

Annotated Bibliography

Last update: April 2018

This document contains a list of research reports, studies and articles related to understanding the barriers women face, and increasing the number of women pursuing and advancing in STEM careers. This is an open report that will be updated periodically and shared as a resource to our partners and other organizations interested in this topic.

Women in STEM – Current Landscape
<p><i>Increasing the Number of Women in Science, Technology, Engineering and Math (STEM)</i> 2018, Canada-United States Council for Advancement of Women Entrepreneurs and Business Leaders</p> <p>Conducted by the Canada-United States Council for Advancement of Women Entrepreneurs and Business Leaders, this report examines the women’s role in science, technology, engineering, and mathematics (STEM). The paper highlights the work that needs to be done in business, governments, and educational institutions, specifically around mentorship, promotion, and the education system to give more women the opportunity to pursue STEM fields. The document address recommendations to address specific barriers to eliminate the gender gap.</p> <p>https://advancingwomeninbusiness.com/wpcontent/uploads/2018/03/IncreasingtheNumberofWomeninSTEM</p>
<p><i>Accelerating for Impact 2018 Gender Inflection Point, When Women Thrive Business and Society Thrives</i> 2018, Mercer</p> <p>The current landscape and dynamics of gender diversity provide a unique opportunity and platform for organizations to make strides now. Neither women nor organizations can afford to wait any longer for women to survive and thrive in the new economy. Your actions today as leaders will have an impact on the fate of progress on gender equality. Helping women thrive requires: 1) Data and analytics that underlie and support all of the decisions being made to advance women 2) Courageous leadership at all levels of the organization committed to helping women thrive 3) Holistic coordination and linkage across all aspects of the change effort to make sure that they reinforce one another and accelerate progress</p> <p>https://www.mercer.ca/content/dam/mercer/attachments/north-america/canada/ca-2018-when-women-thrive-accelerating-for-impact-gender-inflection-point.pdf</p>
<p><i>Where’s the Dial Now? Benchmark Report</i> 2017, Movethedial</p> <p>Where’s the Dial Now? examines the current state of women in the tech and innovation community in Canada. Its purpose is to generate awareness of the gender disparity that exists in our industry and</p>

to challenge education, government, community and business leaders to take action to drive positive change. This report establishes a baseline against which we can measure the collective impact of #movethedial as we continue to increase the participation and advancement of women in our tech community

Key research findings: 1) Currently, only 5% of Canadian tech companies have a solo female founder. When companies with male and female co-founders are factored in, the percentage of tech companies with female founders increases only to 13%. 2) Only 5% of Canadian tech companies have a solo female CEO — and when companies with male and female co-CEOs are factored in, that statistic increases only to 6%. 3) Women comprise 13% of the average tech company's executive team, while 53% of tech companies have no female executives at all. 4) On average, only 8% of directors on boards of Canadian tech companies are women. 73% of boards have no women at all. 5) Approximately 30% of Canadian venture capital firms have a female partner, and on average, 12% of partners are women.

https://docs.wixstatic.com/ugd/55c9d2_ebf58fc4258b40978b5d2bc3a9d2a577.pdf

Women and STEM: Bridging the Divide
2017, TD Economics

The authors TD Economics used Elizabeth MacGill's story, an accomplished Engineer in the 1930's, to draw some contemporary parallels regarding the progress of women within STEM fields. The report seeks to measure and understand why, despite the 30% employment growth in STEM since 2010, women still make up less than one-quarter of those employed in these occupations. Consequently, this trend contradicts the claim that the labour market is increasingly in demand of higher skill levels in Science, Technology, Engineering, and Math. The authors analyzed the educational and labour market friction for girls and women in the STEM. In the education area, the attitudes towards STEM are influenced by environmental and cultural factors; therefore, it is imperative to make subjects more inclusive and relevant to girls. However, in the workplace the potential causes are presented via occupational sorting within technical fields, lower wages than males peers, and a lack of meaningful and challenging opportunities.

<https://economics.td.com/domains/economics.td.../wistem/Women-and-STEM.pdf>

Discussion paper: Women's Economic Empowerment - A Call to Action for Ontario
2017, Ministry of the Status of Women

This discussion paper provides a draft framework to enhance women's empowerment in Ontario. The vision is that "Every woman and girl in Ontario is empowered to succeed, with their choices supported and sustained by a society that provides equal access to economic and social opportunities." The Ministry of the Status of Women (MSW) proposes to achieve this vision by starting with four key areas: empowering youth; promoting economic opportunities; encouraging leadership and shifting social attitudes. In addition, MSW proposes to use the following guiding principles to achieve this work: including the voices of women and girls; diversity and inclusion; perspectives of indigenous peoples; and collaboration and partnerships. Lastly, the proposed outcomes are: educational and career pathways are used by youth and women in all fields; increased opportunities to participate in activities that generate economic wellbeing and access to skills

development; targets set to promote the advancement of women in public, private, and community leadership roles; increased awareness and longer-term generational shifts in attitudes about gender; and improving the educational and economic status of low-income women and girls in Ontario.
<https://www.ontario.ca/page/discussion-paper-womens-economic-empowerment-call-action-ontario>

Untapped Potential: Attracting and engaging women in Canadian Manufacturing
 2017, Canadian Manufacturers & Exporters

Action plan to promote and inspire women to pursue careers in manufacturing. aims at identifying solutions to showcase the vast and untapped opportunities the sector offers for women to build fulfilling careers and narrow the gender gap in the workforce. The action plan highlights five areas where action is needed in order to improve female representation in manufacturing: 1) More high-profile female role models are needed to inspire and encourage young women to pursue a career in manufacturing. 2) Young women need more exposure to modern manufacturing facilities to gain a more accurate perspective on the career opportunities available to them. Those efforts need to focus on occupations within manufacturing rather than on the sector itself. 3) Efforts to encourage young girls to pursue an education in STEM fields and/or the skilled trades need to be improved. 4) Businesses need to listen to the concerns of women and take steps to make their workplace culture more inclusive. 5) Businesses must find creative ways to improve work-life balance for their employees and to accommodate both women and men who have unavoidable family obligations.

<http://www.cme-mec.ca/download.php?file=5ckdqj7zh.pdf%20>

Women in the Workforce and Society QuickStats
 2016, Canadian Centre for Women in Science, Engineering, Trades and Technology

The Canadian Centre for Women in Science, Engineering, Trades and Technology is an action-oriented, non-profit organization that aspires to recruit, retain, and advance women in science, engineering, trades, and technology. The Women in the Canadian SETT Workforce analyzed Statistics Canada census data from 1996 and 2006 and the 2012 National Household Survey to determine the percentage of women in the workforce. Some of the findings include the following: In 2014, women comprised 50.4% of Canada's population, and in 2011 women represented 48% of employed Canadians.

<http://www.winsett.ca/GetSiteFile/WorkforceSocietyQuickStats20Feb2016small.pdf>

Skills in the Digital Economy: Where Canada Stands and the Way Forward, Information and Communications Technology Council
 2016, Information and Communications Technology Council

This report was written by the Information and Communications Technology Council (ICTC) and aims to shed light on Canada's digital opportunities and challenges. It highlights the opportunities and challenges facing Canada's digital economy and underscores the importance of digital talent as one of the most critical advantages for Canada in a global economy. The strategy is aimed at ensuring that Canadians are well prepared to succeed as skilled workers and entrepreneurs in this fast-paced economy, as well paving the way for greater participation as consumers and citizens in an increasingly digital world.

<https://www.ictc-ctic.ca/wp-content/uploads/2016/05/Skills-in-the-Digital-Economy-Where-Canada-Stands-and-the-Way-Forward-.pdf>

Climate Control: Gender and Racial Bias in Engineering?

2016, Society of Women in Engineering

The Executive Summary analyzes three different patterns of gender and racial bias obtained in the Workplace Survey responses launched by the Society of Women Engineers and the Centre for Work-life Law at the University of California, Hastings College of Law. The results showed significant gender gaps for three patterns of bias: prove-it-again; tightrope; and maternal-wall. Furthermore, significant racial gaps were reported for two patterns of bias: prove-it-again and tightrope. Similarly, the survey results reflect the age effect of prove-it-again bias. Regression analysis in the survey showed that women reported higher levels of bias in hiring, networking/sponsorship, and promotion than their male counterparts. At the same time, African-American engineers reported higher levels of bias in networking, promotion, and mentoring/sponsorship than their white counterparts.

https://research.swe.org/wp-content/uploads/2017/10/16-SWE-020-Work-Study-10_20_16-CP.pdf

Some Assembly Required: STEM Skills and Canada's Economic Productivity / The Expert Panel on STEM Skills for the Future

2015, Council of Canadian Academies

This report centers on how well Canada is prepared to meet future skill requirements in science, technology, engineering and mathematics (STEM). In this report, an expert panel convened by the Council of Canadian Academies challenges the view that a STEM skills deficit is to blame for weak innovation performance. The panel reaches many essential conclusions, three of which have particular relevance to the question of whether STEM skills matter to innovation and whether Canada has enough. The first one infers that "there is no evidence of a current imbalance of advanced STEM skills nationally. Second, the panel considered which STEM skills might be needed in the future, such as reasoning, mathematics, computational facility, critical thinking and problem solving, and the ability to apply these skills in technology-rich environments. Finally, the panel concludes that STEM skills are necessary but not sufficient for innovation and productivity growth.

<http://www.scienceadvice.ca/uploads/ENG/AssessmentsPublicationsNewsReleases/STEM/STEMFullReportEn.pdf>

WVest's Gender Diversity in STEM: A briefing on women in science and engineering

2015, West Coast Women in Engineering Science and Technology

This book is a collection of white papers to answer common questions, topics, and misconceptions on why women do not choose specific careers in as large numbers as men and how we can, together, work to make a change in our decisions, words, and actions. Topics in this book include micro-aggressions; the business case for gender diversity; unconscious bias; stereotype threat; social identity threat in the workplace; and understanding workplace diversity for managers.

<http://www.blurb.ca/books/6755979-wwest-s-gender-diversity-in-stem>

Crisis in Ontario's Engineering Labour Market: Underemployment Among Ontario's Engineering-Degree Holders



2015, Ontario Society of Professional Engineers

In January 2015, the Ontario Society of Professional Engineers (OSPE) released the report based on statistics from the 2011 National Household Survey. The report found that about 30% of engineering graduates work in jobs that do not require a university degree; just over 20% of women and international engineering graduates with engineering degrees actually work as engineers or engineering managers, and, by a wide margin, employed individuals with bachelor's degrees or higher in engineering did not work in their field of study compared to those with medical, law, nursing, or education degrees. OSPE deems this condition to be indicative of "underemployment" and says the situation is unacceptable and "demonstrates a vast underuse of people who obtained a rigorous university degree at great cost to the individual, as well as society, only to end up working in jobs that likely wastes their education, skills, and talent."

<https://www.ospe.on.ca/public/.../2015-crisis-in-engineering-labour-market.pdf>

Through Both Eyes: The Case for a Gender Lens in STEM

2014, Science Grrl

This report provides background and insights on issues around girls and STEM in the UK, namely the factors that lead to exclusion and marginalization. This report examines the challenges facing girls and young women from an early age and up until the time they decide whether or not to pursue STEM. It goes on to review current solutions to address the underrepresentation of women. The author's approach was informed by a strong commitment to exploring what is happening on the ground through a literature review and consultation with core stakeholders. It has proved to be a useful strategy and has revealed that these solutions rarely engage with academic literature and rarely embed gender equality into mainstream practice. The report strongly recommends applying a gender lens against this background of persistent gender inequality. Moreover, the article notes that recognizing patriarchy (a social order in which men are the primary holders of power and decision making) is not an accusatory statement. It is necessary to look at long-held systems through a gender lens to make progress towards real equality.

http://sciencegrrl.co.uk/assets/SCIENCE-GRRL-Stem-Report_FINAL_WEBLINKS-1.pdf

Retention of Women in STEM

Why Do So Many Women Who Study Engineering Leave the Field?

2016, Harvard Business Review

This article seeks to understand why women who study engineering leave to pursue careers in other fields? The authors conducted a longitudinal study of engineering students to determine how the culture of engineering influences the students' future job options. According to the study, men and women have similar reasons for enrolling in engineering. However, women are significantly more interested in engineering work that is "socially conscious." The researchers also identified why women who go to college intending to become engineers leave the profession when "they encountered a culture where sexism and stereotypes were left unaddressed, and they saw only lip service toward improving society." The article questions the view that to tackle the low proportion of

women engineers, efforts should only focus on changing engineering curriculum, as educators and businesses have to pay attention to gender-related challenges.

<https://hbr.org/2016/08/why-do-so-many-women-who-study-engineering-leave-the-field>

What's So Special about STEM? A Comparison of Women's Retention in STEM and Professional Occupations

2013, Oxford Academic, Social Forces

This paper compares the retention of women in STEM fields to those in non-STEM fields. The researchers used data from the 1979 National Longitudinal Survey of Youth to track 1,258 women and compare their careers to women in other occupations. The findings include that women in STEM are significantly more likely to leave their occupational field than women working in other professional areas. Another significant result of the study is that marriage and children are more likely to propel women out of STEM careers than professional non-STEM occupations, which implies that neither marriage nor spouse choice is significant for non-STEM women.

from <https://academic.oup.com/sf/article/92/2/723/2235817>

Stemming the Tide: Why Women Leave Engineering

2011, University of Wisconsin-Milwaukee

The study was conducted at the University of Wisconsin-Milwaukee and funded with a grant from the National Science Foundation. The study is a systematic investigation of the retention of women in engineering, and the results are based on data collected through an online survey of more than 3,700 women with degrees from 230 universities. Some of the critical findings include that about 11% of respondents said they left their engineering career because of working conditions, too much travel, lack of advancement, or a low salary. Approximately one-in-five women left because they did not like the workplace climate, their boss or the culture. Eight percent left to spend time with family. In regards to staying in the field, the study found that women's decisions to stay in engineering can be influenced by key supportive people in the organization, such as supervisors and co-workers. Women engineers who working companies that value and recognize their contributions and invested substantially in their training and professional development expressed the most significant levels of satisfaction with their jobs and careers.

https://www.energy.gov/sites/prod/files/NSF_Stemming%20the%20Tide%20Why%20Women%20Leave%20Engineering.pdf

Women in Leadership

The Power of Parity: Advancing Womens Equality in Canada

2017, McKinsey

This report found that Canada could add \$150 billion in GDP to the economy in 2026 by adding more women to high-productivity sectors like technology, raising women's participation in the labour force, and increasing women's working hours. McKinsey suggests corporations embrace "a holistic set of initiatives", focus on implementing them well. and sustain their efforts over time including: 1)Go beyond a vocal commitment to diversity by

cascading a clear business case for change, 2) Set targets, track performance, share results, and hold leaders accountable, 3) Create formal sponsorship programs to help promote women, 4) Make flexibility compatible with promotion, 5) Raise awareness of, and combat, unconscious bias to create a truly inclusive environment.

<https://www.mckinsey.com/global-themes/gender-equality/the-power-of-parity-advancing-womens-equality-in-canada>

Diversity Disclosure Practices. Women in Leadership Roles at TSX Listed Companies
2017, Osler

This report is Osler's third annual Diversity Disclosure paper and provides an update on the representation of women in leadership roles in corporate Canada. The report analyzes gender diversity at the executive and board levels of all TSX-listed companies. The report presents some of the progress that has been made regarding gender equality and highlights the changes in the representation of women.

<https://www.osler.com/en/resources/governance/2017/2017-diversity-disclosure-practices-report-women>

Diversity on Board!
2015, Credit Suisse

The author examines the subject of gender diversity and corporate performance in light of the results of a new study, "The CS Gender 3000: Women in Senior Management." The author analyzes the recent study and compares the results with a report conducted in 2012 on gender diversity. The recent study on European diversity levels confirms there is still a lot to be done in the field of gender equality. As an example, to meet national diversity quotas and targets, Europe has to appoint 400 female directors for benchmark stock indices alone. Notwithstanding, it is not only about the percentages and meeting allowances because there is much more at stake. In the article, there are three main obstacles to achieving greater gender diversity: the first one related to cultural biases, workplace-related biases and structural/policy issues, with the first obstacle being the most difficult to overcome.

<https://www.credit-suisse.com/corporate/en/articles/news-and-expertise/diveristy-on-board-201506.html>

Gender Diversity and Corporate Performance
2012, Credit Suisse Research Institute

The Credit Suisse Research Institute on Gender Diversity and Corporate Performance reviewed 2,360 companies globally since 2006. Their analysis confirms that it would, on average, have been better to have invested in corporations with women on their management boards than those without them. The report's most staggering finding is that "for large-cap stocks (market capitalization greater than USD \$10 billion), companies with women board members outperformed those without women board members by 26%. The Credit Suisse Report also found the net income growth for companies with

women on their boards averaged 14 percent compared with 10 percent for those with no female director.

<https://publications.credit-suisse.com/tasks/render/file/index.cfm?fileid=88EC32A9-83E8-EB92-9D5A40FF69E66808>

Creating Change

Opening Doors and Breaking Down Barriers- Highlights from Engineering Professional Success: OSPE's Pilot Mentorship Program for Female Engineering Graduates

2017, Ontario Society of Professional Engineers

This report discusses the results of the Ontario Society of Professional Engineers' two-year pilot mentorship program. The report makes a strong case for one-on-one mentorship as the mentorship has been a valuable tool to engage young women more actively in their engineering careers, helped build protégées' confidence, improved their communication and leadership skills, professionalism, and ability to navigate the complex challenges of a male-dominated sector. At the same time, the mentors showed greater commitment to promoting women's advancement in engineering, enhanced engineering network, and improved mentoring skills. Summing-up, the results of this pilot demonstrates that a formal mentorship program is essential to achieving a more diverse engineering-profession.

<https://www.ospe.on.ca/downloads/Program-Report>

The Benefits of Gender Inclusive Policies and Practices

2017, Engendering Engineering Success-Project Report

The goal of this study was to track the relationship between gender-inclusive workplace policies and key employee outcomes, such as organizational commitment. The Engendering Engineering Success (EES) project gathered data from 269 professional engineers, both men and women. EES aimed to identify which organizational practices best predict an inclusive and supportive workplace culture that maximizes organizational commitment and productivity. The main findings indicate a correlation between strong implicit stereotypes and a lower feeling of belonging. The study suggests that the gender difference explored here might be caused by these implicit stereotypes (i.e., the belief that engineering is a more of a "man's" job) although EES notes that their findings are correlational, and further research needs to be done on how implicit stereotypes can impact workplace cultures.

<http://wwest.mech.ubc.ca/files/2016/10/benefits-inclusive-policies.pdf>

The impact of Human Resource Policies & Practices on the Retention & Advancement of Female Engineers

2017, Engendering Engineering Success-Project Report

The study's objective was to determine what kinds of human resource policies create an inclusive workplace culture and maximize the retention and advancement of women engineers. The participants in the study represented 39 Canadian organizations with at least three female engineers

employed in their operations. The information was gathered through a 20-minute online survey and a 30-minute telephone interview. The Engendering Engineering Success study found that women were paid less and had a shorter average tenure than men at all career levels. At the same time, some practices that helped to recruit and retain women included workplace training and mentorship and paid maternity and paternal leaves. Moreover, the results reinforce the notion that gender-inclusive policies benefit both men and women and therefore the company as a whole.

[https://www.sfu.ca/content/dam/sfu/wwest/Documents/EES Project Report \(human resources\).pdf](https://www.sfu.ca/content/dam/sfu/wwest/Documents/EES%20Project%20Report%20(human%20resources).pdf)

Discussion paper: Women's Economic Empowerment - A Call to Action for Ontario
2017, Ministry of the Status of Women Canada

This discussion paper provides a draft framework for how to enhance women's empowerment in Ontario. The vision is that "Every woman and girl in Ontario is empowered to succeed, with their choices supported and sustained by a society that provides equal access to economic and social opportunities." The Ministry of the Status of Women (MSW) proposes to achieve this vision by starting with four key areas: empowering youth; promoting economic opportunities; encouraging leadership, and shifting social attitudes. In addition, MSW proposes to use the following guiding principles to achieve this work: voices of women and girls; diversity and inclusion; perspectives of indigenous peoples, and collaboration and partnerships. Lastly, the proposed outcomes are: educational and career pathways are used by youth and women in all fields; increased opportunities to participate in activities that generate economic wellbeing and access to skills development; targets set to promote the advancement of women in public, private, and community leadership roles; increased awareness and longer-term generational shifts in attitudes about gender; and Improved educational and economic status of low-income women and girls in Ontario.

<https://www.ontario.ca/page/discussion-paper-womens-economic-empowerment-call-action-ontario>

Gender Diversity 101
2016, Engendering Engineering Success Project

The website includes several short papers on different topics from the Engendering Engineering Success project, with information and practical tips on implicit gender stereotypes. Furthermore, this white paper illustrates common implicit and explicit stereotypes, such as how a person can have conscious beliefs that men and women are equally capable engineers, yet may automatically associate engineering more with men than women. The white paper shows how to measure representation in an engineering organization and the connection between the practices and percentages of women at different levels of the organization, pay and tenure relative to men

<http://wwest.mech.ubc.ca/diversity/>

Managing career transitions: Retaining employees through well-managed maternity and parental leave

2016, Engineers Canada

A planning resource guide for employers and employees to better plan for and manage maternity and parental leaves in the engineering and geoscience professions. Knowing what to expect and building a positive, welcoming business culture will entice valued and talented employees to return, whether they be male or female. This benefits both the employee and the employer; leaves of absence will not

disrupt career progression, productivity, project deadlines or employee development. Well-managed transitions reduce factors that contribute to under-representation and a lack of diversity in the workplace and business continuity remains.

<https://engineerscanada.ca/sites/default/files/Managing-Transitions-en.pdf>

Understanding the Student Landscape

Studying Stem: What are the barriers? A literature review of the choices students make
2008, The Institution of Engineering and Technology

The Institution of Engineering and Technology commissioned this review of almost 300 reports and refereed journal publications to identify the most commonly agreed upon barriers to students continuing in their study of science, technology, engineering and mathematics (STEM). The evidence indicates that 13 to 15 years old in developed nations display a positive relationship between self-efficacy and achievement in STEM, but do not place a high value on science and technology. In contrast, in developing countries, a STEM-related career is frequently viewed as the route to improving life for many in their country. The report identified the following barriers as key issues to overcome: the need for quality teaching; the perceived difficulty of STEM subjects; the disillusionment of the transition from primary to secondary school; negative views about success in STEM and negative stereotypes; and the perceptions of careers and opportunities in STEM.

<https://www.theiet.org/factfiles/education/stem-report-page.cfm>