedback, checked-in to see how they were doing, and offered encouragement. Some participants volunteered in employee resource groups that had been established to improve diversity and inclusion. While participants welcomed the initiative, they were frustrated because they did this in addition to their usual work. Many participants were involved in mentoring other young women both in and outside the organization.

Some additional challenges to creating a more diverse and inclusive culture included the lack of change/turnover in senior positions, most of which were held by established professionals who tended to be older, male, and frequently white. Participants cautioned that it was not just a question of having more women in leadership roles because those women had survived, and some had adopted and internalized the sexist and non-inclusive attitudes they had experienced. Engineers and technologists, it was suggested, were data people. They suggested engineers loved metrics and than often assessment and monitoring were key components of their roles. Participants wanted these skills applied to diversity and inclusion because "*we all know, what gets measured, gets done*" they added that "*... the numbers will speak for themselves and then it's hard to ignore. But if you don't actually measure it, then it becomes easier to ignore.*"

Work life balance

All participants stressed the importance of a healthy balance between work and life. Participants explained this was difficult to achieve for all employees, especially those with family caring responsibilities. Participants reported the work culture in the private sector within engineering technology sector was for long work hours.

> *"I was working on the weekends, too. I mean, I couldn't afford not to because of the opportunities I was getting. I wanted to excel and do better. And since everybody was doing that, I had to put in those hours. So, it was like an endless cycle."*

One of the key attractions for the women who worked in the public sector was the better balance between work and life. They hoped by moving into the public sector they would have more flexibility and stability, they reported they believed it "*would be a decent lifestyle.*"

Recruitment and retention

Except for their first job, before applying for a position, participants often contacted friends and colleagues to find out about the workplace culture, the type of work they did and the opportunities for advancement. For most, this network did not exist when they were looking for their first job. Only a couple of participants secured their first position through networking.

Participants made a distinction between the private and public sector in terms of applying for jobs. The recruitment process in the public sector was perceived as being more equitable as it had processes within it to reduce biases. For example, the interview process was competency based and was attended by a member of the HR team. Within the private sector the recruitment process was more varied and 'being a good fit' was perceived to have as much or more weight as competencies for some organizations. Within the private sector the recruitment process was reported to have fewer checks and balances for biases.

Retention

The main reason participants stayed in the sector was their love and passion for their work. Participants found the work "enjoyable" and added "it pays well, for goodness sakes, that's important." The challenges that arose from the difficulties in achieving a positive work life balance have were discussed and participants suggested greater flexibility in the workplace around start and end times and working from home would be helpful in perhaps encouraging more women to remain in the sector. All participants were hopeful that the lessons relating to flexible working learned during COVID-19 would make a difference going forward.

Career advancement

Most participants believed there had been occasions when they were in the private sector careers in which they had not been promoted because of their gender. They attributed this to a process that lacked transparency and was not competency based. Participants reported often *"there is not a set of objectives and then you meet those, then you move."* Participants explained that to get promoted you had to be involved in "big" projects where you had the 'opportunity to do well." The challenge for participants was to get access to these opportunities as senior staff picked who was on project teams. These decisions were based on *"behind the scenes conversations"* about whether an individual was *"good at this or that."*

Participants explained that not only do young female engineers and technologists *"not know how to play the game, they don't even know there is a game going on!"* It was suggested that young female engineers do not realize the need to network within their organization and that they have to self-advocate and self-promote if they are to progress.

> *"They're all super hardworking, keen, and [think] somebody will recognize me for my hard work. And it's like, no, actually, you have to advocate for yourself or those opportunities won't come up."*

Participants discussed the role of mentors for women and those from other equity seeking groups. Mentors were viewed positively as being a good and useful support. They provided information, helped individuals identify career goals and develop a plan for achieving them. Many of the participants were active mentors both within their organizations and externally. They noted that very few organizations provide training for mentors.

While participants acknowledged the benefits of mentoring, they also recognized its limitations. Participants argued that mentoring did not help individuals overcome bias. Instead, participants suggested that what was needed was sponsorship. They identified a sponsor as someone who's willing to say this person needs to be promoted because they have the necessary skills, that they are good and are doing good job. Participants suggested that,

> *"mentorship is I talk to you and I try and help you as an individual, but I don't necessarily do anything in the background to make sure that you're that you are given opportunities and that's what sponsorship is."*

Participants believed sponsorship is necessary for women and those from equity seeking groups to overcome workplace biases that prevent them from accessing the same opportunities as their colleagues. This is because a sponsor would be able to speak up on behalf of an individual in situations where decisions are made "in the background'. It was also suggested that sponsors could support internal networking.

DISCUSSION

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 and the data presented above including the voices from women in the sector, 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 the pipeline, diversity and inclusion is about changing organizational cultures so that women and equity seeking groups feel welcome, safe, valued for their skill set in the same way as other employees and ensuring they have access to the necessary supports (including mentoring and networking) to help them navigate and succeed in the workplace. The goal is when women and equity seeking groups enter the STEM sector they stay and thrive like their male colleagues.

In reviewing the reasons women leave engineering, Gill and colleagues (2017) found that workplace or organizational culture was the one of the main reasons women left the sector. Organizational culture played an important role in driving women away from the sector as it determined the behaviour deemed appropriate and acceptable, and the sanctions for inappropriate behaviours and the rewards for effort. Research has shown the women who left engineering were very similar to those that stayed; the difference was not in 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."*

The majority of employers, key informants and women in the focus groups would agree with Fouad. They are aware there needs to be a more foundational change in organizational culture to address the inequities in the sector. Providing training and or supports to women and equity seeking groups to better equip them to deal with the lack of diversity and inclusion is doomed to fail if the systemic biases within the system are not addressed and when individuals do raise concerns, they are treated seriously and merit more investigation, than just being documented.

The data presented in this report from the survey with those in the sector, the review of the literature, the interviews with employers, key informants and focus groups with women, all demonstrate a lack of diversity and inclusion in the sector. While there are some employers and organizations in the sector that have prioritized diversity and inclusion and worked hard to

create workplaces in which all employees are welcomed and respected, they are the minority. Diversity and inclusion within the sector are at best a patchwork of initiatives rather than comprehensive policies and programs that are embedded in the organization and championed by leadership.

Two surprising findings from the survey were that those who experienced discrimination opted not to take formal action to address it and, when asked about diversity and inclusion initiatives, only 30 per cent of respondents were aware of them and just 17 per cent of women found these to be helpful. These findings are important when considering actions to improve diversity and inclusion in the sector. The findings from the literature and interviews suggest the important foundational groundwork that must precede authentic initiatives.

The focus groups, interviews with key informants and employers remind us that not all employers are the same. There are employers who have worked hard to create welcoming, safe, and respectful workplaces for all employees. Most employers interviewed described diversity and inclusion as a process, a journey, and while they had made progress, they acknowledged they were not "where we want to be yet."

BRINGING IT TOGETHER

The literature and this research suggest any initiative to increase the recruitment, retention and career advancement of women and equity seeking groups must first lay the groundwork by listening to all employees. After that, initiatives must be authentic, transparent and have accountability. To make positive changes in this sector, all employees, including men and equity seeking groups, have to be engaged.

The discussion below brings together insights from the literature review, survey, and interviews with those in the sector to address the three research questions:

Question 1: 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?

Data from the literature review and the data presented suggest the following factors contribute to a successful diversity and inclusion initiative. The factors identified below are necessary to support a welcoming, safe, and respectful workplace culture which is the foundational piece of diversity and inclusive policies and practices.

Buy-in from leadership: Leaders within engineering and technology organizations are crucial to the success of diversity and inclusion initiatives. They set the tone for the organizational culture

and their behaviour sends a clear message to all employees whether the initiative is authentic. The literature provides evidence that diverse and inclusive workplaces are more productive and creative and, that these workplaces are happier and healthier – all factors which have positive impacts on the success of the organization. Leaders need to communicate this to all employees that not only is diversity and inclusion a social justice issue, but it also makes good business sense.

Engaging staff: Employers and employees must engage in honest dialogue about the state of diversity and inclusion in their organization and assess where they are in terms of being a diverse and inclusion workplace. This dialogue, which should be informed by organizational data, will help identify where organizations are on their diversity and inclusion journey as well as helping to set clear targets. This step is key as it sets expectations and identifies lines of accountability.

Development of a plan: Successful diversity and inclusion initiatives must have a long-term plan to sustain effort and ensure targets are met by identifying a series of coordinated short-term actions. While, one-off initiatives might raise awareness, they are unable to change the workplace culture. Ideally, diversity and inclusion plans would have time and resources allocated to them, and at the very minimum there needs to be clear lines of responsibility and transparency. Diversity and inclusion policies should be proactive and be incorporated into the strategic planning. Reactive policies aimed at addressing specific issues are often not sustained and are viewed as punitive. Diversity and inclusion policies and practices should be aligned with other organizational policies. In addition, diversity and inclusion should be an organizational endeavour and not just left to the HR department or the person responsible for recruitment and staffing. As part of this plan organizations need to set clear expectations for all employees. Training and resources should be available to support these targets. In addition, organizations had to send clear messaging about any sanctions for failing to comply. Accountability and transparency were seen as essential. To communicate respondents advocated for clear and consistency messaging which had inclusive language.

Shared Values Statement: There was consensus around the need for a shared and explicit values and or mission statement which explicitly stated the goal of the workplace was to be inclusive and to be welcoming and safe for all employees. This set the expectation for behaviour in the workplace and the culture. All cautioned that this had to be seen as the minimum starting point of an ongoing process in which there was senior leadership responsibility. If this values statement was not embedded into the organization, it would alienate women and equity seeking groups.

Education around diversity and inclusion: While a shared values statement is important, ongoing education is key to ensuring workplaces were continuing to be welcoming and inclusive. Training and supports are essential for all employees at all levels of the organizations, especially

for decision makers for recruitment and career advancement. Training and education on unconscious bias was deemed essential to raise awareness of the existence of unconscious biases and how these could be addressed. Respondents who had developed and delivered this training recommended scenario-based training to engage employees and to inform them what unconscious bias is, how it shows up in the workplace and how to respond. Education was needed around cultural competencies to orient people who may be new to the organization and this could help resolve misunderstanding.

Transparency: Organizations need to be transparent in their dealings with employees including hiring policies, promotion criteria and salaries. Most employers in this research had written competency-based criteria for promotions, but the decision rested with the employee's manager. To support transparency organizations should monitor and track data on recruitment, retention and career advancement by equity seeking groups.

Organizational and employee targets: The majority of the key informants agreed that setting realistic but ambitious targets for the organization was important. They also stressed the reporting responsibility for these should be with a representative of the leadership. Some respondents suggested the targets should be a standing item on management agendas to ensure continued focus. It was suggested that employees also have targets that could include attending diversity and inclusion training, participating in mentoring activities and supporting outreach activities.

Monitoring and review: Metrics and feedback are important to the success of a diversity and inclusion policy. Those interviewed suggested that in the sector, 'what gets measured, gets done'. Data allows for benchmarking and identifying progress which should be celebrated. and bottlenecks which should be addressed. Metrics should include information about recruitment – who applies and what happens to them; retention and attrition – who leaves and their reasons for doing so and career advancement – who is promoted and differences between those who do and do not get promoted. Data should also be collected and review on the targets set and any programs implemented. An example of one issue that could be tracked was onramps for returning employees, including those returning from maternity and paternity leave.

Flexible working: A key challenge for creating and maintaining a diverse and inclusive workplace is to support employees to balance work-life demands including caring responsibilities. Those interviewed suggested the engineering and technology sector did not embrace flexible working. This was referred to this as an "old-school mentality." The flexibility that arose from the COVID-19 restrictions has demonstrated to organizations what is possible and has highlighted that people are just as equally as productive at home.

Mentors and Sponsors: Throughout the sector, mentors have been identified as a key resource in supporting women and equity seeking groups in the sector. The focus is on supporting the

individual. The literature and interview data suggests that sponsors within organizations may be more effective at increasing diversity and inclusion. Sponsors would not only support individuals they would advocate on their behalf to ensure they were considered for key projects, roles, and promotions. Mentors should have access to resources and training to help them support women, people with disabilities, indigenous people, and racialized employees.

PROMISING PRACTICES IN DIVERSITY AND INCLUSION IN THE SECTOR AND HOW CAN THESE BE IMPLEMENTED

This section focuses on promising practices within workplaces and it draws on lessons from diversity and inclusion toolkits and literature developed by organizations in the sector and the findings of this research. 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. The four guides used to identify the promising practices were AAUW and Dell (2017) Playbook on Best Practices – Gender Equity in Tech, Workplace Gender Equality Agency (2019a and 2019b), *Engendering STEM – Best Practice Guide for Small and Medium* Enterprises (2018) and *Electricity Human Resources Canada (2020)*. A brief overview of four guides is available in Appendix A.

One practice guides, Workplace Gender Equality Agency (WGEA) identifies four components to implementing a successful diversity and inclusion program to increase the representation of women and equity seeking groups (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. WGEA 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 playbook 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. WGEA 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 and relevant 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.

Steps in implementation of successful diversity and inclusion initiatives

Figure 2 presents a modified version of the WGEA steps to implementing a diversity and inclusion strategy. The modifications are based on the literature, interview data and the other guides reviewed. The keys to success are authenticity, transparency, and accountability. The diversity and inclusion plan should be an organizational plan for all employees, it should not be a plan just for equity seeking groups. There has to be an opportunity for all employees to become engaged in diversity and inclusion policies and practices.

Figure 2   Modified WGEA ten steps to implement a diversity and inclusion strategy

Analyze
- Step 1 – Communiicate the Business Case for D&I
- Step 2 – Obtain authentic and long term commitment from leadership
- Step 3 – Analyze workplace culture and assess diversity and inclusion, identify indicators to be tracked. Communicate findings to employees

Design
- Step 4 – Develop an organizational vision for diversity and inclusion that has leadership buy-in
- Step 5 – Develop an action plan with priorities, resources including training and timelines

Implement
- Step 6 – Implement the plan
- Step 7 – Communicate the plan to that leadership and managers so all are on message. Communicate with all employees

Monitor and Review
- Step 8 – Monitor and review progress, identify and celebrate successes and identify bottlenecks
- Step 9 – Share information with organization and engage in authentic discussion about next steps
- Step 10 – Include diversity and inclusion in annual reports

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. While there is considerable evidence in the literature on the business case for diversity and inclusion initiatives the HR Tech hub (https://diversity.hrtechgroup.com/business-case) provides resources for organizations to use to develop their own business case. The WGEA 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. However, Ely and Thomas (2020) caution business leaders and organizations that to experience the benefits identified by the business case, the diversity and inclusion initiatives must be fully implemented. They state you cannot adopt an "add diversity and stir approach, while business continues as usual" as this will not increase effectiveness or financial performance." (p. 3)

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 and equity seeking groups 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 the organization risks not being taken seriously by employees. Leadership should be trained on unconscious bias and other features of their diversity and inclusion policy. This will 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 t practice guides provide tools (WGEA strategy and DT, Engendering Success and Electricity Canada Human Resources) to assess the culture of the organization. These tools walk organizations through the areas to assess. What is important is that this step should include 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 their experiences of everyday culture in the organizations so that there is 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. questions about diversity and inclusion may lead to difficult conversations within organizations and employers should be aware of this and be prepared to engage constructively with employees. These conversations could include difficult topics including, bias, bullying, discrimination, inappropriate behaviour as well as other issues. 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.

Analyze organizational data to provide an overview of diversity and inclusion. Identify indicators to be tracked and that will be reviewed to benchmark and measure progress. Paradigm4Parity suggests the following organizational indicators (Figure 3) including:

- current employees by equity seeking group /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 equity seeking group to identify where employees get stuck;

- retrospective review of data (three years is suggested) on the gender and equity seeking group mix of recent applicants and recruits;

- promotion analyzed by equity seeking group.

Figure 3   Paradigm4Parity – Minimum tracking indicators

Examples of Tracking Indicators

Recruitment	Retention	Career Development
% of women hired each year (# of women hired/# of total new hires	% of women in the org. (# of women/# of employees)	Promotion Gap
		% of women promoted each each - % of men promoted each year
# of resumes or applications received from men and women each year	Attrition Gap (% YTD men total attrition-%YTD women total attrition	# of women promoted/total # of women - # men promoted / total # of men
	# of women leaving certain positions compared to men	Percentage of women in senior leader ship roles
	Reasons for leaving tracked by gender	

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 and time 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. WGEA 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 – Implementation of the diversity and inclusion 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 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, women and equity seeking groups. 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 equity seeking groups. The implementation plan should identify how all employees can participate. For example, the Be More than a Bystander program implemented in BCCWITT, encouraged male employees to speak up when they saw inappropriate or discriminatory behaviour. It also gave them tools to do this. This would help change the narrative from equity seeking groups as 'trouble-makers' or 'complainers.' Implementation should address the cynicism some women and equity seeking groups may feel about the initiative and the plan should include strategies to convince them of the sincerity of the organization. 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 minority issue. The diversity and inclusion strategy should be embedded into the organization and be aligned with other policies and practices.

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

WGEA 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 and solutions to address them. 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 progress, what is and is not working and what the next steps are and to get their input.

Step 10 – Include diversity and inclusion in annual reports

For larger organizations, making a commitment to include information on diversity and inclusion in annual reports which are shared with shareholders and clients reinforces the message (internally and externally) that this is an important issue that impacts the business processes. It also ensures accountability. For smaller organizations, reporting back to employees and making diversity and inclusion policies and practices available to clients and potential employees.

Factors to support a diversity and inclusion initiative

The table below is a summary of some of the actions that could be incorporated into a successful diversity and inclusion plan.

Table 1   Factors contribute to a successful diversity and inclusion initiative within this sector

Recruitment	Retention	Career development	Workplace culture
Use neutral language in job adverts, marketing materials and other documents	Provide sponsorship, mentoring and networking opportunities	Monitor allocation of career development opportunities	Leadership support for diversity and inclusion who model behaviour
Remove the "essential person specification" description as this deters women from applying	Review how project work is allocated	Develop promotion competencies and guidelines and make these visible	Offer flexible working arrangements
Use of blind reviewing of resumes	Mixed project teams when possible – ideally at least three women	Support the development of a career plan for staff. Use sponsors within the organization to support staff progress	Provide diversity and inclusion training including unconscious bias for all staff that includes scenario based training
Use of panels to interview candidates and agree objective criteria, include women on panel and have standard questions	Include diversity and inclusion questions in performance review	Invest in leadership training and ensure women are included	Share D&I targets with staff, tell them who is responsible in leadership. Include targets e.g. for D&I training in workplans and performance reviews
Ensure diverse candidates are interviewed	Provide training to managers and supervisors about diversity and inclusion and bias	Review data on pay and develop pay scales or bands that are competency based	Provide training that highlights why diversity and inclusion is important including business case information
Include diversity and inclusion statements in mission statement and in other materials	Call out unacceptable behaviour. Initiatives to support this action have been developed by BC Women in Trades[3]	Review data on who is promoted and how long staff are in roles	Make the unwritten rules in an organization known to all

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[3]   Enhancing the Retention and Advancement of Women in Trades in British Columbia: Final Report (2017) https://www.workbc.ca/getmedia/08872319-a2db-45bc-935e-a4d44f8a3ac0/Construction_Retention_and_Advancement_of_Women_in_Trades_Feb-2017.pdf.aspx

Recruitment	Retention	Career development	Workplace culture
Recruit from a broad and diverse network including women returning to the sector	Encourage women to chair meetings	Develop existing staff to allow for career progression	Make the physical environment welcoming to all
Include information about flexible working and other supports	Ensure project administration and other non-project tasks are shared fairly	Review succession plans with a diversity and inclusion lens	Ensure decision making happens during working hours
Ensure all those involved in interviewing receive training on bias	Conduct exit interviews to find out why staff left	Provide supports for parents to enable them to return and continue to work including flexible hours etc.	Have work-life effectiveness or balance conversations
Monitor the demographics and qualifications of individuals who apply and are recruited	Conduct stay interviews to identify problems and what is working	Support organizational planning for career breaks. Parents, particularly women feel they have to choose between career and family.	Make diversity and inclusion a standing item on management agenda
Develop an outreach program with schools and colleges. Review the outreach program to ensure diversity.	Empower and support Human Resource Departments to act upon D&I complaints and not simply document them		Report out on diversity and inclusion in annual reports. Share this information with staff, invite feedback and use it to plan next steps
Promote diverse role models from within the organization. If necessary, link to diversity and inclusion organizations.			Salary levels should be based on an assessment of job position, professional designation with salary supplements set by clear and objective criteria – conduct pay audits

Recruitment	Retention	Career development	Workplace culture
Ensure job postings are distributed on websites and job boards accessed by women and other equity seeking groups are known to access.			Ensure social events are inclusion and are arranged at appropriate times and locations
			Survey staff and collect feedback about diversity and inclusion
			Make sure women have appropriate access to safety equipment

Question 2: What are the major barriers to implementing diversity and inclusion initiatives within the sector? What evidence is there for strategies for addressing these?

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

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; and

4. Lack of monitoring, reviewing, and reporting on diversity and inclusion both at an organizational and sector level.

The data from the literature and those interviewed suggest the following factors also make it challenging to implement workplace diversity and inclusion policies and practice.

▪ **Accessing adequate time and resources to develop and implement policies and practices to support diversity and inclusion within the organizations**: One of the biggest challenges for women and equity seeking groups in STEM and employers in the sector, is in accessing the available support and resources. While there is a considerable amount of

information available, it is not housed centrally which makes accessing it difficult.[4] Developing and implementing diversity and inclusion policies was the remit of the HR departments or with those individuals who had responsibility for HR. These individuals and HR departments were often described as being "over capacity." For employers without a HR department, diversity and inclusion was not their top priority in terms of time and resources. All those interviewed agreed additional resources were required to successfully develop, implement and sustain diversity and inclusion policies. Those organization that have more developed policies have developed and established teams, which included employee representation as well as senior leader involvement.

- **How-to Knowledge:** With the exception of those organization with a diversity and inclusion team, most organizations struggle to know how to implement diversity and inclusion policies and practices that are tailored to their context and relevant to their employees. The literature and interview data suggests organizations understand the business case for a diverse and inclusive workplace but do not know how to go beyond statements and or one-off training sessions. A further challenge is implementing policies in such a way that they do not alienate existing employees but at the same time promote diversity and inclusion.

- **Addressing bias and buy-in from all levels of management:** A persistent challenge for organizations how to address bias and getting buy-in from all levels of management – from the board to the supervisors.

- **Small pool of well-qualified and diverse candidates:** A perceived challenge is that there was a small pool of qualified and diverse candidates who apply for positions and, as the goal is to hire the best candidate for the job, technical skills and experience drive selection rather than demographic characteristics. The challenge is how to improve recruiting practices including the language in the job postings and where these are posted to ensure they appeal to a wide range of diverse candidates. Also, the engineering and technology sector is 'a relatively small world' people from equity seeking groups talk to each and share information about whether they would be welcomed in a workplace. Organizations should consider the possibility that they do not get diverse applicants because they are not known to welcome diverse employees.

- **Adequate time and resources:** 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

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[4] HR Tech Hub brings together some of this information and the AWET website provides information and resources.

in the short-term but they produce stronger results in the long run that will benefit everyone including the organization (Debusschere et al., 2017).

- **Investing in groundwork:** 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.

Question 3. What insights does a GBA+ lens provide to the understanding of diversity and inclusion for equity seeking groups within the sector?

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.
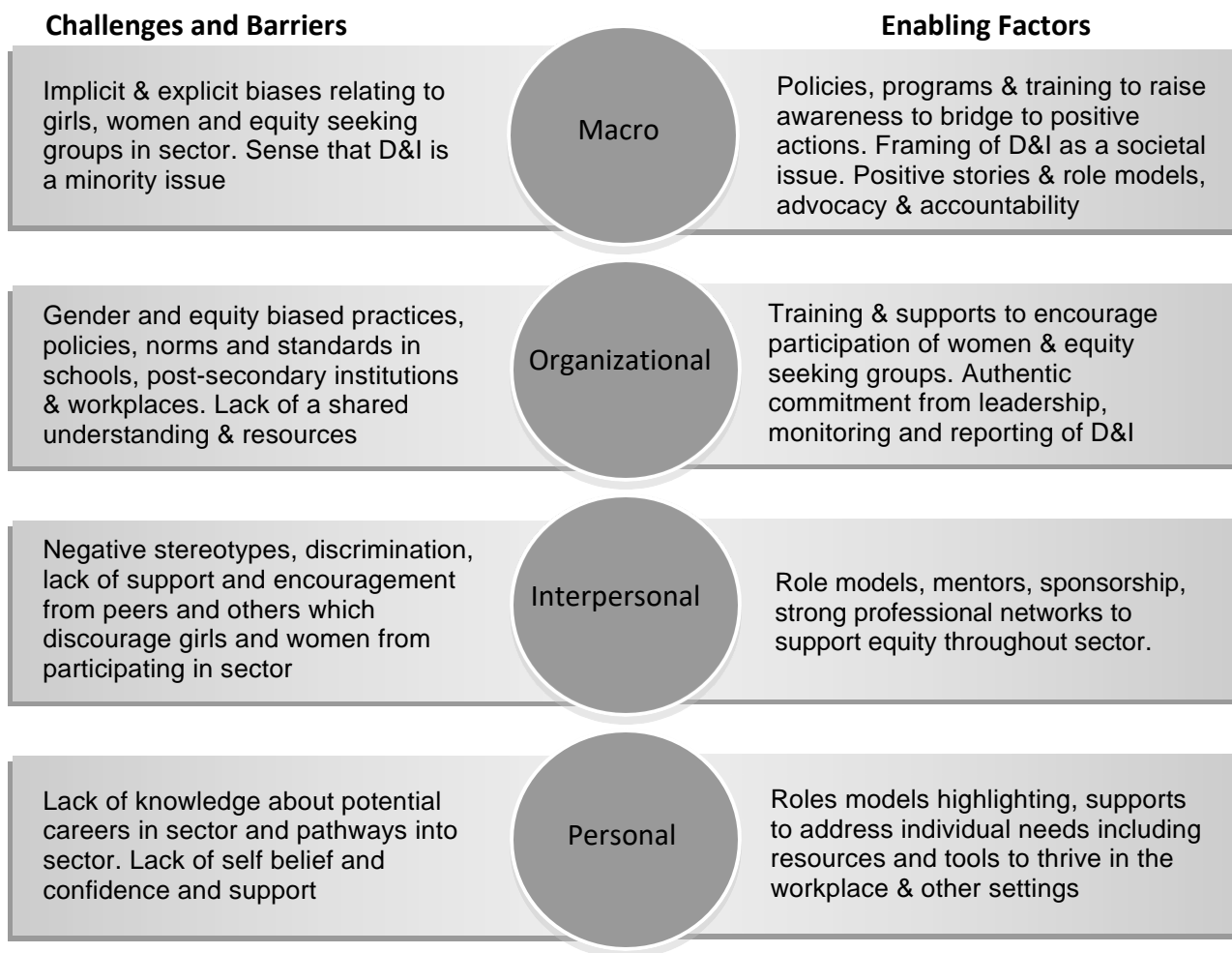
The survey data highlighted that differences between the experiences of men, women and equity seeking groups in engineering and technology. Most of the differences were negative and resulted in women reporting lower rates of satisfaction with their careers. The survey data also highlighted the heterogeneity in the experiences of women and equity seeking groups. A more nuanced understanding of the complexities of diversity and inclusion in the workplace is necessary. For example, while women had lower rates of career advancement and satisfaction and were less satisfied with their salaries, for foreign born women and those with disabilities, the differences were more pronounced. The findings of the survey also highlighted that discrimination remains a significant problem within the sector, in fact respondents reported that it had changed relatively little over time. This is despite legislation to prevent discrimination in the workplace. Again, these findings are supported by the literature and the data from the interviews with those in the sector.

Summary of the barriers and enabling factors women in STEM experience

Figure 4 summarizes the challenges and the enabling factors for women and equity seeking groups in engineering and technology. Enabling factors include actions, resources, and supports that make it possible (or easier) for individuals/ organizations or populations to change their culture and 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 4   Challenges and enabling factors for women and equity seeking groups in STEM

Challenges and Barriers		Enabling Factors
Implicit & explicit biases relating to girls, women and equity seeking groups in sector. Sense that D&I is a minority issue	**Macro**	Policies, programs & training to raise awareness to bridge to positive actions. Framing of D&I as a societal issue. Positive stories & role models, advocacy & accountability
Gender and equity biased practices, policies, norms and standards in schools, post-secondary institutions & workplaces. Lack of a shared understanding & resources	**Organizational**	Training & supports to encourage participation of women & equity seeking groups. Authentic commitment from leadership, monitoring and reporting of D&I
Negative stereotypes, discrimination, lack of support and encouragement from peers and others which discourage girls and women from participating in sector	**Interpersonal**	Role models, mentors, sponsorship, strong professional networks to support equity throughout sector.
Lack of knowledge about potential careers in sector and pathways into sector. Lack of self belief and confidence and support	**Personal**	Roles models highlighting, supports to address individual needs including resources and tools to thrive in the workplace & other settings

CONCLUSION

The reasons women are underrepresented in the engineering and technology sector are complex and to address them requires a comprehensive and sustained approach which is relevant to the organizations and their employees and reflects the context in which they are being applied. Some initiatives within this sector have focused on increasing the number of women entering the

sector. These pipeline initiatives suggest that if more women are encouraged to enter the sector, 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 and those interviewed, is that this approach has met with limited success; gender and diversity gaps persist in recruitment, participation, career progression and in the salaries of men and women.

The 'problem' with the pipeline approach is that the pipeline still leaks, so no matter how many women and diverse engineers and technologists enter, if they continue to feel unwelcome, unequal, that do not feel they belong, and they 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 persist, and the benefits of having a diverse workforce will remain a series of lost opportunities for the sector and society.

The data included in this report suggests that to increase diversity, the sector has to change its organizational culture so that it is not only more diverse but that it is more inclusive. Women and equity seeking groups want to be part of organizations where they feel welcome and valued for their skills and expertise and, that their gender, ethnicity, or presence of a disability, is not a barrier to their career development.

To do this, diversity and inclusion initiatives must be authentic, intentional and go beyond compliance, so they remove the barriers and the biases women and equity seeking groups encounter in engineering and technology organizations. The promising practices identified in this report, suggest practical steps can be taken by those in the sector to increase diversity and inclusion but the research cautions changing workplace culture will take time and require sustained and consistent effort and resources.

The findings of this study suggest changing workplace culture will also require some challenging, and even uncomfortable, conversations if the status quo in engineering and technology is to move in a positive direction. Organizations must be convinced of the benefits for making their workplace cultures 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 in diversity **and** inclusion are a priority. 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 must 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, 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 and follow through.

Workplace diversity and inclusion initiatives must be data driven. Employers need to track, monitor a range of diversity and inclusion indicators and report out on these using a GBA+ lens to highlight discrepancies between employees based on gender, ethnicity, and the presence of a disability.

The most important message from this report is that diversity and inclusion are not an event; they are a process. The literature and those interviewed had reasons to be optimistic that the engineering and technology sector would become more diverse and inclusive. While all acknowledged change had been too slow, they were hopefully that as more diverse engineers and technologists entered the sector, they would expect equal opportunities and they anticipated this expectation would help drive greater change and transformation. The caveat is that employers have to do their part to authentically address implicit and explicit biases and create a welcoming and equitable workplace culture. Initiatives must be intentional and aimed at building trust. The key informants speculated good employers would rise to the challenge, not only because it was the socially just thing to do, but because, if done properly diversity and inclusion made good business sense. They speculated that these employers would become the employer of choice and would benefit from recruiting and retaining the best engineers and technologists. Other employers it was argued, would need a 'burning bridge', an unavoidable mandate for change, but those who participated in this research stated that with skills shortages looming, what choice do employer have?

Recommendations for next steps

1. The engineering and technology sector have to find the 'burning bridge' that will persuade all employers to address diversity and inclusion within their organizations. Currently the impetus for change is coming from two sources: internally from employees and progressive leaders and externally as customers and contracts require reporting on diversity and inclusion policies and practices.

2. Raise awareness about the benefits of diversity and inclusion to the organization and sector. Consider recognizing or rewarding those employers who actively and authentically promote diversity and inclusion in their organizations.

3. An array of carrots and sticks will be needed to bring some employers to the table. These should reflect the capacity and context within which they are operating.

4. Make how-to information readily and easily available and consider providing supports to employers. Provide workshops on how to make recruitment and career advancement processes more diverse and inclusive as well as what and how to track and monitor progress.

5. Empower and train HR professionals to promote and respond to employees who have experienced bullying and discrimination because of their gender or because they are racialized.

6. Provide unconscious bias training that is scenario based and that goes beyond defining bias but helps employers and employees know how to respond to it. Some employers may be concerned about what they discover so training should provide a bridge to action.

7. Consider convening a leadership table that focuses on diversity and inclusion in the sector to share best practices and to highlight what is possible.

8. Provide support to outreach programs in elementary and high schools to encourage girls and those from equity seeking groups to participate in STEM.

As indicated by the multiple voices represented in this study, developing and implementing Diversity and Inclusion in the sector is a journey and multiple strategies are needed to increase the recruitment, retention and the career advancement of all equity seeking groups in the sector. Those in the sector remind us that,

> *"[this] isn't just women who are under-represented, who aren't promoted. It is bigger and more fundamental. Go back to basics. It is about making all employees feel welcome at work, to feel safe, to be respected and to have the same opportunities as all others. Once we compartmentalize this, it is one group against the other. That's not what we want, and that won't change anything. All that achieves is people saying, that's nothing to do with me. We need to include everyone. … I ask companies if they want to be the best in field. They all say yes. To be the best, they need the best staff, they need the competitive edge that comes from a diverse workforce. Once they say yes, it becomes a conversation of how."*

This report outlines some of the practical steps that those in the sector could take along this pathway.

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APPENDIX A: OVERVIEW OF PROMISING PRACTICE GUIDES

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 Eramus+ 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.

WGEA 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 (WGEA guide) (Workplace Gender Equality Agency, 2019b) and a gender equality diagnostic tool (WGEA DT) (Workplace Gender Equality Agency, 2019a). The WGEA guide identifies eight steps that business need to work their way through to develop, implement policies and to monitor their effectiveness. The WGEA 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 WGEA DT to review progress and assess their current situation. The WGEA 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 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 for 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.

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