More Than Just Numbers Revisited

Progress on Women in Engineering Since 1992

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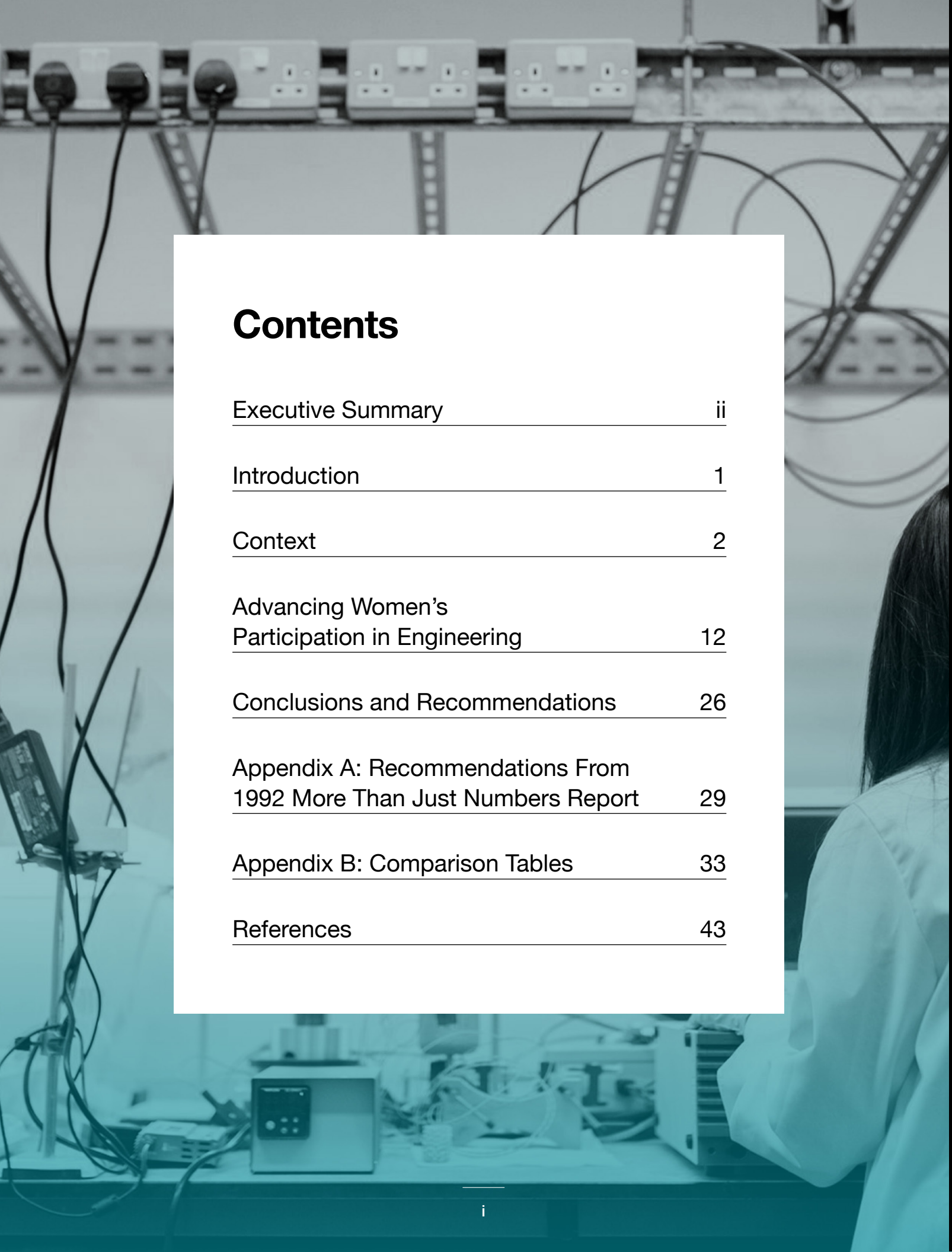

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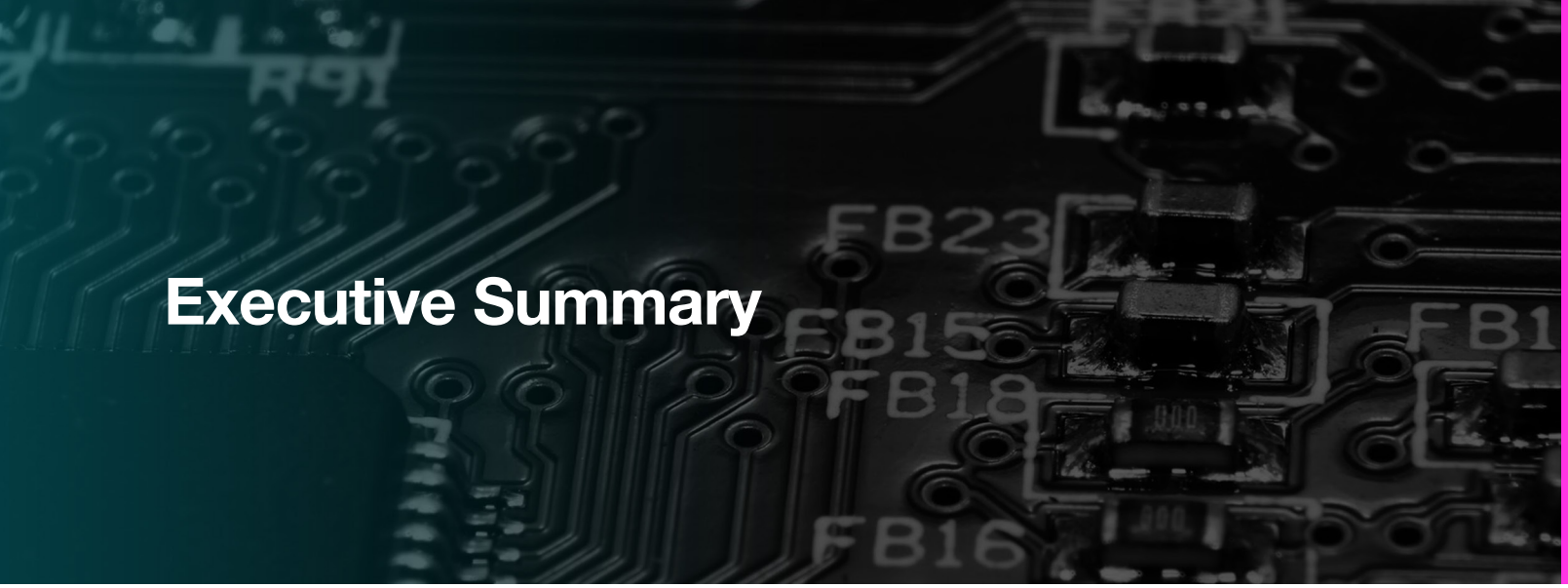


Executive Summary

In 1992, the Canadian Committee on Women in Engineering (CCWE) published the More Than Just Numbers report, which identified numerous barriers to women entering and succeeding in the engineering profession. These obstacles include under-representation, gender stereotyping, a lack of role models and workplace challenges. More recently, Engineers Canada issued their 30 by 30 call to action that raises the percentage of newly licensed engineers who identify as women to 30 per cent by the year 2030. This report is intended to review progress, identify the remaining gaps and advance an evidence-based action plan.

Context

In 1990, 17.7% of first-year undergraduate engineering students were women and CCWE set a target of increasing representation to 25% to 35% by 1997. In 2022, women represented only 25.2% of all undergraduate engineering enrolments. Although some universities have seen significant improvements in women's representation, others lag. Emerging fields where the human impact is clear, such as environmental and biosystems engineering, have seen growth in representation. However, traditional disciplines such as electrical and mechanical engineering still see lower women's participation.

As was the case when More Than Just Numbers was released in 1992, gender stereotypes exist and girls self-select out of science, technology, engineering and mathematics (STEM) from kindergarten to Grade 12 (K-12) education. While women's participation in math and some science disciplines is now close to parity, women remain under-represented in Grade 12 physics. Even women who are STEM-ready in their secondary school coursework and

academic performance are less likely than men to pursue a math-intensive bachelor's STEM program.

Despite increases in engineering school enrolments, only 15% of engineering professionals and 20.2% of newly licensed engineers in Canada were women by 2022. While this marks an improvement from 1992 (when 3.2% of licensed engineers were women), it is less impressive considering the time span of 30 years. Academia has followed a similarly slow trajectory, with women now making up 19.5% of the full-time engineering professoriate, versus 2% in 1992. These persistent disparities mean women continue to lack the role models and mentors needed for change.

A highly gendered educational and work environment – described by CCWE as a "chilly climate" – also continues to this day. Recent research across Canada has highlighted negative workplace cultures, gender bias in performance assessments, remuneration and challenges with parental leave support.

Women have characterized engineering work environments as "old boys' clubs" or "toxic bro cultures" with misogynistic and sexist attitudes, bias and microaggressions toward women being commonplace.

In academic settings, women engineering faculty reported a lack of recognition and an unsupportive work culture, one that influences decisions to leave the profession. Women, Black, Indigenous and racialized engineering students continue to face higher rates of microaggressions compared to students who identify as white men. They are subject to stereotypes and have their technical abilities and presence questioned while needing to work harder for the same opportunities.

Despite Engineers Canada's 30 by 30 campaign, progress is slow and the leaky pipeline of women opting out of engineering education and leaving the profession remains.

Women now make up 19.5% *of the full-time engineering professoriate,* ***versus 2% in 1992.***

Advancing women's participation in engineering

The More Than Just Numbers report stressed the importance of systems change to advance women's representation in engineering. It identified actions at the societal, organizational and individual levels. More than 30 years later, despite numerous initiatives, the representation of women has increased slowly. Perhaps, in part, this is because of the lack of coordinating and accountability mechanisms. Our review of the literature and practices informed our recommendations, which take into account the need for a systems approach that include all three levels.

Societal level

Government policies, cultural shifts and the support of regulators are key to advancing gender equity in engineering. In Canada, the government has used procurement policies to incentivize aspiring engineering and infrastructure contractors to deliver on equity, diversity and inclusion (EDI). As a national coordinating body for regulators, Engineers Canada plays a pivotal role through initiatives like 30 by 30. Some provincial and territorial regulators have implemented EDI strategies, including increasing women's representation on their boards, issuing public disclosures, including women in engineering committees, developing professional practice guidelines to foster leadership and promoting inclusive workplaces.

Organizational level

Efforts to advance gender equity in Canada's engineering sector rely on employers, educational institutions and professional associations. The most proactive post-secondary institutions have introduced outreach programs, scholarships and mentorship initiatives and have successfully increased women's enrolment within their university engineering programs to 40%. Employers and professional associations also contribute by creating inclusive organizational cultures, offering training on unconscious bias, setting targets and tracking their progress and establishing mentorship and leadership development programs for women. All of these

measures help retain women in engineering and promote their career advancement. These efforts collectively address the systemic barriers that women face in the engineering profession.

Individual level

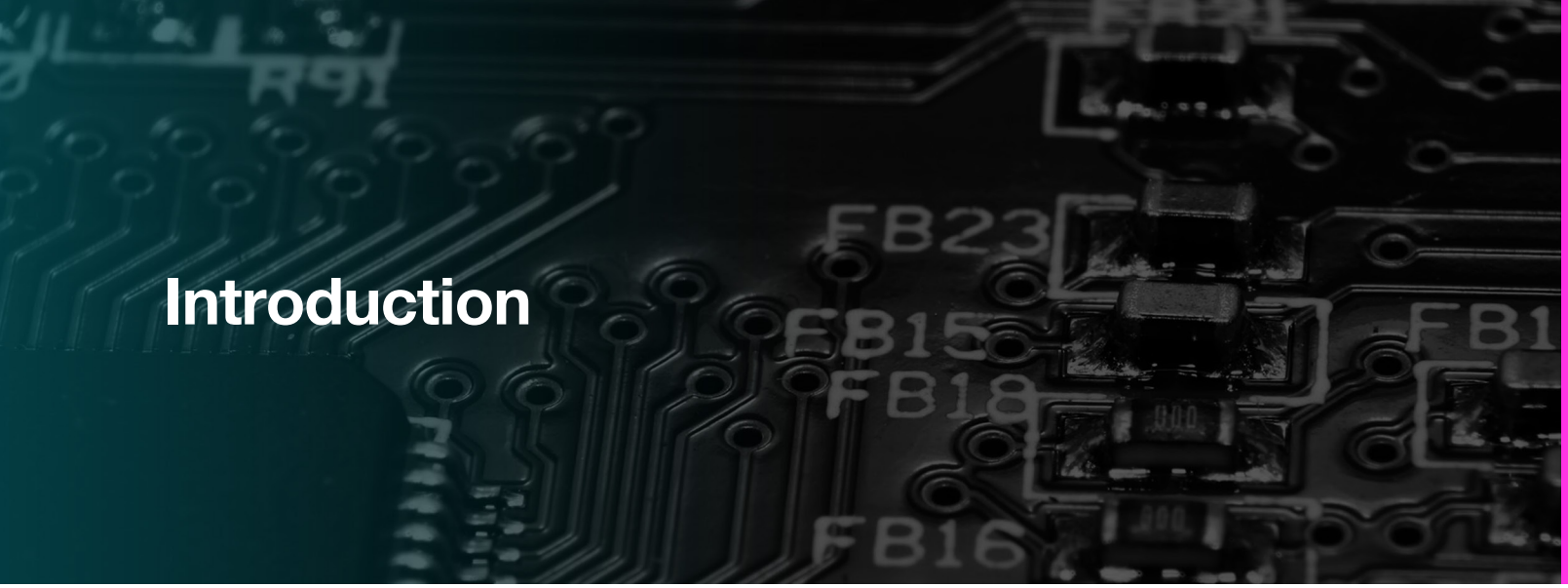
Advancing women in engineering at the individual level requires a comprehensive approach that addresses both the aspirations and career paths of women engineers as well as the biases among educators, employer decision-makers and others.

Conclusions and recommendations

Addressing the gender disparity in engineering requires coordinated efforts across societal, organizational and individual levels. At the societal level, government-led initiatives should be strengthened to promote diversity in hiring, procurement and contracting. Regulators need to step up their game and use their influence and authority to ensure the profession is accountable. Policies that help reduce women's disproportionate share of unpaid work are also crucial to facilitate women's full participation in the workforce.

At the organizational level, employers, educational institutions and professional associations must work together to foster inclusive environments. Organizations should prioritize EDI in their strategy, governance and leadership. Regarding recruitment, selection and promotion, equal opportunities for women's career advancement and leadership initiatives should be prioritized. Values and culture should emphasize fostering inclusive environments supported by zero-tolerance policies for workplace harassment. Measurement and tracking of EDI are crucial, as is ensuring diversity metrics are consistently monitored. The principles of EDI should also be embedded across the value chain, including in procurement, product design and marketing. Finally, outreach and expanding the talent pool are vital to attract and support diverse candidates.

Addressing the knowledge, skills and attitudes of women and girls is critical to shaping their aspirations and success. Education, mentoring, coaching and sponsorship are key. At the same time, there needs to be strong commitment to addressing bias, discrimination and harassment among educators, employers and decision makers.



Introduction

This report assesses the ongoing gender disparity in Canada's engineering profession and explores strategies to overcome the persistent barriers women face. It reviews progress since the Canadian Committee on Women in Engineering (CCWE)'s 1992 More Than Just Numbers report, which first outlined women's challenges in the field.

Despite some improvements, gender disparity remains significant, with women still under-represented in both engineering education and the workforce.

This report provides an in-depth analysis of the obstacles women in engineering face. It examines the strategies used to address them, focusing on initiatives that promote equity, diversity and inclusion (EDI) and career advancement. It concludes with recommendations for creating more inclusive environments, as well as a call for coordinated efforts to ensure women enter the profession and are supported in their career growth and leadership development.

Context

Improving the representation of women in engineering has been a long-standing goal in Canada. Gender disparities limit industry's access to talent, compounding the impact of labour shortages. While women are now at parity among medical and law school graduates (Appendix B: Table B3), they remain under-represented in science, technology, engineering and mathematics (STEM). This occupational segregation contributes to the wage gap.

Even more importantly, perhaps, is that the lack of diversity in engineering has ripple effects on the design of products, often with fatal consequences. For example, U.S. crash data between 1998 and 2008 shows women drivers wearing seat belts are 47% more likely to be severely injured than men drivers with seat belts. The suspected reason is that the design of women crash test dummies did not consider many biological differences between men and women's bodies.[1] Engineering design is integral to our lives, affecting everything from the cars we drive to personal protective equipment, medical devices, robotics and the software and algorithms that power decision making. To deliver inclusive design and products that are safe and effective for all, women and diverse individuals and perspectives must be represented. More women in the profession, as well as in engineering leadership, also increases the likelihood of centring the human impact of products and sustainable development goals.

Diverse teams yield better performance. They are significantly more likely to deliver radical innovation and better financial performance while avoiding group-think.[2, 3, 4, 5] When asked to rate their leaders, employees reporting to women are twice as likely to rate them as wise (i.e., displaying the courage to do the right thing even when it's difficult) and compassionate (i.e., showing care and empathy) than employees reporting to men.[6] As these attributes have been shown to drive 86% higher job satisfaction, greater engagement and productivity, the damage to organizational performance resulting from having fewer women in leadership is significant.[7] There are strong moral and business imperatives to advance women's participation in engineering.

In 1992, the More Than Just Numbers report quantified the gender gap and identified the barriers to women entering and succeeding in the engineering profession.[8] Table 1 summarizes the CCWE's 1992 findings, its stated goals and the progress as of 2022.

*When asked to rate their leaders, employees reporting to women are **twice as likely** to rate them as wise and compassionate than employees reporting to men.*

Table 1

More Than Just Numbers 1992 findings, stated goals and 2022 outcomes

1992	2022
3% of licensed engineers are women.	15% of licensed engineers and 20.2% of newly licensed engineers are women.[9]
14% of engineering undergraduate students are women.	25.2% of engineering undergraduate students are women.[10]
2% of full-time university engineering faculty are women.	19.5% of full-time university engineering faculty are women.
Gender stereotyping and bias is pervasive at all levels: elementary school, secondary school, university and employment.	Gender stereotyping and bias persist.
Chilly climate: Women engineers face workplace challenges that include sexist attitudes and sexual harassment, as well as discrimination in hiring, promotion, job assignments and salaries.	The chilly climate persists in the workplace.
More boys than girls study physics and mathematics in secondary school. The proportions of girls and boys who study chemistry in secondary school is more equal and more women study biology. **Goal:** By 1997, girls and boys will pursue mathematics and science equally, especially at advanced levels throughout high school.	Gains have been made and girls' standing in advanced mathematics and most sciences is strong; however, women's participation in Grade 12 physics remains an issue in many provinces. As of 2016 in Ontario, girls represented 47% of Grade 12 advanced functions students, 44% of Grade 12 calculus and vectors students and 53% of Grade 12 chemistry students. However, they made up only 34% of students in Grade 12 physics.[11] More recent data from outside Ontario shows that girls' representation in Grade 12 physics is 49% in New Brunswick, 48% in Quebec, 46% in Saskatchewan, 41% in the Northwest Territories and 40% in Nova Scotia and Prince Edward Island. In other provinces and territories, representation ranges from 34% to 38%.[12] Grade 11 physics courses have achieved greater representation, with girls making up 40% or more of students across Canada.[13]
Women represent 17.7% of first-year engineering students, 10% of master's students, 6.1% of doctoral students and 2% of the full-time professoriate in engineering faculties across Canada. **Goal:** By 1997, women will comprise 25% to 35% of first-year students, 20% of master's students, 10% of doctoral students and 5% of the professors in engineering faculties across Canada.	This goal was not reached by 1997. In 2022, women made up 25.2% of fall undergraduate engineering enrolments for the first time.[14] In 2022, women represented 27% of master's students in engineering (29% among domestic students) and 29.7% of doctoral students. Women made up 19.5% of full-time engineering faculty.
Women represent 14% of graduates from undergraduate engineering programs. **Goal:** By 1997, women will make up at least 18% of graduates from undergraduate engineering programs.	In 2022, women made up 23.3% of graduates from undergraduate engineering programs.[15]

More than 30 years later, women remain significantly under-represented in the engineering profession and the reported chilly campus and workplace climate has failed to improve in any substantive way. In 2022, women made up only 25.2% of undergraduate enrolments in engineering (Appendix B: Table B1) and 15% of engineering professionals in Canada (Appendix B: Table B2). Women accounted for just 20.2% of newly licensed engineers in 2022.[16]

Women's representation among engineering undergraduate enrolments has increased by only 11 percentage points since 1990, falling short of the CCWE's target of 25% to 35% by 1997.[17] Similarly, women's representation among licensed engineers has increased by only 11.8 percentage points in over 30 years (Appendix B: Table B2).

Figure 1

Women's representation among engineering undergraduate enrolments at Canadian universities 1990 – 2022 (% and total women)[18, 19]

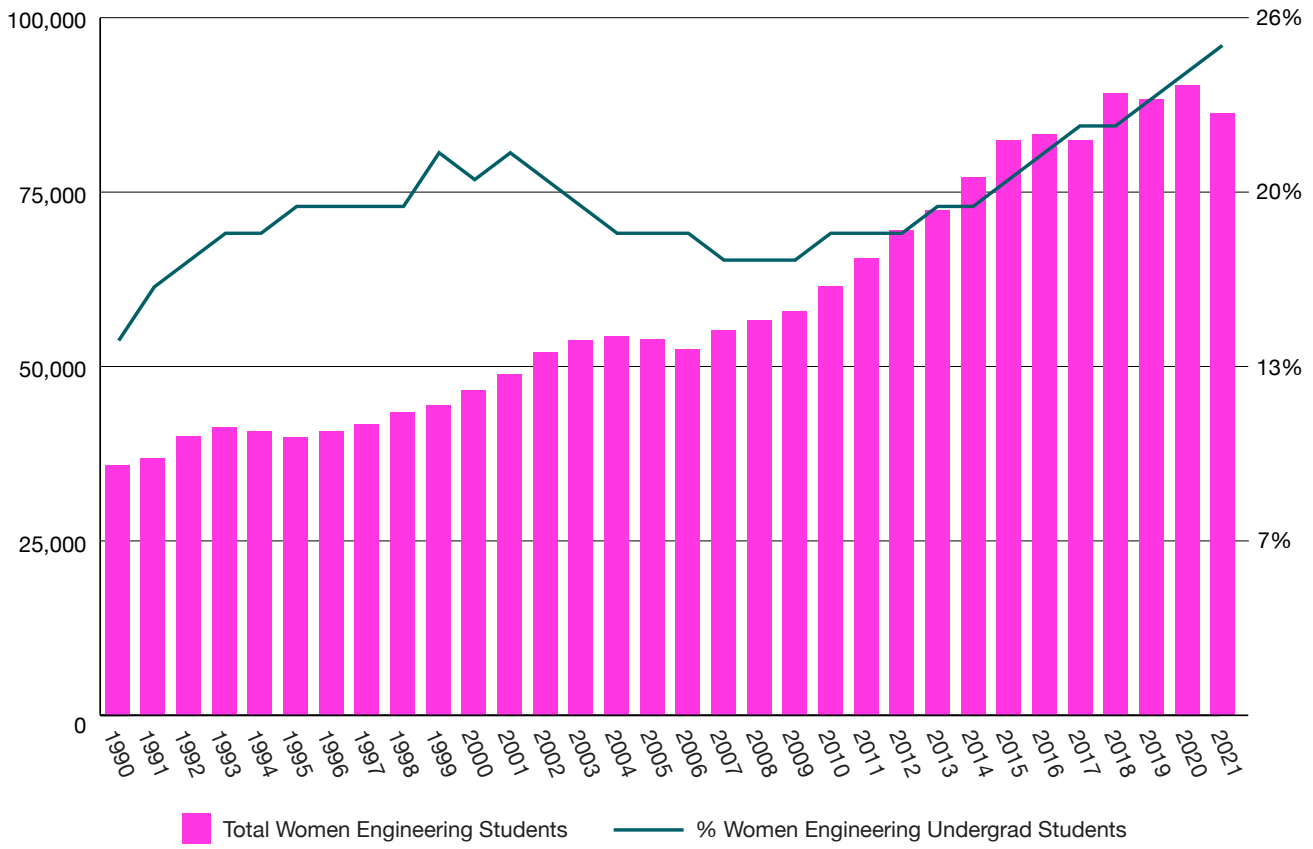


Table 2

Top 10 and bottom 10 Canadian institutions by progress in women's representation in undergraduate engineering enrolments (1990–2022)

Academic Institution	% Women (1992)	% Women (2022)	Change
Highest Performers			
University of Toronto	15.1	39	23.9
McMaster University	11.4	32.9	21.5
University of Waterloo	13.7	31	17.3
University of British Columbia	11.1	28.2	17.1
Université de Moncton	9.5	23.9	14.4
University of Calgary	13	27	14
University of Western Ontario	11.4	25.3	13.9
University of Victoria	7.6	21.4	13.8
University of New Brunswick	11.5	25.1	13.6
University of Regina	7.3	20.3	13
Lowest Performers			
École de technologie supérieure	4.4	13.4	9
University of Windsor	8.5	16.9	8.4
University of Saskatchewan	10.5	18.6	8.1
Royal Military College of Canada	10.5	18.3	7.8
Concordia University	15.6	23.1	7.5
Université du Québec à Trois-Rivières	13.3	18.3	5
Laurentian University	12.5	16.3	3.8
Université du Québec à Chicoutimi	15.2	18.2	3
Université Laval	18.7	20.9	2.2
Université de Sherbrooke	17.7	19.4	1.7

There has been varied progress in women's representation among undergraduate enrolments across Canadian engineering institutions (Table 2). Some universities have significantly improved, while others have struggled to keep pace.

The University of Toronto exhibited the most remarkable progress, increasing women's enrolment to 39% in 2022, from just 15.1% in 1990, an improvement of 23.9 percentage points. Similarly, McMaster University saw women's representation rise to 32.9% from 11.4%, an increase of more than 21 percentage points. Other institutions that have made substantial gains include the

University of Waterloo (31%, from 13.7%) and the University of British Columbia (28.2%, from 11.1%), reflecting concerted efforts to close the gender gap in their engineering programs. However, at 32 schools, women's representation remains below 30%. Some schools report women's engineering undergraduate enrolment at 18% or below.

Women's representation varies by field and is often higher in disciplines where the impact on people is more obvious. For example, in undergraduate fields it is highest in environmental engineering (39.3%) and biosystems engineering (54.5%). Women also represent 43.9% of enrolments in chemical engineering (Appendix B: Table B7). However, women's representation drops in more traditional disciplines like electrical (19.5%), mechanical (17.5%) and civil (29.5%) engineering (Appendix B: Table B7). At the undergraduate level, women's representation is lowest in mining, mechanical, computer, software and electrical engineering (Appendix B: Table B7).

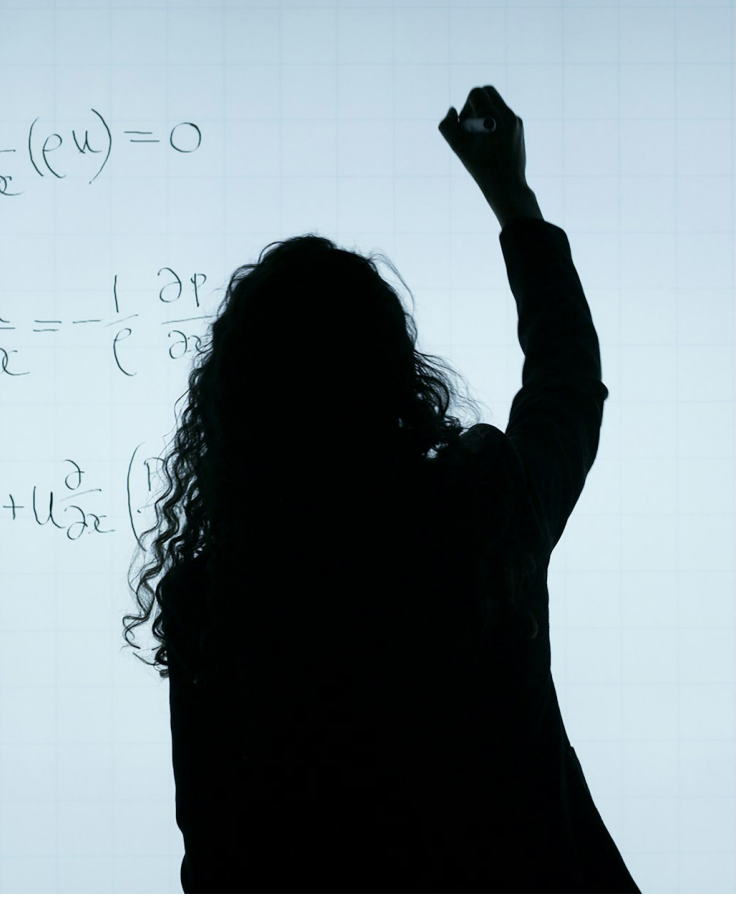
The slow pace of change in engineering parallels the limited progress across STEM fields overall. Over the past 30 years, women's representation in natural and applied sciences and related occupations has increased by only four percentage points.[20, 21] Additionally, in post-secondary STEM enrolments, women's representation has grown by just 3% over the past 11 years.[22] As of 2022, women represented 39%[23] of STEM post-secondary students overall, 28%[24] in math and computer science and 59%[25] in science programs.

Over the past ***30 years,*** women's representation in natural and applied sciences and related occupations *has* ***increased by only four percentage points.***

Gender stereotypes and self-selection in education

Women's under-representation in engineering has its roots in kindergarten to Grade 12 (K-12) education, where gender disparities in STEM begin to emerge as early as Grade 3. Research from the Toronto District School Board, for example, showed that while Grade 3 girls outperform boys in both math and English, boys are more likely to say they are good at math and English.

Regardless of ability, girls often self-select out of STEM subjects, which are often highly gendered in terms of content and pedagogy, as well as presentation. A 2018 survey of 1,172 men and 1,727 women STEM professionals found that women were nearly unanimous in reporting being discouraged or unsupported by their secondary school teachers and counsellors when expressing interest in STEM.[26]



Another study found that, among secondary school graduates, women are 30% less likely than men to enrol in post-secondary STEM programs and only a small proportion of this gap relates to performance in STEM subjects.[27] Among women in the top quintile of the provincial high school science exam who were STEM-ready in course work and academic performance, only 7% enrolled in a math-intensive bachelor's STEM program, compared to 24% of their men peers.[28] Girls are also likely to self-select out of required math and physics courses.[29]

The academic climate is similarly challenging. Women, Black, Indigenous and racialized university engineering students continue to face higher rates of microaggressions compared to students who identify as white men. Research across engineering programs at seven Ontario universities found that all participants who were members of equity-deserving groups experienced microaggressions during their education. They were subject to stereotypes, had assumptions made about their technical abilities and had their presence or belonging in class questioned. They were also assigned to less important tasks in labs or projects, needed to work harder for the same opportunities, had their names mispronounced and received inappropriate personal comments from supervisors, such as how having children would impede their careers.[30]

Women's under-representation among professors in engineering faculties across Canada contributes to this dynamic. Women engineering students lack role models and, with men dominating academia, the chilly climate and gendered pedagogies persist.

Among women** in the top quintile of the provincial high school science exam who were STEM-ready in course work and academic performance, **only 7%** enrolled in a math-intensive bachelor's STEM program, **compared to 24% of their men peers.

Women make up 19.5% of full-time university faculty within Canadian engineering programs,[31] compared to 2% in 1990 (Appendix B: Table B10). And women continue to be over-represented in the lower ranks of university faculties. Among women faculty members, 13.5% are full professors, 18.7% are associate professors, 33.2% are assistant professors, 37.9% are non-tenured instructors or hold other lower-ranked/non-tenured roles (Appendix B: Table B5).

There is also variation at the institutional level. The University of Prince Edward Island and Queen's University have achieved 38% and 28% representation of women among their engineering professoriate, respectively (Appendix B: Table B10). However, at the three institutions awarding the largest number of engineering undergraduate degrees,[32] women's faculty representation is much lower: 21% at the University of Waterloo, 23% at the University of Toronto and 19% at École Polytechnique de Montréal (Appendix B: Table B10).

Women represent 29.7% of full-time doctoral students, up from 6.1% in 1990 (Appendix B: Table B7). In 2022, there were more than three times as many women in engineering doctoral programs as there were women in full-time engineering faculty positions (Appendix B: Tables B9 and B10), indicating a strong pipeline. The question remains, however: why has this not translated into proportional full-time faculty appointments for women?

Employment

Gender disparities persist beyond academia. In Ontario, women represent 21% of all engineering degree holders and 18% are domestic graduates. Of these, 22% of women graduates work in engineering occupations and 45% work in STEM fields—compared to 31% of men engineering degree holders working in engineering and 52% in STEM.[33]

Women are also more likely to be underemployed: 38% of Ontario women engineering graduates face underemployment, compared to 32% of men. Women between the ages of 45 to 64 years are more likely to be underemployed than to work in STEM or another profession.[34] Immigrant women and temporary residents make up the majority (52%) of women in STEM,[35] in part because other cultures

According to the 2021 Canadian census, professional engineers who identify as women ***earn on average $19,700 less*** *than those who identify as men.*

around the world have fewer barriers to women in STEM. Among those who obtained their engineering degrees outside of Canada, 48% of women and 49% of men are underemployed.[36] The barriers are more pronounced for racialized and immigrant women.

Pay gaps between men and women remain. According to the 2021 Canadian census, professional engineers who identify as women earn on average $19,700 less than those who identify as men (Appendix B: Table B14). This nominal wage gap has remained relatively consistent since 2001. Among all engineering graduates, regardless of their field, the gendered wage gap has increased. In 1989, women engineering graduates earned on average $1,939 less than their men peers. By 2021, this wage gap grew to $21,600 (Appendix B: Table B13). A 2017 Engineers Canada report indicated that in their first year of post-graduation employment, women engineers in Canada earned $15,000 less per year than their men peers—and this pay gap widened to $20,000 per year 13 years post-graduation.[37] Women are less likely to be in leadership roles, further amplifying the disparity.

Further, surveys show the chilly climate has continued. An Ontario Society of Professional Engineers (OSPE) study found 65% of women respondents had experienced gender discrimination at work and 31% reported age discrimination—compared to 6% and 13% of men, respectively.[38]

Recent research by Engineers Canada and the Association of Professional Engineers and Geoscientists of Alberta (APEGA) identified similar themes. The top barrier for women engineers and geoscientists in Alberta was the traditionally masculine work environment, characterized as an “old boys’ club” or “toxic bro culture” with misogynistic and sexist attitudes, bias and microaggressions toward women being commonplace.[39] Other barriers included challenges to career progression and advancement (21%), bias, discrimination and harassment (17%), maternity and parental leave issues (15%),and work-life balance issues

(10%).[40] Overall, 83% of women engineers expressed that their gender affected their treatment in the workplace.[41] This study also analyzed hiring, promotion and retention rates across engineering and geoscience employers. The authors found that women engineers and geoscientists had 50% lower promotion rates and slightly higher exit rates than men at earlier career stages. Women were three times more likely to exit the workforce at the executive level than their men peers.[42]

Research across Canada echoed the regional findings regarding negative workplace cultures, gender bias in performance assessments, remuneration and challenges with parental leave support.[43] In academic settings, women engineering faculty reported a lack of recognition and an unsupportive work culture, significantly influencing their decisions to leave the profession.[44]

While there has been some improvement, women role models remain few, both in the workplace and in educational settings. Only 18% of engineering managers are women, representing an improvement of eight percentage points since 2006.[45, 46]

Leadership in the engineering profession is also critical. Across Canada, 38% of all elected council members at professional engineer regulators are women, compared to just 13% in 1992. The regulators in Alberta, New Brunswick and Quebec have all reached gender parity (Appendix B: Table B15). However, in Newfoundland, Ontario, Saskatchewan, the Northwest Territories and Nunavut, women's representation on councils remains below 30%.

In 2021, a report commissioned by Professional Engineers Ontario (PEO) identified various vulnerabilities to systemic racism and discrimination within PEO's practices and operations, and its role as regulator of the practice of professional engineering and governor of the engineering profession.[47] As a result, PEO established the Anti-Racism and Anti-Discrimination Exploratory Working Group (AREWG) which created an Anti-Racism and Equity Code in 2022. However, there has been little published or shared publicly since.[48]

All provincial and territorial regulators have affirmed their support for Engineers Canada's 30 by 30 initiative, which aims to increase women's representation among newly licensed engineers to 30% by 2030.[49] The initiative's primary focus is fostering a network of support for women in engineering and collaborating with educational institutions, regulators, employers and advocacy organizations to create systemic change.

Advancing Women's Participation in Engineering

In recent years, despite a lack of widespread transformation in women's representation across the engineering profession, notable areas of progress demonstrate the potential for change. Understanding the systemic components that reinforce the current gender disparity is essential, and learning from emerging pockets of success can provide valuable insights. This section explores initiatives and strategies at the societal, organizational and individual levels that have begun to shift the status quo, offering actionable solutions to create more inclusive environments that broadly support women in engineering and other STEM fields.

Societal level

The World Economic Forum's Global Gender Gap Report 2021 reveals that women make up 20% of the global engineering workforce, marking a 0.4% increase since 2018. Despite these modest gains, the gender disparity in engineering remains prominent, including in progressive countries. For instance, Canada has around 15% women's representation in engineering, trailing nations such as Singapore (27%) and the United States (23%). Other countries with higher representation include India (20%), Ireland (20%), Italy (19%), Australia (19%) and New Zealand (17%).[50]

Singapore has demonstrated standout performance in women's participation in STEM, with women representing 41% of the tech workforce. This success is driven by comprehensive government policies, corporate initiatives and societal shifts. The Singapore government's SG Women in Tech initiative focuses on attracting and retaining women's talent in STEM by providing mentorship, promoting corporate pledges for inclusivity and publicly recognizing women's contributions.[51] Singapore's example illustrates how actions at the societal level, both by governments and other actors, can shape outcomes.

Role of government

In Canada, government procurement policies have had an impact in civil engineering and infrastructure projects, where large contracts can significantly influence hiring and subcontracting practices. By mandating or incentivizing diversity in procurement, the federal government helps ensure that women-led businesses or firms with strong gender diversity initiatives have greater access to opportunities.[52] These measures aim to increase the number of women in engineering by creating a more inclusive industry landscape. Research conducted by the Ontario Society of Professional Engineers has developed a list of recommended strategies and best practices that governments can use to use procurement as a tool to influence diversity, not only in engineering, but throughout the supply chain.[53]

Culture and values

One of the most significant barriers to women's participation in engineering is the gendered nature of the profession. Historically, engineering has been a field dominated by men, with societal norms often discouraging women from pursuing careers in technical disciplines.[54]

Policies and processes

Supporting women's participation in engineering requires addressing the burden of unpaid work and related challenges many women face, particularly child care. Research indicates that women are more likely to leave the engineering profession due to difficulties in balancing family responsibilities with demanding work schedules.[55] Canada's national child-care program, which launched in 2021 and aims to provide $10-per-day care by 2025 to 2026, is likely to have a significant impact.

Regulators

Provincial and territorial regulators and their national counterpart, Engineers Canada, play a vital role in addressing gender disparities within engineering. These organizations set professional standards, licensure requirements and accreditation processes, all of which shape behaviour at the societal level.

The aforementioned 30 by 30 initiative has gained support across the country. To varied degrees, provincial regulators have taken steps to promote the objective of 30% representation by 2030 and create inclusive professional environments through their policies, mentorship programs, scholarships and networking opportunities aimed at women.[56] These initiatives aim to foster leadership, create inclusive workplaces and increase the number of women entering and remaining in the engineering profession. Below are key actions taken by these regulators to advance women in engineering:

> **Public disclosure of strategies and progress:** Regulators such as Engineers and Geoscientists BC (EGBC) and APEGA make their strategies, guidelines and action plans publicly available on their websites.[57, 58] These disclosures include updates on progress toward achieving the 30 by 30 goal. The Professional Engineers Ontario (PEO) 2022 anti-racism and equity (ARE) code commits to incorporating measurement, training and leadership to promote EDI. However, their detailed action plans and progress are yet to be publicly disclosed.[59]

> **EDI Statements:** Regulators, including the Association of Professional Engineers and Geoscientists of New Brunswick (APEGNB), EGBC, Engineers Geoscientists Manitoba (ENGGEOMB) and APEGA, prominently feature EDI statements on their websites, signaling a clear commitment to fostering a diverse and inclusive profession.[60, 61, 62, 63]

> **Women in engineering committees:** Several provincial regulators, such as Engineers P.E.I. and APEGA, have formed women in engineering committees. These committees monitor women's participation, provide recommendations to their governing councils and lead various initiatives such as research, outreach and professional development to promote gender parity in engineering.[64, 65] In 2020, PEO also established an anti-racism and anti-discrimination exploratory working group (AREWG) to further promote EDI within the profession.[66]

> **Professional practice guidelines:** Regulatory bodies such as EGBC, APEGA and PEO have introduced professional practice guidelines that explicitly address EDI in relation to engineers' responsibilities and ethical requirements. These guidelines emphasize that engineers must act in the public interest, which includes promoting inclusive practices within the profession.[67, 68, 69]

Professional associations and standards agencies

Professional associations in Canada, such as the Ontario Society of Professional Engineers (OSPE), the Canadian Federation of Engineering Students and the Canadian Academy of Engineering, also play an important role. For example, OSPE represents the engineering community in Ontario, conducting research, advocating with governments, offering member services and providing opportunities for professional development, networking and community building.[70] It sets the tone from the top by advocating for a more equitable, diverse and inclusive engineering profession and exemplifying this value through its actions and its board of directors, as seven of OSPE's 12 board directors are women.

Standards organizations are also important, both in their influence and on the norms of the industries with which they work and with respect to the standards they develop. Improving the diversity of the experts that help to develop standards and ensuring an EDI lens is applied to standards creation is critical to ensuring products and services meet the needs of diverse communities.[71]

The standards community has drawn heavily upon those with engineering and STEM expertise, the builders of technology. In the absence of an intervention, this limits women's participation, influence and leadership in the space due to their low representation within these occupations.

The International Organization for Standardization (ISO) aims to change this. The organization committed to gender-balanced representation in the standards development process by signing a United Nations Economic Commission for Europe declaration on gender-responsive standards and standards development.[72] As a part of this declaration, ISO pledged to create and implement a gender action plan, including measurement and initiatives to advance women's participation and leadership of ISO technical committees. Their ongoing outreach, education initiatives and efforts to drive gender equity can help reset the norms and expectations within the global standards community and the industries they serve.

Additionally, ISO and the Canadian Standards Association (CSA) have set guidelines to promote diversity and inclusion in the workplace. For instance, an ISO standard (ISO 30415:2021 Human resource management – diversity and inclusion) provides best practices for fostering an inclusive work environment. These standards encourage fair recruitment and promotion practices and hold companies accountable for implementing inclusive policies.[73] Adherence to such standards is essential for building a work culture where women feel supported and are more likely to thrive in their engineering careers.

Organizational level

Employers

Sector employers and their practices play a critical role. They dictate whether the engineering labour force and workplaces are representative and inclusive, or not. The Diversity Institute has developed a comprehensive, research-backed framework, the Diversity Assessment Tool (DAT), to help organizations assess their performance and advance EDI within their workplaces.

Leveraging this framework, a desk review of publicly available documents for the 15 largest engineering employers in Canada and others was conducted. The analysis focuses on six aspects of organizations derived from international research and standards, including recently developed Canadian guidelines[74]:

1. **Governance, leadership and strategy:** This includes measures to set targets and improve the representation of equity-deserving groups. It also involves applying an EDI lens to the processes of leadership, strategy development and setting the tone at the top.

2. **Human resources (HR) processes:** Actions are needed at every step of the HR process, including job design, recruitment, selection, training and development, management and employee engagement.

3. **Values and culture:** It is crucial to implement initiatives that ensure policies and procedures reflect and reinforce EDI and embed them into the organization's core values and work environment.

4. **Measurement and tracking:** As the saying goes, "what gets measured gets done." This includes a series of benchmarks mapped to each dimension of the corporation's EDI strategy to set targets, track progress and promote transparency and accountability.

5. **Diversity across the value chain:** This step evaluates whether the organization has embedded EDI across its core systems. Whether a bank, a hospital, or a small and medium-sized enterprise (SME), an organization needs to apply an EDI lens to its end-to-end processes, including procurement, research and development, product and service design, marketing, and sales and service.

6. **Outreach and expanding the pool:** This refers to how an organization engages and shapes its ecosystem through government relations, philanthropic and community partnerships, as well as how it helps use its influence to advance EDI more broadly.[75]

*CIMA+ set and reached their goal of achieving **36% representation of women** in leadership development programs to ensure a strong pipeline of women leaders.*

Overall, *EDI* efforts are not as advanced across engineering workplaces when compared to other sectors, such as financial services. However, promising practices exist:

Governance, leadership and strategy: Diverse representation on boards and among executive teams fosters a wider range of perspectives throughout the organization. Setting diversity targets for leadership positions has proven to be an effective strategy for achieving this improved representation. Implementation of these strategies helps organizations develop diverse talent and identify, recruit and nominate individuals from equity-deserving groups to their board and senior management team.

Stantec, for example, earned a place on the Globe and Mail's 2023 Women Lead Here ranking, with women comprising 38% of its senior executive team.[76] The company also achieved gender parity on its board[77] as have the GHD Group[78] and CIMA+ firms.[79] In the case of CIMA+, this achievement is a part of a larger commitment to diversity and gender equality in leadership roles. They prioritize EDI in executive recruitment and require executive search firms to present a balanced slate of candidates, with between 40% and 60% being women or individuals from other equity-deserving groups.[80] Further, CIMA+ set and reached their goal of achieving 36% representation of women in leadership development programs to ensure a strong pipeline of women leaders.[81] At all of these organizations, leadership has committed to EDI values and communicates this commitment to employees.

Engineering firms might also establish term and tenure limits for director positions to create opportunities for new perspectives. Participation in voluntary codes have also proved effective at galvanizing action. For example, the 50 – 30 Challenge calls on organizations to publicly commit to achieving gender parity (50% women and/or non-binary people) and increased representation (30%) of other equity-deserving groups on their boards or senior leadership teams.[82] Yhe 50 – 30 Challenge supports participant organizations with EDI research, resources, self-assessments and toolkits.

Human resources processes: Building a diverse and engaged workforce and an inclusive organizational culture is strongly shaped by having inclusive HR practices in place. These practices encompass the job design process and employee recruitment, selection, training and development, promotion, retention and separation.

An inclusive workplace improves employee satisfaction, job retention and commitment.[83] For example, organizations should use job postings with inclusive language and employ expansive and intentional outreach aimed at women and equity-deserving groups when recruiting potential candidates. This approach includes leveraging partner networks, matching platforms, community organizations, specialized search firms and partnering with non-profit and advocacy groups focused on equity-deserving populations. Hiring processes should be formally and regularly reviewed. For example, diverse selection committees and assessment methods that are less subjective (e.g., technical testing, case studies and work assignments) help make selection processes bias-free.

Several engineering firms in Canada have started implementing HR diversity initiatives to create more inclusive environments. Companies like AtkinsRéalis (formerly SNC-Lavalin),[84] Stantec,[85] WSP Global, Aecon Group[86] and Hatch[87] have introduced programs addressing unconscious biases in hiring and promotion, established gender-balanced leadership teams and offered mentorship opportunities for women engineers.[88] Stantec and Hatch run leadership development programs for women.[89]

Considerable research has been conducted regarding the role of coaching, mentoring and sponsorship and their importance in advancing women and other equity-deserving groups. These actions not only help to create a more supportive workplace culture but also contribute to higher retention rates for women in engineering roles.[90]

Values and culture: Inclusive cultures create an environment where women and other equity-deserving employees feel valued and supported.[91] An organization's culture is shaped and reflected by its policies and work environment.

Canadian Natural Resources Limited (CNRL) developed policies and programs to standardize expectations and provide valuable behavioural guidance to employees, including its code of integrity, business ethics and conduct, diversity and inclusion policy statement, workplace harassment and violence prevention policy, parental leave policy, respect in the workplace training program and its employee wellness program.[92]

EllisDon has partnered with WomanACT and the Society for Canadian Women in Science & Technology (SCWIST) to improve its workplace policies, training, prevention and response measures to address gender-based and sexual harassment.[93] The goal is to create positive change to attract and retain women in STEM.

Supportive, positive and inclusive organizational cultures can be enhanced by helping employees manage a healthy work-life balance. Family-friendly benefits that are inclusive for working and 2SLGBTQ+ parents, strong parental leave policies and support for flexible working arrangements can go a long way in supporting employees.[94] AtkinsRéalis, for example, provides flexible hybrid working arrangements and a remote holiday policy, allowing employees to work abroad for up to 20 days per year.[95]

Family-friendly benefits that are inclusive for working and 2SLGBTQ+ parents, strong parental leave policies and support for flexible working arrangements ***can go a long way in supporting employees.***

Mental health support and benefits reinforce an organization's commitment to inclusion and a healthy work culture. Engineering firms can support employees through wellness efforts and efforts to support employee capacity.

Measurement and tracking: Metrics and benchmarking are needed to ensure that an organization's efforts to advance EDI translate into concrete actions that are effective at driving results. Setting targets, while measuring outcomes through anonymous surveys and publishing their results, also reinforces the organization's EDI commitment to its employees.[96]

Most of the organizations studied had EDI tracking in place. For example, CIMA+ has set a goal of raising the percentage of newly licensed women engineers to 30% by 2030.[97] It established a robust framework for measuring and tracking EDI, aligning its initiatives and key performance indicators (KPIs) with the United Nations' sustainable development goals. Bantel conducts assessments to evaluate the efficacy of EDI initiatives[98] and EllisDon has implemented employee engagement surveys and it tracks hiring, retention and promotion rates for diverse talent.[99]

Diversity across the value chain: This refers to embedding EDI considerations across an organization's core business functions, including procurement, research and development, product design, marketing and communications and customer service.[100]

Within engineering, where the workforce lacks diversity, incorporating EDI considerations into the design process is most forward looking. Inclusive design is defined as one "that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference."[101] It involves understanding customer and user diversity, engaging these populations throughout the design process and responding with informed design decisions. Each individual product needs to be as accessible as technically possible, and accessibility is considered across the product portfolio.[102]

Hatch, for example, has a D&I design team and a six-step process to embed inclusive design into all its engineering projects.[103] Its client offer includes the application of this process to audit, organize and improve the client's existing facilities.

Also key are supplier diversity programs that set targets for engaging with businesses that are majority-owned by women, Indigenous Peoples and other equity-deserving groups. Such programs demonstrate an organization's commitment to EDI and deliver business benefits. These include increasing customer satisfaction and revenues, strengthening supply chains and reducing risk by identifying a wide range of qualified suppliers.[104] Aecon Group has a supplier diversity program that encourages the inclusion of businesses that are at least 51% owned by women, Indigenous Peoples and/or racialized people. They have partnered with diverse vendor associations, such as the Women's Business Enterprises Canada Council (WBE Canada) and Canadian Council for Indigenous Business (CCIB), while seeking out suppliers that provide women-fitted personal protective equipment.[105]

Outreach and expanding the pool: This refers to the organization's efforts to develop its resources, including partnerships to attract diverse individuals into the engineering workforce and develop its future talent pipeline.[106]

For example, the EXP firm participates in external mentorship programs with high schools, colleges and university STEM programs. In Quebec, EXP partners with Concordia University and others to advance women in STEM through internship and employment opportunities.[107] In a U.S. example, Intel created the Rotation Engineers Program (REP) to address industry-specific

barriers in STEM recruitment. The program hires diverse recent engineering graduates while developing and fostering growth through three six-month-long employment rotations. This allows participants to gain deep technical knowledge from multiple areas while being paid.[108]

Meanwhile, IBM offers its STEM for Girls program in nine major cities across Canada. It helps create awareness and a connection to STEM among girls in grades 6 through 8 through hands-on experience and real-life applications such as circuits and robotics, coding, tower building and design.[109, 110] These examples demonstrate the ways in which private-sector firms can advance gender equity both within their organizations and beyond.

Educational institutions

The variation in progress across universities regarding gender diversity in engineering can be attributed to a combination of institutional policies, recruitment strategies and the nature of disciplines. Some engineering programs have historically attracted fewer women, while others have made significant strides due to concerted efforts to create a more inclusive environment.

Outreach, recruitment and selection: Universities, such as the University of Toronto and McMaster University, have implemented robust outreach and support initiatives that have led to a noticeable increase in women's enrolment in engineering programs.[111, 112] For example, McMaster achieved a significant milestone in 2023, as 40% of its incoming engineering class were women. This growth reflects the success of outreach programs, mentorship opportunities and scholarships to attract and support women students.[113] The University of Toronto has demonstrated that transformation is possible even where the gender gap was greatest. It advanced its first year electrical and computer engineering class from 15% women in 2009 to 40% in 2023.[114] Targeted strategies, coupled with a commitment to gender parity, are pivotal in creating an environment that appeals to women interested in engineering.

Role models, mentors and supports: Creating women-friendly universities is essential to attracting and retaining women students and faculty members. At the University of Toronto, initiatives, such as Go ENG Girl and Girls Jr. DEEP, focus on early recruitment of women-identifying students. These programs emphasize hands-on learning, community support and role models, who are crucial in promoting engineering careers among young women.

The recruitment and retention of women faculty are equally important for achieving gender parity in engineering. Flexible tenure requirements, research funding and pathways to full-time positions are crucial. Increasing the number of women in faculty positions helps distribute the mentoring burden. It provides women students with role models who can guide and support them in their academic and professional journeys.

At McGill University, initiatives like Women in Engineering (WiE) focus on creating a supportive environment through mentorship and professional development, ensuring that women students and faculty have the resources they need to succeed.[115] Having a woman mentor has been found to significantly improve women engineering students' emotional well-being, retention, pursuit of post-graduate engineering degrees and success in obtaining internships.[116] The University of Toronto ensures representation of women in leadership, with 50% of its Canada Research Chairs in engineering being held by women.[117, 118]

Culture, pedagogy and curriculum:
The culture, pedagogy and curriculum in engineering programs can create chilly climates for women and reinforce gendered outcomes. While women and men are equally likely to exit engineering programs, men most often do so due to poor academic performance. For women, however, it is most often due to a lack of fit or interest.[119]

The historic disparity in women's representation among instructors and students has created a "masculine default" within engineering. This has led to more competitive and strictly technical learning environments that exclude broader considerations such as public policy learning.[120] In contrast, where curriculum transcends a purely technical focus and emphasizes creativity and values (e.g., how technological solutions can enhance quality of life) women engineering students are more motivated and engaged.[121] This is even more the case where the learning environment is also more collaborative.[122]

The emphasis on values is evidenced by women's disproportionate enrolment in engineering disciplines where the social and human impact is clear (e.g., biosystems and environmental engineering). This insight has been central to the Ontario Network of Women in Engineering (ONWiE)'s successful interventions with students. They dispel stereotypes around who can be an engineer, demonstrating the social impact of the field and advancing gender diversity in engineering programs.[123]

Individual level

These initiatives target decision-makers, prospective engineers and women already working in the field. They focus on personal development, support and changing attitudes at a micro level, affecting how individuals experience and contribute to gender diversity in engineering.

Knowledge and attitudes of decision-makers: At this level, initiatives often focus on educating and training decision-makers such as faculty, hiring managers and industry leaders. The goal is to challenge implicit biases and create more inclusive environments within academic institutions and workplaces.

Training programs aim to raise awareness about women's structural barriers in entering and progressing within the engineering field, including biases embedded in hiring practices, promotion pathways and organizational policies. For example, McGill's WiE initiative is critical in addressing these challenges. By providing mentorship for students and leadership development for decision-makers, the program ensures that leaders understand the barriers to gender equality and actively work to dismantle them, promoting an inclusive environment within academia.[124]

Meanwhile, APEGA offers professional development training and resources that address workplace issues such as microaggressions, competency-based hiring and unconscious bias. They also provide guidelines on navigating leaves of absence and ensuring inclusive HR practices. In addition, ENGGEOMB offers strategies for managing transitions in and out of parental leave and recommendations for professionals regarding the Truth and Reconciliation Commission's Calls to Action.[125, 126]

OSPE also offers courses, webinars and tools through it's DiversifySTEM tool and it's Engineering Academy on a wide range of topics, including Mentoring Across Generation, Intersectionality, and Generating Accountability in D&I.[127, 128]

By acknowledging these challenges and actively working to address them, decision-makers can significantly affect the culture within their institutions or companies. These initiatives have proven effective in shaping gender equity in leadership and creating more welcoming environments for women

*Training programs aim to **raise awareness about women's structural barriers** in entering and progressing within the engineering field, including **biases embedded in hiring practices, promotion pathways and organizational policies.***

engineers. Research shows that decision-makers who invest in their own personal development toward recognizing and addressing gender biases are better equipped to create policies and environments that foster the advancement of women in engineering.

Support for prospective engineers: Exposure to positive role models and mentors is crucial for prospective engineers, especially girls and young women in school. Individual-level initiatives, such as the Go ENG Girl program, are designed to introduce young women to STEM fields. This program allows girls in grades 7 to 10 to visit university campuses and engage with women engineers and students through hands-on activities. The goal is to break down stereotypes and inspire girls to see engineering as a viable career path.[129]

Similarly, Go Code Girl offers young women exposure to software engineering and coding through workshops and mentorship. Hosted by universities such as Queen's University and the University of Toronto, Go Code Girl allows women students to explore tech-related career opportunities and develop technical skills in an inclusive environment.[130]

The University of Calgary's Cybermentor initiative provides young women (between the ages of 11 and 18 years) with access to mentors working in STEM fields. This virtual space allows the students to ask questions and seek advice from women already established in engineering and related careers. It offers support that builds confidence and encourages their interest in the field.[131]

Educators play a significant role by fostering inclusive classroom environments that support diverse learning styles and encourage women's participation in math and science courses. Teachers and mentors guide women students to pursue advanced courses in mathematics and physics—prerequisites critical for engineering programs—by helping dismantle preconceived notions or societal barriers that may dissuade girls from pursuing these subjects.

Support for women in early careers: Women already in engineering programs or at the early stages of their careers can benefit significantly from individual-level initiatives to build personal networks and provide mentorship. These initiatives, often organized by universities and professional associations, mitigate feelings of isolation many women experience in environments dominated by men. Programs like the University of Toronto's Women in Science and Engineering (WISE) offer mentorship and leadership training for women studying engineering at undergraduate and graduate levels. Mentorship initiatives aimed at supporting women engineers have also been introduced by regulators, such as ENGGEOMB and Engineers P.E.I.[132, 133] These programs foster connections between women engineers and experienced mentors in the field, providing valuable guidance on overcoming gender bias, balancing work-life responsibilities and navigating career progression.[134]

Mentorship programs and leadership development initiatives are especially critical for early-career engineers, as they offer practical support and insights from women who have successfully navigated similar paths. By creating these opportunities, decision-makers and institutions help women not only enter, but thrive in engineering. As these individuals advance, they also contribute to creating a pipeline of women who can inspire and support the next generation of women engineers.

Conclusions and Recommendations

Addressing the gender disparity in engineering requires concerted efforts at the societal, organizational and individual levels. While significant progress has been made with initiatives like Engineers Canada's 30 by 30 campaign, systemic barriers still limit women's participation and advancement in engineering. The following recommendations provide a path forward, building on efforts at each level of engagement.

Societal level

Efforts here must focus on government policies, public campaigns and cultural shifts to address gender disparities and create a more inclusive engineering profession.

- **Strengthen government-led initiatives:** Expand initiatives like the federal government's supplier diversity action plan to incentivize diversity in procurement and influence hiring and contracting in sectors traditionally dominated by men, including engineering.
- **Promote cultural campaigns:** Launch campaigns targeting young girls and the broader public to challenge societal norms and stereotypes that discourage women from pursuing careers in engineering.
- **Improve work-life balance policies:** Support women's full workforce participation by addressing challenges related to family responsibilities.
- **Accelerate regulator actions:** Provincial and territorial regulators shape the values and conduct of the profession, but their commitment to EDI varies. A greater commitment and concrete actions are needed.

Organizational level

Here, employers and educational institutions must foster an inclusive and supportive environment for women in engineering.

Leadership and governance

> **Promote transparency and accountability:** Publicly disclose EDI strategies with clear action plans and progress reports to drive accountability across the engineering sector.
> **Establish women in leadership initiatives:** Encourage women to take on leadership roles through mentorship opportunities and leadership development programs.

Recruitment, selection and promotion

> **Ensure equal opportunities for career advancement:** Develop clear pathways for women's promotion and career progression within the engineering profession. Ensure pay inequities are addressed.

Values and culture

> **Foster inclusive organizational cultures:** Provide ongoing training on EDI and unconscious bias to create a culture of inclusivity.
> **Address workplace harassment:** Implement zero-tolerance policies for harassment and discrimination to ensure all employees feel safe and valued.

Measurement and tracking

> **Track and report EDI progress:** Regularly monitor developments to promote transparency and accountability.
> **Set benchmarks for gender equity:** Establish benchmarks and report regularly to ensure sustained commitment to gender equity goals.

The value chain

> **Embed EDI in procurement:** Prioritize diversity and gender equity when selecting suppliers, contractors and partners to support inclusive participation throughout the procurement process.
> **Incorporate inclusive design:** Develop products and services that consider diverse needs and perspectives to ensure accessibility and relevance for all users from concept to completion.
> **Integrate EDI in marketing:** Use inclusive language and imagery in marketing campaigns to reflect audience diversity, promote representation and build brand trust.

Outreach and expanding the talent pool

> **Expand STEM outreach programs:** Increase the reach of programs to introduce young women to engineering and technology through hands-on learning and mentorship.

> **Provide scholarships and awards:** Make engineering education more accessible by offering scholarships and awards to women entering engineering programs.

> **Challenge stereotypes:** Develop campaigns that challenge perceptions of engineering as a field dominated by men, while encouraging more women to pursue engineering careers.

Focus on education

> **Role models and supports:** Address women's under-representation within the engineering professoriate and offer mentoring and support structures for women faculty and students.

> **Pedagogy and curriculum:** Create inclusive, collaborative learning environments that emphasize creativity and values, while engendering a sense of purpose and the need for equitable technical solutions.

Individual level

Here, initiatives must empower decision-makers, prospective engineers and women already in the field by addressing implicit biases and fostering mentorship and networking opportunities.

> **Decision-maker training:** Train faculty and industry leaders to identify and mitigate implicit biases in hiring, promotion and retention practices. Implement mentorship and leadership development programs across institutions to support these efforts.

> **Mentorship for prospective engineers:** Expand mentorship programs offering role models and inspiring hands-on experiences to more girls across Canada. Provide educators with support and training to foster inclusive classroom environments that encourage diverse learning styles and support women's participation in STEM subjects.

> **Support for early-career professionals:** Ensure that women already in engineering have access to structured mentorship programs and leadership development opportunities to help them navigate challenges like gender bias and career progression.

Appendix A: Recommendations From 1992 More Than Just Numbers Report

1. The Canadian Committee on Women in Engineering (CCWE) recommends that the active role of women in engineering be portrayed so that parents and the public will encourage young women to pursue careers in engineering.

2. The CCWE recommends that educators empower young women to fully develop self-esteem through significant and appropriate learning experiences in elementary and secondary school.

3. The CCWE recommends that faculties of education include the study of equity issues, gender stereotyping and gender differences in teacher education programs so that all students have equal opportunities for learning, participating and contributing in the classroom.

4. The CCWE recommends that educators enhance the mathematics, science and technical learning experiences of women students in elementary and secondary schools so that they develop interests and abilities in these subjects and acquire the academic prerequisites for engineering studies.

5. The CCWE recommends that teachers and guidance counsellors provide career information and guidance free of gender bias about engineering and related fields to all students, so that women with interests in and aptitudes for engineering are informed, encouraged and supported.

6. The CCWE recommends that educators introduce girls and young women to role models in the fields of mathematics, science, technology and engineering so that they realize women have career options in non-traditional professions.

7 The CCWE recommends that educators and employers develop extracurricular programs to ensure that girls and women develop self-confidence and competence in mathematics, science, technology and engineering in a non-competitive environment.

8 The CCWE recommends that universities create attractive environments for women and commit – in principle and practice – to the recruitment and retention of women faculty and students, especially in faculties of engineering.

9 The CCWE recommends that faculties and schools of engineering develop programs to attract women into undergraduate engineering programs to increase the pool of well-qualified, talented engineers.

10 The CCWE recommends that faculties of engineering encourage mature and other nontraditional students to enter engineering programs.

11 The CCWE recommends that faculties of engineering establish academic adjustment and social support programs for undergraduate students and especially for women students.

12 The CCWE recommends that faculties of engineering create an environment that ensures the physical, emotional and psychological security of all students and contributes to a more positive image of engineering students.

13 The CCWE recommends that faculties of engineering accelerate efforts to attract women students to graduate studies and to ensure they continue to graduation so that the pool of candidates for faculty positions and senior positions in industry is increased.

14 The CCWE recommends that faculties of engineering develop an action plan to increase the number of women faculty in engineering so that a more gender-balanced engineering faculty is created and all engineering students have women role models.

15 The CCWE recommends that universities design tenure and promotion criteria and processes to allow for family responsibilities so that maternity, paternity and parental leaves do not jeopardize career progression or achievement of tenure and promotion.

16 The CCWE recommends that the engineering curriculum be made relevant to current societal realities and future needs so that engineering students are conscious of the effects of engineering decisions and designs and develop an understanding of and appreciation for the humanities and social sciences.

17 The CCWE recommends that faculties of engineering develop and expand work/experience programs and encourage women students to participate so that they are able to validate their career choice and relate engineering studies to the workplace.

18 The CCWE recommends that all employers of engineers develop and implement corporate strategies and policies that demonstrate commitment to the hiring, promotion and career development of women professionals, especially engineers.

19 The CCWE recommends that employers of engineers develop recruitment practices to attract women engineers and ensure the hiring of the best-qualified and most productive employees by creating a selection process that is fair, objective, free of gender bias.

20 The CCWE recommends that employers of engineers institute career development and promotion strategies to prepare women engineers for management and to ensure the promotion of the best-qualified and most productive employees.

21 The CCWE recommends that employers of engineers adopt policies that support the professional, personal and family needs of all employees and ensure employees are able to balance family responsibilities with professional responsibilities and career development.

22 The CCWE recommends that employers of engineers initiate, update, promote and enforce policies to eradicate harassment in the workplace.

23 The CCWE recommends that associations of professional engineers develop and institute programs for all members and engineers-in-training to ensure full acceptance of women engineers in the profession and to eradicate harassment and discrimination against women members.

24 The CCWE recommends that associations of professional engineers improve the information base on equity and human resource distribution, particularly as it pertains to women engineers, by expanding regular member surveys.

25 The CCWE recommends that associations of professional engineers design and launch a public awareness campaign to promote engineering, especially as a career for women, across Canada.

26 The CCWE recommends that associations of professional engineers establish or expand comprehensive attraction programs at elementary and secondary schools in cooperation with other organizations concerned with encouraging women to study engineering.

27 The CCWE recommends that associations of professional engineers develop voluntary career advisory programs to provide support and guidance to young people who are just beginning engineering careers.

28 The CCWE recommends that associations of professional engineers develop close working relationships with faculties of engineering to ensure engineering students are aware of the associations' expectations regarding fairness and equity.

29 The CCWE recommends that associations of professional engineers make employers aware of the different perspectives and qualities women bring to engineering work.

Appendix B: Comparison Tables

The tables below compare updated outcomes versus those in the 1992 More Than Just Numbers report.

Table B1

Full-time fall enrolments in engineering (undergraduate), 1989[135] and 2022,[136] Canada

Year	Total Enrolment	Men Enrolment	% Men	Women Enrolment	% Women
1989	34,145	29,710	87.0	4,435	13.0
2022	85,113	63,669	74.8	21,444	25.2
% Change	+149.3	+114.3	n/a	+383.5	n/a

Table B2

Women registered as professional engineers in Canada, 1990[137] and 2022[138]/year end

Year	Total Engineers	Women Engineers	% Women
1990	121,464	3,875	3.2
2022	319,023	47,941	15

Table B3

Percentage of first professional degrees awarded to women in Canada, 1989[139] and 2021[140]

Field of Study	1989 (% Women)	2021 (% Women)
Medicine	45	50
Law	48	50
Engineering	13	20

Table B4

Canadian Committee on Women in Engineering goals for participation of women in engineering faculties across Canada[141]

	Fall 1990 (%)	Goal for 1995 (%)	2022 (%)
First-year undergraduate students	16	25 to 35	n/a
Master's students	10	20	27
Doctoral students	6	10	30
Full-time engineering faculty	2	5	19.5

Table B5

Distribution of full-time faculty by gender and rank in Canadian universities, 1988[142] and 2022[143]

Rank	% Women (1988)	% Women (2022)
Full professor	13	13.5
Associate professor	34	18.7
Assistant professor	34	33.2
Rank below/non-tenured instructors/others	19	37.9

Table B6

Undergraduate enrolment of Canadian women in accredited engineering programs as a proportion of the total by academic institution, 1990[144] and 2022[145]

Academic Institution	% Women (1990)	% Women (2022)	% Change
British Columbia Institute of Technology		11.1	n/a
Carleton University	9.5	20.7	118
Concordia University	15.6	23.1	48
Conestoga College		9.7	n/a
Dalhousie University	12.9	23.2	80
École de technologie supérieure	4.4	13.4	204
École Polytechnique de Montréal	19.4	29.8	53
Lakehead University	6		n/a
Laurentian University	12.5	16.3	31
McGill University	21.2	33	56
McMaster University	11.4	32.9	188
Memorial University of Newfoundland	13.9	26	87
Queen's University	17.8	27.4	54
Royal Military College of Canada	10.5	18.3	74
Simon Fraser University	9.3	18.8	102
Toronto Metropolitan University		21.1	n/a
University of Alberta	9.7	22.3	130
University of British Columbia	11.1	28.2	154
University of British Columbia, Okanagan		16.1	n/a
University of Manitoba	11.1	22.5	103
University of Western Ontario	11.4	25.3	122
Université de Moncton	9.5	23.9	151
Université de Sherbrooke	17.7	19.4	10
Université du Québec à Chicoutimi	15.2	18.2	20
Université du Québec à Rimouski			n/a
Université du Québec à Trois-Rivières	13.3	18.3	38
Université du Québec en Abitibi-Témiscamingue		18.2	n/a
Université Laval	18.7	20.9	12
University of Calgary	13	27	108

Academic Institution	% Women (1990)	% Women (2022)	% Change
University of Guelph	21.8		n/a
University of New Brunswick	11.5	25.1	119
University of Ontario Institute of Technology		11.1	n/a
University of Ottawa	15.6	26.4	69
University of Prince Edward Island		20.8	n/a
University of Regina	7.3	20.3	179
University of Saskatchewan	10.5	18.6	77
University of Toronto	15.1	39	158
University of Victoria	7.6	21.4	182
University of Waterloo	13.7	31	126
University of Windsor	8.5	16.9	99
York University		15.6	n/a
TOTAL	**14**	**25.2**	**80%**

Table B7

Fall enrolment of Canadian women in accredited engineering programs as a proportion of the total by discipline, 1990[146] and 2022[147]

Discipline	1990: % Women [148]	2022: % Women [149]	Change +/-	1990: % Women [150]	2022: % Women [151]	Change +/-	1990: % Women [152]	2022: % Women [153]	Change +/-
	Undergraduate Programs			Master's Programs			PhD Programs		
Aerospace				8.1	n/a	n/a	4.4		n/a
Agriculture	17.8		n/a	9.1	n/a	n/a	3.8	n/a	n/a
Biosystems		54.5	n/a		47.7	n/a		44.1	n/a
Chemical	28.9	43.9	15	20.1	32.3	12.2	8	39.7	31.7
Civil	19	29.5	10.5	11.4	31	19.6	6.5	31.6	25.1
Computer	6.9	18.6	11.7	7.9	25.6	17.7	8.7	28.9	20.2
Electrical	8.8	19.5	10.7	6.2	25.4	19.2	4.4	23.9	19.5
Engineering physics	10.3	23.7	13.4	5.9	17.6	11.7	3.2	17.4	14.2
Environmental		39.3	n/a		39.1	n/a		38.6	n/a
Geological	21.5	34.8	13.3	15.2	37.2	22.0	11.5	34.7	23.2
Industrial or manufacturing	18	33.4	15.4	17.9	20.8	2.9	19	36.2	17.2

Discipline	1990: % Women [148]	2022: % Women [149]	Change +/-	1990: % Women [150]	2022: % Women [151]	Change +/-	1990: % Women [152]	2022: % Women [153]	Change +/-
Materials or metallurgical	16 | 13.8	26.6	11.7	9.8	35	25.2	8.1	32.5	24.4
Mechanical	9.4	17.5	8.1	6.7	16.5	9.8	5.4	23.9	18.5
Mining or mineral	13	17.3	4.3	8.5	31.5	23.0	3.6	29.9	26.3
Software		19	n/a		30.7	n/a		31.6	n/a
Surveying	12.3		n/a	6	n/a	n/a	11.8	n/a	n/a
Other	14.7	27.5	12.8	16.4	28.5	12.1	6.3	28.4	22.1
Year 1/2 common year			n/a						
TOTAL	**14**	**25.2**	**11.2**	**10**	**27**	**17**	**6.1**	**29.7**	**23.6**

Table B8

Enrolment of Canadian women in engineering master's programs as a proportion of the total, 1990[154] and 2022[155]

Program Status	1990 (% Women)	2022 (% Women)	2022 Totals
Women part-time	9.9	27.2	542
Women full-time	10.1	27	5,005
Total (women full-time and part-time)	10	27	5,547
Total full-time			18,538
Total part-time			1,996
Total full-time and part-time			20,534

Table B9

Enrolment of Canadian women in engineering doctorate programs as a proportion of the total, 1990[156] and 2022[157]

Program Status	1990 (% Women)	2022 (% Women)	2022 Totals
Women part-time	6.5	23.7	77
Women full-time	6	29.8	3,241
Total (women full-time and part-time)	6.1	29.7	3,318
Total full-time			10,862
Total part-time			326
Total full-time and part-time			11,188

Table B10

Full-time faculty members by academic institution, 1990[158] and 2022[159]

Academic Institution	1990 (Full-Time Total)	1990 (Women Total)	1990 (% Women)	2022 Total Full Time Equivalent (FTE) Faculty	2022 Women Total FTE Faculty	2022 (% Women)
British Columbia Institute of Technology				92	15	16
Carleton University	74	2	3	155	24	15
Concordia University	72	0	0	241	53	22
Conestoga College				52	9	17
Dalhousie University	85	1	1	101	20	20
École de technologie supérieure	42	2	5	454	87	19
École Polytechnique de Montréal	215	3	1	398	75	19
Laurentian University	15	0	0	19	2	11
McGill University	104	1	1	144	31	22
McMaster University	84	2	2	167	29	17
Memorial University of Newfoundland	59	2	3	69	12	17
Queen's University	101	4	4	123	34	28
Royal Military College of Canada	84	1	1	82	13	16
Simon Fraser University	18	1	6	64	15	24

Academic Institution	1990 (Full-Time Total)	1990 (Women Total)	1990 (% Women)	2022 Total Full Time Equivalent (FTE) Faculty	2022 Women Total FTE Faculty	2022 (% Women)
Toronto Metropolitan University				153	19	12
Université de Moncton	24	0	0	23	3	13
Université de Sherbrooke	66	0	0	167	28	17
Université du Québec à Chicoutimi	39	0	0	95	19	20
Université du Québec à Trois-Rivières	42	1	2	34	3	9
Université du Québec en Abitibi-Témiscamingue				21	0	0
Université Laval	118	2	2	0	0	0
University of Alberta	128	1	1	252	48	19
University of British Columbia	129	5	4	231	55	24
University of British Columbia, Okanagan				59	14	24
University of Calgary	88	1	1	190	50	26
University of Manitoba	74	1	1	91	17	19
University of New Brunswick	72	3	4	65	7	10
University of Northern British Columbia				21	4	19
University of Ontario Institute of Technology				73	15	21
University of Ottawa	66	4	6	139	29	21
University of Prince Edward Island				15	6	38
University of Regina	23	1	4	43	6	14
University of Saskatchewan	79	0	0	90	20	22
University of Toronto	202	8	4	279	65	23
University of Victoria	27	1	4	84	18	22
University of Waterloo	167	4	2	336	70	21
University of Western Ontario	47	0	0	120	24	20
University of Windsor	46	2	4	90	16	18
York University				96	20	21
TOTAL	**2438**	**54**	**2**	**4925**	**972**	**20**

Table B11

Percentage of women professional engineers by province, 1990[160] and 2022[161]

Province	1990 (% Women)	2022 (% Women)
Quebec	4.7	16.7
Alberta	4.6	15.8
Northwest Territories	3.8	11.3
New Brunswick	3.1	13
Ontario	2.8	14.3
Nova Scotia	2.7	14
Prince Edward Island	2.5	10.5
British Columbia	2.1	14.8
Manitoba	2	13.6
Saskatchewan	1.8	12.4
Yukon	1.4	12
Newfoundland and Labrador	3.4	15.6

Table B12

Professional engineers in manager job level responsibility, by gender, 2006-2021

Year	Number of Men	Number of Women	Total (Men and Women)	% Women
2006[162]	16,245	1,805	18,050	10
2011[163]	15,630	2,170	17,800	12.2
2016[164]	16,910	2,815	19,725	14.3
2021[165]	26,765	6,010	32,775	18.3

Table B13

Average income of engineering graduates, 1989[166] and 2021[167]

Engineering graduates	1989 (Men)	1989 (Women)	2021 (Men)	2021 (Women)
Annual income	48,353	46,414	88,100	66,500
Women's income as a percentage of men's income		96%		75.5%

Table B14

Average income of professional engineers in Canada, 2001 to 2021

Occupation	2001 (Men) [168]	2001 (Women)	2006 (Men) [169]	2006 (Women)	2011 (Men) [170]	2011 (Women)	2016 (Men) [171]	2016 (Women)	2021 (Men) [172]	2021 (Women)
Average income of civil, mechanical, electrical & chemical engineers	67,960	46,558	73,083	53,038	88,956	69,088	100,960	79,780		
Number of civil, mechanical, electrical & chemical engineers	101,190	10,985	107,430	13,880	110,785	18,025	124,860	22,305		
Average income of other engineers	70,377	49,991	85,905	60,371	100,189	72,950	110,060	89,444		
Number of other engineers	62,295	9,685	60,070	9,655	46,545	8,055	45,335	8,770		
Number of engineers (civil, mechanical, electrical, chemical & others)	163,485	20,670	167,500	23,535	157,330	26,080	170,195	31,075		
Weighted income of civil, mechanical, electrical, chemical & other engineers	68,881	48,167	77,681	56,046	92,279	70,281	103,384	82,507		
Average income of professional occupations in engineering									104,600	84,900
Women's income as a percentage of men's income		69.9%		72.1%		76.2%		79.8%		81.2%

Table B15

Representation of women on the councils of associations of professional engineers, 1992 and 2024

Association / Regulatory Body	1992 Total # Councillors	1992 # Women Councillors	1992 % Women Councillors [173]	2024 Total # Councillors	2024 # Women Councillors	2024 % Women Councillors
Alberta (APEGA)[174]	18	4	22	17	8	47
British Columbia (EGBC)[175]	17	3	18	12	5	42
Manitoba (ENGGEOMB)[176]	11	2	18	16	7	44
New Brunswick (APEGNB)[177]	14	1	7	16	8	50
Newfoundland and Labrador (AETTNL)[178]	14	1	7	10	2	20
Nova Scotia (ENS)[179]	11	2	18	13	5	38
Ontario (PEO)[180]	26	4	15	25	7	28
Prince Edward Island (APEPEI)[181]	7	1	14	10	3	30
Quebec (OIQ[182])	24	3	12	15	9	60
Saskatchewan (APEGS)[183]	15	1	7	13	3	23
Yukon (APEY)[184]	6	0	0	11	5	45
Northwest Territories & Nunavut (NAPEG)[185]	11	0	0	12	3	25
Canada	174	22	13	170	65	38

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